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ANUSANDHAN NATIONAL RESEARCH FOUNDATION (DST-SERB)

SPONSORED 2ND INTERNATIONAL CONFERENCE

on

Modern Tools and Approaches in the Emerging Field of Pharmaceutical and Biomedical Research

Abstract of the Participants

ORAL PRESENTATION

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POSTER PRESENTATION

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JISUCONPH2024/OP001

Preparation and Evaluation of Vesicles as Lipophilic and Hydrophilic Drug Delivery Systems

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The challenge of delivering multiple drugs in a single drug delivery system led to the formation of microscopic vesicles with non-ionic surfactants. As these vesicles are stable in nature and consist of bilayers, that is aqueous core and non-aqueous core which provides an opportunity to load drugs with opposite affinity in the same drug delivery system but in different compartments in combination to decrease the number of times of administrations. Vesicular drug delivery systems, especially Niosomes are getting more preferences overother vesicles such as liposomes. Due to the ease of preparation and availability of all raw materials Niosomes are preferred over liposomes. Niosomes are having more stability and drug entrapment for the lipophilic and hydrophilic drugs are also high as it consists of two vesicular compartments, that is one within another, aqueous and non-aqueous. Wecan prepare them in different sizes and as per our need single or multilamellar and are made up of non-ionic surfactants. They can be used for controlled drug delivery and enhanced bioavailability as well as carrier for NDDS, therefore, the vesicles, that is Niosome is the need of the hour as a Novel Carrier.

Keywords: Niosomes, Drug, Vesicular, Lipophilic, Hydrophilic, Liposomes

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Isolation, Characterization and Application of Hydroxychavicol Conjugated Chitosan Nanoparticle for its Multifaceted Role

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Free radicals are the major triggers of oxidative stress to the body which inflicts various diseases. On the other hand, polyphenols extracted from plant sources have significant therapeutic potential, like mitigating reactive oxygen species. Hydroxychavicol (H) is one such polyphenol extracted from *Piper betle* L., the most popular and widely consumed ethnomedicinal plants with immense medicinal properties. Chloroform based extraction, isolation and biochemical confirmation by sodium hydroxide was done for preliminary confirmation of hydroxychavicol extraction. UV-Visible spectroscopy (maxima absorbance peak at 419 nm) and phytochemical analysis through TLC confirmed the R_f value of hydroxychavicol at 0.634 which corroborates with the expected value of 0.64. Chitosan, the abundant exopolymer, stands out for its biodegradability and bioremediation studies but poor water solubility and less H atom donors curb its antioxidant applications. To address these limitations and to increase reactive surface area, chitosan is converted to chitosan nanoparticle and conjugated with hydroxychavicol (Ch-NP-H), to enhance antimicrobial and bioremediation potential. UV-Vis spectroscopy (absorbance peak at 419 nm) and DLS (particle size ~53 nm) confirmed the formation of Chitosan nanoparticle whereas the pre-coating and post-coating of chitosan with hydroxychavicol was confirmed by changes in the wavelength through FTIR. The Ch-NP-H extract exhibited strong antibacterial activity against cohort of all the three bacterial strains responsible for respiratory infections. The IC_{50} value obtained against the cohort of *Haemophilu influenza, Klebsiella pneumonia* and *S. aureus* displayed 68% inhibition after 3 hrs of growth in liquid broth. Thus the synthesized hydroxychavicol coated chitosan nano displayed multiple potentials in different avenues.

Keywords: *Piper betle*, Hydroxychavicol, Chitosan, Antibacterial, Cohort, Bioremediation

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JISUCONPH2024/OP003

Metal nanoparticle synthesis, fabrication, characterization, immobilization on coated silk sutures, and its various effects

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In order to close and stabilize wound edges and encourage healing, sutures are an essential part of surgical treatments. However, due to pathogen colonization, microbial contamination of sutures might raise the risk of surgical site infections (SSI). By creating silver nanoparticles (AgNPs) via the co-precipitation technique and applying them to sutures, this study sought to address SSI. Trisodium citrate was used to diminish the AgNPs. The physicochemical characteristics of AgNPs were confirmed by FTIR analysis, morphology with a particle size range of nanometer range, a PDIrange indicates broad particle size distribution of the formulation, and a zeta potential range indicates from neutral to strongly anionic/cationic. The coating of NP-coated sutures was assessed using scanning electron microscopy (SEM). Using the agar diffusion method, the antimicrobial activity of both AgNPs and suture-coated AgNPs was investigated in microorganisms (Candida albicans). According to the findings, NPs and NP-coated sutures both showed improved antibacterial activity against microbes. Finally, HACAT (Human Skin Keratinocyte cell line), which showed greater cell viability, was used to examine the cytotoxicity of the sutures for 24 hours. All things considered, the findings suggest that NP-coated sutures may be employed as antimicrobials to reduce or prevent SSI in patients undergoing general surgery or postoperative care.

Keywords: Sutures, Silver Nanoparticles, Physicochemical Study, Pharmacokinetics Study, Antimicrobial Effect, Cytotoxic Effect

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MEDICOTTON: A Journey Towards Effective Wound Dressing

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In recent years, understanding of the blood coagulation system has evolved significantly in haemostasis research. Haemostasis, the body's natural process to stop bleeding, begins after an injury when platelets adhere to each other and to the damaged vessel wall, forming a temporary "platelet plug." Several wound dressing materials are available in the market which does not provide any haemostatic activity. Cotton, which is applied on any wound as a dressing material doesn't directly cause blood to clot, its absorbent fibres attract blood and platelets to the injury site, supporting initial clot formation. The fibrous structure of cotton acts as a framework, providing temporary stability to the clot until natural clotting processes take over. Regular absorbent cotton, derived from the Gossypium plant, is commonly used for general cleaning and hygiene, but lacks antimicrobial, haemostasis and wound-healing properties. Medicated cotton is a modified version of the old cotton which is infused with biopolymer chitosan, and crossed linked with an ionic cross linker ferric chloride to enhance coagulation and antimicrobial action. Several physicochemical studies of the modified cotton were done like swelling, degradation, IR spectroscopy, etc. The swelling and the degradation data predicted that increase in the concentration of the cross linker decreases the swelling property of the material and also decreases the degradation rate. The *in vitro* blood coagulation study and antimicrobial effects were also conducted to conclude that the fabricated cotton is highly effective for topical application on wounds, providing convenience and increased healing potential.

Keywords: Haemostasis, Coagulation, Cotton, Antimicrobial, Wound

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Preparation and Evaluation of Waste Material Derived Carbon Dots

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Carbon dots (CDs) are nanoscale materials with sizes under 10 nm, known for their excellent fluorescence, stability, and biocompatibility. This study explores the sustainable synthesis of CDs using waste materials through the hydrothermal method, offering an environmentally friendly and cost-effective approach. CDs derived from waste show great promise for applications in bioimaging, drug delivery, and environmental sensing. The hydrothermal method was selected due to its simplicity and ability to produce uniform particles with high quantum yield. The synthesized CDs were characterized using UV-vis spectroscopy, FTIR, dynamic light scattering (DLS), and Zeta potential analysis. Fluorescence was confirmed under UV light at 254 nm and 365 nm, while FTIR analysis identified surface functional groups such as OH, CO, and C=C, contributing to the structural and chemical properties of the CDs. The Zeta potential indicated a negative surface charge, enhancing colloidal stability. In vivo toxicity studies were conducted using zebrafish embryos (*Danio rerio*) to assess biocompatibility and safe dosage levels. The CDs exhibited low toxicity and excellent potential for future biomedical applications. The study also demonstrated the fluorescent properties of CDs, supporting their use in molecular bioimaging. This research confirms the viability of utilizing waste materials to produce functional carbon dots, promoting sustainable nanotechnology. Future work will focus on optimizing synthesis conditions and expanding the scope of CDs in advanced biomedical applications and real-time environmental monitoring.

Keywords: Carbon Dots, Hydrothermal, Fluorescence, Nanotechnology, Molecular Bioimaging, Zebra fish

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JISUCONPH2024/OP006

Influence of Serum on differentiation of Fibrocytes into Adipocytes in Graves' Orbitopathy

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Graves' Orbitopathy (GO) is an inflammatory autoimmune disorder associated with Graves' Disease (GD). It is characterized by the remodelling of orbital tissues due to inflammation, fibrosis and adipogenesis. The thyrotropin receptor (TSHR) on orbital fibroblasts is a key autoantigen connecting GD and GO. Fibrocytes are spindle-shaped cells, derived from monocytes in peripheral blood mononuclear cells (PBMCs) that share some common characteristics with orbital fibroblasts. This study aims to investigate the adipogenic differentiation potential of fibrocytes in GD, GO, and healthy control (HC) subjects. Specifically, we aim to observe i) adipocytes differentiation of serum treated cultured fibrocytes ii) expression of adiponectin and PPAR- γ of serum treated cultured fibrocytes among HC, GD and GO. Peripheral blood mononuclear cells (PBMCs) were isolated and cultured for 7 days to obtain fibrocytes. The culture was extended for 14 days to assess adipocyte differentiation using Nile red staining. Adiponectin and PPAR-γ expressions were measured through sandwich ELISA and real-time PCR. Fibrocytes were transformed into adipocytes due to lipid droplet accumulation when patient's (GD and GO) serum treated HC fibrocytes and autologous serum treated GD and GO fibrocytes were cultured for 14 days. GO serum triggered adipocyte conversion of HC fibrocytes and also induced adiponectin and Peroxisome Proliferator-Activated Receptor-γ (PPAR-γ) expression in HC and GO fibrocytes. These findings highlight the intrinsic adipogenic potential of fibrocytes in GO and these differentiation mechanisms may open new therapeutic avenues for managing GO.

Keywords: Fibrocytes, Peripheral Blood Mononuclear Cells, Adipocytes, Fibroblast

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JISUCONPH2024/OP007

Dual Ligand Conjugated Docetaxel Loaded Carbon Dots Nano-Formulation for Targeted Delivery Against Breast Cancer

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Female breast cancer is one of the deadliest forms of cancer and it was reported with the second highest number of 2.34 million new cases in year 2022. In breast cancer treatment, chemotherapy is still the most popular strategy although it is limited by some major side effects due to non-specific drug delivery and absence of advanced drug delivery systems. Thus, in current work, hyaluronic acid (HA) and cyclic RGD (cRGD)-dual ligand conjugated carbon dots (CDU) system was developed to specifically target cancer cells and angiogenic neovasculature. *In vitro* cytotoxicity study in MCF-7 cancer cells showed significantly greater cytotoxicity for cRGD-HA-CDU@DTX as compared to DTX alone and CDU-DTX. The cell viability dropped to 34% for cRGD-HA-CDU@DTX treatment for 16 h at 5µg/ml concentration while for DTX and CDU-DTX group cell viability was 63% and 74%, respectively. In apoptosis study, early apoptotic cell count for DTX was found only 2.6%, while for cRGD-HA-CDU@DTX, it was seen much higher as 8.2%. Expression level of proapoptotic genes BAX and CAS-8 was found significantly higher for cRGD-HA-CDU@DTX group as compared to DOX or CDU-DTX treatment. Further, expression level of anti-apoptotic genes Bcl-2 and Mcl-1 was significantly lower for cRGD-HA-CDU@DTX group while comparing with DTX or CDU-DTX treatment. In *in vivo* antitumor activity study, the tumor growth was significantly lesser (>3-fold) in the cRGD-HA-CDU@DTX group in comparison with the control group and almost halved from the DTX and CDU-DTX treated group. The pronounced tumor growth inhibition by cRGD-HA-CDU@DTX than the DTX and CDU-DTX attributes to the active targeting of the breast cancer mediated via dual receptor targeting.

Keywords: Carbon Dots, Dual Targeting, MCF-7 Cell Line, Breast Cancer

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JISUCONPH2024/OP008

Enhancing the Oral Bioavailability of Diclofenac Sodium with *Basella alba* Mucilage Based Carrier: An *In Vivo* Pharmacokinetics Study

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Diclofenac sodium, on oral administration, gets completely absorbed but half of its concentration is only available in systemic circulation due to fast pass metabolism. Therefore, Diclofenac sodium was entrapped in a natural polysaccharide based carrier to improve its oral bioavailability by limiting the drug release in the stomach. Tailored *Basella alba* mucilage in combination with sodium carboxymethylcellulose lead to the development of a smart hydrogel bead loaded with Diclofenac sodium. The resultant pH dependent beads with minimum *in vitro* release of drug in acidic pH and sustained release in intestinal pH led to the assessment of *in vivo* pharmacokinetics and bioavailability study. The pharmacokinetics of the raw drug, drug loaded formulation was studied and compared with a marketed formulation of Diclofenac sodium (Subsyde®- CR DRCM capsule) at an equivalent dose in three groups of Wistar albino rats containing six rats in each group. Blood samples were collected via retro orbital puncture for a period of 24 hrs. The concentration of Diclofenac sodium in a plasma sample of rats was detected by HPLC and the pharmacokinetic parameters were analyzed by non compartmental modelling using PK solver. The results showed higher mean residence time, increased t_{max} and decreased C_{max} of drug-loaded beads and marketed formulation as compared to the raw drug. The pharmacokinetic parameters of the test and marketed formulation appeared similar without any significant difference. The relative bioavailability of Diclofenac sodium increased from 54.50% to 96.88% by entrapping it in *Basella alba* mucilage-based bead, confirming the potential of *Basella alba* mucilage as bioavailability enhancer.

Keywords: Pharmacokinetics, Diclofenac sodium, *Basella alba*, Bioavailability, Marketed Formulation

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JISUCONPH2024/OP009

Exploration of Jute Leaves (*Corchorus olitorius*) Polysaccharides In Pharmaceutical Formulation

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Jute leaves (*Corchorus olitorius*) are traditionally known for their medicinal properties and recent studies have highlighted their potential for polysaccharide extraction. This project explores jute leaf polysaccharides as a biocompatible and biodegradable material for wound healing applications. The primary aim is to extract and characterize jute leaf polysaccharides and formulate them into biodegradable beads. Key objectives include developing beads via ionic gelation, loading them with bioactive agents, and evaluating their wound healing efficacy through in vitro and in vivo studies. Polysaccharides were extracted from jute leaves, purified, and subjected to identification tests. The ionic gelation method with calcium chloride was employed to form beads, and a model drug was encapsulated to assess controlled release properties. Tests showed that the extracted polysaccharides were suitable for bead formulation, with positive mucilage identification. The prepared beads demonstrated appropriate swelling and drug release behaviours, showing promise for wound healing. The project reveals that polysaccharides from jute leaves can be successfully extracted and formulated into beads capable of controlled drug release. This formulation addresses the need for bioactive, biocompatible materials in wound healing. Jute leaf polysaccharides offer a natural, cost-effective alternative for wound healing, combining biocompatibility with controlled drug release. Further research and in vivo testing could establish them as a viable option for advanced wound care.

Keywords: Polysaccharides, Jute leaves, Extraction, Beads, Controlled release

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Formulation and Development of Sitagliptin Phosphate Loaded Microsphere followed by Evaluation on the Basis of In-Vitro and In-Vivo Parameters

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In the past several decades a continuous increase in the diabetic population has been observed all over the world. Apart from injecting insulin parentally, several orally active antihyperglycemic medications can be taken like sitagliptin, which works by increasing the insulin production in order to control the diabetic condition. Only 38% of the sitagliptin gets bound with the plasma protein and nearly 79% of it gets excluded in unchanged form by urination which results in multiple dose requirements. The objective of this study was to use hydrophobic primary polymer ethyl cellulose (EC) and hydrophilic secondary polymer Hydroxypropyl Methylcellulose (HPMC) to fabricate a microsphere with initial burst release followed by sustained drug release to decrease the onset of action and increase the duration of action. To prepare the microsphere, the emulsion solvent evaporation (ESE) method has been used. Different formulations have been prepared and the % yield has been observed to vary within a range of 76% to 85%. Entrapment efficiency (EE) has been observed to be within the range of 71.70% to 80.96%. Formulation F2 (drug: polymer 1:3, polymer: copolymer 9:1) shows 35.24% burst release within 15 minutes on dissolution study action and only 74.30% drug release within 12 hours. FTIR data indicates that the selected polymers are non-reactive to sitagliptin. Further characterizations of microspheres have been done like micromeritics property, scanning electron microscopy (SEM), dissolution kinetics, particle size determination, etc. *Ex-vivo* permeation study has been done from which the permeability was obtained to be 1271.387 µg/cm2. *In-vivo* study has been performed on Zebrafish (*Danio rario*) to ensure the therapeutic effectivity of sitagliptin in the microspheres. The results of this study show parity between claims of achieving faster onset time and sustained release of the novel formulation to provide better efficacy.

Keywords: Sitagliptin, Microspheres, Sustained release, Emulsion solvent evaporation, Dissolution, Zebrafish

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Effect of Hydroxy Propyl Methyl Cellulose (HPMC E5 LV Premium and HPMC E15 LV Premium) on the Oral Polymeric Film of An Antihistaminic Drug

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Orally dissolving films (ODFs) is a new drug delivery approach that provides a beneficial, patient-friendly option compared to traditional dosage forms. ODFs have attracted significant attention as a promising substitute for typical oral medications due to their easy administration and convenience. This study aimed to create and assess antihistamine ODFs utilizing croscarmellose sodium (CCS) as a super disintegrant. The ODFs were made using solvent casting, incorporating hydroxypropyl methylcellulose (HPMC E5 LV Premium) as a film-forming agent, propylene glycol as a plasticizer, and CCS as a super disintegrant. The films were evaluated for thickness, weight consistency, disintegration time, folding endurance, drug content, and in vitro dissolution profile. The outcomes indicated that the films were consistent in thickness, weight, and drug content. They disintegrated within 30 seconds, demonstrating their rapidly dissolving nature. The dissolution profile indicated an immediate release of the drug, with over 80% of the drug released within 5 minutes. Overall, using Croscarmellose Sodium as a super disintegrant effectively proved in enhancing the disintegration time of ODFs, leading to a swift drug release. Thus, the antihistamine ODFs were successfully formulated and displayed promising disintegration time and dissolution profile results. These ODFs could provide a user-friendly, easy-to-administer option for managing allergies and related conditions, which is particularly beneficial for pediatric and geriatric patients who struggle with swallowing conventional dosage forms.

Keywords: Orally Dissolving Film, Antihistamine, Hydroxypropyl Methylcellulose, Croscarmellose Sodium, Allergic Condition

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Design, Synthesis of Pyrazole and Isoxazole-Based Novel Bacterial Topoisomerase Inhibitors as New Antibacterial Agents

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Bacteria play an important role in maintaining the environment in which we live. Infections caused by Multidrug resistant organisms (MDRO) which result in significantly fewer treatment options, are ranked among the top global public health concerns. Topoisomerases are essential enzymes to carry out complex interconversions of DNA supercoils, knots and catenae. The study aimed to develop Novel bacterial topoisomerase inhibitors (NBTI), reduce antimicrobial resistance. Synthesis of Quinolone intermediate was done through Vilsmeier-Haack reaction. Synthesis of substituted isoxazole and pyrazole intermediate Claisen condensation process was used and to obtain the finished product, coupling method was performed to treat the isoxazole/pyrazole intermediate by treating the quinolone intermediate. As of right now, we have generated ten compounds and carried out in-silico research. We took the compound with the most favourable docking score, and the characterisation process is already underway. The target molecule was identified using various literature reports and in-silico studies. As per previous report, the quinoline moiety exhibits DNA intercalation tenacity. In this research we have design, synthesis and aim to characterize Isoxazole and Pyrazole based NBTIs for antibacterial studies Therefore, isoxazole and pyrazole moiety was identified to be the Right-Hand Site (R.H.S) of the designed compounds.

Keywords: Bacteria, Topoisomerase, DNA gyrase, NBTI, Pyrazole, Isoxazole

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Utilization of *Luffa* sp. in the treatment of Pharmaceutical Wastewater

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Luffa sp., a natural fibre of the Cucurbitacea family obtained from ripened fruit of the *Luffa* plant. It harbors a high percentage of lignocellulosic content, which offers pharmaceutical wastewater clean-up from various drugs, antibiotics, hormones, beta blockers and others. The pollutants are directly disposed of during the manufacturing process or eliminated through the human body into the environment. No single treatment process is sufficient enough to remove the complex pharmaceutical constituents albeit; natural treatment offers low cost and sustainable ones. The porous nature of *Luffa* relates to biofilter entrapping pollutants in its structure. The propensity of hydroxyl groups in cellulose encourages physical adsorption, ion exchange or chemisorption to withheld contaminants like Ibuprofen drug. *Luffa* has also been reinforced with other organic components like polypyrrole or immobilized with microbial consortium to reduce pharmaceutical contaminants. *Luffa* modified with metal nanoparticles like silver or zinc have successfully reduced ketoprofen and dye pollutants from wastewater. In this current context machine learning has emerged as a powerful tool to address pharmaceutical wastewater management problems which are very precision specific. Thus *Luffa* could be a sustainable alternative to treat pharmaceutical wastewater.

Keywords: *Luffa*, Pharmaceutical, Wastewater, Nanoparticles, AI

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Bioassay-Guided Discovery of Anti-cancer Phytoconstituents from *Aloe vera* Leaves: *In-vitro* and *In-vivo* Evidence

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Traditional Indian medicine has long employed the xerophytic plant Aloe vera (Family: Liliaceae) to treat various ailments, including diabetes and cancer, despite the limited scientific validation of these claims. This study aimed to identify and characterize secondary metabolites from the ethanol extract of A. vera leaves and assess their anti-cancer effects. The ethyl acetate extract (EAE) and the isolated compounds were subjected to *in vitro* and *in vivo* analyses. *In vitro* cytotoxicity was evaluated against human OAW42 (ovarian) and MCF-7 (breast) cancer cell lines, while the *in vivo* antitumor efficacy was assessed using the Ehrlich ascites carcinoma (EAC) tumor model in Swiss albino mice. Following extraction, two fractions were prepared: the ethyl acetate soluble fraction (EAF) and the chloroform fraction (CF). Among the two, EAF exhibited superior potency and was further utilized to isolate bioactive compounds, barbaloin (1) and gallic acid (2), which showed significant anti-cancer activity in both *in vitro* and *in vivo* assays. Both isolated compounds demonstrated cytotoxic effects against the OAW42 and MCF-7 cancer cell lines. We further evaluated the antitumor activity of the ethyl acetate extract and the isolated compounds in EAC tumor-bearing mice. We measured key parameters such as tumor volume, packed cell volume, viable and non-viable cell counts, mean survival time, and percentage increase in lifespan. The *in vivo* results indicated that the EAF and the isolated compounds effectively modulated tumor-associated parameters and restored various hematological indices in EAC tumor-bearing mice.

Keywords: *Aloe vera*, Anti-Cancer, Packed Cell Volume, Hematological Parameter

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New Age Artificial Intelligence (AI)-Driven Approaches to Get Insights into the Chemical Space, Scaffold Diversity of a Large Data Set of Small Molecules Targeting PPARγ: Enhancing Anti-Diabetic Drug Discovery

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PPARγ serves as a key regulator of adipocyte differentiation and enhances insulin sensitivity. In contemporary drug discovery, *in-silico* design strategies offer significant advantages by revealing essential structural insights for lead optimization. This study integrates ligand- and structure-based drug discovery techniques, focusing on chemical space analysis, scaffold diversity, and the application of artificial intelligence (AI) to a diverse range of PPARγ modulators. This study is guided by three main objectives: (i) a ligand-based approach to explore the chemical space of PPARγ modulators, (ii) the development of a supervised AI model for a large dataset, and (iii) a structure-based approach utilizing docking and molecular dynamics (MD) simulations to investigate ligand-binding interactions. Additionally, the combination of classical QSAR with new age AI models enables the rapid screening and prediction of heterocyclic PPARγ modulators. These modelling analyses will assist medicinal chemists in designing more potent PPARγ modulators. The integration of these computational methods has uncovered crucial structural motifs that are essential for PPARγ activity, advancing the anti-diabetic drug discovery in the future.

Keywords: Diabetes mellitus, PPAR, Artificial Intelligence, Chemical Space, Scaffold Analysis, MD Simulations

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Identification of Tinocordifolin from *Tinospora Cordifolia* for the Nephroprotective Activity through Gentamicin Induced Rats: An Integrated Approach through Computational Chemistry and Network Pharmacology

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TC (*Tinospora cordifolia*) has a historic immunomodulatory usage, indicating its potential as a nephroprotective agent. This study demonstrates the methanolic extract of *Tinospora cordifolia* (METC) as a potential nephroprotective agent against gentamicin-induced nephrotoxicity. The primary aim of this study is to find out a potential nephroprotective agent from *Tinospora cordifolia* through the computational approach of network pharmacology and molecular docking. The in-vivo research on gentamicin-induced nephrotoxicity was conducted over seven days with six distinct groups, utilizing both male and female albino wistar rats. The active constituents of *Tinospora cordifolia* were derived from the IMPPAT 2.0 database (Indian Medicinal Plants, Phytochemistry And Therapeutics 2.0). Network pharmacological analysis was done to find out the compound- target network. Subsequently molecular docking analysis was performed to find out the various interactions involved. Thereafter we had gone through HUB gene analysis to find out the most effective genes involved. Afterwards we went through GOBP (Gene ontological biological process) analysis to figure out the important pathways involved. The group receiving TC (400mg/kg) for 7 days showed the highest efficacy ($P< 0.0001$) in decreasing blood urea nitrogen and serum creatinine, while significantly enhancing serum electrolyte levels (Na^+, K^+). The nephroprotective network results in an important interaction of the protein involved in nephrotoxicity and we have identified 194 nodes and 665 edges. Molecular docking study was performed which indicates that tinocordifolin (-9.56) was most favorable among the 12 phytochemical compounds. Network pharmacological analysis, Hub gene identification and molecular docking study indicates that tinocordifolin may serve as a potential nephroprotective moiety.

Keywords: *Tinospora cordifolia*, Nephrotoxicity, Network Pharmacology, Molecular Docking; GOBP

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Pharmacognostical Properties, Phytochemical Evaluation, and Biological Investigation of the Plant of *Aganosoma Heynei* (Spreng.) I.M.Turner

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Aganosoma heynei (Spreng.) I.M.Turner, a species recognized for its traditional medicinal applications, has recently garnered attention for its pharmacognostic and phytochemical potential. This study comprehensively evaluates the Pharmacognostical characteristics, phytochemical profile, and biological activities of *Aganosoma heynei*. Through microscopic and macroscopic examination, key diagnostic features were identified, contributing to the plant's botanical profile standardization. Phytochemical screening revealed the presence of bioactive compounds such as alkaloids, flavonoids, phenolics, saponins, and tannins, supporting the plant's therapeutic claims. Advanced methods, including gas chromatography-mass spectrometry (GC-MS) and high-performance liquid chromatography (HPLC), were employed to analyze the phytochemical constituents in detail. Additionally, various biological assays, such as antioxidant, antimicrobial, and anti-inflammatory tests, hypoglycaemic activity, antiarthritic activity, antinociceptive activity, and antiurolithiatic Activity were conducted to evaluate the plant's efficacy. The findings indicate that *Aganosoma heynei* exhibits significant pharmacological properties, which could serve as a basis for developing novel therapeutic agents. Further in vivo studies and clinical trials are essential to confirm its safety and efficacy for potential medical applications.

Keywords: *Aganosoma heynei*, Pharmacognostic Properties, Phytochemical Evaluation, Biological Activity, Pharmacological Activity

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Design, Synthesis & Broad-Spectrum Pharmacological Evaluation of Benzyl Thiazolidinedione-Based Novel Molecules

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In the present situation, cancer and microbial infection are major global problems in human health. The major issues associated with conventional therapy are toxicity and resistance development. So, novel anti-cancer and anti-microbial drug development and synthesis is a major part of novel research in the medicinal chemistry field. More or less synthetic drugs contain various heterocyclic rings in their structural backbone. Among them, Thiazolidinedione is a popular heterocyclic ring with versatile pharmacological potential. Benzyl thiazolidinedione-based series of compounds were synthesized by Knoevenagel condensation and Mannich base reaction and structural confirmation was performed by IR spectroscopy, NMR, and Mass spectroscopy. *In-silico* molecular docking on VEGFR (PDBID: 3B8Q, 4ASD) and Glucosamine -6-phosphate synthase of *E.Coli* (PDBID:2vfs) by using Schrödinger software. In-vitro antimicrobial activity was determined by the calculation of the zone of inhibition and in-vitro anticancer activity was performed by the MTT assay on breast cancer cell line MCF-7. All the molecules have good antibacterial potency and docking score. Among them RSP5, PDC-11 have the best docking score and RSP has the best antimicrobial potency against both gram +Ve and gram – Ve bacteria. MTT assay reveals that RSP-4 molecule has the best anticancer activity (IC50 =52.65±0.17µM).

Keywords: Anti-cancer, Anti-microbial, Thiazolidinedione, Synthesis, Molecular Docking

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Alluring the Potential Therapeutic Efficacy of Nano-Gold Adorned Rare Earth Metal Oxide Nanoformulation in Biomedical Applications

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Exploration of the potential therapeutic efficacy of rare earth metal oxide as cancer chemotherapeutics has garnered significant interest, including cerium, lanthanum, and yttrium oxides, exhibiting unique physicochemical properties of promising candidates for targeted drug delivery and cancer treatment. These nanostructures can be designed to minimize off-target effects on healthy organs while targeting cancer cells. Our work is to employ a synergistic approach to assess the efficacy of functionalized nanoceria nanotherapeutics. According to the study, nanogold damages cells while oxidative stress and altered respiration stabilize nanoceria particles and inhibit cell growth. The potential efficacy of functionalized cerium oxide to combat illnesses and improve infection control systems is demonstrated by its dual-action mechanism. This included evaluating cellular uptake of nanoceria and examining its dual-action mechanism, where folic acid exposure led to cellular damage while oxidative stress contributed to particle stabilization and inhibited cell growth. Results indicated significant antibacterial action and a reduction in cancer cell migration. DAPI staining micrographs revealed that after treatment with nanoparticles the nucleus gets fragmented and disintegrated. Ruptured cellular architecture with loss in cell membrane integrity was also noticed which implies the anticancer efficacy of the synthesized nanoparticle validated from the scanning electron micrographs. Functionalized nanoceria release pro-inflammatory indicators, activate c-Jun N-terminal kinase and NF-kB, triggering apoptotic pathways resulting in cell death confirmed by ROS study. In summary, we have outlined the process of synthesizing folic acid-conjugated nanoceria and thoroughly investigated its effectiveness in combating breast cancer cells by impeding pathogenesis and interrupting cellular pathways.

Keywords: Nanogold, Nanoceria, Antimicrobial, Chemotherapeutics, Antioxidant

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Chemometrics Guided Lead Identification and Design of Novel Analogs with Trypanothione Reductase Activity Based on 2-Aminobenzimidazole Scaffolds and Molecular Simulations for Addressing Leishmaniasis

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We have developed an advanced quantitative structure–activity relationship (QSAR) model targeting Leishmaniasis, a widespread Neglected Tropical Disease (NTD) affecting millions worldwide. Current treatments face challenges such as relapse, toxicity, and extended treatment periods. Recent studies explored the use of a 2-aminobenzimidazole scaffold for Trypanothione reductase (TR) inhibition, a key enzyme in Leishmaniasis pathology. While the activity (IC50) observed showed moderate potency, the compounds demonstrated acceptable toxicity in vivo. This motivated us to create a QSAR model for TR inhibition based on available experimental in vivo data. We employed straightforward 2D molecular descriptors for clear interpretability, enabling the identification of structural features correlated with inhibitory activity, which can guide the design of new molecules. A 2D QSAR approach was used to select the final model, adhering strictly to OECD guidelines, and Intelligent Consensus Prediction (ICP) was applied to enhance prediction accuracy. Key structural factors such as hydrophobicity, aromaticity, hydrogen bond acceptors/donors, and the presence of heteroatoms (e.g., nitrogen, fluorine) were found to strengthen inhibitory activity. This model was applied to predict the TR inhibitory activity of DrugBank compounds. QSAR-informed structural modifications were implemented to develop potential analogs of the top candidates. Molecular docking was used to evaluate the binding affinity and interactions of these analogs compared to a known TR inhibitor (TRL190) at the active site. In-depth in-silico ADMET profiling and 300ns molecular dynamics simulations were conducted to assess the stability of the protein-ligand interactions for the leading candidates (DB03231-A6 and DB12269-A4) with the apo-TR. The analysis indicates that DB12269-A4 is the most promising lead, meriting further in vitro and in vivo studies for potential application in Leishmaniasis treatment.

Keywords: QSAR, NTDs, Leishmaniasis, PLS, Molecular dynamics

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An Integrated Cheminformatics Effort to Explore Chemical Space, Activity Landscape, and Scaffold Diversity of a Large Dataset of Heterocyclic Derivatives against Neurodegenerative Diseases

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The brain plays a crucial role in many essential processes, including memory and learning, with histone deacetylase 3 (HDAC3) being particularly important for long-term memory formation. Histone deacetylase inhibitors (HDACIs) have been shown to directly enhance memory function. As a result, identifying potent and selective HDAC3 inhibitors may offer significant benefits for long-term memory and learning. In this study, we explore the relationship between chemical compounds and visualise the network of hydroxamate candidates. Additionally, clustering these compounds and visualising their chemical space provides insights into their overall diversity. Incorporating pairwise activity differences further enhances the activity landscape, revealing complex structure-activity relationships (SARs). Ultimately, this study offers valuable insights for identifying potential scaffolds and chemical moieties critical for activity, helping to strategically optimise lead compounds in the development of HDAC3 inhibitors with strong therapeutic potential.

Keywords: Neurodegenerative diseases; HDAC3; structure-activity relationships; chemical space; scaffold analysis

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Green Synthesis and In vitro Characterizations of Copper Nanoparticles using *Trigonella Foenum* Seeds Extract

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Metal nanoparticles production is an expanding field of study owing to its promise in advancing technologies. Typically, these nanoparticles are created through chemical processes that are often detrimental to the environment. *Trigonella Foenum-graecum* commonly known as 'methi' is a dicotyledonous plant that belongs to the Fabaceae or Leguminosae family. The constituents of fenugreek include various chemical components such as alkaloids, amino acids, saponins, flavonoids, fibers, vitamins, minerals, mucilage and protein. Utilizing these fenugreek seeds to create metal nanoparticles using copper sulfate as a precursor through environmentally friendly methods presents an innovative, cost-efficient, and eco-friendly approach compared to conventional energy intensive, costly and hazardous techniques. Characterizations of the experimental batches of CuNPs were done by UV-Visible spectroscopy, DLS, FTIR, SEM, TEM and XRD. The nanoparticles showed surface plasmon resonance peaks at 265 nm, and their average size were found to be 363.4 nm. FTIR analysis confirmed the presence of flavonoids and other phenolic compounds in both fenugreek seed extract and the CuNPs. The synthesized CuNPs demonstrated modest antioxidant activity, which revealed 43.68% of inhibition for CuNPs synthesized from the fenugreek seed and 97.42% of inhibition for standard ascorbic acid. The synthesized CuNPs were found to successfully inhibit growth of both gram-positive (*Staphylococcus aureus*) and gram-negative (*Escherichia coli*) bacteria. Therefore, fenugreek seed can be utilized to synthesize CuNPs that could be employed in the near future for the treatment of diseases caused by free radicals.

Keywords: Fenugreek Seed, Green Synthesis, Copper Nanoparticles, Flavonoid, Antioxidant Activity

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Drug and Green Synthesized Nanoparticles Loaded Polymeric Hydrogel: A Novel Approach towards Wound Care Management

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The complex biological process of wound healing, aimed at restoring tissue integrity, is hindered by microorganisms that delay healing in acute and chronic wounds. This study focused on creating a novel topical drug delivery system to aid wound healing by assessing antimicrobial effects. Fluconazole and silver nanoparticles synthesized from *Ocimum tenuiflorum* leaves were separately incorporated into a sodium alginate-gelatin hydrogel at varying concentrations. In one setup, fluconazole was combined with a divalent chloride salt solution; in another, green-synthesized silver nanoparticles were used. Swelling ratio tests confirmed a denser network at higher alginate concentrations. Drug release studies showed approximately 60% release within 10 hours, with fluconazole-loaded hydrogels producing a 2-2.5 cm inhibition zone against *Candida albicans*. *Ocimum* leaves were processed for methanolic and aqueous extracts, with colour change and surface plasmon resonance at ~420 nm confirming nanoparticle formation. These nanoparticles, added to the polymeric solution, showed a 2.5-3.0 cm inhibition zone against *E. coli*. The IR studies were also conducted for all the ingredients used in producing the hydrogel which showed no interactions among each other. The in vitro haemostatic activity conducted by tube inversion method showed better result for the final product. In vivo wound healing activity conducted on rats by incision model showed significant results with the final product. The study indicates the developed hydrogel's effectiveness in antimicrobial activity, paving the way for future research on cytotoxicity and in-vivo wound healing.

Keywords: Wound, Alginate, Hydrogel, Nanoparticles, Fluconazole

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Cynaroside, a Flavonoid Glycoside from *Codonopsis ovata* Showed Binding Affinity Towards Sortase-A Enzyme (PDB ID- 7s56) from *Streptococcus agalactiae*, *In-silico*

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Sortase A is a transpeptidase enzyme that plays a crucial role in biofilm formation in Gram-positive bacteria. In *Streptococcus agalactiae,* Sortase – A helps to attach pilus structures to the bacteria's outer layer. This anchoring is important for the bacteria's ability to stick to surfaces, which can contribute to infection. The diverse chemical structures of small molecules derived from plants provide a valuable source of bioactive compounds. In this study, we report on a flavonoid glycoside, Cynaroside, which demonstrated an in-silico binding affinity of -8.8 kcal/mol (using CB-DOCK 2) for Sortase A (PDB ID: 7S56) among 21 naturally sourced compounds selected from the curated database of Indian Medicinal Plants (IMPPAT). Cynaroside is derived from *Codonopsis ovata*, commonly known as Kashmir Bonnet Bellflower, found in the Himalayas. Although this molecule violates two of Lipinski's rules of five, it adheres to the Ghose rule and exhibits favorable ADME properties (SwissADME) along with drug-likeness. Toxicity predictions (using Protox II) suggest that the compound is safe for further investigation. Based on these findings, we can conclude that additional research may provide valuable insights that could assist in the development of Sortase A inhibitors, potentially offering new avenues for therapeutic interventions against infections caused by *S. agalactiae* and related pathogens.

Keywords: Sortase A, IMPPAT, Cynaroside, Streptococcus agalactiae, Docking Studies

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Unveiling the Therapeutic Potential of *Vitex negundo*: A Critical Evaluation of Phenolic & Flavonoid Content, Antioxidant Activity, and Antibacterial Properties

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This study examines the total phenolic content, antibacterial efficacy, and antioxidant activity of methanolic extracts derived from the leaves of *Vitex negundo*, a plant known for its therapeutic attributes. The total phenolic content (TPC) was assessed with the Folin-Ciocalteu reagent technique, indicating a notable concentration of 242.97 ± 7.65 mg of gallic acid equivalent per gram of dry extract weight. Qualitative phytochemical analysis verified the existence of many secondary metabolites, such as carbohydrates, proteins, amino acids, steroids, glycosides, flavonoids, alkaloids, and phenolic substances. The GC-MS study of Vitex negundo demonstrated a varied assortment of chemicals, as seen by the chromatogram and peak report. Thirty-seven compounds were discovered, exhibiting diverse retention durations and peak regions, indicating a complex blend of phytochemicals. The DPPH (2,2-diphenyl-1-picrylhydrazyl) experiment showed that the extract greatly decreased absorbance, which means that it effectively removed DPPH radicals. The IC50 value, indicating the concentration necessary to block 50% of DPPH radicals, was found to be far lower than that of the standard antioxidant, ascorbic acid, implying that *Vitex negundo* has potent radical-scavenging ability.

Keywords: *Vitex negundo*, TPC, Antioxidant Activity, GC-MS Analysis, DPPH Assay

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Development of Nano-Based Botanical Pesticides: A Sustainable Approach towards Minimizing Health Risk

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Infestation of agricultural pests threatens food security and results in significant losses in agricultural productivity. Toxic chemicals included in synthetic pesticides are usually the foundation of conventional pest control methods. Due to their ability to bioaccumulate into the food chain, these compounds are expensive and provide a number of risks to human health and the environment. With their high efficacy, durability, and controlled release, nanoparticle-assisted pesticides present a viable alternative for sustainable pest management and have become a need-based research area pertaining to issues of human health. In this study, we used laboratory bioassays on target pests to compare the effectiveness of conventional pesticides and botanical pesticides based on nanotechnology. Furthermore, in order to investigate chromosomal structural alterations brought about by nano-based botanical pesticides in contrast to commercial pesticides, we evaluated cytotoxicity using the *Allium cepa* model. Data recorded from this study with promising results is expected to minimize residual toxicity in food and the environment by using less pesticide and improving insect control effectiveness, which may align to minimizing health risk.

Keywords: Nano Biotechnology, Botanical Pesticides, Sustainable Pest Management, Hazardous Agrochemicals, Cytotoxicity

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Cytotoxicity and Anticancer Activity of *Hevea brasiliensis* Leaf Extracts on EAC Cell Lines

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In recent times, the popularity of plant-based medicines has surged, driven by several factors such as their efficacy and comparatively fewer side effects in contrast to contemporary pharmaceuticals. One example of such plants is the Rubber tree, scientifically known as *Hevea brasiliensis* (HB), belonging to the Euphorbiaceae family Spurge. The anticancer efficacy of *Hevea brasiliensis* leaf extracts was evaluated *in vitro* and *in vivo* using the 3-(4,5-dimethylthiazole-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay, tryphan blue dye exclusion assay, and xenograft technique against an EAC cell line. The hydroalcoholic leaf extracts derived from *Hevea brasiliensis* have demonstrated anticancer properties. Upon administering different doses of the hydroalcoholic extract, it was noted that the *Hevea brasiliensis* hydroalcoholic extract resulted in a concentration-dependent reduction in cell survival within the EAC cell line. Additionally, the extract demonstrated a dose-dependent inhibition of cell proliferation. Notably, the tumor volume, packed cell volume, and viable cell count were significantly diminished by HB hydroalcoholic extract, leading to increased survival in animals with EAC tumors. The study findings highlight that HB hydroalcoholic extract markedly curtailed tumor growth in mice carrying EAC. The application of *Hevea brasiliensis* hydroalcoholic extract notably decreased tumor volume in animals with solid tumors. This study highlights the significant advantages seen more in treating animals with solid tumors using *Hevea brasiliensis* hydroalcoholic extract. The study highlights the potential of the HB hydroalcoholic extract as an anticancer agent, emphasizing the need for further research to identify and evaluate specific components for their therapeutic significance in combating oxidative stress-induced diseases.

Key words: Anticancer Activity, MTT assay, Trypan Blue Dye Exclusion Assay, Xenograft

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Methanolic Extract of *Withania somnifera* (root) Evaluated for Potential Anti-Abortifacient Activity in Misoprostol-Induced Female Wistar Rats

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Research on anti-abortifacients targets features that avoid pregnancy termination by sustaining hormonal homeostasis and fetus growth. Medicinally, *Withania somnifera* has been suggested to mitigate the effects of abortifacient agents including Misoprostol. Natural progesterone therapy shows promise as a safer alternative for maintaining pregnancies and preventing early pregnancy loss. The anti-abortifacient influences of *Withania somnifera* (Ashwagandha) root extract were assessed in pregnant albino Wistar rats. Misoprostol, a medication that causes abortion, was utilised to assess the extract's efficacy in preventing pregnancy termination. Female rats were randomly assigned to four groups: normal, control, standard, and test. Treatments were given orally once a day for 10 days, beginning on the first day of pregnancy. IAEC and CPCSEA established standards for experimental techniques, and acute oral toxicity was measured in accordance with OECD 423 principles. On the 15th day of pregnancy, rats were anaesthetised for biochemical examination, and uterine tissues were obtained to assess foetal health. The phytochemical study of the methanolic extract revealed the presence of active chemicals such as steroidal lactones, glycosides, alkaloids, and terpenoids. These elements are thought to increase progesterone and other sex hormones, so facilitating pregnancy. The study discovered that the extract dramatically boosted progesterone levels, reduced internal bleeding, and enhanced gestational outcomes when compared to the Misoprostol control group.

The findings indicate that *Withania somnifera* root extract may have anti-abortifacient actions, increasing hormone secretion and minimising pregnancy problems in Misoprostol-induced abortion models. Thus, methanolic root extract may be a promising natural therapeutic for avoiding early pregnancy loss.

Keywords: Anti-abortifacient, Abortion, Misoprostol, *Withania Somnifera,* Gestational retardation

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In-vitro, Network Pharmacological & Molecular Dynamics Based Assessment of Anti-Aging & Anti-Cancer Properties of *Marsilea minuta*: Promising Natural Agents for Disease Prevention

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Age-associated disorders, cancer, and cellular senescence are critical issues due to India's increasing number of elderly people. Plants with high levels of antioxidants may help alleviate disorders associated with free radicals, but their protection for normal cells necessitates thorough examination. The purpose of this study was to evaluate the anti-ageing and anti-cancer abilities of an aquatic plant, *Marsilea minuta. In-vitro* analysis revealed that plant extracts exhibited high antioxidant, hydrogen peroxide scavenging, and DNA damage prevention capabilities. We have performed MTT assays on all the plant extracts to access their anticancer potential. The next step of this research was to provide a network pharmacology-based approach for determining *Marsilea minuta*'s ageing and cancer-related therapeutic networks. We have acquired the active constituents of *Marsilea minuta* and the targets of the investigated compounds from the IMPPAT 2.0 database. We have consequently built a network to illustrate the relationships between the suspected objectives of *Marsilea minuta* and the recognized therapeutic areas of ageing and cancer, using this network to examine the pharmacological processes of *Marsilea minuta* in relation to ageing and cancer. We have identified a total of 15 active constituents, 170 active constituents of *Marsilea minuta*, and 286 ageing-related targets. Following data integration, we have conducted network development and pathway enrichment. We have then performed molecular docking and molecular dynamics simulation (200 ns) to identify the most potential compounds for anti-ageing and anti-cancer. The aforementioned study revealed that *Marsilea minuta* possesses anti-ageing & anti-cancer properties. It may also be utilised for therapeutic applications.

Keywords: Cancer, Senescent cells, Marsilea minuta, Network pharmacology, Molecular dynamics

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Formulation and Evaluation of Topical Curcumin Gel for Skin Infection

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The Curcuma species has a lengthy history, dating back 5,000 years in Ayurveda and 2,000 years in Atharveda. In 1815, one of the most active curcuminoids in C. longa was identified, and its structure was established in 1910. For millennia, curcumin, a yellow polyphenolic pigment produced from the rhizome of Curcuma longa L. (turmeric), has been employed in cooking and food colouring, as well as in a number of therapeutic therapies. The most well-known Curcuma species is Curcuma longa L. (Turmeric, Curcuma); it is a cultivated plant that thrives in warm climates all over the world. Rhizomes are the most commonly utilized plant portion, and they contain a range of compounds, including bioactive non-volatile curcuminoids (curcumin, dimethoxy-, and bisdemethoxy-curcumin) and volatile oil components (mono and sesquiterpenoids). To prepare curcumin gel for antimicrobial infection. The main objective of the study is to isolate the curcumin from the mixture of curcuminoids, for better result in the skin infection. Curcumin gel is prepared by extracting the curcumin from the roots of turmeric. It's converted into a gel formulation by using suitable polymer. For the antimicrobial study in vitro disc diffusion method is used. The effectiveness of topical gel was demonstrated in an antibacterial trial with a zone of inhibition of 13.5 mm for *S. aureus* and 15.1 mm for *E. coli*. Curcumin in the dosage form of gel has the ability to treat skin infections with promising antimicrobial and antifungal activity, with a zone of inhibition of 15.8 mm. The study was performed to check the activity of curcumin. The result confirms that curcumin has a potential to cure anti-microbial skin infection. This proves that curcumin in the dosage form of gel has the ability to treat skin infections with promising antimicrobial and antifungal activity without causing any skin irritation.

Keywords: Gel, Curcumin, Antimicrobial, *S. aureus, E. coli*

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Enhancing Cardiac Hypertrophy Assessment in Pre-clinical Pharmacology: Advancing Precision with Revised ECG Nine-Lead Localization Technique

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Cardiac hypertrophy poses challenges in drug development due to limitations in replicating human complexity. The 14-day isoprenaline protocol often leads to false cases and premature developments, compromising group homogeneity. While ECG lead II is the gold standard for real-time assessment, it has limitations in detecting areas beyond the inferior wall. An extended protocol addresses these issues, ensuring more accurate assessment and reducing false inductions in cardiac hypertrophy models. To overcome limitations by introducing an extended isoprenaline administration protocol. This will continue until nine-lead consecutive ECGs can accurately pinpoint the involvement and extent of specific cardiac walls, such as the anterior, inferior, anterolateral, and others, thereby providing a comprehensive assessment. The experimental model consisted of healthy male albino Wistar rats (10–12 weeks old, 250 to 280 g). Nine lead ECG-lead localisation by BIOPAC-46 was concentrated on days 1, 5, 10, and subsequently, until successful ECG signs appeared. Leads II and I revealed TP and ST segment depression, T wave inversion, and peaked QRS complexes, indicating ventricular wall enlargement. Lead V3 displayed ST elevation, suggesting left lateral and left inferior cardiac wall involvement. Increased heart weight, elevated lactate dehydrogenase, creatine kinase, and N-terminal pro-brain natriuretic peptide levels implied cardiac stress. Histopathological examination unveiled myocyte disarray, mucinous degeneration, hydropic degeneration, and corrugated fibrosis in localised cardiac tissue (left lateral and left inferior). This study surpassed the constraints of the traditional 14th-day regimen with enhanced homogeneity among subjects, where the novelty lies in its ability to detect wall involvements and minimise the false induction cases.

Keywords Electrocardiograms, Cardiac Hypertrophy, Isoprenaline, N-terminal Pro-Brain Natriuretic Peptide, Creatine Kinase, Lactate dehydrogenase

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IGF-I Critically Modulate the Prognostic Risks Factors for Hepatotoxicity under the Co-Morbid Conditions of Type 2 Diabetes Mellitus

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Type 2 diabetes mellitus (T2DM) increases the occurrence of hepatotoxicity. Studies showed that critical regulation of Insulin like growth factor -1 (IGF-1) closely gets associated with the impaired glucose tolerance and insulin resistance which predisposes higher risks for T2DM. The chronic secretion of IGF-1 suppresses the anti-lipolytic action of Insulin and consequently increases the influx of free fatty acid into the systemic circulation, which aggravates higher rate of lipid-peroxidation by the induction of harmful strong oxidants. Under such T2DM co-morbid condition, damage of the hepatocytes, leading to fibrosis, steatosis and cirrhotic stages are very common. This study mainly highlights the IGF-1 role, as the critical marker in the damaged hepatocytes that mediates intercellular interactions and cellular differentiation in the hepatic stellate cells which ultimately forms the myofibroblasts and enhances the accumulation of the extracellular matrix (ECM). Under the inflammatory responses, overproduction of the cytokines would also result in the dysregulation of ECM synthesis which subsequently leads to the fibrotic and/or cirrhotic stages. Hence via the in-situ hybridization process we target the localization and expression pattern of the IGF-1 marker under the pathological conditions of T2DM that can identify and define the hepatocellular risk factors through the underlying molecular pathways.

Keywords: IGF-I, T2DM, Hepatocytes, Insulin Resistance, In-Situ Hybridization

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Phenolic Diterpene Compound from Rosemary Mitigates Adjuvant-Induced Arthritis and Bone Loss via mPGES-1 and COX-2 Inhibition in Male Sprague Dawley Rats

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Rheumatoid arthritis (RA), a chronic inflammatory disease, is marked by joint swelling, cartilage erosion, and bone destruction. This study evaluated the therapeutic efficacy of Carnosic acid (CA), a phenolic diterperne compound from Rosemary with anti-inflammatory and antioxidant properties, in an adjuvant-induced arthritis (AIA) model. CA's effects on paw swelling, arthritis index, oxidative stress, and pro-inflammatory markers (mPGES-1, iNOS, COX-2) were evaluated. Bone loss was assessed via microcomputed tomography (μCT) and X-ray radiography. CA treatment significantly reduced joint inflammation and paw swelling, mitigated oxidative stress, and enhanced the antioxidant defense system. CA inhibited the expression of microsomal prostaglandin E synthase-1 (mPGES-1), inducible nitric oxide synthase (iNOS), and cyclooxygenase-2 (COX-2), alleviating arthritis symptoms without severe gastrointestinal side effects. Notably, CA prevented weight loss, bone degradation, and gastric ulcers. These findings suggest that CA, through targeted enzyme inhibition, offers a promising therapeutic approach for RA. Further research is needed to explore the potential of CA in other arthritis models and its applicability to human RA treatment.

Keywords: Rheumatoid arthritis, Carnosic acid, mPGES-1, COX-2

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Impact of Obesity on Cardiovascular Parameters in Young Adult Undergraduate Students: A Comparative Study

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Obesity, characterized as the build-up of extra body fat brought on by a positive energy balance, raises the chance of developing chronic illnesses like type II diabetes, high blood pressure, some types of cancer, and heart problems. Additionally, it damages the autonomic nerve system in all age groups, resulting in several medical and psychological issues. The current study compares the cardiovascular responses to submaximal treadmill exercise and examines the differences between obese and nonobese people throughout the post-exercise recovery phase. The study was conducted on 60 students of either sex between the age group of 18 to 21 years selected randomly. All the students except those with a BMI less than 18.5 are considered for this study and classified into two groups as per WHO guidelines- Group A: Non-Obese Group B: Obese. Pre-exercise pulse rate and Blood pressure and post-exercise changes in heart rate and blood pressure were measured at the intervals of Immediately after exercise, 2 minutes after exercise, and 5 minutes after exercise. According to the study, there was no discernible change in resting heart rate between the non-obese and obese groups, irrespective of sex. Blood pressure and pulse rate increased noticeably after exercise for all individuals, while obese students had a longer blood pressure recovery period—more than five minutes. The study that examined the recovery of blood pressure and heart rate after exercise demonstrates that both metrics fully recovered to baseline except for the obese groups.

Keywords: Obesity, Post-Exercise Pulse, Post-Exercise Pressure

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Assessing the Impact of Zinc Oxide Nanoparticles on the Growth of Hydroponically and In-Vitro Cultivated *Centella asiatica* (Urban) L

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This study investigates the impact of zinc oxide nanoparticles (ZnONPs) on the growth of *Centella asiatica* (CA), a medicinal plant known for its wide therapeutic applications, under both hydroponic and in vitro conditions. *Centella asiatica* plants were propagated and grown in both hydroponic and in vitro conditions. Hydroponically, plants were exposed to ZnONPs at concentrations ranging from 50 mg/L to 250 mg/L and grown for 28 days under controlled conditions. In vitro cultures involved sterilizing nodal explants and inoculating them into Murashige and Skoog (MS) medium supplemented with ZnONPs (50 mg/L to 300 mg/L) for 5 weeks. ZnONPs were characterized using Field Emission Scanning Electron Microscopy (FESEM) and Energy Dispersive X-ray Spectroscopy (EDX) to confirm their uptake and distribution in plant tissues. Data were analyzed statistically using one-way ANOVA. The results revealed a concentration-dependent response: lower concentrations (50 mg/L to 150 mg/L) of ZnONPs enhanced plant growth in both growth medium, evidenced by darker green leaves, increased root elongation, and greater shoot proliferation. However, at higher concentrations (200 mg/L and above), phytotoxic effects were observed, such as stunted growth, leaf discoloration, reduced root length, and decreased biomass. These negative effects were attributed to oxidative stress induced by reactive oxygen species (ROS) generated from the accumulation of ZnONPs in plant tissues. Additionally, the study highlighted the antimicrobial properties of ZnONPs, which reduced microbial contamination in in vitro cultures. However, the potential toxicity at higher concentrations emphasizes the need for careful management of ZnONPs in agricultural practices.

Keywords: *Centella asiatica*, Zinc Oxide Nanoparticles, Hydroponic, In-Vitro Culture, Antimicrobial

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Understanding the Genetic Risk Associated with Blood Disorder among the Orang Asli and Malay in Malaysia: Mining the Whole Genome Sequence Database

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Single Nucleotide Polymorphisms (SNPs) in genes associated with blood disorders have significant implications for an individual's health. In this study, we aimed to identify the genetic variants associated with blood disorders that are present among the Orang Asli and the Malays by analysing their whole genome sequenced previously. We investigated the polymorphism of 14 genes including *BMP2, CD164, CYBRD1, EPAS1, EPO, HAMP, HBB, HFE, MTHFR, SH2B3, SLC40A1, TF, TMPRSS6*, and *VHL*. A bioinformatics pipeline was developed to mine the whole-genome sequence databases of the Orang Asli and Malays to determine the presence of pathogenic SNPs associated with increased risks of blood disorders. Two different *in silico* tools, SIFT and Poly-Phen-2 were used to predict and assess the functional impact of the SNPs. Of the 4535-blood disorder-related nsSNPs, 45 nsSNPs were found among the Orang Asli and Malays. They were further analyzed to identify pathogenic variants based on the prediction of functional effects, conservation, and stability of blood-related disorder variants. Five (5) nsSNPs; rs235768 (*BMP2*), rs1799945 (*HFE*), rs1801133 (*MTHFR*), rs41298977 (*TF*) and rs190329416 (*TMPRSS6*), were classified as pathogenic variants. These mutations alter the protein interface and alter the allosteric sites of the respective proteins which affect the regulation of cell proliferation, iron transportation and iron homeostasis. In conclusion, rs235768, rs1799945, rs1801133, rs41298977 and rs190329416 are important pathogenic variants that increase the risks of blood disorders among Orang Asli and Malays. The role and impact of these variants in blood disorders require further investigation.

Keywords: Data Mining, Blood Disorders, Genetic Risks, Single Nucleotide Polymorphisms

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Sortase A: A Promising Target to Combat Anti-Microbial Resistance

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Bacterial infections are a major global health concern, with 20% to 30% of the population affected by both Gram-positive and Gram-negative bacteria. The increasing resistance to common antibiotics is significantly reducing treatment efficacy, largely due to biofilm formation, a thick layer of exopolysaccharides that contributes to antibiotic resistance. This review aims to evaluate Sortase A (SrtA), an extracellular enzyme in the bacterial cell wall, as a promising target for anti-virulence drug development. The objective is to identify potential SrtA inhibitors that could effectively combat drug-resistant Gram-positive bacteria without promoting resistance. The review examines existing research on peptide and non-peptide SrtA inhibitors, focusing on their binding affinity, specificity, safety, and efficacy. Several experimental approaches are discussed to provide insights into the potential of these inhibitors as therapeutic agents. SrtA inhibitors show strong potential in reducing bacterial virulence and biofilm formation. These inhibitors exhibit high specificity and binding affinity to SrtA, with minimal impact on bacterial growth and viability, thereby reducing the likelihood of resistance development. SrtA is a viable target for the development of novel anti-virulence drugs against drug- resistant Gram-positive bacteria. Unlike traditional antibiotics, SrtA inhibitors reduce virulence without exerting significant pressure for resistance evolution, making them a valuable tool in addressing the urgent issue of antimicrobial resistance. Further research into these inhibitors is essential for their future clinical application.

Keywords: Gram-Positive Bacterium, Sortase A, Biofilm, Anti-Microbial Resistance, Anti-Virulence

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Ecology And Evolution of MDR: In-vitro and In-silico Study of Plumbagin-Based Cadmium Oxide and Synthetic Nanoparticles Against Multi Drug Resistant *Klebsiella pneumoniae, Staphylococcus aureus & Enterococcus faecalis*

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Antibiotic Misuse has led to a surge in cases of Multi Drug Resistance driven by rapid evolution of the microbial immune system by limiting drug uptake, modifying drug targets, Drug inactivation and MDR efflux pump overexpression. This study aims to combat MDR using cadmium oxide and synthetic nanoparticles, both indi vidually and in combination. Following the biochemical analysis of leaf extract of *Plumbago Zeylanica*, 5% plumbagin solution was combined with cadmium sulphate and sodium sulphide forming the green nanoparticles. The synthetic nanoparticle combined *Pseudomonas fluorescens* with PEG-Citric Acid Polymer(1:5). The UV scans determined the cut wavelength. Following the isolation of *Klebsiella pneumoniae, Staphylococcus aureus & Enterococcus faecalis* from pond water, quantitative assays, RAPD and Octadic assay (Amikacin, Co-trimoxazole, Colistin, Augmentin, Netillin, Norfloxacin, Ceftriaxone, Ciprofloxacin, Cefotaxime, Gentamicin, Furazolidone & Amoxicillin), followed by cup plate assay, biofilm assays and in-silico-analysis were performed to verify the effectiveness of nanoparticles. The bacterial supernatant showed 185.86 µg/ml carbohydrates and 959.64 µg/ml protein. All isolates showed resistance to 2 or more antibiotics in octa disc assay while RAPD revealed *staphylococcus aureus* mutation. The cut wavelength for the green nanoparticle was reduced to 462 nm compared to 515nm (Pure-cadmium). The cup plate assay, biofilm assays (with various dilutions of green and synthetic nanoparticles) confirmed their anti-microbial activities and docking analysis (on FtsZ and 1BNA) cemented the properties with binding energies -10.30 and -12.63 Kcal/mol through strong interactions. Cadmium oxide nanoparticles offer significant potential in developing drugs to counter MDR. Further studies are needed to explore their clinical applications and safety.

Keywords: Multi Drug Resistance, UTI Pathogen, Cadmium-Oxide-Nanoparticle, Synthetic-Nanoparticle

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Bioactivity-Guided Isolation and Characterization of Antitumor Principles from *Glycosmis Pentaphylla* (Retz.) DC Leaves Extract

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The increasing prevalence of cancer has prompted the search for novel therapeutic agents derived from natural sources. This study investigates the anticancer activity of *Glycosmis pentaphylla* (Retz.) DC, belonging to the Rutaceae family, a plant known for its traditional medicinal uses. The extraction of phytochemicals from the leaves of *Glycosmis pentaphylla* was performed using solvent extraction methods. The obtained extracts were tested for their cytotoxic effects against various cancer cell lines, including breast (MCF-7) and liver (HepG2) cancer. Furthermore, the extracts exhibited antioxidant properties, suggesting a dual mechanism of action. Cytotoxicity assays, including MTT and mechanistic studies, revealed significant dose-dependent inhibition of cell proliferation, with the leaf extract demonstrating the highest potency. Induction of apoptosis was evidenced by cell cycle analysis and apoptosis assays on cancer cell lines. Antioxidant properties were evaluated using the DPPH assay. Phytochemical screening, MTT assay results, FTIR, GCMS studies, and antioxidant properties indicated significant potential in *Glycosmis pentaphylla* for anticancer activity. Overall, *Glycosmis pentaphylla* presents a broad range of therapeutic benefits, underscoring its potential as a natural remedy, though additional clinical research is necessary to confirm its efficacy and safety. These findings support the potential of *Glycosmis pentaphylla* as a source of anticancer agents and warrant further investigation into its active compounds and clinical applications.

Keywords: *Glycosmis pentaphylla*, Phytoconstituents, MTT Assay. GCMS Studies

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Marine Source for New Anticancer Drug Discovery

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Cancer is a deadly disease which is spreading all over the world. That is why we must find several ways to root out the disease. Some marine sources like bacteria, cyanobacteria, microalgae, halophytes, plantae, protozoa, fungi etc., are the earth's main marine assets, accounting for over 90% of the biomass of the oceans. Our study is focusing on the taxonomically diverse marine sources and their different potent chemical constituents that can be effective as anticancer agents. In essence, various marine molecules like stypoldione, condriamide A and many others have been approved by regulatory authorities from all over the world, and synthetic derivatives have also been made for the treatment of cancer in search of new anticancer drugs. Polyphenols and sulphated polysaccharides are main constituents found in marine flora. The phytochemicals are showing immuno-stimulatory and anti-tumour activities by activating macrophages, preventing oxidative damage of DNA. The new knowledge on cancer mechanisms significantly contributed to the advancements in cancer prevention; unfortunately, we are still far from finding an effective cure and clinical strategies to combat cancer. A large part of the marine biomass is unexplored for lead compounds having anticancer activity. This review will elaborate on the significance of recently approved molecules from marine sources through discussing the original organism, their structure, and mechanisms of action. The bio-compounds will be used as model compounds to demonstrate potential bioinformatics methods for discovering new targets to enhance our understanding of anticancer therapies.

Keywords: Cancer, Marine Sources, Stypoldione, Immuno-Stimulatory

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Readdressing Nootropic Herbal Plant for Overcoming Imatinib Resistance in Chronic Myelogenous Leukemia

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The advent of imatinib mesylate as a tyrosine kinase inhibitor marked a paradigm shift in the treatment of chronic myelogenous leukemia (CML). However, the emergence of resistance mechanisms has necessitated the exploration of alternative therapeutic strategies. *Bacopa monnieri*, a nootropic herb with a rich ethnopharmacological history, has garnered attention for its putative anti-neoplastic properties. To evaluate the anti-cancer efficacy of *Bacopa monnieri* methanolic extract (BMME) against imatinib-resistant K562 (K562-R) CML cells, elucidate its molecular mechanisms, and assess its safety profile. Cell viability was assessed using MTT and trypan blue assays. Apoptosis was detected through DNA fragmentation analysis, DAPI staining, and flow cytometry. Mechanistic studies included Z-VAD-FMK caspase inhibition, western blot analysis, and Reactive Oxygen Species (ROS) involvement assessment using N-acetyl cysteine (NAC). BMME's effect on human peripheral blood mononuclear cells (hPBMCs) was examined for safety. BMME significantly reduced K562-R cell viability within 24 hours. Apoptosis was confirmed through multiple methods, with Z-VAD-FMK reversing BMME's effects, indicating caspase involvement. Western blot analysis revealed upregulation of cleaved PARP, Caspase-3, Caspase-9, and pro-apoptotic Bax, and downregulation of Bcl-2 and Survivin. ROS involvement was demonstrated by NAC-mediated reversal of BMME's cytotoxic effects. Importantly, BMME was non-toxic to hPBMCs, suggesting its safety profile. BMME exhibits potent anti-cancer efficacy against imatinib-resistant CML cells via caspase-dependent apoptosis and ROS generation, with no significant toxicity to normal cells. These findings support its potential as a safe adjunct therapy for overcoming imatinib resistance, warranting further in vivo and clinical research.

Keywords: *Bacopa monnieri*, Apoptosis, Cancer, CML, ROS, Imatinib Resistance

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A Review on Herbal Cream on Wound Healing Activity

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The research addresses the seriousness of wounds as a major medical concern by concentrating on wound healing with herbal skin lotions. An injury that compromises the skin's integrity is called a wound. This can result in infections, a protracted healing period, and in extreme situations, death. According to statistics, 2% of people worldwide suffer from chronic wounds, which places a significant financial strain on healthcare systems. Wound infections can raise mortality rates, particularly in people with weakened immune systems i.e. According to the National Library of Medicine, in diabetics it goes up to 45%, where 5–10% of deaths are attributable to infections. And Burns, diabetic ulcers, bed sores, and surgical and traumatic wounds are examples of acute wound types. Alternatives are required because, despite their effectiveness, synthetic wound therapies can cause adverse consequences such allergic responses, delayed healing, and antibiotic resistance. Herbal remedies are becoming more popular. The study focuses on the formulation and application of herbal skin creams for wound healing.

Keywords: Herbal Cream, Diabetic Ulcers, Bed Sores, Traumatic Wounds

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Palbociclib: Efficacy, Applications, and Future Directions in HR+/HER2− Breast Cancer Management

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Breast cancer, one of the most prevalent cancers among women, affects about 1 in 8 women in the U.S., with hormone receptor-positive (HR+) and human epidermal growth factor receptor 2-negative (HER2−) subtypes posing significant challenges, particularly in advanced stages. Palbociclib (Ibrance, C24H29N7O2), a highly selective, reversible CDK4/6 inhibitor, has revolutionized treatment for HR+/HER2− advanced or metastatic breast cancer. Often combined with aromatase inhibitors like Letrozole and Anastrozole, it significantly enhances efficacy and improves progression-free survival rates. Developed by Pfizer in 2001, Palbociclib has demonstrated strong efficacy in clinical trials, representing a major breakthrough in oncology. Palbociclib works by inhibiting cell cycle progression, thus limiting tumor growth. Current research explores its combination with other agents such as Fulvestrant and novel targeted therapies to combat treatment resistance and refine treatment strategies across different stages of breast cancer. Its potential application in early-stage breast cancer and other cancers is also under active investigation. Recent studies on Palbociclib have emphasized its efficacy with Letrozole, Fulvestrant, and other aromatase inhibitors for advanced HR+ breast cancer. Additional research in Japan has explored real-world treatment patterns, neutropenia management, and ways to enhance therapeutic outcomes. The growing body of work on Palbociclib highlights its versatile applications, evolving role in personalized medicine, and potential to address significant unmet needs in oncology. Researchers are also assessing Palbociclib's formulation and degradation behaviour in various environments to optimize drug stability and effectiveness. This abstract reflects a systematic review of Palbociclib's broad-spectrum applications and significance.

Keywords: Palbociclib, Breast Cancer, HR+, CDK4/6 Inhibitor, Personalized Medicine

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Harnessing the Antioxidant Potential of Fenugreek Seeds: A Natural Shield against Oxidative Stress

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Oxidative stress, resulting from an imbalance between reactive oxygen species (ROS) and the body's antioxidant defense, is a major contributor to the development of chronic diseases such as cardiovascular disorders, cancer, and neurodegenerative conditions. The growing interest in natural antioxidants has highlighted fenugreek seeds (*Trigonella foenum-graecum*) as a promising source of bioactive compounds with antioxidant potential. This study explores the antioxidant properties of fenugreek seed extracts and their relevance in promoting health and preventing oxidative damage. Fenugreek seeds are rich in polyphenols, flavonoids, alkaloids, and saponins, which scavenge free radicals, inhibit lipid peroxidation, and reduce oxidative stress. Recent study suggested that fenugreek extracts show significant antioxidant activity through various in vitro assays, such as DPPH, ABTS, and ferric reducing antioxidant power (FRAP). These compounds also enhance endogenous antioxidant enzymes, including superoxide dismutase (SOD) and catalase, further supporting cellular defense mechanisms. In addition to their antioxidant properties, fenugreek seeds exhibit anti-inflammatory effects, contributing to their therapeutic value in preventing chronic diseases linked to oxidative stress. Potential applications include cardiovascular protection, neuro-protection, anti-aging treatments, and skin care formulations. However, variability in extraction methods, dosage, and bioavailability needs further exploration to optimize their use. In conclusion, fenugreek seed extracts represent a potent natural antioxidant, offering a sustainable approach to combating oxidative stress. With increasing focus on herbal antioxidants, fenugreek holds promise for enhancing health and preventing oxidative stress-related diseases.

Keywords: Oxidative Stress, Fenugreek Seeds, Anti-Inflammatory Effects, Polyphenols

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Polyphenols in the Diet and their Neuroprotective Effects: From Laboratory to Clinical Trials

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The neuroprotective qualities of polyphenols, a broad class of naturally occurring substances present in fruits, vegetables, tea, and wine, have drawn more and more attention. The strong antioxidant, anti-inflammatory, and anti-apoptotic properties of these bioactive substances which include flavonoids, phenolic acids, and stilbenes are essential for shielding neurons from oxidative stress and neuroinflammation, two major causes of neurodegenerative illnesses like Parkinson's and Alzheimer's. This study investigates the neuroprotective properties of dietary polyphenols, emphasizing how they can alter important physiological processes such protein aggregation, neural plasticity, and mitochondrial function. Polyphenols such as resveratrol, curcumin, and epigallocatechin gallate (EGCG) have been shown in preclinical research to improve cognitive performance, prevent amyloid plaque development, and protect against neuronal damage. This study examines how these discoveries have been translated into clinical studies, where polyphenols are being assessed for their capacity to postpone the development or course of neurodegenerative illnesses. Clinical results are still inconsistent despite encouraging laboratory findings because of variables including dose and bioavailability. The most recent developments in polyphenol research are highlighted in this poster, along with the difficulties and potential paths forward in turning these substances into potent neuroprotective treatments.

Keywords: Polyphenols, Fruits, Vegetables, Neuroinflammation, Epigallocatechin Gallate

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Therapeutic Potential of Marine-Derived Compounds for Neuroprotection: A New Frontier

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A promising area for neuroprotection is presented by the abundance of bioactive chemicals with a variety of pharmacological characteristics found in marine environments. Polyunsaturated fatty acids, alkaloids, peptides, and secondary metabolites from algae, sponges, and marine microorganisms are examples of chemicals obtained from the ocean that have demonstrated great promise in preventing neurological illnesses like Parkinson's and Alzheimer's. This examines the neuroprotective properties of important chemicals obtained from marine sources, emphasizing various modes of action, including neurotrophic, antioxidant, and anti-inflammatory properties. By improving synaptic plasticity and lowering neuroinflammation, omega-3 fatty acids found in fish oil, for example, are known to support neuronal health. Similar to this, substances such as marine algae's brominated furanones have neuroprotective properties through modifying signaling pathways essential for neuronal survival. Extracts from marine sources have been shown in recent preclinical research to enhance cognitive performance, lessen protein aggregation, and decrease oxidative stress. To successfully convert these results into clinical applications, however, issues with dose and bioavailability must be resolved. This paper addresses current research initiatives targeted at creating innovative treatments that take advantage of marine biodiversity to fight neurodegenerative illnesses and emphasizes the potential of chemicals obtained from marine environments as neuroprotective agents.

Keywords: Marine-Derived Compounds, Neuroprotection, Neuroinflammation, Omega-3 Fatty Acids, Fish Oil

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Induction of Apoptosis by *Rivina humilis* Extracts in Breast Cancer Cells

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Rivina humilis, a flowering shrub native to Asia, has a long history in traditional medicine. While its medicinal properties have been utilized for centuries, scientific research on its potential therapeutic applications remains limited. This study aimed to investigate the bioactivity of *Rivina humilis* plant extracts as potential anti-cancer agents against breast cancer cell lines. Acetone, methanol, n-hexane, and chloroform extracts of *Rivina humilis* were prepared. Their cytotoxic effects were evaluated on breast cancer cell lines (MCF7 & MDAMB-231) and healthy human cells (normal epithelial cells) using MTT and Trypan blue dye exclusion assays. DAPI staining was performed to confirm apoptosis. Western blot analysis was conducted to examine the modulation of key proteins involved in the apoptotic pathway. The acetone and methanol extracts demonstrated strong cytotoxic effects on breast cancer cells while showing no cytotoxicity towards normal cells, whereas n-hexane and chloroform extracts showed no effect on the cancer cell lines. Western blot analysis revealed upregulation of cleaved PARP and cleaved caspase 3, indicating activation of the apoptotic pathway. This study highlights the potential of *Rivina humilis* extracts, particularly acetone and methanol, as promising anti-cancer agents specific to breast cancer cells. The findings warrant further investigation into the active biocomponents and underlying mechanisms of action. This research opens avenues for the development of novel anti-cancer therapies derived from *Rivina humilis*.

Keywords: *Rivina humilis*, Breast Cancer, Apoptosis, Anti-Cancer

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Anti-Inflammatory and Anti-Osteoporotic Activity of *Mikania micrantha* leaves

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Osteoporosis is one of the major public health problems worldwide which is characterized by increased bone fragility, low bone mass, deterioration of bone tissue, and disruption of bone microarchitecture, which can lead to an increase in the risk of fractures. Natural products like various plants play a crucial role in osteoporotic and anti-inflammatory management by providing bioactive compounds that can treat against the anti-inflammatory condition and offer antioxidant protection. *Mikania micrantha* is a fast-growing tropical weed which not only causes a significant reduction in the growth and productivity of several crops but on the other hand it has several important therapeutic activities. The present study mainly focused on evaluation of anti-inflammatory and anti-osteoporotic activity of *Mikania micrantha* leaves collected in the winter seasons. *Mikania micrantha* leaves were collected in the winter season and authenticated, and hydroalcoholic extracts were prepared using maceration. Phytochemical analysis, anti-inflammatory and anti-oxidant were performed. Assessment of anti-osteoporotic activity of *Mikania micrantha* extract is done using iron stress induced zebrafish model by high concentration of Ferric ammonium citrate (FAC). Recent experiment assessed *Mikania micrantha* leaves, finding higher anthocyanin, flavonoid, and phenolic content in the winter hydroalcoholic extract compared to summer. The extract exhibited more robust antioxidant and anti-inflammatory properties during winter. The hydro-alcoholic extracts of *Mikania micrantha* leaves showed significant anti-osteoporotic activity by observing and comparing skeletal character of FAC induced zebra fishes and extract induced zebra fishes using alizarin red stain. This study explores the potential benefits of *Mikania micrantha* leaves in managing osteoporosis, emphasizing its seasonal variation in phytoconstituents and potent anti-inflammatory effects during winter.

Keywords: *Mikania micrantha,* Osteoporosis, Ferric Ammonium Citrate, Alizarin Red

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Phytochemicals as Emerging Neuroprotective Agents: A Focus on Flavonoids

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Promising neuroprotective agents are flavonoids, a type of polyphenolic compounds present in fruits, vegetables, and drinks like wine and tea. Since they have strong anti-inflammatory, anti-apoptotic, and antioxidant qualities, they can be used to fight the mechanisms behind neurological illnesses including Parkinson's and Alzheimer's. Flavonoids like quercetin, kaempferol, and epigallocatechin gallate (EGCG) are examined in this study for their neuroprotective properties. Specifically, their capacity to lessen oxidative stress, lower neuroinflammation, and stop misfolded protein aggregation is examined. Additionally, flavonoids enhance synaptic plasticity and boost mitochondrial activity, both of which are essential for preserving brain health. According to preclinical research, flavonoids can prevent tau hyperphosphorylation, lessen the buildup of amyloid-β plaque, and prevent dopaminergic neurons from degenerating. These outcomes imply that flavonoids may postpone or stop the development of neurodegenerative diseases. Preclinical results are promising, but for clinical translation to be effective, issues including low bioavailability and the requirement for ideal dosage must be resolved.

Keywords: Flavonoids, Antioxidant, Anti-Inflammatory, Alzheimer’s, Parkinson’s

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Chronopharmacological Evaluation of The Hypoglycemic Effect of Metformin Formulation Influences Hepatic Clock Regulation

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Research indicates that gastrointestinal motility can be influenced by the time of day, potentially affecting drug absorption. For instance, if metformin is taken when gastrointestinal motility is slower, absorption might be delayed or reduced. Elevated melatonin levels at night might slow down gastrointestinal transit time. This could affect the rate and extent of metformin absorption if the drug is taken during periods of high melatonin secretion.To determine the impact of metformin on the circadian rhythm of diabetic mice, we investigated the metformin microsphere in this study. In an animal model that Streptozotocin produced, its melatonin administration altered the hepatic circadian rhythm. Lipid and lipoprotein profiles in serum hepatic function test in serum testing were used to evaluate each treatment. Lipid and lipoprotein profiles in serum were used to evaluate each treatment.Metformin microspheres demonstrated noteworthy outcomes in *in vitro* and an *in vivo* and clarified how the metformin microspheres might be used to provide a novel therapeutic approach against liver circadian disturbance.Blood samples were collected under fasting at the end of 21 days. After testing different parameters, all inter-group variation values were measured by one-way variance analysis (ANOVA) followed by Tukey's post hoc test. *=P<0.05, as compared to groups. In the trial, melatonin caused a delay in the progression of diabetes.

Keywords: Melatonin, Chronopharmacology, Hepatic Circadian, Microspheres, Lipid Profile

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Impact of Green Coffee Extract on *Escherichia coli* and Its Resistance

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Antimicrobial resistance (AMR) poses a critical global health threat, making infections harder to treat, increasing illness duration, healthcare costs, and mortality rates. The rise of antibiotic-resistant bacterial pathogens has driven researchers to explore alternative treatments, including plant-based compounds with potential antibacterial activity. Plants have long been used for their medicinal properties, and recent studies have identified several with antimicrobial effects, including green coffee beans. Present study investigated the anti-inflammatory, antioxidant and antibacterial activity of green coffee bean aqueous extract against *Escherichia coli* (E. coli) and its AMR strains, with extended-spectrum β-lactamase (ESBL) encoding genes, such as *blaSHV*, and *blaCTX-M*. Aqueous extracts of GCB exhibited significant antioxidant and antimicrobial effects in a dose-dependent manner, and anti-inflammatory effect comparable to the standard Diclofenac Sodium. In this study, disc diffusion assays demonstrated that green coffee extract (GCE) exhibited promising antibacterial activity against normal *E. coli* strains, with a minimum inhibitory concentration (MIC) of 3.13 mg/ml. However, its effect on antibiotic-resistant *E. coli* strains was not profound. By comparison, the standard antibiotic Ceftriaxone showed an MIC of 25 µg/ml for normal *E. coli* but had reduced efficacy against resistant strains. These findings suggest that while GCB shows potential as an antimicrobial agent against gram-negative *E. coli*, its effects may be attributed to its significant antioxidant and anti-inflammatory properties, but it lacks efficacy against resistant strains. Further research is required to enhance its effectiveness against resistant pathogens.

Keywords: Antimicrobial Resistance, Green Coffee Bean, Anti-Inflammatory, Antioxidant, *Escherichia coli*

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Combination Therapy Targeting Lipid and Bile Acid Metabolism in the Treatment of Non-Alcoholic Steatohepatitis (NASH)

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The progressive liver illness known as non-alcoholic steatohepatitis (NASH) is defined by fibrosis, hepatocellular damage, and inflammation; it is frequently linked to metabolic dysfunction. New therapy approaches concentrate on treating several pathogenic pathways at once. The combined effect of two pharmaceutical drugs that target different pathways linked to NASH is examined in this review. The first substance is a selective agonist that reduces hepatic fat content, improves lipid profiles, and reduces liver inflammation by modulating a particular hormone target involved in lipid metabolism. Another substance, is naturally occurring bile acid, has anti-inflammatory and cytoprotective properties, protects hepatocytes, and improves bile flow. Their complementing mechanisms of action—one focusing on cholesterol regulation, the other on enhancing bile acid metabolism and lowering liver stress—provide justification for this combination therapy. Compared to monotherapy, preclinical as well as early clinical research indicates that this combination strategy may provide synergistic advantages, such as better liver function indices, reduced fibrosis, and greater hepatic fat reduction. In addition to improving the safety profile, the combination may have the ability to slow down the progression of liver damage. Despite the encouraging results, more extensive clinical trials are required to verify the combination's safety and effectiveness in a range of patient demographics. The review also emphasizes the best dosing practices, the pharmacokinetic relationships between the medications, and the possibility of long-term advantages in halting the course of NASH patients' diseases. The results encourage further research into multi-targeted treatments as a means of addressing the intricate pathophysiology of NASH.

Keywords: Non-Alcoholic Steatohepatitis (NASH), Combination Therapy, Lipid Metabolism, Bile Acid Metabolism, Liver Fibrosis

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Natural Plant Extract in Wound Healing

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The application of natural plant extracts in wound healing has garnered significant attention due to their potent bioactive compounds and minimal side effects. Plant-derived substances such as flavonoids, tannins, saponins, and alkaloids demonstrate antimicrobial, anti-inflammatory, and antioxidant properties, all of which play essential roles in promoting wound repair and reducing infection. This review examines the efficacy of plant extracts as a viable alternative or adjunct to conventional wound treatments, focusing on the stages of wound healing—hemostasis, inflammation, proliferation, and remodeling. Research indicates that specific plant extracts, including aloe vera, curcumin, and *Centella asiatica*, enhance collagen synthesis, stimulate cellular regeneration, and expedite the wound-healing process. The antimicrobial properties of certain plant extracts also help reduce the risk of infection, thereby creating an optimal environment for wound healing. Moreover, these extracts have been found to inhibit excessive inflammation, which can delay healing, while promoting the formation of new tissue. Despite promising outcomes, the clinical use of plant extracts faces challenges such as standardizing dosages and isolating active components to ensure consistent therapeutic effects. This review will provide a comprehensive overview of recent advances in plant-based wound healing agents, highlighting key studies, mechanisms of action, and potential applications in clinical settings. Future research directions will emphasize the development of more effective formulations integrating plant-based therapies into modern wound management.

Keywords: Plant Extracts, Wound Healing, Bioactive Compounds, Antimicrobial Properties, Tissue Regeneration

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Herbal Antimalarial Agents: An Overview

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Malaria is a widespread infectious disease, particularly prevalent in tropical regions. For much of history, treatments for malaria relied heavily on natural plant-based remedies. These traditional treatments were largely replaced by synthetic antimalarial drugs. In recent years, alongside conventional methods, growing interest is observed in developing traditional herbal remedies as potential treatments for malaria due to its least side-effects. Drawing from recent literature, data have been gathered on several aspects related to malaria treatment, including the use of medicinal plants, assessment methods for antimalarial activity in plant extracts, and the mechanisms by which natural antimalarial agents act. These remedies may offer an affordable option for individuals unable to access the medications needed to combat chloroquine-resistant *Plasmodium falciparum* infections. In their article, *Mojab et al.*, discuss several plants traditionally used to treat malaria. Notably, species of Cinchona are well-known for their antimalarial effects, largely due to the alkaloid quinine, which remains a recognized antimalarial drug. Quinidine, a lesser-known stereoisomer of quinine, may be equally effective or even more potent. Traditional Chinese medicine also employs *Artemisia annua*, with its active component artemisinin, which has recently gained significant attention for its antimalarial properties. Additionally, *Dichroea febrifuga* (from the Saxifragaceae family) has been used in Chinese medicine, where its active compound, febrifugine, has shown clinical efficacy against *P. vivax* and *P. ovale* infections. The urgent need for new malaria treatments has highlighted the value of exploring medicinal plants. This review explores several plant species that have regained importance for treating malaria and discusses various testing methods available to assess the antimalarial potential of plant extracts.

Keywords: Antimalarial Plants, Malaria, Natural Products, *Plasmodium falciparum,* Cinchona

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Preliminary Analysis of the Effect of Stevia (*Stevia rebaudiana*) in Patients with Chronic Kidney Disease (Stage I to Stage III)

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Stevia rebaudiana, commonly used as a natural sweetener, has shown promise in managing various chronic conditions such as diabetes and hypertension. This prospective, randomized, single-blind, placebo-controlled clinical trial explored the effects of Stevia on patients with chronic kidney disease (CKD) at stages I to III. Ninety-seven participants were enrolled and divided into three groups: those receiving Stevia (STV group), those on a placebo (PLC group), and a healthy control group (CL). Participants were administered Stevia capsules (250 mg) or placebo twice daily for three months, in conjunction with standard antihypertensive and anti-diabetic medications such as Angiotensin-II Receptor Blockers (ARBs) and Calcium Channel Blockers (CCBs). Clinical assessments, including blood and urine tests, were conducted at baseline and after three months. Results demonstrated a significant reduction in serum creatinine ($p < 0.027$), uric acid ($p < 0.009$), fasting blood sugar ($p < 0.041$), postprandial blood sugar ($p < 0.013$), and microalbumin levels ($p < 0.041$) in the Stevia group compared to the placebo group. The study confirmed that CKD was closely associated with hypertension and diabetes, with 52.3% of the Stevia group in CKD stage II. These findings indicate that Stevia supplementation can potentially improve vital biochemical markers in CKD patients, supporting its beneficial role in managing CKD when used alongside conventional treatments. However, further research over an extended period is required to confirm these preliminary results. This study provides a foundation for the therapeutic use of Stevia in CKD patients, offering a potential adjunct treatment that could enhance kidney function and metabolic control in affected individuals.

Keywords: *Stevia rebaudiana*, Chronic Kidney Disease, Hypertension, Serum Creatinine, Diabetes

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Exploring the Antimicrobial Properties of Fenugreek: A Promising Alternative to Conventional Antibiotics

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The rise of antibiotic resistance has intensified the search for natural alternatives to conventional antimicrobial agents. Fenugreek (*Trigonella foenum-graecum*), a well-known medicinal herb, has gained attention for its diverse pharmacological properties, including antibacterial potential. This study explores the antimicrobial properties of fenugreek seed extracts, emphasizing their potential as an alternative to synthetic antibiotics. Fenugreek seeds contain bioactive compounds such as alkaloids, flavonoids, saponins, and polyphenols, which contribute to their antibacterial activity. Recent studies show that these compounds can disrupt bacterial membranes, inhibit biofilm formation, and interfere with protein synthesis, effectively combating both Gram-positive and Gram-negative bacteria. Additionally, fenugreek extract has shown potential against multidrug-resistant bacterial strains, making it a valuable candidate in the fight against antibiotic resistance. Aside from its antibacterial activity, fenugreek possesses antioxidant and anti-inflammatory properties, which further support its role in infection management and wound healing. However, the variability in extraction methods, concentration, and bacterial susceptibility necessitates further research to establish standardized protocols and dosages. In conclusion, fenugreek seed extract offers a promising, natural alternative to conventional antibiotics. With growing interest in herbal remedies, fenugreek could play a significant role in sustainable infection management, particularly as a complementary therapy to tackle antibiotic resistance.

Keywords: Antibacterial Activity, Antimicrobial Agents, Infection Management, Fenugreek Seeds

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Exploring the Therapeutic Potential of a Phenothiazine Derivative for Anti- Inflammatory and Anti-Arthritic Treatment: A Preclinical Research Investigation

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Rheumatoid Arthritis (RA) is an autoimmune chronic inflammatory disease resulting in joint discomfort, pain, swelling, and cartilage damage. According to WHO estimates, the number of RA in both men and women is about 18 million worldwide. The effective treatment of RA remains partially elusive, despite advancements in medical sciences and the invention of several drugs. There is a need for more secure, and more potent reasserts of drugs to treat RA effectively. The present investigation aims to repurpose the antipsychotic drug flupentixol (phenothiazine derivative) for the treatment of RA. Flupentixol is primarily used for the treatment of schizophrenia and other psychotic disorders. Emerging evidence reports that flupentixol possesses anti-inflammatory and anti-cancer activity which could be beneficial for RA. Recent study assessed the efficacy of flupentixol in reducing inflammatory markers and joint swelling, alongside its impact on pain perception and functional mobility utilizing a preclinical model [collagen-induced arthritic Wistar rat (*Rattus norvegicus*)]. Furthermore, *in vivo* assessments of body weight, paw diameter, and volume, determination of arthritic score, and spleen index, NO test, ESR, X-ray, and bone tissue histopathology. Arthritic score and histopathology showed significant improvements in cartilage destruction, also pain relief and mobility in treated subjects compared to standards. These results justify further exploration of flupentixol as a potential adjunct therapy in the management of inflammatory and arthritic conditions, with implications for improving patient outcomes and expanding the therapeutic repertoire for rheumatic diseases.

Keywords: Rheumatoid Arthritis, Phenothiazine Derivative, Repurposing of Drug, Histopathology, Arthritic Score

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Phytochemical Profiling and Bioactive Potential of *Trichosanthes trilobatum* (L.) Schott: A Promising Source for Antioxidant and Antimicrobial Agents

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The present study investigates the phytochemical profile and bioactive potential of *Trichosanthes trilobatum* (L.) Schott, aiming to identify lead scaffolds with promising biological activities. Methanolic extracts of *T. trilobatum* leaves were analyzed using Thin Layer Chromatography (TLC) and High-Performance Thin Layer Chromatography (HPTLC), alongside Gas Chromatography-Mass Spectrometry (GC-MS) for volatile component identification. Phytochemical screening confirmed the presence of chlorogenic acid, caffeic acid, and kaempferol. GC-MS analysis revealed 55 distinct phyto-constituents. The extract's antioxidant properties were evaluated through DPPH Radical Scavenging and Hydrogen Peroxide Scavenging assays, with IC_{50} values supporting notable radical-scavenging potential. Total phenolic and flavonoid content were also quantified. Additionally, the extract displayed significant antimicrobial activity, with pronounced effects on gram-positive *Bacillus subtilis* compared to gram-negative *Escherichia coli*. This study highlights *T. trilobatum*'s phytochemical and therapeutic relevance, advocating for further studies focused on isolating lead compounds and exploring in vivo efficacy. These findings underscore the plant's potential for diverse phytotherapeutic applications.

Keywords: *T. trilobatum* (L.) Schott, Phytochemical Screening, GCMS, Antioxidant, Antimicrobial

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Nanomedicine: A Promising Pathway for the Diagnosis & Treatment of Cancer

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Regarding mortality and the lack of appropriate treatment, the most dangerous illness in the world is thought to be cancer. By offering creative alternatives to traditional medications, cancer treatment is being revolutionized by nanomedicine. Nanomedicine enables lower doses and results in fewer side effects due to precise targeting, while anticancer drugs require higher doses and lead to more widespread toxicity and side effects due to non-specific drug distribution. By functionalizing nanoparticles, which are made to precisely carry anticancer drugs, to target particular tumor cells or tissues, chemotherapy side effects can be minimized and therapeutic efficacy increased. Cancer cells are targeted by nanoparticles through both active and passive processes. DOXIL was the first FDA-approved nanomedicine to hit the market in 1995. Although scaling up from a laboratory setup to a clinical arrangement presents many problems, nanomedicine is one of the most promising medical innovations of the contemporary era. Additionally essential for imaging and diagnostics, nanoparticles allow for real-time tracking of treatment results and early cancer detection. They can be used as contrast agents in imaging examinations such as PET, CT, and MRI studies. The development and present state of cancer treatment are emphasized in this study, along with the present difficulties and potential prospects for the clinical application of cancer nanomedicines.

Keywords: Nanomedicine, Challenges, Cancer, Chemotherapy, Contrast agents

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Ginger in Blood Clot Management: A Natural Path to Healthier Circulation

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Blood coagulation disorders, including thrombosis and excessive clot formation, pose significant health risks, such as stroke and cardiovascular diseases. While conventional anticoagulants like aspirin and warfarin are widely used, they can present side effects such as bleeding complications, prompting a growing interest in herbal alternatives. *Zingiber officinale*, a widely used medicinal plant, has gained attention for its anticoagulant and antiplatelet properties. This review explores the potential of ginger as a natural remedy for managing blood clotting disorders and promoting healthier circulation. The active components in ginger, including gingerols, shogaols, and paradols, have demonstrated the ability to inhibit platelet aggregation, modulate thromboxane production, and improve blood flow. These mechanisms make ginger a promising agent in preventing clot formation without the severe side effects associated with conventional drugs. Additionally, its antioxidant and anti-inflammatory properties contribute to cardiovascular health by reducing oxidative stress and inflammation, two key factors involved in clot formation. Moreover, combining ginger with conventional anticoagulants requires careful monitoring to avoid potential interactions that could increase the risk of bleeding. Ginger offers significant potential as a complementary therapy in managing blood coagulation disorders. However, further research is needed to establish its clinical efficacy, optimal dosage, and long-term safety. With increasing awareness of herbal therapies, ginger presents a natural, accessible path to healthier circulation and improved cardiovascular outcomes.

Keywords: Anticoagulant, Phytochemicals, Natural Anticoagulants, Prothrombin Time

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Multiplex Biosensing for the Detection of Epithelial Ovarian Cancer Biomarkers

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Epithelial ovarian cancer (EOC) is the predominant form of ovarian cancer, primarily affecting older women with a mean age of 63 years, particularly those with a familial history of ovarian, breast, or colorectal cancer, as well as individuals who are obese and on hormone therapy. The incidence of this disease differs by region; Europe reports 65,000 cases annually, whilst Asia has a range of 4 to 10 cases per 100,000 individuals. Epithelial ovarian carcinoma originates from the epithelial cells that line the outer surface of the ovaries and disseminates aggressively throughout the pelvis and abdomen before the onset of visible symptoms. The five-year survival rate for ovarian cancer is approximately 50.8%. The elevated mortality rate necessitates the early identification of biomarkers for epithelial carcinoma detection. The sanctioned biomarkers for the identification of epithelial ovarian cancer (EOC) comprise CA125 (Cancer Antigen 125), HE4 (Human Epididymis Secretory Protein 4), and OPN (Osteopontin). Biosensors are instruments employed to detect these biomarkers. Conventional biosensors exhibit limitations in achieving sensitive detection. Optical biosensors provide multiplexed detection and particularly identify and attach to target biomarkers. They are label-free and provide real-time detection of biomolecules. This project intends to investigate advanced diagnostic multiplex EOC biomarkers using immunoassay techniques, specifically focusing on Luminex technology, which incorporates advanced optics and digital signaling processes utilizing fluorescent detection and Proximity Extension Assay (PEA) technology for protein detection, functioning as both a biomarker and confirmatory assay.

Keywords: Epithelial Ovarian Cancer, Optical Biosensors, Luminex Technology, Proximity Extension Assay

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Targeting Mitochondrial Dysfunction for Neuroprotection In Neurodegenerative Diseases

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Neurodegenerative illnesses like Alzheimer's, Parkinson's, and amyotrophic lateral sclerosis (ALS) are characterized by mitochondrial dysfunction, where oxidative stress, disturbed calcium homeostasis, and decreased energy generation all lead to neuronal death. Given their critical role in preserving brain function, mitochondria are important targets for neuroprotective therapy. The current strategies for addressing mitochondrial dysfunction in dementia are reviewed in this poster. Pharmacological medicines such as coenzyme Q10 and natural substances like curcumin and resveratrol are examples of strategies that improve mitochondrial biogenesis, lower oxidative damage, and stabilize mitochondrial membranes. Furthermore, controlling the fusion, fission, and mitophagy of mitochondria appears to be a promising intervention. Mitochondrial fragmentation and ineffective removal of damaged mitochondria are connected to dysregulation of these processes, which speeds up brain damage. Restoring mitochondrial health presents a viable neuroprotective tactic that may be able to halt or decrease the progression of illness. By emphasizing processes such as improved mitophagy and oxidative stress reduction, we offer an integrated strategy for preserving mitochondrial function in neurons. This study offers insights into new therapy options for neurodegenerative illnesses by highlighting current developments in mitochondrial-targeted therapeutics.

Keywords: Mitochondrial Dysfunction, Alzheimer’s, Parkinson’s, Amyotrophic Lateral Sclerosis, Neuroprotection

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In Vitro Antioxidant Activity of Ethnomedicinal Plant *Spermacoce alata* Aubl.

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Spermacoce alata Abul. in the family Rubiaceae are herbs or low shrubs widespread in tropical and subtropical regions around the world. The inflorescence is terminal or axillary, capitate or glomerulate, and many-flowered. Corolla is a funnel form with a white color. Fruits are capsular in shape. The plant is traditionally used to treat malaria, fever, headache, and respiratory infections. Studies demonstrated that the main chemical compounds of these plants are flavonoids, alkaloids, phenols, and terpenoids. In this study, antioxidants are compounds that can prevent, delay, or reverse oxidation reactions by donating electrons to free radicals, thereby preventing cell dysfunction caused by free radicals. They are commonly used to prevent the oxidation of lipids and proteins and have been shown to play an essential role in preventing and controlling many diseases in the body, such as diabetes mellitus, neurodegenerative diseases, inflammation, and cancer, by mitigating the adverse effects of oxidative stress. Furthermore, the antioxidant capacity was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical-scavenging ability, 2,2′-azino-bis (3-ethylbenzothiazoline-6-sulfonic acid) ($ABTS^{\bullet+}$) radical-scavenging ability, and ferric reducing antioxidant power (FRAP) assay for total antioxidant capacity. The results suggest that *S. alata* has the potential to treat diseases and is also worthy of more research and study.

Keywords: *Spermacoce alata*, Antioxidants, Reverse Oxidation, Neurodegenerative Diseases

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Wound Healing Activity of Ethanolic Extract of *Benincasa hispida* Assessed through an Incision Wound Model in Rats

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The skin functions as a crucial barrier vital for survival, regulating body temperature, maintaining nutritional balance, and enabling interactions with the environment. It shields the body from harm and facilitates the healing of wounds. Historically, wound care has relied on indigenous resources, including plants and animals, alongside traditional practices. In areas such as Asia, Africa, the Middle East, and Latin America, traditional medicine frequently utilizes natural remedies exclusively for managing wounds. This study explored the effectiveness of medicinal plants in treating skin wounds caused by the breakdown of the epidermal layer, which undergoes a complex healing process that includes inflammation, proliferation, and remodeling. An incision wound model in rats was employed to assess wound healing activity. After making standardized incisions, ointment formulations were applied daily, and wound strength was evaluated on the 10th day post-injury. Results revealed that ethanolic extracts of *Benincasa hispida* significantly surpassed the standard treatment (silver sulfadiazine), resulting in improved wound closure among the test subjects. *Benincasa hispida*, rich in various compounds such as flavonoids and vitamins, demonstrates promising wound healing properties. Although traditional remedies like sulfur are used with caution due to possible side effects, this study highlights the potential of natural plant extracts as effective alternatives for wound care. Future in vitro results will aid in evaluating the in vivo antimicrobial and cytotoxic effects of these extracts.

Keywords: *Benincasa hispida,* Wound Healing, Ethanolic, Incision, Antimicrobial

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Altered Gene Expression of Glutamate NMDA and AMPA Encoded Genes in Autistic Model's Treated with Polyherbal Formulation (Pathin)

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The purpose of this study was to analyze how a polyherbal formulation (Pathin) containing various neural protective compounds influences autistic-like behaviors induced by Valporate injection. The current study aims to look at the altered gene expression of glutamate receptor subunit encoded genes NMDA (N-methyl-D-aspartate) and AMPA (-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid). Behavioral analysis was performed on all experimental groups (three-chamber sociability test, open field analysis, elevated plus maze, and Y-maze test). The excitatory-inhibitory imbalance theory of autism and the crucial functions that GABA and glutamate play in the early development of neural circuits led us to uncover those genes. The altered mRNA expression of the gene encoding the (GRIN1, Grin2b, & GRIN2A) NMDA receptor subunit, and AMPA receptors subunit encoded the gene GRIN2A, & GRIA2 was assessed using RT-PCR to investigate the mechanism of the polyherbal formulation's neuroprotective effect. The excessive grooming, repetitive, and social interaction behavior in the VPA-treated group was significantly corrected by polyherbal formulation treated (Autistic group + polyherbal formula) animals compared with the autistic-treated rats. The results showed that there was a substantial increase in NMDA and AMPA mRNA expression in the autistic group compared to the saline-treated control group. However, the polyherbal formulation downregulates the gene level after postnatal treatment of polyherbal formulation. The present study concluded that polyherbal formulation could be a potential candidate for ameliorating ASD symptoms in rats, which acts by down-regulating NMDA and AMPA receptor expression.

Keywords: Autism Spectrum Disorder, PHF, Behavior Analysis, AMPA, NMDA

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Exploring the Wound Healing Potential of *Benincasa hispida* (Thunb.) Cogn. Leaves: A Natural Remedy for Enhanced Recovery

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Wound healing is a multifaceted process involving critical stages such as hemostasis, inflammation, and tissue remodeling, all influenced by factors like blood circulation and immune response. Effective wound care aims to enhance these processes to promote healing and minimize complications. This study investigates the wound healing potential of *Benincasa hispida* leaves, a plant known in traditional Indian medicine for its anti-inflammatory and analgesic properties. In the study, burns were induced on the dorsal skin of rats, which were then treated with an extract of *B. hispida*. Wound closure was monitored over time and showed promising results when compared to standard treatments. The dorsal skin was mechanically shaved 24 hours prior to burn induction and disinfected with 70% ethanol. Chemical burns were created by applying concentrated hydrochloric acid, while thermal burns were inflicted using heated metal rods. Following anesthesia, wounds were dressed with sterile gauze, and the animals were housed individually. Treatments were administered daily post-burn, and wound closure was assessed on days 0, 6, 12, and 18 using transparent paper and a permanent marker. The rich traditional knowledge of Indian tribal communities regarding local plants' medicinal properties contributes significantly to both traditional and modern medicine. This study highlights the efficacy of *Benincasa hispida* extracts in promoting wound healing, demonstrating superior wound closure rates compared to standard antibacterial treatments, which may carry mild side effects. The findings support the potential therapeutic benefits of this plant in wound care.

Keyword: *Benincasa hispida,* Wound Healing, Ethanolic, Burn, Hydrochloric Acid

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Exploring *Cinnamomum zeylanicum* Phytochemicals for Mild Blood Clot Treatment

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Cinnamon *(Cinnamomum cassia*) is derived from the Lauraceae family, is extensively used in traditional medicine for its cardiovascular benefits, especially for supporting circulation and offering mild anticoagulant effects. Recent studies attribute these properties to the bioactive compounds present in cinnamon bark and leaf, including cinnamaldehyde, cinnamic acid, polyphenols, eugenol, and coumarin. Coumarin, found abundantly in cassia cinnamon, plays a key role in inhibiting platelet aggregation, a critical factor in blood clot formation. Recent studies show that these compounds display greater inhibitory effects on arachidonic acid (AA)-induced platelet aggregation than acetylsalicylic acid (ASA), a common antiplatelet drug, indicating cinnamon's potential as a natural alternative to help manage thrombotic risks. By reducing platelet aggregation, cinnamon may lower the risk of thrombotic events like heart attacks and strokes. Beyond its anticoagulant properties, cinnamon demonstrates broader therapeutic potential, including antioxidant and anti-inflammatory effects, which may benefit cardiovascular health and related conditions, such as diabetes and metabolic disorders. It provides evidence of cinnamon's capacity to reduce the risk of cardiovascular diseases, including myocardial infarction and cardiac hypertrophy, enhancing its potential use in preventive health strategies. This study aims to present a detailed overview of cinnamon's compounds and their impact on platelet function and cardiovascular health, highlighting cinnamon as a promising natural adjunct for reducing thrombotic risks.

Keywords: Mild Anticoagulant, Cinnamaldehyde, Eugenol, Arachidonic Acid, Coumarin

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Study of In-Vitro Anti-Oxidant and Anti-Diabetic Activity of *mikania micrantha* Leaf

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Mikania micrantha, a fast-growing tropical weed, has been recognized for its therapeutic properties in traditional medicine. It has been used to treat a variety of conditions, including skin itches, and rheumatism. Managing diabetes effectively while minimizing side effects is a significant challenge; conventional treatments include various drugs like biguanides, and thiazolidinediones are effective but can sometimes lead to adverse effects thus the reputation of the herbal remedies has increased due to its therapeutic value. The present study mainly focused on the evaluation of anti-oxidant and anti-diabetic activity of *Mikania micrantha* leaf. *Mikania micrantha* leaves were collected in the winter season, authenticated and hydroalcoholic extracts were prepared using maceration. During the winter season there is an accumulation of red colour pigment denoted the presence of anthocyanins, considered to be one of the potent antioxidants. Phytochemical analysis, flavonoid and phenolic content, anti-oxidant and anti-diabetic studies were performed. The Total Phenolic Content (TPC) of *Mikania micrantha* was significant as 111.98 mg/GAE g of extract. The *in-vitro* anti-oxidant study revealed that the *Mikania micrantha* leaf is potent having an IC_{50} value of 11.79 µg/ml by DPPH free radical scavenging action, the reducing power assay revealed the potent anti-oxidant activity in a dose dependent manner. Reactive Oxygen Species (ROS) that contribute to pathogenesis of many diseases such as diabetes might be ameliorated with this antioxidant efficacy of the extract. The *in-vitro* anti-diabetic study revealed the extract having a moderate effect through the α-amylase inhibitory activity with an IC_{50} value of 712.50 µg/ml. The present study data indicated that *Mikania micrantha* leaves have promising anti-oxidant and this can modulate the anti-diabetic activity with potent flavonoid and phenolic contents. Further research on detailed chemical profiling and its anti-diabetic effect may also contribute to the development of the natural product-based therapies with potential biomedical and environmental applications.

Keywords: *Mikania micrantha*, oxidative stress, antioxidant, diabetes

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Iron Stress Induced Zebrafish Model of Osteoporosis and Effect of Freshwater Snail *Bellamya bengalensis*

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The aquatic ecosystem has proven to be a valuable source of bioactive compounds with potential pharmaceutical applications. Molluscs, a diverse group of organisms, have been found to produce medicinally significant metabolites. Recent research has shed light on the potential role of molluscs in treating inflammatory disorders associated with conditions like arthritis, osteoporosis. While non-steroidal anti-inflammatory drugs (NSAIDs) are commonly prescribed for inflammation, they carry significant health risks. Therefore, finding safer alternatives for these disorders is a global research priority. *Bellamya bengalensis*, an edible mollusc, comprises high nutritive content. Their flesh extract was obtained using polar solvents, phosphate buffer saline (PBS), showed some characteristic peaks near 200 nm and 400 nm, correlated with the protein estimation and confirmation of rich protein compounds in the extract. An in-vitro study was conducted to assess the anti-oxidant properties of the extracts, and it was found that the extracts (PBS) of *B. bengalensis* exhibited the highest potency. The IC_{50} value was observed at 16.82 µg/ml, as it reacted with free radicals to convert them to more stable products and terminate the radical chain reaction. In-vivo model on zebrafish, the degenerative changes following alizarin red staining, induced by the ferric ammonium citrate (FAC) were markedly ameliorated with the extract treatment. *Bellamya bengalensis* holds potential as a source of nutraceutical supplementation and a therapeutic remedy for osteoporotic disorders. Further detailed study for the chemical composition of the extract and effect on other experimental animal models for osteoporosis is needed to confirm the mechanistic evidence.

Keywords: Mollusc, Zebra fish, Osteoporosis, Bone degeneration

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Probiotic ameliorate Rotenone induced oxidation and behavioral alteration in Parkinson's disease

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Gut microbiota and its derived metabolites affect brain physiology through several pathways. Dysfunction of gut-microbiota involved in pathogenesis of Parkinson's diseases (PD). Introduced pleiotropic effect of probiotic (PBT) in the function of the central nervous system, can delay the disease progression through the microbiota-gut-brain axis (MGBA). Parkinson's disease is a neurodegenerative disorder characterized by aggregated alpha-synuclein (α-syn), oxidative stress and neuroinflammation leading to depletion of dopaminergic neurons in the midbrain region. In this study we aimed to assess the potential neuroprotective effect of probiotic *Bacillus coagulans* (*B. coagulans*) against rotenone (ROT) induced PD rats. A pharmacological intervention of *B. coagulans* at doses of 2×10^9 CFU/mL for 28 days was found to attenuate the cognitive and motor changes in the ROT treated rat. Additionally, it also reduced oxidative stress in ROT induced rats. However, this therapy needs further investigation with in-depth mechanistic insights in the future for the treatment of PD.

Keywords: Gut Microbata, Probiotic, Parkinson's Disease, Microbiota-Gut-Brain Axis

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Phytoconstituent and Trace Element Analysis of Fenugreek Seeds for Its Antidiabetic Activity

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Spices, edible plant parts, consumed on a daily basis, have several ethnomedicinal health benefits. These health benefits are due to their phytoconstituents and trace elements. One of the important spices is *Trigonella foenum-graecum* seeds, commonly known as Fenugreek. Fenugreek shows potent activity in managing lifestyle-related disorders and shows an anti-diabetic effect. The current review aims to discuss the antidiabetic effect of fenugreek due to the activity of its phytoconstituents and trace elements. Literature review explores, besides traditional use, fenugreek has established significant antidiabetic effects on Streptozotocin-induced diabetic rat models. It contains several phytoconstituents like trigonelline, fenugreekine, and 4-hydroxyisoleucine that increase peripheral glucose resistance, thus promoting cellular glucose uptake and reducing blood glucose and glycosylated haemoglobin evels. Fenugreek is a rich source of chromium, which facilitates insulin binding to receptors on the cell surface and hence upregulates GLUT-4 receptor opening. Zinc content in fenugreek is also responsible for the antidiabetic activity by reducing glucagon synthesis, thereby reducing gluconeogenesis in the liver. Due to the presence of several bioactive molecules and trace elements like chromium and zinc, fenugreek seeds show significant blood glucose-lowering potential. Therefore, these seeds can be recommended to the diabetic and pre-diabetic population for regular intake to manage the blood glucose level. In the future, an antidiabetic herbal formulation can be prepared by fenugreek seed powder along with the derivative of its anti-diabetic constituents.

Keywords: Fenugreek, Anti-diabetic, Spices, Insulin resistance, Fenugreekine

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Neuroprotective Potential of Zonisamide in Haloperidol Model of Parkinson's Disease

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The defining characteristic of Parkinson's disease (PD) is the progressive degeneration of dopamine-producing neurones in the brain's substantia nigra pars compacta, resulting in movement-related disorders. Previous research suggests that MAO-B dopamine metabolism generates reactive oxygen species (ROS), which can lead to nigrostriatal degeneration. Zonisamide activates tyrosine hydroxylase and inhibits MAO-B, leading to an increase in dopamine levels and showing neuroprotective effect. The current study is to assess the effect of zonisamide on motor symptoms and enzymatic activity as influenced by haloperidol-induced PD in rat models. In the investigation of haloperidol's anti-parkinsonian action, 24 Wistar rats of both sexes were randomly allocated to one of 4 groups, with the 1st group receiving normal saline as a control and the 2nd group receiving haloperidol (1 mg/kg, i.p.). 3rd and 4th groups were given Levodopa (100 mg/kg, p.o.) and Zonisamide (50 mg/kg, p.o.) one hour prior to receiving haloperidol. All doses were given once a day for 21 days. Memory function was assessed using elevated plus maze, Y-maze, radial arm maze, catalepsy, and Rotarod tests. Following antioxidant status, SOD, MDA levels, enzyme levels (MAO-B enzyme, α-synuclein), and histopathology of the brain's hippocampal area were assessed. L. dopa and zonisamide mitigated haloperidol-induced cognitive impairment by enhancing spontaneous alternation, correct response rate, and transfer latency. Additionally, they enhance antioxidant status by elevating SOD levels, reducing MDA and enzymatic levels through MAO-B enzyme suppression, and lowering α-Syn concentrations. These actions counteract the histopathological changes induced by haloperidol in the hippocampus region, enhancing antioxidant defence mechanisms and diminishing α-Synuclein accumulation. Our findings indicate that zonisamide acts as a neuroprotective via modulating dopamine turnover, inhibiting oxidative stress, inhibiting neuroinflammation, and modulating synaptic transmission. This may also help to remove protein clumps from the brain and alleviate Parkinson's disease symptoms.

Keywords: Parkinson's Disease (PD), Zonisamide, Neuroprotection, Oxidative Stress Haloperidol-induced Model

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Evaluation of Adverse Drug Reactions in Cancer Therapy: A Cross-Sectional Study in a Tertiary Care Hospital in Kolkata

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Cancer is the most threatening disease, presenting a significant challenge in therapeutic development worldwide. Although numerous drugs are introduced to combat this condition, many of them are associated with a range of adverse complications for patients. Sometimes these complications become so severe that they cannot be ignored. These adverse effects of drugs thus need to be identified and detected, and preventive measures are to be adopted to reduce patient suffering. The present study aimed to identify adverse drug reactions (ADRs) in cancer patients to aid in the early detection and prevention of these complications. Data for this cross-sectional observational study was obtained from the oncology department of a tertiary care hospital in Kolkata and analyzed based on age, sex distribution, drugs responsible for adverse effects, and the symptoms of the adverse effects. The reports collected revealed a female predominance (70%). The mean age of the study subjects was about 45.3 years. Most of the patients (50%) were found to be suffering from breast carcinoma, justifying the female predominance in the study. Docetaxel was responsible for 18% of the ADR cases and the most common adverse effect was anemia (28.57%). Though the present study was conducted for a limited period and a limited number of patients, the implication of the study is essential for society. Early detection of these ADRs may help in minimizing the damage by either modifying the dose or changing the offending agent. This knowledge can also prevent the occurrence of such reactions in the future.

Keywords: Adverse Drug Reactions (ADRs), Anemia, Breast Carcinoma, Cancer Therapeutics, Docetaxel.

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The Role of Gut Microbiota in the Progression and Management of Cancer

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The human microbiota, comprising diverse microorganisms, plays a crucial role in health and disease, with a significant proportion of tumours believed to be induced by microbial factors. Gut microbiota has been implicated in the pathogenesis and progression of cancer. The microbiota influences physiological processes and its alteration can contribute to carcinogenesis and tumour progression. It is now known that the tumour microenvironment and commensal microbiota have a significant role in the initiation and development of cancer. The gut microbiome affects the efficacy of anticancer drugs, often causing resistance to chemotherapeutic drugs. The gut microbiome has been shown to modulate drug biotransformation, affecting the bioavailability, bioactivity, and toxicity of therapeutic agents. Inflammation and tumour microenvironment further promote chemo-resistance. Research has also highlighted the deliberate introduction of microorganisms to the oncological patient is assumed to mobilize the immune system to become able to, at least, limit the development of cancer. Microbes are used as vectors that carry specific antineoplastic agents that reduce the side effects of chemotherapy. This intricate interaction between gut microbiota and cancer therapy highlights the requirement for further research to elucidate underlying mechanisms, with possible applications in personalized medicine and optimized treatment outcomes. The gut microbiota's influence on host immune responses and anticancer medication efficacy has become increasingly evident, and restoring gut microbial homeostasis may lead to improved treatment outcomes. The present review further highlights few clinical studies that are designed to ensure clinical translation of these microbial therapies.

Keywords: Cancer Therapy, Chemo-Resistance, Gut Microbiome, Microbial Therapies, Tumour Microenvironment

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Circadian Rhythms and the Blood-Brain Barrier: Advancing Precision in Neuropharmacology through Chronotherapy

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Circadian rhythms, the body's internal 24-hour cycles, play a crucial role in regulating neurological functions and the dynamics of the blood-brain barrier (BBB), significantly influencing the efficacy of neuropharmacological treatments. This study investigates how synchronizing drug delivery with circadian oscillations can optimize therapeutic interventions for various neurological conditions, particularly where BBB permeability and drug transport vary throughout the day. The BBB serves as a protective gatekeeper for the central nervous system, selectively permitting essential molecules to cross while blocking harmful substances. Recent research highlights the circadian control of BBB transporter activity, which impacts the passage of both endogenous substrates and therapeutic agents. By timing treatment administration to align with circadian phases, chronotherapy demonstrates potential for enhancing the precision of drug delivery to the brain, thereby minimizing side effects and improving overall patient outcomes. This review emphasizes recent advancements in elucidating the molecular mechanisms underlying circadian regulation of the BBB and positions chronopharmacology as a novel strategy for addressing neurodegenerative and sleep-related disorders. Highlighting the importance of drug administration timing marks a new frontier in neuropharmacology, enabling treatments to resonate with the body's natural rhythms, ultimately fostering improved brain health and therapeutic effectiveness. By exploring these critical interactions, this review aims to provide insights into a transformative shift in pharmacology for neurological diseases, focusing on daily rhythms of brain function and their implications for innovative chronotherapeutic approaches.

Keywords: Circadian Rhythms, Blood-Brain Barrier (BBB), Chronotherapy, Neuropharmacology, Therapeutic Efficacy

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CAR-T Cell Therapy: Transforming Cancer Treatment in India with Emerging Promise and Challenges

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Chimeric antigen receptor (CAR) T-cell therapy is a transformative approach in cancer treatment, particularly for certain blood cancers. By genetically engineering a patient's T cells to express CAR proteins, the modified cells gain the ability to recognize and kill cancer cells, offering an alternative for patients unresponsive to conventional therapies. In India, CAR T-cell therapy is still in its nascent stages but has shown promising results in clinical trials. For instance, recent studies indicate a response rate of approximately 60-70% in patients with relapsed or refractory blood cancers such as acute lymphoblastic leukemia (ALL) and diffuse large B-cell lymphoma (DLBCL). While global statistics suggest long-term remission rates of around 40-50% for these conditions, Indian cohorts are still being evaluated, with early data reflecting comparable outcomes. Despite the promise, challenges such as high treatment costs, limited infrastructure, and access to advanced technology have restricted the widespread implementation of CAR T-cell therapy in India. Efforts are ongoing to reduce costs through local manufacturing and to improve accessibility, as well as to address unique challenges in treating solid tumors with this therapy. In conclusion, CAR T-cell therapy holds significant potential in the Indian oncology landscape, with advancements in local infrastructure and cost-effective manufacturing poised to enhance its accessibility and impact. Further research and investment could make CAR T-cell therapy a viable, individualized immunotherapy option for a larger population in India.

Keywords: (CAR) T- Cell, Cancer, Leukemia, Clinical Trials, Tumors

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Pharmacological Evaluation of *Mikania micrantha* Leaves in Diabetes and Associated Disorders in Experimental Animal Model

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Diabetes mellitus (DM) associated with sustained hyperglycemia is responsible for long term damage, dysfunction and failure of various organs and is a major factor in the development of many complications in patients with diabetes. In diabetes, elevated blood sugar triggers free radicals, causing oxidative stress and inflammation, contributing to complications, and deteriorating overall health. Research focuses on the natural antioxidants, which can support overall health in managing diabetes effectively. Modern pharmacological studies provide scientific evidence that *Mikania micrantha*, a perennial climbing vine possesses outstanding therapeutic potencies, i.e., antimicrobial, anti-inflammatory, cytotoxic, anticancer, antidiabetic, antioxidant, and wound healing activities. The present study aimed to evaluate the effect of hydro-alcoholic extract of *M. micrantha* (MME) leaves in high-fat diet and streptozotocin induced diabetic Wistar rats. The extract showed a significant dose-dependent reduction in blood glucose level compared to metformin. The extract treatment significantly lowered total cholesterol, and LDL level in a dose dependent manner, compared to diabetic control and increased the HDL-cholesterol. The promising antioxidant properties by inhibiting free radicals (ROS) and thus decreased the oxidative cellular damage caused by diabetes through improving the antioxidant response. *Mikania micrantha* leaves significantly lower lipid peroxidation in liver and kidney than the diabetic control group. The effective anti-hyperglycemic, hypolipidemic, and antioxidant activity of the hydro-ethanolic extract of *Mikania micrantha* leaves may effectively protect from diabetes and its associated organ damage. Further detailed research on the chemical composition and understanding the mechanisms of action can help in targeted therapies for safer, more sustainable antidiabetic options.

Keywords: Diabetes Mellitus, Hypolipidemic, Antioxidant, HFD-STZ, Phenolic Compunds

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The Role of an MMP2 Rnhibitor in the Context of Endometrial Cancer

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Endometrial cancer is a type of gynecologic malignancy that originates in the lining of the uterus. It is the 15th most common cancer among women worldwide, and 5th most common cancer in India according to World Cancer Research Fund International. Matrix metalloproteinases (MMPs) are zinc-dependent endoprotinases that degrade extracellular matrix components. These play an important role in tumor invasion, infiltration, and angiogenesis. MMPs are naturally regulated by several pathways at different levels involving protein expression (protein concentration), pro-enzyme activation, enzyme activity and mRNA transcription etc. Tissue inhibitors of metalloproteinases (TIMPs) selectively regulate MMPs in normal physiological conditions by directly blocking pro-enzyme activation and activity. Different MMPs were studied for their role in development of endometrial cancers. MMP-2 is an important enzyme involved in tumor metastasis and physiological function. The effects of MMP-2 inhibitors such as Marimastat, Tanomastat, Primonoast, Rebimastat have been extensively evaluated against endometrial carcinoma. Overexpression of MMP-2 was correlated between lymph node metastasis in endometrial cancer. This review aims to analyse the present knowledge of the involvement of MMP2 in development of endometrial carcinoma and focuses on the clinical information of the use of MMP2 inhibitors as a targeted treatment.

Keywords: Matrix metalloproteinases-2 (MMP-2), Endometrial Cancer, Tumor Invasion

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Chitosan Based Biomaterials for Combating Wound Infections and Promoting tissue Regeneration

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Chitosan, a naturally derived biopolymer, has emerged as a promising material for wound healing applications due to its inherent antimicrobial properties, biocompatibility, and biodegradability. This research explores the versatility of chitosan-based biomaterials in promoting wound healing and preventing infection.The negatively charged microbial cell membranes can interact with chitosan due to its cationic composition, which damages the membranes and causes cell lysis. This inherent antimicrobial activity makes chitosan an effective agent for combating a broad spectrum of pathogens, including bacteria and fungi. Studies have shown that chitosan-based wound dressings can significantly reduce bacterial growth, minimizing the risk of wound infections that can complicate healing processes.Furthermore, the incorporation of bioactive compounds into chitosan matrices enhances its antimicrobial efficacy while providing additional therapeutic benefits. For instance, chitosan hydrogels can serve as drug delivery systems, releasing antimicrobial agents in a controlled manner to target infected areas directly. This dual functionality not only accelerates healing but also minimizes inflammation and promotes a favorable environment for tissue repair. This research presents a comprehensive overview of the latest advancements in chitosan-based biomaterials for wound healing, highlighting their potential for clinical applications. Ongoing research is essential to optimize these materials for diverse wound management scenarios, ensuring their safety and efficacy. The development of novel chitosan-based biomaterials with tailored properties holds great promise for enhancing wound healing outcomes and improving patient care.

Keywords: Chitosan, Biomaterials, Wound Healing, Infection Prevention, Tissue Regeneration

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Vincristine in the Treatment of Non-Hodgkin Lymphoma

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Vincristine (VCR) is an anti-neoplastic alkaloidal drug which is derived from plant source *Catharanthus roseus*. It has been highly effective in treatments of Non Hodgkin Lymphoma (NHL). NHL is a form of cancer that affects the lymphatic system where cells multiply and move rapidly. This is because it retards the growth of cancer cells and prevents the latter from proliferating. Microtubules are structures inside cells that help them divide, when cancer cells attempt to do this, Vincristine interferes with their microtubules. When given, Vincristine attaches itself to these microtubules and inhibit their function from allowing the cells to division and grow and therefore, slow or stop the growth of the cancer. Vincristine is always administered with other chemotherapy medications. This combination approach is functional since it works on the cancer cells in several ways increasing the possibility of destroying many of them and decreasing the possibility of the cancer recurring again. The side effects of this are fatigue, hair loss, and few neurological signs. These effects can be quite hard to manage, but the benefits of Vincristine include longer life expectancy and chance for remission. Vincristine is still an effective tool in the battle against Non Hodgkin Lymphoma (NHL) which helps to increase the rate of survival and extend people's lives.

Keywords: Vincristine, Anti-neoplastic, Non Hodgkin Lymphoma (NHL), Microtubule.

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Exploring the Healing Potential of *Ziziphus oenopolia*: A Journey through Nature's Remedy

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Ziziphus oenopolia, or small-fruited jujube, is a medicinally valuable plant in traditional, especially Ayurvedic, medicine. This climbing shrub from the Rhamnaceae family is native to tropical and subtropical regions, including India, where it is used to treat ulcers, fever, diarrhea, and skin disorders. The leaf extract of *Z. oenopolia* shows various pharmacological activities, such as antioxidant, antimicrobial, anti-inflammatory, and antidiabetic effects, due to its bioactive phytoconstituents, which include flavonoids, tannins, saponins, alkaloids, and glycosides. Flavonoids like quercetin and kaempferol, abundant in the leaves, provide potent antioxidant benefits, which may aid in managing oxidative stress-related conditions. Additionally, alkaloids and saponins contribute to antimicrobial and anti-inflammatory properties, supporting its traditional applications in wound healing and infection management. Preliminary phytochemical analyses affirm the leaf's diverse compound profile, marking it as a candidate for further pharmacological studies. Current findings suggest *Z. oenopolia* leaf extract could be a natural alternative or adjunct for treating chronic inflammation and diabetes. In conclusion, the medicinal potential of *Ziziphusoenopolia* is substantial, with its phytoconstituents holding promise for developing safer, more accessible herbal treatments. This study highlights the role of traditional medicinal plants in enhancing modern therapeutic options.

Keywords: *Ziziphus oenopolia*, Rhamnaceae, Antimicrobial, Antidiabetic, Flavonoids.

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Antidiabetic Potential of *Clitoria Ternetea* Flower through Antioxidant and Anti-Inflammatory Effects

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Clitoria ternetea has been used in traditional medicine for many years across the world. The edible flower of *Clitoria ternetea* possesses several medicinal properties. It contains bioactive compounds such as phenolics, flavonoids, anthocyanins, resins, saponins, terpenoids, myricetin, tannins, steroids, and metallic compounds. These compounds are known for their antioxidant, anti-inflammatory, antidiabetic, and cholesterol-lowering effects. Diabetes mellitus, characterized by high blood glucose levels (fasting blood glucose > 126 mg/dL and postprandial > 200 mg/dL), occurs due to insufficient insulin secretion, increased glucagon production, decreased glucose absorption, and insulin resistance. Insulin, produced by pancreatic β-cells, regulates blood glucose levels. However, oxidative stress and inflammatory mediators impair the function of these β-cells. Additionally, Glycogen synthase kinase-3 (GSK-3) interferes with insulin activity. *Clitoria ternetea* has strong antioxidant and anti-inflammatory properties due to bioactive compounds like delphinidin, rutin, kaempferol, malvidin, and quercetin. Literature shows that chloroform extracts of the flower significantly reduced blood glucose levels (from 382.43 mg/dL to 171.42 mg/dL) in male albino Wistar rats compared to the standard drug Glibenclamide. Another study using ethanolic extracts of the flower on male diabetic Sprague-Dawley rats also showed a reduction in glucose levels and an increase in insulin levels. Quercetin, anthocyanins, catechin, and inositol are the key bioactive compounds contributing to its antidiabetic effects. This study highlights the potential of *Clitoria ternetea*'s edible flowers in managing diabetes mellitus. Future research can be focused on the safety profile of these bioactive compounds and their possible interactions with other chemical compounds.

Keywords: Antidiabetic, *Clitoria ternetea*, Antioxidant, Anti-inflammatory, Insulin Secretion

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Comparative Studies of Diabetes Mellitus and Insulin Resistance: Treatment Strategies and Emerging Therapeutics

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Diabetic mellitus is a chronic clinical symptom characterized by hyperglycemia due to lack of insulin. Research has found that over 537 million adults are affected worldwide by diabetes mellitus, and it will reach 643 million by 2030 and 783 million by 2045. Symptoms of diabetic mellitus include increased thirst, frequent urination, increased hunger, extreme fatigue, blurred vision, cuts or bruises that are slow to heal, and tingling, numbness, or pain in the extremities. Insulin resistance is when muscle cells don't respond well to the insulin in the body.. Symptoms of insulin resistance include acanthosis nigricans, skin tags, blurred vision, weight gain, irregular menstrual periods, acne, and hirsutism. Treatments for insulin resistance include medication and lifestyle changes, such as regular physical activity, healthy eating patterns, regular sleep patterns, and losing weight by the drugs that reverse the abnormal adipocyte effects by drugs that improve insulin sensitivity at the level of the liver and by anti-inflammatory agents that block activation of the nuclear factor kappa B cascade. The review concentrates on the key distinctions between diabetes mellitus and insulin resistance, as well as the various strategies and approaches used to treat insulin resistance. These strategies include the use of nutraceuticals and herbal products, which are less likely to cause adverse effects, and the recent development of novel drugs such as selective GSK-3 inhibitors, which have demonstrated the ability to stimulate insulin-like effects and function as insulin synthesisers in both in vitro and in vivo systems.

Keywords: Diabetes Melitus, Insulin Resistance, Hyperglycaemia, Treatment of Insulin Resistance, Nutraceutical

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Role of Plant-Derived Estrogen in Early Menopause Syndrome

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Premature menopause syndrome, also known as premature ovarian failure, affecting approximately 1% of the total woman population, is characterised by amenorrhoea, increased gonadotropin level, decreased oestrogen level, and hot flush. Premature menopause syndrome poses significant health risks, including osteoporosis, psychosexual issues, infertility, ischaemic heart disease, and mood disorders. It is a complex condition with diverse underlying causes. While the majority of cases remain idiopathic, research has identified several contributing factors, including autoimmune disorders, genetic diseases, infections, enzyme deficiencies, and metabolic syndrome. These factors can disrupt ovarian function, leading to premature cessation of menstrual cycles and ovarian failure. This condition can be potentially influenced by phytoestrogen, a plant-derived biphenolic compound having structural similarity to endogen estradiol. The review mainly focuses on the role of these phytoestrogens in influencing early menopause syndrome. The phytoestrogens are abundant in plants like soy, legume , flax seed that elevates the estrogen level by binding to estrogen receptors, modulating estrogenic activity or influencing gene expression. Isoflavone is the most important. Phytoestrogen involved, as well as coumestant and lignan, also have the above-mentioned properties. Phytoestrogens are also capable of inhibiting aromatase and cytochrome P450 enzymes, improving bone density, reducing the risk of breast cancer, alleviating menopausal symptoms, and supporting cardiovascular health. As selective oestrogen receptor modulators (SERMs), phytooestrogens offer promising therapeutic potential, warranting further research to fully understand their effects.

Keywords: Early Menopause, Phytooestrogen, Soy, Legume, Oestrogen Receptor, Isoflavone, Coumestant, Lignan

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Optimized Antibiotics-Antipyretic Combination Pharmacotherapy, A Weapon against Antibiotic Resistance in Bacteria Supercharged By Global Warming - A Meta-Analysis

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The ramifications of global warming and climate change on bacterial strains, particularly with respect to their thermotolerance, are emerging as a significant concern within the scientific community, which can alter microbial community dynamics, increasing pathogenic strains. This phenomenon can be attributed to the adaptive mechanisms that bacteria employ to withstand heat stress, which often involve substantial metabolic changes that enhance their survival capabilities. For example, studies have noted an increase in thermotolerant coliforms in water sources, correlating with a higher risk of foodborne illnesses Another critical dimension of global warming is the acceleration of mutation rates at elevated temperatures. Research also demonstrated an astonishing increase in mutation rates—approximately 100-fold—when temperatures are elevated from 32°C to 38°C, highlighting temperature's role in bacterial mutational dynamics. Hypermutation allows bacteria to rapidly adapt to changing conditions, contributing to increased antimicrobial resistance. Moreover, studies indicate that the Minimum Inhibitory Concentration (MIC) values for antibiotic efficacy can diminish significantly when drug-resistant microbial populations are cultured at higher temperatures. This trend indicates that fever and may promote bacterial proliferation, infectivity, and antibiotic resistance. Consequently, to prevent host's susceptibility to Antimicrobial Resistant (AMR) infections, designing effective combination pharmacotherapy of antipyretics and antibiotics is the key, as the contrary of high temperature pushing higher antibiotic susceptibility, also exists in rare cases in certain microbial infections. Henceforth the focus would be on an effective response rather than a generalised response.

Keywords: Global Warming, Thermotolerance, Hypermutuation, Antibiotic Resistance, Fever-Suppression

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Potential of Ethnomedicinal Plants in Leukemia Management

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Leukemia, a common cancer marked by abnormal white blood cell proliferation, varies in form, influencing treatment options and survival outcomes. Conventional treatments face several challenges like adverse effects and drug resistance, underscoring the need for safer, more effective alternatives. Ethnomedicinal plants have shown promise in traditional medicine for leukemia, providing natural compounds that support cell health and could be beneficial in cancer therapy. This review highlights various plant species with potential anti-leukemic properties, focusing on their role in developing improved treatments to enhance patient outcomes. After thorough scrutinization of preclinical and clinical studies, homoharringtonine and harringtonine, alkaloids derived from the plant *Cephalotaxus harringtonia*, have been approved by the United States Food and Drug Administration (FDA) for the management of chronic myeloid leukemia. Research has also confirmed the cytotoxic potential of *Maytenus serrata* and its effectiveness in the management of leukemia. Flavopiridol, derived from *Dysoxylum binectariferum*, also possesses anti-leukemic potential. The cytotoxic potential of *Nyctanthes arbor-tristis* is also nurtured for anti-leukemic activity. The seed extract of *Annona glabra* was also found to be effective against leukemia cell lines. Certain plants that are used in Ayurvedic medications are also found to be beneficial in addressing leukemia. *Withania somnifera* (Ashwagandha), *Ocimum tenuiflorum* (Tulsi), *Curcuma longa* (Curcumin), *Emblica officinalis* (Amalaki), *Terminalia chebula* (Haritaki), Giloy (Guduchi), *Terminalia belerica* (Vibhitaki) are effective in treating leukemia. Ethnomedicinal plants offer a promising avenue for leukemia treatment, thereby reinforcing the need for further research to develop safer and more effective alternatives.

Keywords: Anti-leukemic, Ayurveda, Cytotoxic, Ethnomedicinal Plants, Leukemia

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Unveiling the Healing Power of *Schima Wallichii*: Analgesic and Antipyretic Activities and Toxicity Assessment

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This study evaluates the analgesic, antipyretic, and toxicity profiles of various fractions extracted from the bark of *Schima Wallichii*, an evergreen tree belonging to the Theaceae family. In this study, the extraction of bioactive compounds from the bark was carried out through the Soxhlet extraction process. The analgesic effects of the extract were analyzed in mice using hot plates and acetic acid-induced writhing tests. In the hot plate test, ethyl acetate fraction exhibited significant analgesic effects by prolonging reaction time up to 65.23% after 150 min of treatment which is comparable with that caused by morphine (70.34%). This fraction was a very effective peripheral analgesic, producing inhibition of writhes by almost 70%, as close to aspirin's action (79%) in the acetic acid-induced writhing test. The antipyretic activity was evaluated in brewer's yeast-induced pyrexia in rats. By the 15th hour, the body temperature of the treated group decreased compared to the control group, which remained elevated. The ethyl acetate fraction-treated group maintained normal temperature levels for up to 30 hours post-treatment, compared to the paracetamol group, which showed a significant return to normothermia within 24 hours. Acute toxicity tests of these extracts were conducted using mice of the Swiss albino type, with doses administered ranging from 200 to 2000 mg/kg. No mortality or notable physiological change was observed up to 2000 mg/kg, whereas slight modification in some behavioural patterns was found above the dose of 1500 mg/kg. No deaths occurred, thus confirming extracts as having a high safety margin.

Keywords: *Schima wallichii*, Analgesic, Antipyretic, Toxicity, Bioactive compounds

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An Overview of Anti-Cancer Activity of Sunflower Oil

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Sunflower oil is non-volatile oil pressed from the seeds of Helianthus annuus (sunflower). It has significant attention for its anticancer properties, especially due to its rich composition of bioactive compounds, including vitamin E, polyunsaturated fatty acids, phenolic acids, and phytosterols. These constituents contribute to sunflower oil's antioxidant, anti-inflammatory, and immune-modulating activities, which jointly help to inhibit cancer development. Vitamin E, specifically in its gamma-tocopherol form present in sunflower oil, has the potential to reduce oxidative stress and promote apoptosis in cancer cells. It also reduces the risk of certain cancers such as colon, bladder, and prostate. It is a good source of selenium that acts as an antioxidant, helps rejuvenate the damaged DNA slows the growth of the cancer cells, and hence boosts the immune response. Tannin is a widely distributed plant phenolic that was recently reported as an anticancer agent along with induced cell death in cancer cells in a dose-depended mummer but did not affect the growth of the normal cells. The numerous other active compounds in sunflower seed oil identified include palmitic acid, linolenic acid, alpha-linolenic acid and stearidonic acid all of them have antioxidant properties and anti-carcinogenic effects. Linoleic acid, a predominant polyunsaturated fatty acid in sunflower oil, may impact cancer progression by modulating cellular signaling pathways essential for tumor growth and survival. Phenolic compounds like chlorogenic acid also exhibit anticancer activity by inducing apoptosis and reducing inflammation, which is crucial in the tumor microenvironment.

Keywords: Sunflower Oil, Anticancer Activity, Anticancer Bioactive Compound

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A Review on De Novo Nucleotide Biosynthetic Pathway and Cancer

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A basic biological process seen in almost all species, the de novo nucleotide biosynthesis pathway makes it possible to synthesize the purine and pyrimidine nucleotides required for DNA and RNA. The growth, proliferation, and metabolism of cells depend on this route. Numerous illnesses have been connected to dysregulation in nucleotide biosynthesis, most notably cancer, where increased activity in this pathway contributes to the tumors' propensity for fast cell division. According to recent studies, malignancies of the liver, breast, and lung, among other organs, frequently overexpress or over activate important enzymes involved in de novo nucleotide production. Numerous potential treatment targets have emerged as a result of our growing understanding of the regulatory mechanisms and functions of these enzymes in the metabolism of cancer cells. Specifically, blocking these enzymes reduces the potential for tumor growth by interfering with the cancer cells' capacity to maintain high nucleotide output. An overview of recent research on the pathway's role in the development of cancer is given in this review, which also looks at potential treatments by focusing on its regulatory points. Precision medications that target nucleotide biosynthesis present a novel approach to treating cancer, particularly in cases where treatments are not working, and may improve the prognosis of aggressive malignancies.

Keywords: De Novo Nucleotide Biosynthesis, Enzyme Overaction, DNA/RNA Synthesis, Tumor Growth, Enzyme Inhibitor.

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An Extensive Overview of Metronidazole Therapy for Anaerobic Bacteria

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Metronidazole, long used in treating trichomoniasis, amoebiasis, and giardiasis, has recently been found effective against anaerobic bacteria. Effective concentrations for killing Bacteroides species can be achieved with standard oral or intravenous doses, or with higher rectal (suppository) doses. Studies show that adding metronidazole to pre-operative bowel preparation regimens reduces postoperative infections and prevents anaerobic infections. Its use before and for up to one week following surgeries, like acute appendectomy or hysterectomy, has nearly eliminated anaerobic infections in these cases. Metronidazole has also proven effective in treating anaerobic infections in the chest, head, gastrointestinal tract, female genitourinary tract, and in cases of anaerobic septicemia and bacteremia. Metronidazole remains the most potent drug available against obligate anaerobes and is highly valuable for treating severe infections caused by these organisms. Although formal comparisons with other drugs (like clindamycin, chloramphenicol, or penicillin) are limited in some areas, metronidazole is nonetheless highly effective in both treating and preventing anaerobic infections. Anaerobic bacteria are responsible for numerous infection types and are commonly identified in clinical samples from abdominal abscesses, peritonitis, thoracic empyema, and infections of the female genital tract. While distinguishing between organisms that are harmless or contaminants and those that are true pathogens can sometimes be challenging with routine specimens, anaerobes are known to play a significant role in abdominal postoperative infections. Bacteroides species are often isolated from abdominal abscesses, wounds and in mixed cultures associated with bowel mucosa integrity loss and surgeries involving the female genital tract.

Keyword: Metronidazole, Anti-Microbial Therapy, Anaerobic Bacteria, Trichomoniasis vaginalis, Amoebiasis

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Brain-Derived Neurotrophic Factor (BDNF): A Promising Therapeutic Option in Clinical Neuroscience

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Neurodegenerative diseases worldwide lead to considerable disability and suffering. Brain-Derived Neurotrophic Factor (BDNF), a neurotrophic factor found in the central nervous system, is essential for the survival, differentiation, and synaptic plasticity of neurons, making it a key element in neurodevelopment and neuroprotection. Recent studies indicate that BDNF could be a promising therapeutic target for various neurological and psychiatric conditions, such as depression, Alzheimer's disease, and schizophrenia. BDNF has a wide role in the central nervous system and its wide significance in clinical neuroscience. Multiple clinical trials for Parkinson's disease have used implanted devices to deliver BDNF. The molecular pathways involved in BDNF signalling that regulate its function via the TrkB receptor, have a role in stimulating neurogenesis and regulating synaptic efficiency. The present review evaluated recent progress in gene therapy and pharmacological approaches that boost BDNF expression or replicate its effects. It also explores BDNF's potential as a biomarker for monitoring disease progression and treatment efficacy, offering insights into its clinical applications. Abnormal BDNF levels may result from chronic brain inflammation seen in certain disorders, as neuroinflammation disrupts BDNF-related signalling pathways. Glial cell activation can elevate pro and anti-inflammatory cytokines and reactive oxygen species, impacting neuronal function and contributing to neurotoxicity in various brain conditions. At present several ongoing clinical trials and future research is aimed to overcome these challenges, fully associated with BDNF's therapeutic potential, and evaluating its role in advancing treatment strategies. Further exploration of BDNF, as a potential therapeutic tool, emphasize its significance in the dynamic field of clinical neuroscience and its implications for future patient treatment strategies.

Keywords: Neurological Disorders, BDNF, Tyrosine Kinase, Inflammation, Gene Therapy

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Aspirin in Colorectal Cancer: Exploring Pathways beyond COX Inhibition

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Colorectal cancer (CRC) ranks as the third most common cancer worldwide, with insufficient screening accessibility in low-resource settings, emphasizing the need for primary prevention. Evidence from epidemiological studies, randomized trials, and mechanistic research supports the chemopreventive potential of aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) in reducing CRC incidence and mortality. Present review aimed to discuss the molecular mechanism, therapeutic potency of aspirin as a chemo-preventive approach. Aspirin, at low daily doses (≥75 mg). Commonly used for cardiovascular protection, exhibits antitumor efficacy is largely attributed to its Inhibition of cyclooxygenase (COX)-1 in platelets, while COX-2 and COX-1 in nucleated cells are less persistently affected. Despite the established role of COX inhibition, aspirin's chemo-preventive mechanisms likely extend beyond COX pathways. Aspirin metabolites, including salicylic acid and its derivatives, have shown potential to inhibit cyclin-dependent kinases (CDKs) like CDK1 and CDK6, indicating a COX-independent impact on CRC cell proliferation. Furthermore, metabolites generated by cytochrome P450 (CYP450) enzymes or gut microbiota may preferentially target colorectal tissues, enhancing aspirin's site-specific effects. This multi-targeted approach, encompassing both COX-dependent and COX-independent mechanisms, highlights the need for continued exploration of aspirin's chemo-preventive pathways and the development of novel agents for cancer prevention.

Keywords: Aspirin, Colorectal Cancer, Cyclooxygenase Inhibitor, Cyclin-Dependent Kinases, Chemotherapy

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A Comprehensive Review of *Mikania micrantha*: Phytochemistry, Mechanisms, and Potential as a Lipid-Lowering agent

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Dyslipidemia is a known risk factor for cardiovascular and cerebrovascular diseases, significantly increasing the chances of stroke and myocardial infarction (MI). An abnormal lipid profile and inflammation play central roles in these conditions. Traditional medicine suggests certain plants can combat dyslipidemia, including *Mikania micrantha* Kunth, a vine traditionally used for ailments like stomach issues, jaundice, diabetes, hypertension, and high cholesterol. This review explores *Mikania micrantha* leaves for their potential in reducing hyperlipidemia and cardiovascular risk. The plant contains beneficial compounds, notably terpenoids like stigmasterol, which mimics cholesterol and effectively lowers blood cholesterol levels. It also contains flavonoids that inhibit HMG-CoA reductase, a crucial enzyme in cholesterol production, thereby reducing fat accumulation in the liver. In-silico studies identified 26 bioactive compounds in *Mikania* that act as inhibitors of human HMG-CoA reductase, nitric oxide synthase, and squalene synthase, all of which play roles in lipid metabolism and inflammation. This invasive plant is rich in diverse phenolics with promising health benefits. Further research is encouraged to validate *Mikania micrantha* as a natural, cardioprotective therapy, especially given its antioxidant, anti-inflammatory, and lipid-lowering properties.

Keywords: Dyslipidemia, Cardiovascular Diseases, Phenolic, *Mikania micrantha*

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A Systematic Review on Therapeutic Potential of *Agaricus bisporus* Extract on Obesity and Orlistat Triggered Hypovitaminosis D and Its Related Disorders Especially for Vegan People

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Since 1980, the prevalence of obesity has been continuously increasing, making it a global health concern. According to WHO, by 2030, chronic non-communicable diseases associated with obesity would make up two-thirds of the world's disease burden, with children in nations like China, India and the United States being disproportionately affected. Current obesity treatments, including medications like Orlistat, are effective but it may lead to deficiencies in fat-soluble vitamins, especially vitamin D because of low absorption of dietary fat according to a research oriented African-American and Caucasian adolescents. Obesity can also induce vitamin D deficiency. As a result of these two things, hypovitaminosis D in humans triggers. Further this vitamin D deficiency is associated with various serious health conditions, including cardiovascular diseases, diabetes, and mental health disorders. In the present scenario, vitamin D is obtained from animal sources on most occasions. The white button mushroom or *Agaricus bisporus* offers a promising way to close a significant dietary gap, particularly for vegans. Since it contains a lot of ergosterol, UV light can convert it to vitamin D2, providing a natural source of this vital mineral. This present review aims to explore the phytochemical and pharmacological effects of vitamin D-rich polyphenolic extracts of *Agaricus bisporus* on obesity and orlistat triggered vitamin D deficiency and its related disorders so that the integration of natural sources with synthetic treatments may seek to address both obesity and hypovitaminosis D, offering a synergistic holistic approach for improving health outcomes therapeutically.

Keywords: Obesity, Orlistat, Hypovitaminosis D, *Agaricus bisporus*, Vegan People

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Investigating Geniposide from *Paederia foetida* as a Potential Antihypertensive Therapy: A Comprehensive In-vivo and Computational Analysis

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One of the most utmost case is hypertension, which is expected to affect 29% of adults worldwide by 2025, or almost 1.56 billion people. There are a number of active ingredients in medicinal plants with pharmacological and preventive qualities that can be utilized to treat this. The plant *Paederia foetida* has demonstrated its biological significance in numerous ways. It has been successfully shown that Paederia foetida's ethanolic extract possesses antihypertensive properties against hypertension produced by amphetamines in the current investigation. In a study with five groups showed that the ethanolic extract of *Paederia foetida* effectively reduced blood pressure and maintained sodium-potassium balance in rats. To ascertain the antihypertensive efficacy of the active component, geniposide, it was docked against various PDB IDs. With a docking score of -8.91, the estrogen receptor (PDB ID: 3OLS) was determined to be the most likely site of action compared to Estradiol. Geniposide may operate as an activator of the estrogen receptor through β-ligand binding, according to a molecular dynamics simulation used to evaluate its binding affinity with the receptor. According to this research, geniposide may be used to treat hypertension by modifying the estrogen receptor's function.

Keywords: Hypertension, Paederia foetida, Geniposide, Estrogen receptor

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Potential of Herbal Therapies in Managing Obesity-Associated Dyslipidemia

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Obesity in all age groups, including children and adolescents, poses a significant risk to health worldwide. Higher total and abdominal fat during adolescence is associated with adult atherosclerosis. The central fat accumulation also shows a correlation with insulin resistance. Obesity leads to a significant reduction in life expectancy, and extreme obesity results in a more adverse impact on mortality rates among younger adults than among the geriatric population. Lipid metabolism abnormalities affecting 60-70% of obese patients, commonly result in dyslipidemia. Commonly prescribed antihyperlipidemic therapies, including statins, ezetimibe, cholestyramine, fibrates, and omega-3, are commonly associated with several limitations owing to side effects and limited effectiveness. Research thus focuses on natural alternatives with lipid-lowering potential, fewer side effects, better safety, and sustained efficacy compared to their synthetic counterparts. Several plants including fenugreek, garlic, Guggulu, black cumin, and ginger, rich in bioactive phytochemicals, are found to be effective in hypercholesterolemia through multiple mechanisms, such as inhibiting cholesterol absorption, reducing lipid synthesis, increasing bile acid excretion, and enhancing antioxidant activity. Preclinical and clinical studies confirm the effectiveness of these natural remedies in lowering low-density lipoprotein (LDL) levels and improving lipid profiles, thereby contributing to cardiovascular health. Several Ayurvedic herbal preparations have also been found to be beneficial in addressing the problem of dyslipidemia. Clinical studies also highlighted the minimal side effects of these natural therapies, thereby optimizing the therapeutic outcome. Herbal therapies, coupled with lifestyle modifications, may offer an alternative or complementary approach to synthetic lipid-lowering medications.

Keywords: Dyslipidemia, Herbal Preparations, Lipid-Lowering, Obesity, Phytochemicals

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Leveraging Curcumin for Enhanced Anticancer Efficacy: Co-Delivery Strategies in Breast and Pancreatic Cancer

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Curcumin, a bioactive compound from turmeric, has shown potential in enhancing the efficacy of various chemotherapeutic agents in cancer treatment. Both studies focus on curcumin's role in improving anticancer outcomes in breast and pancreatic cancers when combined with conventional chemotherapy agents like docetaxel and gemcitabine. The first study highlights curcumin's synergistic effects with gemcitabine and docetaxel in pancreatic cancer. Curcumin enhances apoptosis and inhibits proliferation and metastasis, largely through the PARP/caspase-3 pathway, demonstrating synergism in suppressing tumor cell viability. The combination leads to more effective anti-metastatic outcomes by upregulating TIMP proteins and downregulating MMP proteins, critical in invasion and migration processes. The second study investigates a novel liposomal co-delivery system of curcumin and docetaxel for breast cancer treatment. This system improves the bioavailability of both drugs and exhibits enhanced antitumor efficacy by overcoming drug resistance, a significant barrier in cancer therapy. In MCF-7 breast cancer models, this co-delivery liposome method showed superior results in reducing tumor size, delaying release kinetics, and improving drug targeting, thus reducing systemic toxicity.

Keywords: Synergistic Effects, Docetaxel, Gemcitabine, Breast Cancer, Pancreatic Cancer

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Addressing Drug-Induced Hepatotoxicity in Tuberculosis Management: Diagnosis, Prevention and Risk-Mitigation Techniques

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Numerous first-line drugs used to treat both latent and active Mycobacterium tuberculosis are hepatotoxic and can result in acute liver failure (ALF) and other forms of anti-tuberculosis drug-induced liver injury (ATLI). Isoniazid is still one of the main causes of DILI and drug-induced ALF, even with improvements in the diagnosis and treatment of ATLI. Professional judgment: Although there are currently conflicting social recommendations on ATLI monitoring, several advise liver enzyme testing for high-risk individuals. For all patients receiving isoniazid medication or multidrug therapy, we advise liver test monitoring. N-acetyltransferase-2 polymorphism genotyping is one precision medicine technique that is believed to help lower the incidence of ATLI in high-risk groups. However, broader implementation is currently cost prohibitive. Hepatoprotective drugs are not currently recommended, although we do recognize their potential. Strategies to resume the same or less hepatotoxic regimens are currently being used in individuals who develop ATLI but still need continuous anti-TB medication.

Keywords: Anti-Tuberculosis Drug Liver Injury (ATLI), Isoniazid, N-acetyltransferase-2 (NAT-2), Multi-Drug Resistance.

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Antidiabetic Activity of Isolated Bioactive Phyto-Constituents from *Litsea glutinosa*

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Litsea glutinosa, a multipurpose deciduous tree belonging to the family Lauraceae has the property of fast-growing and multidirectional pharmacological activity. *L.glutinosa* has proven to enlist major therapeutic purposes in the treatment of traumatic injuries, colds, arthritis, asthma, diabetes, indigestion, diarrhea, dysentery, edema, and poignant sexual power. Pharmacological divergences like antioxidant, anti-inflammatory, antipyretic, antimicrobial and wound healing have been reported from various research findings. The investigation focuses on identifying the anti-diabetic property as the primary target area, as associated with the antioxidant property of *L. glutinosa*. *L.glutinosa* reduces body fat without hampering food intake possibility. Methaolic extract from leaves of this particular species have alkaloids and glycosides both as a means of targeting different pathways for streptozocin induced diabetic mice. Alkaloid fractionating *L.glutinosa* showed decrease in DPP-4 serine protease level inhibiting the rise of type 2 diabetes mellitus in Metformin resistant patients. Similarly 4′-*O*-methyl afzelin and quercetin α glycosides methanolic reach compound isolated from leaves of *L.glutinosa* decreases the fasting glucose level ($p<0.05$) from first week of the treatment. Dose dependence of α amylase and aldose reductase binding affinities in comparison to conventional drugs are needed to be more quantified reducing the toxicity and increasing the safety of dose regimen for human use.

Keywords: DPP-4, α-Amylase, Streptozocin, Quercetin, Diabetes Mellitus.

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Carbon Dots as Antimicrobial Agent

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Carbon dots (CDots) have *emerged* as a promising class of nanomaterials with potent antimicrobial properties. This project explores the synthesis, characterization, and antimicrobial efficacy of CDots against various microorganisms, including Gram-positive and Gram-negative bacteria and fungi. The study focuses on optimizing synthesis methods to enhance CDots' antimicrobial activity, using techniques such as spectroscopic and microscopic analyses to understand their physical and chemical properties. The antimicrobial efficacy is assessed through *in vitro* tests, measuring the inhibition zones created by CDots on Petri plates inoculated with *E. coli*. Key findings indicate that CDots effectively inhibit microbial growth, as evidenced by clear zones of inhibition. This antimicrobial activity is attributed to their ability to generate reactive oxygen species (ROS) and induce membrane damage in microorganisms. The project also examines the stability of CDots under different environmental conditions and explores their applications in various materials and formulations. By providing insights into the mechanisms of CDots' antimicrobial action and identifying optimal conditions for their use, this research contributes to the development of novel and effective antimicrobial strategies. The findings suggest that CDots hold significant promise as an alternative to traditional antibiotics and enhance infection control measures.

Keywords: Carbon Dots, Antimicrobial Agent, Nanomaterial, Synthesis, Pathogen

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Potential of Syzygium *aromaticum* as a Natural Anticoagulant

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Clove (*Syzygium aromaticum*) exhibits notable anticoagulant properties due to its bioactive compounds, particularly eugenol, a phenolic compound with well-documented therapeutic effects. Traditionally used in medicine for its anti-inflammatory, analgesic, and antimicrobial properties, clove has recently gained recognition for its anticoagulant potential. *In vitro* studies examining the anticoagulant effects of aqueous clove extracts measured prothrombin time (PT) and activated partial thromboplastin time (aPTT), both of which demonstrated a significant delay in clotting time. These findings suggest that clove could offer a natural, complementary alternative to conventional anticoagulant drugs, potentially minimizing the side effects often associated with synthetic options. The results indicate that clove extracts prolonged PT, likely due to the high concentration of phytochemicals, which contribute to its anticoagulant properties. Eugenol, the primary active component in clove, works by inhibiting platelet aggregation and reducing the production of thromboxane, a compound that promotes blood clot formation. This mechanism may help lower the risk of thrombosis, a leading cause of cardiovascular disorders, including stroke and heart attack. By modulating this pathway, clove could reduce the risk of thrombotic events such as stroke and myocardial infarction. Continued research into clove's anticoagulant potential could pave the way for safer, more accessible anticoagulant therapies, particularly valuable for individuals seeking natural or complementary treatment options.

Keywords: Anticoagulant, Phytochemicals, Clove, Natural Anticoagulants, Eugenol

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Anti-Oxidant and Anti-Proliferative Activity of Corn Silk in Liver Toxicity

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In recent times liver toxicity is a very well-known disease and if not treated it turns fatal , therefore in traditional medicine, such as to treat bladder infections, inflammation, and kidney problems. It is also sometimes used in herbal teas and supplements for its potential diuretic and antioxidant properties However, more scientific research is needed to fully understand its potential health benefits and for assessing their cellular toxicity levels and possibly can be included in the nutraceutical domain. In the present study, we evaluated the antioxidant capabilities of methanolic extracts of corn silk in vitro. Methanolic extract was used as previous studies suggested it contained more phenols and flavonoids which are considered as major phytochemical antioxidant groups. Our results suggest the extract contained more flavonoid and phenol groups which are mostly near to the standard. In the IN vitro antioxidant Assay higher % scavenging activity in lower concentrations in both 2,2-diphenyl-1-picrylhydrazyl and hydrogen peroxide scavenging activity tests shows near about same of the standard.. Due to its greater activity, we further explored its protective activities in a Paracetamol650 induced Wistar rat model. A significant difference was observed in the hepatotoxicity markers of the vehicle treated, and the positive control group and the Standard group, which was then influenced by the treatment of corn silk extract as the higher concentration treatment group showed positivity in the enzyme system restoration.

Keywords: Corn Silk, Paracetamol, Anti-Oxidant, Hepatotoxicity, Flavonoids

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Diabetes-Tuberculosis: Addressing the Current Challenges and Future Directions

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The correlation between diabetes and tuberculosis (TB) presents significant public health challenges, particularly as both conditions are on the rise globally. This paper explores the complex nexus between diabetes and TB, highlighting current challenges and potential future directions for management and prevention. Epidemiological studies indicate that individuals with diabetes are two to three times more likely to develop active TB, complicating treatment outcomes and increasing morbidity. The mechanisms underlying this correlation involve immune dysregulation, increased susceptibility to infection, and metabolic factors that hinder recovery. Current challenges include inadequate screening for TB in diabetic patients, limited access to healthcare, and the need for integrated care models that address both diseases concurrently. Furthermore, socioeconomic factors play a crucial role in the prevalence of comorbidity, with vulnerable populations facing higher risks. The present study focuses on a multi-faceted approach that includes enhancing diagnostic capabilities, improving public health policies, and promoting awareness of the TB-diabetes link among healthcare providers and patients. By addressing these challenges, health outcomes can be improved for individuals affected by both diabetes and TB, ultimately contributing to global health equity and disease prevention efforts, combating the dual burden of TB and diabetes in an increasingly interconnected world.

Keywords: Diabetes, Tuberculosis, Epidemiological Studies, Socioeconomic Factors, Morbidity

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Bellamya bengalensis: A Promising Therapeutic Approach against Breast Cancer

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Breast cancer is the leading cancer among women in India, accounting for 25-32% of all female cancers, with especially high rates in urban areas. Despite awareness initiatives, challenges in early detection and access to effective treatment continue to hinder efforts to reduce the impact of breast cancer in India. The biodiversity of marine organisms provides a rich source for the discovery and development of novel anticancer peptides in the treatment of human cancer. Molluscs have been a significant focus in the search for biologically active secondary metabolites, with > 1,145 natural products isolated from molluscan species in the last three decades. The present study evaluated the anticancer potential of *Bellamya bengalensis*, a freshwater mollusca, against MDA-MB-231 and MCF7 breast cancer cell lines by MTT assay. The flesh extract of *Bellamya bengalensis* exhibited pronounced effect on the breast cancer cell line MCF7 cells with a significantly low IC_{50} value of 10.02 µg/ml, however was nontoxic to the murine macrophage cell line. The more aggressive triple negative breast cancer cell line MDA-MB-231, also showed a marked reduction in cell viability with an IC_{50} value of 11.32µg/ml and 7.65µg/ml in 24hrs and 48hrs of treatment, respectively. *Bellamya bengalensis* being an edible mollusca can be a dietary supplement and its potential to selectively target and inhibit cancer cells while leaving healthy cells unharmed, highlighting their potential value in developing targeted cancer therapies. Novel therapeutic agents can be developed against breast cancer with improved patient compliance, particularly in targeting aggressive subtypes like MDA-MB-231. Further research is warranted to elucidate the mechanisms underlying its action and to isolate specific active components, which could lead to new therapeutic strategies in breast cancer treatment.

Keywords: Cytotoxicity, Breast Cancer, Molluscs, Anticancer Peptides, Targeted Therapy

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Kantkari: A Herbaceous Remedy for Respiratory and Inflammatory Medical Malady

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Kantakari (*Solanum xanthocarpum*), is a plant that is extensively used herb in classical and conventional medicine throughout the world. It is a remedy and medicine that is widely used for its therapeutic properties in treating pulmonary obstructive disorders, inflammatory malady, and digestion ailments. The phytochemical profile of the kantakari plant includes the alkaloids, flavonoids, glycosides and steroids as a solasonine, solamargine, diosgenin that will be highlighted in this review. It sustains some pharmacological effects based on these phytochemical profiles which generally include anti-inflammatory, anti-asthmatic, and antimicrobial effect. It is highly used in classical ayurvedic treatment in the medical conditions like asthma, pulmonary obstructive disorders. Using kantakari as an anti-inflammatory the retardation in inflammation is observed and inhibitory action against microbial development also observed. As far as the use of this ayurvedic medicine emerged the authentication of the implementation of the kantakari plant also arises and hence support in further research and study.

Keywords: Kantakari, Anti-Asthmatic, Medical Malady, *Solanum xanthocarpum*

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Edible Snail as a Hidden Gem in Ethnopharmacology in Combatting Inflammation and Oxidative Stress

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Bellamya bengalensis, a freshwater mollusk indigenous to South Asia, has gained attention in ethnopharmacology for its potential therapeutic properties. Traditionally used in folk medicine, this species is recognized for its rich phytochemical profile, which includes bioactive compounds with promising anti-inflammatory and antioxidant activities. This research explores the mechanisms through which *Bellamya bengalensis* exerts its effects against inflammation and oxidative stress, conditions linked to various chronic diseases including cancer. In vitro studies were conducted to evaluate the extract's efficacy. The results demonstrated a significant reduction in inflammatory cytokines and markers of oxidative stress, suggesting that the bioactive constituents of *Bellamya bengalensis* inhibit pathways associated with inflammation and cellular damage. Additionally, the antioxidant assays indicated a robust scavenging activity against free radicals, highlighting the potential for *Bellamya bengalensis* as a natural source of antioxidants. The findings support the integration of *Bellamya bengalensis* into dietary supplements and functional foods aimed at mitigating inflammatory and oxidative stress-related disorders. Furthermore, the study underscores the need for further investigation into its pharmacological properties and active compounds, paving the way for future therapeutic applications. Overall, this study provides a valuable candidate in the search for natural remedies in modern medicine, reaffirming the importance of traditional knowledge in the discovery of novel pharmacological agents.

Keywords: Freshwater Mollusk, Anti-Inflammatory Activity, Oxidative Stress, Dietary Supplements

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Create Plans for the Development of Novel Thalidomide Derivatives for Cancer Treatment

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Thalidomide, initially developed as a sedative in the 1950s, gained notoriety due to its teratogenic effects, leading to severe birth defects. However, subsequent research revealed its potent immunomodulatory and anti-angiogenic properties, paving the way for its repositioning as a therapeutic agent, particularly in cancer treatment. Thalidomide exerts its anticancer effects through several mechanisms. It inhibits angiogenesis, a crucial process in tumor growth. Additionally, thalidomide modulates the immune system, enhancing the activity of T cells and natural killer (NK) cells, which play significant roles in tumor suppression. These properties have led to its successful use in treating multiple myeloma, a type of blood cancer, where it has demonstrated substantial efficacy. The present study primarily focuses on developing strategies for the computational design of new thalidomide derivatives with an acceptable pharmaceutical profile. This research aims to design and validate new protocols and strategies for the computational development of thalidomide derivatives. From literature, the structural features of known thalidomide derivatives that modulate T cells and NK cells were obtained. New modulators will be developed through suitable de novo design techniques followed by dynamics analysis and molecular docking. The de novo design procedure was developed by analyzing the hydration profiles and receptor pocket volume. To create modulators, over 10,000 different pieces were created and carefully combined. Following an examination of amino acid interactions, a threshold of -8.5 KJ/mol was established for the docking score. According to the results of the molecular dynamics investigation, the presence of the developed binders may greatly enhance the modulatory impact on T cells and natural killer cells. Using receptor pocket volume and hydration profile measurements to create and carefully assemble various molecular fragments, the study effectively developed a strong de novo design procedure.

Keywords: Thalidomide, Anticancer, De Novo Design, T-cells, Natural Killer Cells, Tumor, Computational Design

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The Multifaceted Role of Vitamin D in Various Disease Management: An Overview

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Vitamin D, a steroid hormone primarily synthesized in the skin through sunlight exposure, has emerged as a key regulator of numerous physiological processes. Beyond its well-established role in maintaining bone health, calcium-phosphorus balance, and muscle function, vitamin D also exerts significant effects on immune modulation, cell growth, and neural function. Growing evidence links vitamin D deficiency to a heightened risk of multiple chronic diseases, including autoimmune disorders, metabolic syndrome, cardiovascular diseases, certain cancers, and inflammatory conditions, all contributing to increased morbidity and mortality. Furthermore, recent studies indicate that low vitamin D levels may exacerbate mental health disorders such as anxiety and depression, highlighting its broad impact on both physical and mental health. This review offers a comprehensive overview of the multifaceted role of vitamin D in disease management, examining its influence on various health outcomes and discussing underlying mechanisms. Through an analysis of randomized controlled trials, meta-analyses, and observational studies, this presentation emphasizes the need for adequate vitamin D levels as part of preventive and therapeutic approaches in health care. It also addresses the ongoing challenges of vitamin D deficiency in global populations and explores potential interventions to improve health outcomes through optimal vitamin D management. This overview seeks to inform a more integrative approach to disease prevention, underscoring vitamin D's vital role in enhancing both longevity and quality of life.

Keywords: Vitamin D, Disease Management, Immune Modulation, Chronic Diseases, Mental Health

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Teratogenic Study of Ampicillin in Zebrafish (*Danio rerio*) Embryo

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Ampicillin trihydrate, a widely utilized antibiotic, raises concerns regarding its potential teratogenic effects on embryonic development. This study investigates the teratogenic activity of ampicillin trihydrate using zebrafish embryos (*Danio rerio*) as a model organism. Zebrafish embryos at various developmental stages were exposed to different concentrations of ampicillin trihydrate, and subsequent morphological changes were assessed. Experimental groups were exposed to a range of ampicillin trihydrate concentrations, alongside a control group with no exposure. Daily monitoring was conducted to identify visible developmental abnormalities and teratogenic effects, with parameters such as mortality rate, hatching success, and phenotypic alterations recorded and analyzed. Preliminary results indicate a concentration-dependent teratogenic effect of ampicillin trihydrate on zebrafish embryos, with higher concentrations correlating with increased mortality rates and reduced hatching success. Exposed embryos exhibited significant morphological abnormalities, including craniofacial malformations, body axis defects, and cardiovascular irregularities, while the control group displayed minimal abnormalities. Ongoing investigations aim to elucidate the mechanisms underlying ampicillin trihydrate-induced teratogenicity in zebrafish. This research enhances our understanding of the risks associated with ampicillin trihydrate exposure during embryonic development. Given its widespread use, particularly in pregnant women, these findings underscore the need for careful consideration when prescribing this antibiotic during pregnancy.

Keywords: Malformations, Morphological, Abnormalities, Pregnancy, Teratogenicity, Mortality rate

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Pinpointing Prime Structural Attributes of Kynurenine Monooxygenase (KMO) Inhibitors for CNS Disorders

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Huntington's disease (HD) is a hereditary neurodegenerative disorder. It is an autosomal dominant condition that leads to progressive neurological decline, with patients experiencing a range of motor, cognitive, and psychiatric symptoms that worsen over a period of approximately 20 years, ultimately leading to death. Kynurenine 3-monooxygenase (KMO) inhibitors have shown potential as therapeutic agents for central nervous system disorders and neurodegenerative diseases, especially HD. In this study, a dataset of KMO inhibitors was analysed using fragment-based quantitative structure-activity relationship (QSAR) methods. These techniques identified common structural features and sub-structural fingerprints associated with KMO inhibition. The findings from this study provide a foundation for optimizing KMO inhibitors, potentially improving therapeutic outcomes for HD patients through a more rational approach to drug design.

Keywords: Huntington's Disease, KMO, QSAR, Fingerprint, Fragment

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Phytochemical Screening of *Trichosanthene dioica* Fruit Extract and Its Antimicrobial, Antioxidant and Hypolipidemic Activity

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Trichosanthes dioica belongs to the Cucurbitaceae family, which have medicinal and herbal benefits in human beings. It is mostly cultivated in the Eastern part of India and South East Asia. There are several phytochemical presents in the root, stem, seed, and bark of the plant. The seed contains Alkaloid, Flavonoid, Proteins, Amino Acid, Terpenoids, Reducing sugar Saponins Steroid and Polysterols. On further analysis its shows antimicrobial activity in Gram-positive, Gram-negative bacteria and in broad spectrum bacteria. In the fruit part there is presence of Alkaloid, Cardiac Glycoside, Reducing Sugar, Proteins and Amino Acids that has promising action in reducing the VLD (Very Low-Density Lipoprotein) and increasing the HDL (High Density Lipoproteins). The antioxidative property helps in the reduction of oxidative stress in Hyperlipidaemic individuals, further analysis is in progress to identify the phytochemical constituents of *Trichosanthene dioica* fruit and their in-vitro analysis.

Keywords: *Trichosanthene dioica,* Phytochemical Screening, Anti-Oxidant, Hypolipidemic, Antimicrobial

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Role of Vitamin D in Diabetes Prevention and Management: A Comprehensive Review

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Vitamin D deficiency is linked to an increased risk of developing diabetes and its complications. Research has emphasized the prophylactic and curative role of Vitamin D in diabetes management. This review explores the association of Vitamin D with diabetes mellitus. Ameliorating glucose uptake in muscles, Vitamin D is found to enhance insulin sensitivity. It regulates glucose metabolism, reducing hemoglobin A1c (HbA1c) levels. The anti-inflammatory potential of Vitamin D could successfully mitigate inflammation, a key contributor to diabetes complications. Furthermore, it supports pancreatic beta-cell function, preserving insulin production. Clinical studies demonstrated improved glycemic control in diabetic patients supplemented with Vitamin D medicines, thereby, reducing cardiovascular risk and preventing neuropathy. Diabetic patients with Vitamin D deficiency experience improved outcomes with supplementation. Regular screening and adequate supplementation are essential. The prevalence of Vitamin D deficiency is also found to be high among diabetic patients, particularly those with obesity, dark skin, limited sun exposure, and inadequate diet. Deficiency consequences include increased risk of diabetes complications and poor glycemic control. Healthcare providers should prioritize Vitamin D screening and supplementation. Recommended daily intake is 1,000-2,000 IU. Dietary sources include fatty fish, fortified dairy products, and mushrooms. Moderate sun exposure (10-15 minutes/day) also contributes. Considering the role of Vitamin D in diabetes prevention and management, supplementation is recommended in diabetic patients. Supplementation improves glycemic control and insulin sensitivity and reduces cardiovascular risk. Regular screening and adequate supplementation are crucial for diabetic patients to minimize complications and optimize health outcomes.

Keywords: Diabetes Mellitus, Glycemic Control, Insulin Sensitivity, Vitamin D Deficiency, Vitamin D Supplementation

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Exploring the Neuroprotective Potential of Ficus Species in Diabetic Neuropathy Management: A Comprehensive Review

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One of the most prevalent complications of diabetes, peripheral neuropathy, presents itself in patients with subjective symptoms that range from numbness and tingling, aching or burning, weakness of the limbs, and allodynia. Poor glycemic control poses a significant risk for diabetic neuropathy. To date, the management of this debilitating condition relies on the effective management of diabetes. Apart from antidiabetic drugs, prescribed medications include Serotonin-norepinephrine reuptake inhibitors (SNRIs), N-methyl-D-aspartate receptor (NMDAR) antagonists, anticonvulsants, etc. However, side effects, high costs, poor pharmacokinetics, and increasing drug resistance have declined patient trust in synthetic drugs. This has sparked a global shift to herbal remedies as an alternative to conventional medications. This review emphasizes the pharmacological activity of *Ficus* species indicating the potential for this plant in the management of diabetic neuropathy. *Ficus* species are rich in bioactive compounds such as flavonoids, polyphenols, terpenoids, tannins, alkaloids, glycosides, sterols, and vitamins, which have shown significant potential in enhancing memory, reducing anxiety, neuroprotection, and anti-neurodegenerative effects. *Ficus exasperata* leaf extracts exhibit antinociceptive and antioxidant effects in diabetic rat models, while *Ficus formosana* increases neural response thresholds and relieves pain, indicating beneficial effects in peripheral neuropathy. Another one is the Indian rubber tree, *Ficus elastica*, which has proved its neuroprotective activity in reducing symptoms of depression and anxiety through the use of methanolic extracts. Quercetin and myricetrin have been proven to have strong antioxidant activity; some other rare compounds like ficusamide, ficusoside B, elastiquinone, elasticoside, and elasticamide indicate *Ficus elastica* as a promising source of novel treatments.

Keywords: Diabetic Neuropathy, *Ficus elastica*, Herbal Remedies, Neuroprotection, Phytochemicals

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A Review on Edible Vaccines

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A novel kind of vaccination, edible vaccines work by creating antigens in genetically engineered plants or other edible creatures, which may then be taken by people or animals to trigger an immune response. It is possible to develop edible vaccinations against a variety of illnesses and malignancies, including rotavirus, hepatitis B, and others. Research into the potential of genetically engineered potatoes and tomatoes as vectors for vaccine delivery against certain diseases is one example. Liver cirrhosis and hepatocellular cancer are two of the 600,000 annual fatalities caused by hepatitis B virus (HBV). About 360 million people are chronically infected with the virus. Although there is encouraging research, the results of edible vaccinations may differ. Antigen bioavailability and vaccination stability in the intestines are two of the most important success factors. The possibility for cross-contamination with non-GMO crops is only one of many ecological implications of growing genetically modified plants that must be carefully considered. For the purpose of creating a hepatitis consumable vaccination, potatoes are the plant of choice. To fully realize the promise of edible vaccines for global health, there must be ongoing study and open conversation among the public, regulators, and scientists.

Keywords: Edible Vaccine, Transgenic Plants, Bio-Friendly, Resistance, Mucosal Immunity

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Understanding Bacterial Biofilm Formation: Associated Infections and Treatment

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The majority of bacteria colonizes on the surface of the living and non-living substance and make three-dimensional cluster, is called biofilm. The bacterial biofilm can cause serious human health problems. The ability of the biofilm formation is a universal tendency of microorganism for survival and virulence. Accordingly, National Institute of Health (NIH), an estimated that, 65% to 80% infectious disease, are linked with formation of bacterial biofilm. The procedure of bacterial biofilm formation has several stages, initially microorganisms are attached by each other, to form micro colonies i.e. enclosed by Extra Cellular Polymeric (EPS) substance. Afterwards maturation, detachment will be occurred and allowing the micro colonies to spread out. When the bacterial biofilm formation is being processed then the microorganisms are communicating with each other, is known as quorum sensing i.e. regulate the gene expression to amplify the bacterial biofilm development and also virulence characteristics. The daunting problems of the bacterial biofilm are to treat bacterial infection and cause persistence against bacterial infection, resistance shows against antibiotics and also cause device and non-device associated infections where biofilms were formed on the medical device which is lead to prolonged and complicated human health problems. Addressing the bacterial biofilm problem requires innovative strategies to disrupt their formation and treatment against biofilm associated infection.

Keywords: Bacterial Biofilms, Quorum Sensing, Antibiotic Resistance

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Comprehensive Analysis of Biomarkers in Gastric Cancer: Advances in Early Detection, Prognosis and Targeted Therapeutics

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Gastric cancer (GC) is ranked as the fifth most common cancer and is the third leading cause of cancer deaths worldwide. This underlines the massive impact of this disease in terms of global health burden. Gastric cancer is a multifactorial and heterogeneous disease, often associated with numerous genetic and somatic mutations. Early detection through appropriate screening, the right selection of treatment modalities, and proper monitoring are very important steps in the reduction of mortality of gastric cancer. A biomarker is a molecular marker that indicates a specific biological state, important for the early diagnosis, prognosis, and personalized treatment of Gastric cancer. Genetic alterations, Human Epidermal growth factor Receptor 2 (HER2), Tumor Protein p53 (TP53), and Cadherin 1 (CDH1) genes have been linked to gastric carcinogenesis and serve as predictive biomarkers for targeted therapies. Non-invasive circulating biomarkers, like microRNAs (e.g., miR-21 and miR-200c), show promise for diagnostic applications, while protein markers like carcinoembryonic antigen (CEA) and carbohydrate antigen 72-4 (CA72-4) are routinely utilized. With advancements in research, bioinformatics, and functional genomics, biomarker identification has significantly progressed, leading to the exploration of early therapeutic options. Developing multiplex biomarker panels that incorporate diverse omics data could enhance our understanding of Gastric cancer (GC) biology. Advances have further strengthened the ability to predict patient responses to chemotherapy, targeted therapies, and immunotherapies. Biomarkers hold great promise for improving the clinical management of gastric cancer, from early detection to the development of personalised therapeutic strategies.

Keywords: Gastric Cancer, Mutations, Biomarkers, Chemotherapy, Immunotherapy

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A Review on Anti-cancer Activity of Rice Bran Oil

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Ricebran oil, extracted from the hard outer layer of rice, is a versatile cooking oil renowned for its high smoke point. It is a rich source of antioxidants with mono, and polyunsaturated fatty acids, omega 3, tocopherols, and phylloquinone. Additional benefits of this oil are, that it consists of 27 different phytosterols than any other consumable oil and it reduces cholesterol, provides anti-inflammatory effects, inhibits the growth of cancer cells, improves the immune system, and has other health benefits. The World Health Organization (WHO) reports that cancer is a leading cause of worldwide deaths annually. Rice bran oil's anticancer properties make it an attractive candidate for developing effective and affordable chemopreventive strategies reach a diverse global population. Ricebran oil is composed of healthy oil which ranges from 12–18.5% which further includes 47% monounsaturated, 33% polyunsaturated, and 20% saturated fats as well as highly unsaponifiable ingredients including gamma-oryzanol, tocotrienols, and beta-sitosterol which induce apoptosis in cancer cells and inhibit cancer cell growth by inhibiting the cell cycle between G0/G1 or G2/M and help shelding cells from damage from UV B-induced skin cancer and shows a promising adjuvant role in the treatment of prostate cancer. Research indicates that rice bran oil's bioactive phytochemicals exhibit potent anticancer effects by inducing apoptosis (cell death) in cancer cells, inhibiting cell proliferation and altering cell cycle progression. These mechanisms demonstrate potential in preventing and treating various cancers, including colorectal and prostate cancer. Reducing Inflammation and infection is an important inducer of tumor progression. Thus, it presents itself to be promising cancer therapeutics.

Keywords: Rice Bran Oil, Anticancer Activity, Omega 3 Fatty Acid

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Cucurbits Plants: A Key Emphasis to its Pharmacological Potential

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Beneficial effects of Cucurbita plants have rationalized their use as traditional medication in different cultures. *Cucurbita pepo* L. is among the 15 species of genus Cucurbita in *Cucurbitaceae*. *Cucurbita pepo* L. is commonly referred to as pumpkin, summer squash. *C. pepo* is widely used as a vegetable throughout the world. This review aimed to illustrate the traditional uses, phytochemical composition, and pharmacological activity of *C. pepo*. The medicinal properties of *C. pepo* are attributed to its nutrient-rich profile. Traditional use of this plant in Africa and Asia has been documented for the management of several diseases including fever, lower urinary tract disease, Whopping cough, micturition difficulty, benign prostatic hyperplasia, rheumatism, hemorrhoid, cancer, etc. Seeds are used as an anthelmintic, for the management of urinary disorders, hypertension, and as prophylactic therapy for renal stones. Furthermore, research has also highlighted the antioxidant, antibacterial, antidiabetic, antitumor, and hypolipidemic activities of this plant. *In vitro* and *in vivo* studies have emphasized the association of these pharmacological properties with the nutritional and phytochemical composition of the plant. Among those chemical constituents, carotenoids, saponins, terpenoids, sterols, phenols, tocopherols, fatty acids, and polysaccharides are reported in higher abundance. *C. pepo* is also abundant in nutrients, including carbohydrates, proteins, lipids, and essential minerals. Recently, there has been substantial interest in its triterpenoid compounds, particularly cucurbitacins, due to their well-documented biological properties. Therefore, isolating and characterizing these bioactive compounds is crucial to harness their therapeutic potential for developing safer and more effective drugs.

Keywords: Antioxidant Activity, Antitumor properties, *Cucurbita pepo,* Cucurbitacins, Terpenoids

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A Plant Based Colorant Anthocyanin May Slow or Stop Cancer Progress

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Anthocyanin, a naturally occurring plant-based colorant, has garnered increasing interest for its potential role in cancer treatment and prevention. Structurally, anthocyanins are glycosylated polyphenolic compounds with variations in their aglycone form, known as anthocyanidins, allowing for diverse coloring properties in response to pH changes. Commonly found in berries, grapes, red cabbage, and other richly pigmented vegetables and fruits, anthocyanins are widely used as food colorants and as natural pH indicators due to their vivid red, blue, and purple hues that vary by acidity. Recent studies highlight anthocyanin's antioxidant and anti-inflammatory properties, which may contribute to its promising anticancer effects. Furthermore, anthocyanins have shown promise in overcoming anticancer drug resistance by modulating drug efflux pump activities and targeting multiple cancer-related pathways. Research demonstrates that anthocyanins can inhibit cancer cell proliferation, induce apoptosis, and prevent angiogenesis in vitro and in vivo models, suggesting potential as a supplementary therapeutic agent in oncology. This abstract provides an overview of anthocyanin's chemical structure, sources, application in food color, and recent findings on its efficacy in cancer progression inhibition, overcoming anticancer drug resistance paving the way for further studies on plant-derived compounds in cancer therapy.

Keywords: Anthocyanin, Plant-Based Colorant, Cancer Therapy, Anti-Cancer Properties, Drug Resistance, Antioxidant, Food Colorant, pH Indicator

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Vinca Alkaloids: A Breakthrough Approach for Combating Life-Threatening Cancer

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Cancer is a genetic disease caused when a gene is triggered and cells divide uncontrollably and spread into surrounding cells. Vinca alkaloids are a class of medications obtained from the pink periwinkle plant. These alkaloids cause cell death by interfering with microtubules. Vinca alkaloids—vinblastine, vincristine, vindesine, and vinorelbine are isolated from the plant *Catharanthus rosea*. These Phytoconstituents are commonly used in combination with chemotherapy to treat malignancies such as leukemia, Hodgkin and non-Hodgkin lymphoma, advanced testicular carcinoma, breast cancer, and lung cancers. These Active phytoconstituents were the first natural products to enter clinical use as anticancer agents. The vinca alkaloids inhibit the polymerization of cellular proteins tubulin to microtubules, which occurs in α- and β-forms and is essential for proper cellular function. The equilibrium between unpolymerized α- and β-tubulin and microtubules is an important action; disruption of this equilibrium can send dividing cells into mitotic block and apoptosis. The binding of β-tubulin of vinca alkaloid at a different site from paclitaxel (Taxol) acts to inhibit tubulin assembly. Vinblastine has also been used alone or in combination with other drugs to treat Kaposi sarcoma and bladder, breast, and some selected types of brain malignancies. Nowadays isolated indole alkaloids from *C. roses* are available in the pharmaceutical drug bank under different trade names that are active for this life-threatening genetic disease.

Keywords: Vinblastine, Vincristine, Breast Cancer

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A Brief Review on Phytochemical and Pharmacological Property of *Tinospora cordifolia*

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Throughout history, medicinal plants have provided a valuable source of therapeutic agents, with natural resources continuously offering medicinal benefits. This has led to the development of many modern drugs derived from natural compounds. There is strong interest in investigating plant-based nutraceuticals as alternatives to synthetic drugs to reduce side effects and enhance affordability. Tinospora cordifolia, known as Amrita or Guduchi, is a significant medicinal plant in the Menispermaceae family and plays a central role in the Indian System of Medicine (ISM). Traditionally, it has been used to treat various ailments such as fever, urinary issues, dysentery, skin conditions, leprosy, and diabetes. The plant contains numerous bioactive compounds, including alkaloids, terpenoids, polysaccharides, lignans, and steroids, contributing to its wide-ranging phytochemical and pharmacological effects. While some pharmacological properties of T. cordifolia have been studied in lab and animal models, limited mechanisms of action have been fully understood, highlighting a need for more research. This review explores T. cordifolia's pharmacological significance, including its antioxidant, antimicrobial, antibacterial, antifungal, anti-diabetic, antistress, hypolipidemic, liver-protective, anticancer, anti-HIV, antiosteoporotic, antitoxic, wound-healing, anticomplementary, and immunomodulating effects, as well as its potential in treating systemic infections and Parkinson's disease. This comprehensive overview serves as a crucial resource for future clinical studies and for advancing standardized phytomedicine in healthcare.

Keywords: Plant-Based Nutraceuticals, Phytochemical, Bioactive Compounds

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A Novel Antitubercular Drug Candidate GSK2556286 Effective In-Vivo with the Potential to Shorten Tuberculosis Treatment

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For the year 2019 WHO (World Health Organization) estimated, 10 million people were new victim of Tuberculosis whereas, 1.4 million already died. A new drug candidate for treating tuberculosis was identified by Elena Jimenez and her group. This was as a result of a high throughput compound screening campaign, by using *Mycobacterium tuberculosis*-infected macrophages. GSK 2556286 inhibits growth (50% inhibitory concentration [IC_{50}] = 0.07 µM), no cross resistance is shown with known anti tuberculosis drugs by this, active against in cholesterol containing culture medium extracellular bacteria in human macrophage. It shows a safety profile into pre-clinical species and it is also active in different mouse models of tuberculosis. The properties which indicate a compound with novel mode of action such as Multidrug-resistant (MDR) or extensively drug-resistant (XDR) and drug-sensitive (DS) *M. tuberculosis,* it is effective against both. Although not fully defined, with the potential to certain the duration of treatment in novel combination drug regimen.

Keywords: GSK2556286, Pharmacology, *Mycobacterium tuberculosis*, Tuberculosis

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Stem Cell Research Breakthroughs: Transforming Therapeutic Strategies forAlzheimer's Disease

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Alzheimer's disease (AD) constitutes a persistent global health challenge, currently affecting over 50 million people and imposing significant economic burdens. Current treatment modalities are inadequate for managing disease progression, primarily due to the complex pathophysiological mechanisms involved in the neuropathology of AD. This review delves into the innovative potential of stem cell-based therapies as a promising avenue for AD intervention. The molecular mechanisms of AD are marked by neuroinflammation, oxidative stress, and synaptic dysfunction, which ultimately lead to neuronal loss and cognitive impairment. Various types of stem cells, including neural stem cells (NSCs), embryonic stem cells (ESCs), and mesenchymal stem cells (MSCs) possess regenerative and differentiative properties that can be leveraged to target the underlying pathological cascade of AD. Their unique capabilities offer potential therapeutic avenues for mitigating the effects of neurodegeneration. NSCs have demonstrated the ability to differentiate into neurons and glial cells, offering neuroprotective effects and enhancing cognitive function through targeted transplantation. While ESCs provide opportunities for generating therapeutic neurons due to their pluripotent nature, ethical considerations and immunogenicity pose significant limitations to clinical application. In contrast, MSCs have shown promise in alleviating AD-related pathology and promoting neurogenesis, representing a less contentious alternative. Future research should focus on developing combinatory approaches that leverage synergistic effects of different types of stem cells, optimize transplantation techniques, andenhance cell integration. Overall, it could be said that stem cell-based therapies present an innovative strategy for AD with the potential to restore neuronal function and mitigate disease progression, thereby addressing a critical unmet medical need in the field of neurodegeneration.

Keywords: Alzheimer's Disease, Neurodegeneration, Stem Cell Therapy, Mesenchymal Stem Cell, Neural Stem Cell, Embryonic Stem Cell

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Pharmacological and Antioxidant Activities of Cyperaceae Rhizomes: A Review of Current Research and Traditional Uses

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The Cyperus genus, within the Cyperaceae family, encompasses over 5600 species and 100 genera, each characterized by a diverse range of active phytochemicals with significant pharmacological potential. Traditionally utilized for the treatment of stomach and intestinal ailments, as well as for its diuretic and digestive properties, Cyperus species are rich in flavonoids, alkaloids, polyphenols, sesquiterpenes, and triterpenes. This comprehensive study, based on an extensive review of literature from sources such as Google Scholar and PubMed, highlights the antioxidant, antipyretic, antibacterial, and anti-inflammatory properties of Cyperus rhizomes. The pharmacological effects are linked to the presence of diverse phytoconstituents including phenolic acids, volatile oils, and fatty acids. Despite these findings, further research is needed to validate traditional medicinal uses and elucidate the detailed mechanisms of action of these bioactive compounds. Future studies should focus on confirming therapeutic applications and understanding the precise interactions and efficacy of Cyperus phytochemicals to fully harness their medicinal potential.

Keywords: Cyperaceae Family, Rhizome, Phytoconstituents, Pharmacological Properties

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Heavy Metal Exposure: A Catalyst for Neurodegenerative Disorders

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Heavy metal exposure, particularly to metals like lead, mercury, cadmium, and arsenic, is increasingly recognized as a critical environmental factor in the development and progression of neurodegenerative disorders, including Alzheimer's, Parkinson's, and amyotrophic lateral sclerosis (ALS). These metals accumulate in neural tissue, where they induce oxidative stress, disrupt synaptic function, and promote protein misfolding and aggregation, processes central to the pathology of these diseases. For example, lead exposure has been linked to β-amyloid accumulation in Alzheimer's disease, while cadmium and mercury exposure have been shown to impair dopaminergic pathways, a hallmark of Parkinson's disease. This poster presentation will investigate these mechanisms, illustrating how chronic heavy metal exposure exacerbates protein aggregation and neural inflammation, which, in turn, accelerate neurodegeneration. Current research correlating metal toxicity levels with disease biomarkers will be reviewed, along with recent advances in diagnostic methods for assessing metal burden in the brain. Furthermore, emerging therapeutic strategies, such as chelation therapy and antioxidant applications, will be discussed as potential interventions to counteract heavy metal-induced neurotoxicity. Understanding the link between heavy metal exposure and neurodegenerative disorders could provide new avenues for targeted prevention and treatment strategies, highlighting the urgency of environmental regulation and public health measures in mitigating the impact of these toxins on brain health.

Keywords: Neurodegenerative Disorders, Heavy Metal Poisoning, Oxidative Stress, Neuronal Damage, Chelation Therapy, Public Health Initiatives

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Nano Formulated Natural Bioactive Compound for the Treatment of Neurodegenerative Disease Epilepsy- A Review

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Epilepsy is a chronic CNS disorder characterized by paroxysmal cerebral dysrhythmia. Repetitive generation of seizures are the main characteristics. The aim of this review is to assess the potential therapeutic benefits of natural compounds and their nanostructures using a variety of in vitro and in vivo neurodegenerative model systems. The main therapeutic approaches of antiepileptic drugs are to cross the blood brain barrier (BBB). The BBB is an insuperable barrier for brain drug delivery. Nonetheless, nano formulation allows for regulated release and therapeutic benefits of natural compounds despite their limited solubility and bioavailability. The present review covers the literature available from 2000 to 2024. The information was collected from journals, books, thesis and electronic search (Google Scholar, PubMed, ScienceDirect and SpringerLink). Many phytochemicals have been isolated, identified and published to date, including: flavonoids, alkaloids, glucoside for the treatment of epilepsy. Numerous plants and their components from Chinese, Ayurvedic, Iranian, South American, and African medicine have been shown to have neuroprotective properties in cases of epilepsy. The natural compounds have a low blood-brain penetration rate, the efficacy of nano formulated versions in treating epilepsy has been studied. All of these findings point to the significant potential that natural solutions based on nanotechnology offer for the management and treatment of epilepsy.

Keywords: Neurodegenerative Disease. Epilepsy, Nano Formulation, Natural Drugs

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Microneedle Patches for Vaccination

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Microneedle patches are an emerging technology in the field of vaccination, offering a minimally invasive, pain-free alternative to traditional syringe-based methods. These patches consist of tiny needles, typically less than a millimetre long, which can painlessly penetrate the outer layer of the skin to deliver vaccines. Research and review articles were sourced from databases such as PubMed, Scopus, Web of Science and Google Scholar focusing on publications from 2015 to 2024. The search utilized keywords including "microneedle patches," "vaccine," "immunization," and "self-administration." We gathered a total of 30 articles and found the following results. The skin's immune system allows for a more efficient and potent immune response when vaccines are administered via microneedles. Microneedle patches provide several advantages over conventional vaccination methods, including ease of use, reduced need for healthcare personnel, and the potential for self-administration. Many researchers have demonstrated their efficacy in delivering a wide range of vaccines, including those for influenza, polio, and COVID-19. They offer the possibility of reducing the pain, needle fear, and biohazard waste commonly associated with injections. Current clinical trials focus on their safety, efficacy, and scalability for mass vaccination programs. This comprehensive review seeks to offer an in-depth understanding of a promising advancement in immunization strategies through the use of microneedle patches. These innovative delivery systems have the potential to transform vaccine administration and broaden global access to life-saving vaccines.

Keywords: Microneedle Patches, Vaccine, Immunization, Self-Administration

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Novel Approaches of Nano-Formulation for Targeted Action in Malignant Cells & their Applications

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The constraints present in traditional cancer therapy techniques have prompted current efforts to create safe, highly effective nanomedicines for use in the fight against cancer using a variety of exciting strategies. Several lipid nanoparticles, such as those with targeted drug delivery and biocompatibility as well as bioequivalence, are appealing for application because of their many benefits and special potential. The goals of the present objective can be expressed by achieving a precise and regulated drug release schedule for increased oral bioavailability and optimal anti-tumor effectiveness with minimal cytotoxicity. Nanoparticles have demonstrated promise in lowering systemic toxicity, increasing therapeutic results, and improving the delivery of anticancer agents. Scientists are investigating methods to increase the ability of drugs to be loaded, like altering the surfaces of nanoparticles or creating new ways to encapsulate drugs. The therapeutic efficacy of these systems can be greatly increased by increasing drug loading. Novel drug delivery systems for natural products have been developed recently to improve solubility, bioavailability, tissue distribution, prolonged retention, and enhanced permeation. Recent developments in nanotechnology have demonstrated the enormous potential that nanoparticles offer in the field of medicine. Because of their high carrier capacity, ability to bind both hydrophilic and hydrophobic substances with ease, variability in size and shape, ability to form stable interactions with ligands, nanoparticles are useful platforms for targeted and controlled delivery of micro- and macromolecules in disease therapy. Therefore, it's critical to comprehend the unique characteristics of therapeutic nanoparticles and the methods by which they are delivered.

Keywords: Nanomedicine, Bioequivalence, Therapeutic Efficacy, Nanoparticle, Bioavailability

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Preparation and In-vitro Characterization of Hydroxyapatite-Ciprofloxacin Composite/Plaster of Paris Implants

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The present research deals with preparation and *in vitro* evaluation of effective ciprofloxacin-releasing implantable systems made of hydroxyapatite (HAp)-ciprofloxacin composite (HAp-Cip) powder and plaster of Paris (POP) for bone drug delivery through a one-stage surgical osteomyelitis management. HAp-Cip powder was synthesized by wet precipitation methodology, where the starting raw materials used were $Ca(OH)_2$ and H_3PO_4 in a stoichiometric molar ratio of 10 : 6 along with ciprofloxacin HCl. By the chemical reaction of $Ca(OH)_2$ and H_3PO_4 in the aqueous environment, the yellowish-white colored precipitate of HAp-Cip was formed. The chemical precipitation reaction for HAp synthesis is: $10\ Ca(OH)_2 + 6\ H_3PO_4 \rightarrow Ca_{10}(PO_4)_6(OH)_2 \downarrow + 18\ H_2O$. The HAp-Cip powder was used for HAp-Cip/POP bone-implants (2 mm x 2 mm) via molding technique. *In vitro* drug release study of different HAp-Cip/POP bone-implants in phosphate buffer saline (pH 7.4) was carried out, *in vitro* and all these bone-implants exhibited sustained releasing of ciprofloxacin over 8 weeks. HAp-Cip/POP (33/67) bone-implants exhibited comparatively slower sustained *in vitro* ciprofloxacin releasing (51.02 ± 3.04%) over a period of 8 weeks than that of HAp-Cip/POP (50/50) and HAp-Cip/POP (42/58) bone-implants (66.07 ± 1.30% and 55.97 ± 2.52%, respectively). The *in vitro* ciprofloxacin releasing from these HAp-Cip/POP bone-implants followed the Korsmeyer-Peppas model with Fickian diffusion mechanism of ciprofloxacin releasing. The HAp-Cip/POP (33/67) bone-implants were characterized by FTIR spectroscopy analysis (demonstrated the absence of any interaction in-between excipients-drug interaction within bone-implants) and P-XRD analysis (demonstrated the slightly transformation of the crystalline of ciprofloxacin HCl into its amorphous state within bone-implants). These newly developed HAp-Cip/POP bone-implants can be used in one-stage surgical treatment of osteomyelitis with desired prolonged localized drug delivery with the bone tissue regeneration possibility to fill the diseased bone voids.

Keywords: Ciprofloxacin, Hydroxyapatite, Plaster of Paris, Bone-Implants, Bone Drug Delivery

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Preparation of Moisturizing Herbal Oil Based Nano Emulgel

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The revolutionary concept behind the formulation and characterization of the moisturizing herbal oil base nano-emulgel is its multi utility in cosmetic-therapy which involves a comprehensive analysis of various key aspects in order to ensure optimal performance and skin benefits. Factors such as the size and distribution of nano-oil globules within the emulsion are imparted by selecting specific oils, emulsifiers, gelling agent and formulation method. Desired skin effects and the rheological properties of the gel matrix which play crucial role in determining the emulgel's efficacy and stability under variable conditions bring its compatibility with various skin types and these are essential to guarantee consistent quality and performance. Additionally, assessing the emulgel's moisturizing performance through in vitro and in vivo studies helps validate its ability to improve skin hydration levels, enhance skin texture, and address chronic skin concerns effectively due to the nano-oil globules. The promising results from these evaluations indicate the significant potential of the moisturizing nano-emulgel as a cutting-edge solution for individuals struggling with chronic skin dryness and related conditions. Further advancements in research and development are expected to fine-tune the emulgel's formulation and expand its utility in diverse therapeutic and cosmetic settings, and solidify its position as a standout innovation in the realm of skincare products.

Keywords: Moisturizing, Nano-Emulgel, Cosmetic, Skin, Herbal

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Nanomedicines for Diabetes Management: Current Trends and Future Directions

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Diabetes mellitus is a chronic metabolic disorder which can affect millions worldwide. Conventional treatments face challenges in maintaining blood glucose levels, preventing complications, and improving patient compliance. Nanomedicines have emerged as a promising approach in diabetes management, offering innovative solutions for drug delivery and glucose monitoring. Current research focuses on enhancing the bioavailability and targeted delivery of antidiabetic drugs, such as insulin, using nanomedicines. These nanocarriers, including liposomes, polymeric nanoparticles, and micelles, provide controlled release, protect drugs from enzymatic degradation, and minimize side effects. Insulin-loaded nanomedicines administered via non-invasive routes, aim to improve patient compliance by replacing conventional injections. In addition to drug delivery, nano-medicines are revolutionizing glucose monitoring systems. Nano sensors, employing materials like gold and silver nanoparticles, have been developed for continuous glucose monitoring, offering real-time, highly sensitive, and accurate detection of blood glucose levels. Future directions include the development of smart and stimuli-responsive nanomedicines that can release insulin in response to glucose levels and can mimic the natural pancreatic function. Research is also exploring biocompatible and biodegradable nanomaterials to reduce toxicity and enhance safety.

Keywords: Nanomedicines, Diabetes Management, Insulin Delivery, Glucose Sensing, Pancreatic Islet Cell Targeting

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Design and Development of Nanostructured Lipid Carriers for Enhanced Ocular Drug Delivery

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Ocular drug delivery is a difficult task due to the maximized protective barriers and rapid drug clearance; hence, this study aims to design and develop nanostructured lipid carriers (NLCs) for ocular drug delivery purposes. NLCs were formulated using a mixture of solid and liquid lipids that are stabilized by surfactants, with a particular focus on particle-size optimization, zeta potential, and encapsulation efficiency. The NLCs were produced by having particle sizes of less than 200 nm, good zeta potential, and high drug-loading capacity, thus suitable for ocular application. The lipid-based nanocarrier system allows prolonged ocular residence time and thus could reduce the number of doses, thereby improving patient compliance. Also, the lipid nature used in NLCs contributes further to their safety for ocular therapy. This work has shown that NLCs possess one of the most accepted options to alleviate ocular drug delivery barriers due to involvement with traditional techniques. Future investigations will focus on in vivo feasibility studies to establish the efficacy of treating ocular manifestations with NLCs.

Keywords: Nanostructured Lipid Carriers, Ocular Drug Delivery, Lipid Nanocarriers, Encapsulation Efficiency, Zeta Potential.

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Oral Fast Dissolving Film: A Novel Approach for Mankind

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Fast-dissolving oral film preparation is the aim of the present work to control the route of administration's limit for better patient compliance and immediate action. Several grades of HPMC (Hydroxy Propyl Methyl Cellulose), PG (Propylene Glycol), and PEG (Polyethylene Glycol) 400 are used to prepare fast dissolving oral film for the betterment of bioavailability of the drug. The process is done by solvent casting, rolling, hot melt extrusion, semi-solid casting, and solid dispersion methods. For better therapeutic efficacy, site-specific targeting, improved bioavailability and fast dissolving oral films are used. Since the 1970s, oral fast-dissolving films have been used for better treatment. Oral fast-dissolving films directly enter the systemic circulation after mucosal absorption and bypass first-pass metabolism. Famotidine, loratadine, cetirizine, and ondansetron are used in the formation of oral fast-dissolving films. Oral fast-dissolving films are the future for the treatment of allergy, asthma, epilepsy, etc.

Keywords: Fast-Dissolving Oral Film, Therapeutic Efficacy, Polyethylene Glycol, Bioavailability, First-Pass Metabolism

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Role of Phytoconstituents in the Preparation of Biogenic Silver Nanoparticles

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The field of materials science and technology has recently seen nanotechnology rise as a pivotal area of study. Material scientists worldwide are making extensive efforts to unlock nanotechnology's full potential, particularly as they seek innovative approaches to combat bacterial infections and reduce environmental pollution. With sustainability becoming a central focus, green synthesis methods have become especially relevant for producing silver nanoparticles (AgNPs). Traditionally, AgNPs are created through physical and chemical methods that involve reducing agents; however, these often result in toxic byproducts, raising ecological concerns. This issue has driven a shift toward environmentally friendly alternatives, such as green synthesis, which uses plant-based biomolecules. Plants, through their leaves, seeds, and roots, offer a wide range of biomolecules like carbohydrates, fats, enzymes, flavonoids, terpenoids, polyphenols, and alkaloids that are capable of enabling a streamlined and eco-friendly nanoparticle synthesis process by their reducing and capping property. Biogenic synthesis of AgNPs has shown promise in nanomedicine, especially in food and pharmaceutical applications, where these nanoparticles are valued for their antimicrobial and antioxidant properties. Studies reveal that AgNPs are effective against pathogens like *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhi*, acting through mechanisms such as free radical generation and cell penetration. Advances in nanobiotechnology have expanded treatment possibilities for microbial infections, with biogenic AgNPs emerging as powerful antibacterial agents. Important characteristics such as size, shape, and surface charge influence AgNPs' effectiveness, pointing to areas for improvement to maximize their potency, safety, and biocompatibility.

Keywords: Silver Nanoparticles, Nanomedicine, Nanotechnology, Green Synthesis, Biogenic Synthesis

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Rheological and In-vitro Release Kinetic Modelling of Herbal Organogels

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Globally, topical phytopharmaceuticals become a potent substitute for synthetic preparations owing to their easy accessibility with minimal side effects. The objectives of the present investigations were to prepare isolated Putush essential oil (2%W/V) loaded organogels via the fluid fiber method and characterize the formulations on the basis of their rheological behavior and *in vitro* drug release profile. Isolated essential oil was subjected to solubility analysis and FT-IR spectroscopy to indicate compatibility with other formulation excipients. Ostwald-de waele modified power law and Herschel-Bulkley law were adapted for viscometric analysis to determine the flow behavior, consistency index, and yield stress, respectively. The viscosity (at 25°C) and yield stress of the herbal organogel were found to be in the range of 31000-162000 cps and 10346-17110 cps, respectively, with Pseudoplastic flow behavior. The cumulative percentage release of essential oil from the organogel was found to be decreased with the increase in gelator (Span 80) concentration. The low viscous formulation (containing 40% W/V Span 80) demonstrated highest drug release (78.03±0.9%) and followed Korsmeyer-Peppas model with Super case II transport mechanism. However, there is a transformation of release kinetics from Korsmeyer-Peppas to zero order following the same diffusion mechanism with the increase in gelator concentration. Therefore, mechanically and thermodynamically stable herbal organogels with satisfactory release profile suggest further *in vivo* studies to explore traditionally claimed pharmacological activity of Putush.

Keywords: Herbal Organogel, Herschel-Bulkley Law, Korsmeyer-Peppas Model, Ostwald-De Waele Modified Power Law

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Fabrication and Characterization of Atorvastatin-Loaded Nanoliposomes Using 3^2 Full Factorial Design in view of Improved Oral Bioavailability

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Atorvastatin (ATV) is a drug of choice for the management of hyperlipidemia, and the commonly available marketed product of ATV is tablets. ATV is a poor water-soluble drug with a low oral bioavailability (about 12%). The first-pass metabolism of ATV is another cause of low bioavailability. Liposomal ATV to increase bioavailability, hypothesize the reduction of metabolism (by reducing free exposure of the drug and protecting it from metabolizing enzyme), and increase their solubility due to the greater surface area of tiny liposomal ATV were fabricated. Liposomes are tiny spherical vesicles with one or more lipid bilayers made from physiological lipids. The novelty of the work lies in the dose reduction with sustained action and increased bioavailability. In this work, liposomes of ATV were prepared by the thin film hydration method and characterized by vesicle size and size distribution and drug loading efficiency. The preliminary investigation of batches designed by using 32 full factorial designs, keeping the size and drug loading as dependent variables, showed formulation batch 2 (NL2) showed liposomes 110.3 ± 14.6 nm in size with a PDI value of 0.28 ± 0.03 and zeta potential of 58.7 ± 7.1 mV with drug loading more than 60%% and this batch was considered the optimized one. Further, this batch will be studied for their shape by FESEM and lamellarity by cryo-TEM analysis, and the justification of the increase in bioavailability will be carried out in a selected animal model by HPLC or LCMS method. In conclusion, the fabricated nanoliposomes of ATV may be a fruitful strategy for enhancing the bioavailability of ATV.

Keywords: ATV, Liposome, Bioavailability. HPLC

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Cutting Edge Cancer Theranostics-Using Hybrid Nanoplatform Combining Exosomes and Nano-Particles in the Detection and Treatment of Early Onset Cancer

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Research and development in oncology is at the forefront of contemporary scientific developments, as cancer continues to be a predominant cause of mortality globally. Early onset malignancies have proliferated over the 20th century, with diagnoses in persons under 50 years of age increasing by approximately 79% globally. Thus, there is a desire for early cancer detection and tailored medication. Exosomes are invaluable instruments in cancer research, as they participate in tumor cell metastasis, and the creation of cancer stem cells, and serve as key biomarkers with both therapeutic and diagnostic implications. However, it is linked to certain limitations, like inadequate encapsulation and the incapacity to accommodate big molecules. Likewise, nanoparticles are regarded as highly effective in targeted drug delivery technology; yet, they possess disadvantages including low biocompatibility, cytotoxicity, and inadequate cellular absorption. Hybrid platforms are created to surmount the constraints of exosomes and nanoparticles when utilized independently. The synergistic impact maximizes the benefits of these compounds by boosting bio-distribution, enhancing target selectivity, and enabling real-time tracking of disease progression. Surface alterations facilitate the detection of early-stage cancers. This thorough review elucidates the development of these hybrid nanoplatforms and the mechanics underlying their functionality. Nevertheless, a more comprehensive study is necessary to address the obstacles posed by the hybrid system, and subsequently completing clinical trials can facilitate the accurate detection of early-onset cancer and aid in the development of tailored medication, ultimately enhancing patient outcomes.

Keywords: Exosomes, Nanoparticles, Hybrid Platform, Bio-Distribution, Early Stage Detection

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Colon Targeted Drug Delivery by Xerogel Formulation of Chitosan-Conjugated Polymer

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The research focuses on developing a novel, colon-targeted delivery system using a xerogel formulation of chitosan-conjugated polymers. Colon-targeted drug delivery faces a significant hurdle: the highly acidic environment of the upper gastrointestinal tract. The stomach's low pH(1-3) can degrade drugs and delivery systems, leading to reduced efficacy, premature release, and potential side effects. Xerogel formulations of chitosan-conjugated polymers offer a promising platform for colon-targeted drug delivery. Delivery to the colon is ensured by the xerogel matrix, which protects the medication from the severe conditions of upper GIT. Chitosan, a biocompatible and mucoadhesive polymer, is conjugated with synthetic polymers to enhance drug loading and release characteristics. Xerogel formulation allows for sustained and controlled drug release within the therapeutic needs. Chitosan, a natural biopolymer derived from chitin, offers several advantages in colon-targeted drug delivery. Chitosan is a linear polysaccharide composed of two main sugar units: (1,4)-2-amino-2-deoxy-β-D-glucan, responsible for the chitosan's cationic nature which is linked with (1,4)-2-acetamido-2-deoxy-β-D-glucan. Because of its high biodegradability in acidic media-the upper gastrointestinal tract has a pH of 1.2 to 1.3 and its ability to dissolve quickly in the gastric cavity, chitosan was unable to shield its drug load during transit through the stomach and small intestine. Some chemical or other changes are required to suppress its strong degradability in order to make it colon-targeting. The treatment of diseases of the large intestine, including colon cancer, ulcerative colitis, and irritable bowel syndrome, is one of the significant therapeutic uses of colon-targeted delivery systems.

Keywords: Colon Targeted Drug Delivery, Chitosan, Upper Gastrointestinal Tract, Xerogel

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Revolutionizing Diabetic Wound Healing: The Role of Biopolymers

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Diabetic wounds are a significant health concern due to their slow healing rates and increased risk of infections. Recent advancements in wound management have highlighted the potential of biopolymers as effective materials for promoting healing. Common biopolymers utilized in diabetic wound healing include alginate, chitosan, collagen, and hyaluronic acid. Alginate, derived from brown seaweed, is renowned for its excellent moisture-retentive properties and ability to form hydrogels, which facilitate a conducive healing environment. Chitosan, obtained from crustacean shells, possesses antimicrobial properties that can help prevent infection while promoting cell proliferation. Collagen, a key structural protein sourced from animal tissues, supports cell attachment and enhances tissue regeneration. Hyaluronic acid, found in connective tissues, plays a critical role in cellular migration and proliferation, essential for wound healing processes. These biopolymers can be utilized individually or in combination to create advanced wound dressings that enhance healing outcomes. Their biocompatibility, biodegradability, and ability to support the healing microenvironment make them ideal candidates for diabetic wound management. In conclusion, biopolymers such as alginate, chitosan, collagen, and hyaluronic acid offer promising solutions for diabetic wound healing. Their natural origins and beneficial properties not only improve healing rates but also minimize complications associated with traditional treatments. Future research should focus on optimizing formulations and exploring novel combinations to further enhance the efficacy of biopolymer-based dressings in diabetic wound care.

Keywords: Diabetic, Wound Healing, Biopolymer, Chitosan, Natural

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Exploring Wound Healing Potentials of Functionalized Tamarind Gum/Guar Gum-Based Hydrogel

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The present research endeavors focused on developing ferulic acid-grafted tamarind gum/guar gum (FA-g-TG/GG) hydrogel which was designed to transform into gels upon interaction with wound exudate and ultimately exploited as wound dressing materials. Initially, tamarind gum (TG) was grafted with variable amounts of ferulic acid (FA) using the Steglich esterification method. The resulting FA-grafted conjugates were then combined with guar gum (GG) and lyophilized to produce dry powder formulations (F-1 - F-3) with particle sizes averaging between 5.10 and 5.54 µm and angles of repose around 30º. The structural characterization was performed using ^{1}H NMR, FTIR, DSC, TGA, and XRD analyses. The SEM analyses of pristine TG, FA-g-TG, and FA-g-TG/GG hydrogel (F-2) showed distinct morphological differences among them. Among several formulations, F-2 demonstrated optimal water vapor transmission rate (WVTR, 2564.94 ± 32.47 g/m²/day) and high-water retention and swelling capacity in simulated wound fluid (4559.00 ± 41.57%). Additionally, the hydrogel was biocompatible, showed antioxidant activity, and promoted fibroblast cell adhesion, proliferation, and migration, indicating strong wound-healing potentials. Consequently, these hydrogels would display promising capabilities as wound care dressings.

Keywords: Wound Dressings, Polysaccharides, Ferulic Acid, Steglich Esterification, Fibroblast Cells

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Challenges & Progress: Microneedle Technology for Cancer Therapy

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Cancer is becoming a grave threat to socio-economic development, a global burden that negatively affects the patient's health, and has been one of the major challenges in the field of biomedicine. Although there are many conventional approaches, they have certain drawbacks. These approaches include immunotherapy, photothermal therapy, photodynamic therapy, chemotherapy, and more. Despite numerous advances in prevention, early detection, and updated more successful treatment techniques, cancer is still one of the most terrible and traumatic experiences for anyone who receives this diagnosis. Microneedle (micron-sized needling system) technology refers to an attractive, non-invasive administration of medications via the skin's surface or transdermal route that offers high bioavailability while avoiding gastrointestinal degradation and first-pass metabolism. To build microchannels in the skin without causing discomfort, bleeding, or infection, those are intended to disrupt the epidermal layer. The dermal layer, which is rich in blood vessels, these channels enable the diffusion of therapeutic substances. The microneedle distribution is not restricted by molecular size (molecular weight should be less than 500 Da) because the channels are significantly larger than those of the conventional medication. MN-based systems have demonstrated remarkable scientific abilities and have undergone testing for immunotherapy, photothermal therapy, photodynamic therapy, and pre-clinical chemotherapy. Our target is to develop a painless, affordable, cost-effective, and self-administration drug delivery strategy to overcome the drawbacks of painful conventional treatments.

Keywords: Microneedle, Transdermal Drug Delivery, Cancer, Painless Therapy

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Microsphere and its Application

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Microsphere is a small spherical with diameter typically ranging from 1 μm to 1000 μm. They are protective polymeric waxy or other protective materials such as nature, Semi-Synthetic and synthetic polymer. Microspheres are two types Microcapsules and Micromatrices. Microcapsules are those in which entrapped substance is distinctly surrounded by a distinct capsule wall. Micromatrices in which entrapped substances are dispersed throughout the matrix. Microsphere provides constant and prolonged therapeutic effect, improved the patient compliance, improved the bioavailability and reduced the adverse effect. Microsphere Preparation also depends on particle size, route of administration. Microsphere methods are emulsion evaporation methods, phase separation methods, spray drying methods, hotmelt extrusion methods. Microspheres methods are also depending on physiochemical properties corresponding products on the market. Microsphere parameters are also used in particle size and shape, isoelectric point, angle of contact, in vitro methods. Recent advancement in microsphere in the cosmetic industry, dental medicine, increased stability of drug. Microsphere is short term but it has wide applications in controlled drug delivery system, sustained drug delivery system and microsphere is an effective carrier of the novel drug delivery system.

Keywords: Microsphere, Micromatrices, Improved Bioavailability, Novel Drug Delivery System

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Formulation and Evaluation of Promitazine HCl Oro-dispersible Tablet

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The main moto of this project work formulation & development Promithazine HCl Oro-dispersible Tablet (ODTs). This formulation is designed to dissolve rapidly in the mouth without the need for water, making it particularly advantageous for patients with swallowing difficulties, paediatric patients, and those requiring quick relief from allergic symptoms such as rhinitis, urticaria, nausea, and vomiting. Prepare with various superdisintegrants agents such as croscarmellose sodium, sodium starch glycolate, and crospovidone at different concentrations to achieve rapid disintegration. The promethazine ODTs are prepared by direct compression method. So many tests performed to evaluate Promithazine ODTs such as weight variation, thickness, hardness, friability, and in-vitro disintegration time. The results showed that the optimal formulation achieved a balance between mechanical strength and fast disintegration, with disintegration times under 30 seconds, making them ideal for orodispersible applications. In-vitro dissolution studies confirmed rapid release of Promethazine HCl, demonstrating that these ODTs could provide quick onset of action for symptomatic relief.

Keywords: Oro-dispersible Tablet, Urticaria, Superdisintegrants

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Nanoemulsion as a Drug Delivery System of Anticancer Drugs

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Nanoemulsions are isotropic systems made up of nanoscale droplets (about 200 nm in size) created by combining two immiscible liquids with the aid of emulsifiers. They are often regarded as harmless excipients and are made to enhance the release of active medicinal compounds. Improving drug distribution to specific areas is the main goal of employing nanoemulsions in cancer treatment. In addition to increasing bioavailability, nanoemulsions reduce adverse effects on healthy cells by encasing medications in a closed structure. This is especially crucial because, in the absence of such formulations, different medications fall short of their intended targets. The study shows that by increasing the solubility and bioavailability of anticancer medications, nanoemulsions can greatly improve their delivery. This is important because a lot of anticancer medications have low solubility, which reduces their ability to effectively target cancer cells. Nanoemulsions have been shown to effectively target tumor cells while minimizing the impact on healthy tissues. This targeted approach helps overcome the common issue of multidrug resistance seen in cancer treatments, as the nanoemulsions can be modified with specific ligands to focus on tumor cells. Targeting tumor cells and preventing multidrug resistance are two benefits of using nanoemulsions. Besides, hydrophilic and hydrophobic compounds can be encapsulated in nanoemulsions to satisfy a range of needs. Therefore, nanoemulsions are a promising new approach to cancer treatment.

Keywords: Nanoemulsion, Cancer, Targeted delivery, Cytotoxic agents, Nano-carriers

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Incorporation of Nanocrystals in Fast-Dissolving Film to Improve the Solubility of Poorly Soluble BCS Class 2 Drugs is a Recent Trend

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The focus of current work is to have a detail review on the development and assessment on fast-dissolving film content -The use of nanocrystals to improve the solubility of poorly soluble BCS class 2 drugs. This study investigates the formulation and evaluation of a novel fast-dissolving film containing nanocrystals to address these issues. Fast-dissolving films offer a unique delivery system that allows drugs to dissolve rapidly upon contact with saliva, bypassing the gastrointestinal tract and facilitating quicker onset of action. Nanocrystals, with their increased surface area and dissolution rate, provide an approach to enhance the solubility and bioavailability of poorly soluble drugs. This study incorporates the formulation of nanocrystals of a selected BCS Class II drug using precipitation and high-energy milling to achieve nanometer-sized particles. These nanocrystals were incorporated into a polymer-based fast-dissolving film matrix, using hydrophilic polymers like hydroxypropyl methylcellulose (HPMC) or polyvinyl alcohol (PVA) to enhance dissolution and drug release. Optimization focused on polymer concentration, nanocrystal loading, and film thickness. Characterization, including particle size analysis, SEM, and FTIR, confirmed stability and uniformity. In vitro dissolution studies showed a marked improvement in drug release, highlighting the potential for enhanced solubility and bioavailability. Resulting indicated that the faster absorption and higher bioavailability. The study concluded that the incorporation of nanocrystals into fast-dissolving films represents a promising approach for the effective delivery of poorly soluble drugs, offering an innovative solution to improve therapeutic efficacy and patient compliance.

Keywords: Nanocrystals, Fast-Dissolving Film, Solubility Enhancement, BCS Class II Drugs, Acid-Base Precipitation.

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Application of Melt Granulation Process in Preparation of Tablet

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Melt granulation (MG) is a tablet preparation technique in which granules are formed by using a low melting point binder to agglomerate particles. Here, no large amount of excipient is required to prepare the relatively large tablet and there is no in-drying process, which is economical and time-saving. Compared to Solvent Granulation (SG) and Wet Granulation (WG), MG yields slightly denser and less friable tablets than the conventional methods of SG and WG. The hardness of all the types of WG tablets is affected by moisture content as opposed to SG tablets, where the effect was moderate, while MG tablets seemed to have no change in mechanical strength and an equal tablet weight each time they are prepared. In comparison to other film-forming methods, MG does not involve water or organic solvents; it is suitable for formulations that are adversely affected by moisture and does not have the risks associated with solvents. Furthermore, it increases dissolution rates by increasing the wettability of hydrophobic API's through solid dispersion techniques. Through the incorporation of blending, granulation, milling, and direct compression in a single-step process known as MG, it becomes easier to control the final product properties besides securing a single high-quality tablet. MG technique provides a space-saving approach to the processing of high-dose active ingredients that are difficult to handle while allowing the creation of new small forms.

Keywords: Melt Granulation**,** Wet Granulation, Moisture Content, Mechanical Strength

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Novel Approaches to Overcome the Poor Oral Bioavailability of Various Class III Drugs

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Class III medications are highly soluble and have poor permeability. Among these are Amikacin and Sotalol Dofetilide, which contribute to the low bioavailability of this particular medication class. As a result, oral administration of these medications is particularly difficult and requires permeability enhancers. Pharmaceutical research and development frequently use permeability enhancers to increase the delivery of medications with poor absorption or bioavailability. The varying pH throughout the GIT is the first concern for a successful oral delivery of AMPs. The GIT encompasses a broad pH range, from a highly acidic milieu in the stomach to neutral and slightly basic environment in the intestinal lumen. Consequently, it is anticipated that a drug's permeability across biological barriers and bio-disposition can be enhanced by PLGA (Poly Lactic-co-Glycolic Acid) nanoparticles. Simultaneously, the drug's prolonged release profile would keep the therapeutic concentration at a lower dose for a longer length of time, reducing systemic toxic effects and improving safety and efficacy. In addition to solubility and permeability limitations, poor chemical and enzymatic stability may provide an additional huddle to oral bioavailability. Examples of commercial medicines that use this strategy are Mycapssa, which contains the somatostatin analog octreotide in a capsule made with sodium caprylate, and semaglutide, which contains sodium N-(8-[2-hydroxybenzoyl]amino)caprylate (SNAC) as the permeability enhancer. Intestinal Permeability Enhancer is a word used to describe several hundred pharmaceutical enhancers, as components of oral formulations, have been clinically proven to improve permeability, but the exact mechanisms of action for pharmaceutical enhancers are not yet fully understood.

Keywords: Permeability Enhancer, Biological Barriers, PLGA, Semaglutide, Sodium Caprylate

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Preparation and *In-Vitro* Characterization of Poorly Aqueous Soluble Drug Loaded Self-Nanoemulsifying Drug Delivery System

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Chlorthalidone (CTD), a BCS class IV drug, is used in the treatment of hypertension via prohibiting water absorption from the kidney through the suppression of Na^+/Cl^- symporter in the distal convoluted tubules. The aim of the present study was to develop CTD loaded self-nanoemulsifying drug delivery system (SNEDDS) to enhance the dissolution profile of the poorly water-soluble CTD via high speed homogenization technique and characterise the formulations on the basis of their emulsification time, globule size, zeta potential, polydispersity index, and cloud point. The drug solubility analysis was performed in various solvents and excipients. FTIR study revealed the compatibility among the excipients used in prepared SNEDDS. The globule size and zeta potential of all the formulations were found to be in the range of 90-100 nm and 10.52±1.76-28.45±1.66 mV respectively with satisfactory emulsification time (39±2.4-64±2.5 s) and polydispersity index (0.112±0.017-0.255±0.043). All thermodynamically stable formulations demonstrated *in vitro* CTD release (75±0.98-87±1.01%) in 1h whereas only 40±1.12% release was observed in case of pure drug solution. Therefore, a self-nanoemulsifying drug delivery system becomes a potential candidate for facilitating the *in vitro* release profile of CTD and the study suggests further *in vivo* characterisation.

Keywords: Antihypertensive, PDI, Zeta Potential, SNEDDS, Surfactants, Dissolution Rate

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Development and Optimization of Soy Lecithin-Based Transfersomes to Enhanced Transdermal Delivery of Etoricoxib for Rheumatoid Arthritis

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This research aims to develop a soy lecithin-based transfersome for the transdermal delivery of Etoricoxib, intended to enhance pain management and provide therapeutic benefits for rheumatoid arthritis (RA). The study began with a preformulation assessment of Etoricoxib, which included identifying physical characteristics (such as appearance, melting point, and IR spectra), solubility profile, and determining λ-max to guide formulation procedures. Formulation optimization involved assessing the effects of different process variables, including varying amounts of lecithin and surfactant. Transfersomes were prepared using a modified hand-shaking method, with Tween 80 as the surfactant in multiple concentrations. Entrapment efficiency depended on the ratio of lecithin to Tween 80, reaching a peak of 72.34±0.022 in formulation F5. Vesicle size, which also influenced entrapment efficiency, averaged 9.69 µm in the F5 formulation. Drug permeation from the transfersomal gel was similarly influenced by the lecithin-to-Tween 80 ratio. Formulation F5, exhibiting high entrapment efficiency, demonstrated superior drug permeation. This study suggests that a PC : Tween 80 ratio of 90:10 (mmol) in transfersomes could be a promising strategy for enhancing the permeability and effectiveness of Etoricoxib over time. The values of the release exponent for both formulations were relatively low, indicating a Fickian diffusion mechanism for the release of the drug. Overall, these results highlight the different kinetic behaviors of the two formulations, with the hydrogel showing a more consistent release pattern as described by the Korsmeyer-Peppas model.

Keywords: Etoricoxib, Transfersomes, Surfactants, Transdermal

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Emerging Innovations in Silver Nanoparticle-Polysaccharide Composites for Enhanced Dental Applications: A Review of Recent Advances

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Dental issues such as caries and periodontitis remain prevalent worldwide, largely due to microbial biofilms and inflammatory responses, despite the presence of traditional interventions. Recent innovations focus on the utilisation of nanoparticles' technology involving metal nanoparticles, carbon nanotubes, and TiO2 nanohybrid particles in experimental dental applications. Among the existing nanomaterials, silver nanoparticles (AgNPs) engineered through various methods have shown promising results, not only in preventive dentistry, implants, or endodontics but also effective in oral cancer treatment when implicated with berberine at low doses. Green synthesis of these AgNPs from plants such as *Alocasia indica, Justicia glauca, Ficus benghalensis,* etc. replaces the toxic effects of chemically synthesised nanoparticles. The dose-dependent toxicities of AgNPs can be overcome by optimising their physicochemical properties and by incorporating polymers or coatings with biocompatible materials like polysaccharides. Interrogating polysaccharides such as chitosan, alginate, and hyaluronic acid influence the optimising factors such as the type of polysaccharide, reaction parameters, and concentrations leading to tailored AgNPs for specific applications, enhancing the stability, effectiveness, and controlled release of AgNPs. Importantly, these systems can minimise harmful byproducts and contribute to a more sustainable approach in dentistry. Therefore, this review highlights the engineering aspect of polysaccharide-conjugated AgNPs for formulation of dental products based on the recent research works and comparative analysis of diverse nanoparticle systems. Apart from that, the review focuses on patented products that have been marketed. Thus, this information enables future pathways of research in dental nanotechnology to analyse the therapeutically active and biologically safe dental product.

Keywords: Silver Nanoparticles, Polysaccharide, Synthesis, Characterization, Dental Applications

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Paclitaxel and Quercetin Nanoparticles Co-Loaded in Microspheres to Prolong Retention Time for Pulmonary Drug Delivery

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Paclitaxel and quercetin co-loaded nanoparticles encapsulated in oleic acid-conjugated chitosan microspheres can be used to enhance pulmonary drug delivery. Paclitaxel, a chemotherapeutic agent, and quercetin, a flavonoid with potential synergistic effects, are aimed at improving therapeutic outcomes in lung cancer treatment. The oleic acid modification of chitosan enhances nanoparticle stability and facilitates mucosal adhesion, potentially prolonging drug retention in the pulmonary system. The microspheres were fabricated using a solvent evaporation technique, optimizing parameters such as particle size, encapsulation efficiency, and release kinetics. Characterization through scanning electron microscopy and dynamic light scattering confirmed the successful formation of nanoparticles within the microspheres. In vitro release studies indicated a sustained release profile, promoting prolonged therapeutic action compared to conventional formulations. Additionally, cytotoxicity assays demonstrated the efficacy of the co-loaded system against lung cancer cell lines, suggesting improved anticancer activity due to the combined effects of paclitaxel and quercetin. This formulation aims to address the challenges of rapid drug clearance in pulmonary delivery systems, offering a promising strategy for enhancing drug retention and therapeutic efficacy in lung cancer treatment. The results indicate that oleic acid-conjugated chitosan microspheres are a viable platform for targeted pulmonary drug delivery, paving the way for more effective therapies in oncology.

Keywords: Paclitaxel, Quercetin, Chitosan, Nanoparticles, Polymeric Microspheres

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Smart Particles: Advancing Precision in Targeted Drug Delivery

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Nanotechnology and nanomedicines are emerging fields in drug delivery, offering distinct advantages over conventional methods due to the exceptionally small size of nanoparticles. These tiny particles can cross the blood-brain barrier more effectively than larger particles, enhancing drug delivery potential for neurological diseases. Nanoparticles also exhibit unique physicochemical and biological properties, making them highly beneficial in delivering drugs and active substances, such as antibiotics, with improved affinity and bioavailability. In targeted drug delivery, nanomaterials enhance stability, absorption, and drug effectiveness in specific disease sites, reducing toxicity and minimizing side effects. Nanomedicines have diverse applications in treating conditions like cancer, neurological diseases, and HIV. Micro-colloidal drug delivery systems, such as emulsions and liposomes under 100 nm in size, have gained attention for their efficacy. Recent advancements have enabled the development of nanoscale materials, often derived from natural or semi-synthetic sources that can improve drug targeting and minimize biological degradation. Nanotechnology advancements have also fostered theranostic nanoparticles, which can diagnose diseases, locate affected areas, identify disease stages, and monitor treatment effectiveness. This review explores the role of nanoparticles in drug delivery, chemotherapy, targeted therapy, and immunotherapy. It also discusses their potential in overcoming drug resistance; highlighting nanomedicine's potential to revolutionize treatment and diagnostics in modern healthcare.

Keywords: Nanotechnology, Drug Delivery, Liposomes, Nanomedicines, Natural Products

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Improving Telmisartan Solubility and Dissolution Through Co-Crystallization Strategies

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Poor aqueous solubility of drugs presents significant challenges in their oral delivery, impacting bioavailability and therapeutic efficacy. Telmisartan, an angiotensin II receptor blocker, is classified under Biopharmaceutical Classification System (BCS) Class II due to its low solubility and high permeability, necessitating innovative strategies for enhancement. This study explores co-crystallization as a viable approach to improve telmisartan's solubility and dissolution properties. Telmisartan-maleic acid co-crystals were prepared using various molar ratios via solvent evaporation, and their physicochemical properties were characterized comprehensively. Melting point analysis revealed reduced melting points in co-crystals compared to pure telmisartan, indicating altered physical properties favorable for formulation. Drug content analysis confirmed consistent and satisfactory levels across formulations. Solubility studies demonstrated a substantial increase in aqueous solubility, up to 7.87-fold, with optimized co-crystals. In-vitro dissolution studies in phosphate buffer (pH 6.8) exhibited enhanced dissolution rates, with the optimal formulation achieving 91.26 ± 2.69% drug release within 120 minutes, surpassing pure telmisartan and physical mixtures. Field Emission Scanning Electron Microscopy (FESEM) revealed distinct crystal morphologies in co-crystals, affirming their formation and stability. Differential Scanning Calorimetry (DSC) and X-Ray Diffraction (XRD) analyses confirmed the crystalline nature of co-crystals and absence of impurities. Overall, telmisartan-maleic acid co-crystallization emerges as a promising strategy to enhance drug solubility and dissolution, potentially improving its oral bioavailability and therapeutic effectiveness.

Keywords: Telmisartan, Co-Crystallization, Maleic Acid, Solubility Enhancement, Bioavailability

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Revolutionize in Cancer Therapy: The Role of Polymeric Nanoparticles in Targeted Drug Delivery

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Today, nanotechnology has emerged as a promising field to enhance the effectiveness, precision, tolerability, and therapeutic value of drugs. The use of nanoparticles for targeted treatment is essential for decreasing inflammation, inhibiting the formation of new blood vessels, and slowing tumour growth. A drug delivery system that uses polymeric nanoparticles as carriers offers a promising approach for advancing cancer therapy. These polymeric nanoparticles have many benefits, such as being easy to make, cheap, biocompatible, biodegradable, non-toxic, non-immunogenic, and water-soluble. This makes them very good at delivering drugs and guiding them to where they need to go. Because of their small size, they are capable of encapsulating medicinal agents and modifying physicochemical properties and are thus well suited for drug delivery systems in cancer treatment. In addition, to obtain precise tumour targeting, cross the blood-brain barrier (BBB) in brain tumours, fewer side effects on healthy cells, and therapeutic enhancement with reduced doses of drug, polymeric nanoparticles are used in drug delivery. Hence, polymeric nanoparticles provide a versatile and efficient platform for targeted drug delivery in cancer therapy to obtain enhanced treatment precision and reduced side effects. With ongoing advancements, these nanoscale carriers hold significant promise for revolutionising cancer treatment, including in challenging areas like gene therapy and overcoming the blood-brain barrier.

Keywords: Polymeric Nanoparticles, Cancer Therapy, Tumour, Drug Delivery, Nanotechnology

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Formulation of Silver Nanoparticles Using *Muehlenbeckia Platyclada* Leaf Extract and Evaluating Their Biological Activities

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Muehlenbeckia platyclada is traditionally used to treat various ailments. The leaf part of *M. platyclada* was utilized to formulate environment-friendly and cost-effective silver nanoparticles through green synthesis. UV-visible spectra revealed a surface plasmon resonance band at 420 nm, confirming the synthesis of AgNPs. The AgNPs show a spherical and average particle size of 155.12 nm. A Fourier transform infrared (FTIR) spectrum showed that the phytochemicals in *M. platyclade* had a bio-reducing capacity which significantly impacted the formation of AgNPs. The physicochemical characteristics of the AgNPs were assessed by dynamic light scattering (DLS), zeta potential, scanning electron microscopy (SEM), X-ray diffraction (XRD), and energy dispersive X-ray spectroscopy (EDX) analysis. Furthermore, formulated AgNPs exhibit strong antioxidant, antidiabetic, anti-inflammatory, antimicrobial, and cytotoxicity properties in different *in vitro* assays such as DPPH radical scavenging assay, reducing power assay, α-amylase inhibition assay, egg denaturation assay, and MTT assay. Therefore, our research established the broad spectrum of therapeutic applications for green synthesized AgNPs (dose-dependent) for further clinical translation.

Keywords: *Muehlenbeckia platyclada,* Silver Nanoparticles, Antioxidant, Antidiabetic, Anti-inflammatory

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Polymer Excipients in Pharmaceutical Formulations

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Polymer excipients play an essential role in the formulation of pharmaceuticals, improving the stability, bioavailability, and controlled release of active pharmaceutical ingredients (APIs). These excipients, primarily derived from natural, semi-synthetic, or synthetic polymers, serve various functions depending on their molecular structure and interaction with the drug and biological environment. Commonly used polymers include cellulose derivatives, and polyacrylates. In controlled-release formulations, polymer excipients enable the sustained or delayed release of APIs, improving therapeutic outcomes and patient compliance. They can form hydrogels, matrices, or coatings that modulate drug dissolution and absorption rates. Additionally, polymer excipients play a role in targeted drug delivery systems, enabling drugs to reach specific tissues or cells and reducing systemic side effects. Recent progress in polymer science has led to the creation of special polymers that can respond to changes in the environment, like pH levels, temperature, or the presence of certain enzymes. This flexibility allows for more precise drug delivery, adjusting the release speed to meet treatment needs. Polymer excipients thus hold immense potential in innovative drug formulation, fostering the development of more effective, safer, and patient- friendly therapies. Polymer excipients also help improve the texture, stability, and appearance of medicines, making them easier to take. They can protect sensitive drugs from breaking down too soon, extending their effectiveness. As research continues, new polymers may allow for even more advanced drug delivery methods.

Keywords: Polymer Excipients, Drug Stability, Bioavailability

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Advancing Phytotherapy: A Phosphatidylcholine-Based Vesicular Systems

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A promising method for improving the solubility, stability, and bioavailability of bioactive chemicals produced from plants is the use of phytosomes based on phosphatidylcholine. These cutting-edge drug delivery methods encapsulate phytoconstituents using phytosomal technology, which prevents degradation and enhances absorption. Phytosomes based on phosphatidylcholine present a promising strategy to improve the medicinal effectiveness of bioactive substances obtained from plants. Phytosomes have the potential to completely transform the fields of medication delivery and herbal medicine by overcoming the drawbacks of conventional herbal formulations. This review explores the basic ideas, benefits, and uses of phytosomes based on phosphatidylcholine. This study reviewed the stability of phytosomal formulation developed through solvent evaporation, thin-film hydration, and reflux method. This study also focuses on effects of important variables in the physicochemical characteristics of phytosomes, including surface charge, particle size, and lipid composition which have a major influence on stability, bioavailability, and therapeutic effectiveness. A box Behnken design in design expert version 13 was used with variable ratios of ingredients and run parameters details to establish a stable formulation. To fully achieve their therapeutic potential, future studies should concentrate on improving the formulation and characterization of phytosomes as well as investigating their clinical uses.

Keywords: Phytosome, Phosphatidylcholine, Design Expert, Phytoconstituents

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Optimizing Flavonoid Delivery: A Comprehensive Review of Phytosomal Formulations

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A class of polyphenolic chemicals known as flavonoids has strong biological effects, such as anti-inflammatory, anti-cancer, and antioxidant capabilities. However, their quick metabolism, low bioavailability, and poor water solubility limit their therapeutic usefulness. A promising method to get around these restrictions is phytosome technology, which encapsulates flavonoids within phospholipid complexes. This review offers a thorough analysis of phytosomal formulations, emphasizing their preclinical and clinical uses, formulation techniques, and mechanism of action. Through the formation of lipophilic complexes and mixed micelles, phytosomes improve the stability, permeability, and solubility of flavonoids. Phytosomal formulations are made using a variety of formulation methods, such as solvent evaporation and thin-film hydration. The physicochemical characteristics of these formulations are evaluated using characterization methods such Fourier-transform infrared spectroscopy, differential scanning calorimetry, and dynamic light scattering. Preclinical research has shown that phytosomal flavonoids are more effective and have a higher bioavailability than traditional formulations. To fully realize the potential of phytosomal technology, however, issues including formulation complexity, scale-up, and regulatory barriers must be resolved. In order to demonstrate the safety and effectiveness of phytosomal flavonoid formulations, future studies should concentrate on refining formulation parameters, investigating innovative delivery methods, and development of stable formulations through clinical trials.

Keywords: Flavonoids, Phytosome, Oral Delivery, Formulation, Characterization

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Folate-Functionalized Nanocarriers: A Promising Strategy for Targeted Delivery of Chemotherapeutic Agents

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The development of targeted drug delivery systems has revolutionized cancer therapy by aiding enhancement in therapeutic efficacy and minimizing side effects. Folate receptor (FR)-mediated drug delivery, utilizing folic acid (FA) as a targeting ligand, has potential as aeffective method for delivering chemotherapeutic agents directly to tumor cells. FA, a crucial vitamin involved in DNA synthesis and cellular metabolism, is overexpressed on the surface of many cancer cells, making it an ideal target for drug delivery. By attaching FA to chemotherapeutic agents or drug delivery systems, researchers can achieve targeted delivery to tumors with high levels of these receptors, enhancing the effectiveness of treatments while reducing side effects. This review summarizes the role of folic acid in surface functionalization for targeted delivery of chemotherapeutic agents. The structure of folic acid consists of a pteroate moiety through which it binds to folate receptors to facilitate the uptake and release of therapeutic agents within cancer cells. Examples of FA conjugation include folate-functionalized nanoparticles designed to deliver curcumin, docetaxel, oxaliplatin, and many other chemotherapeutic agents, which have shown increased cellular uptake and greater cytotoxic effects in cancer cell lines with high receptor levels. Incorporating FA into drug delivery systems not only enhances the pharmacokinetics of traditional chemotherapeutics but also paves the way for innovative treatment approaches. This strategy holds considerable potential for advancing precision medicine in oncology, ultimately leading to better patient outcomes through targeted therapies.

Keywords: Folic Acid, Active Targeted Delivery, Chemotherapeutic Agents, Folate Receptors, Conjugation Linkers

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Recent Discoveries on Innovative Strategies for Oral Delivery of Insulin

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Development of oral insulin is an innovative approach for the treatment of diabetes. Recent advancements in oral insulin formulations have focused on innovative strategies to protect insulin from enzymatic breakdown and improve its bioavailability. This review discusses various approaches, including the use of nanoparticles (NPs), hydrogels, liposomes, and microspheres for insulin encapsulation. Specific strategies such as polymeric nanocarriers, enteric coatings, enzyme inhibitors, and permeation enhancers are highlighted for their roles in facilitating insulin absorption. The intestinal epithelial cells absorb insulin-loaded nanoparticles, which are made utilizing biodegradable polymers such poly(lactide-co-glycolide), polyanhydride, and polyalkyl cyanoacrylate. Furthermore, the review presents findings from recent research work on oral insulin formulations, highlighting the outcomes of different formulations in animal models. For instance, polysaccharides-based hydrogel microparticles have been successful in controlling lipid metabolism and averting the problem of diabetic nephropathy in STZ diabetic mice. Similarly, biodegradable, and insulin-loaded hydrogel has shown promise in lowering plasma glucose levels within 6 hours of administration in streptozotocin-induced diabetic rats. This review examines the development of intestinal iontophoretic devices and mucoadhesive insulin patches, which enable site-specific delivery. Focusing of these numerous uses of modified insulin formulations like Tregopil and enteric-coated capsules like Capsulin, as well as the incorporation of absorption enhancers such as tween, oligoarginine, and sodium glycocholate. Overall, this review underscores the current advancements in oral insulin delivery systems, the comparative analysis emphasizing their potential to improve diabetes management by offering more patient-friendly alternatives to traditional insulin administration methods.

Keywords: Nanoparticles, Insulin, Polymeric Nanoparticles, Hydrogels, Mucoahesive Insulin Patches

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Hydrogels Films Containing Plant Extract for Wound Healing

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Hydrogel is a common soft and wet material made of a physically or chemically cross-linked network and that can hold a large amount of water within the matrix. Polymer hydrogels are often biocompatible with highwater content, giving them material properties similar to those of soft bio-tissues such as tendons, cartilages, and skins. Hydrogels are the most widely used dressing materials that proved their effectiveness for wet wound treatment. The three-dimensional polymer networks created in hydrogels can absorb huge amounts of water, thus ensuring not only a humid environment necessary for wound healing but also an excellent biocompatibility. Other potential ways to enhance the antimicrobial efficacy have been developed by formulating wound dressings loaded with several potent bioactive compounds. Some herbal constituents are reported that have antiseptic, antimicrobial, healing properties due to their camphor bearing volatile oil, rosmarinic acid, diterpene, hesperidin, polyphenolic acids, triterpenoid acids, alkaloids and tannins indicating that the plant product can be applied topically for the treatment of slow healing wounds. Their use for topical preparations with the aim of treatment for minor wounds and various conditions is highly recommended. Different strategies have been employed in the preparation of hydrogels critically, focusing on bulk gels and gel particles.

Keywords: Hydrogel, Tannins, Alkaloids, Antimicrobial, Haemostatic

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Supersaturated Silica-Lipid Hybrid Systems and Co-milled Porous Silica: An Innovative In Vitro Investigation in Solid-State Formulations of Esomeprazole Magnesium

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Esomeprazole Magnesium, a proton pump inhibitor (PPI), is widely used for treating conditions such as GERD, peptic ulcers, and Zollinger-Ellison Syndrome. However, its low solubility classifies it as a BCS Class II drug, posing challenges to effective oral bioavailability. To address these limitations, this study developed two novel formulations: (I) silica-lipid hybrid (SLH) microparticles and (ii) a co-milled mixture of Esomeprazole with porous silica to enhance solubility and dissolution. The SLH formulation incorporated highly porous silicas (Parteck SLC and Neusilin US2) as adsorbents, along with liquid lipids (Labrasol, Capmul, and Miglyol) to improve drug solubilization. The Porous silicas such as Parteck SLC and Neusilin US2 increase drug wetting and dissolution by offering a high surface area for adsorption, while liquid lipids enhance absorption and bioavailability through micelle formation and improved lipid solubilization. With the second approach, Esomeprazole was comilled with Neusilin US2 and Parteck SLC in a 1:5 ratio for 20 hours. Characterization of the formulations was performed using XRPD, DSC, FTIR, and SEM. In vitro dissolution studies showed that the co-milled mixture and SLH formulation achieved drug release rates of (98.01±3.4) % and (97.34±2.87)%, respectively, compared to only 35% for the pure drug and (81.02±1.71)% and (82.36±1.58)% for marketed products. This study highlights the effectiveness of SLH formulations and co-milling technology in enhancing the dissolution of poorly water-soluble drugs like Esomeprazole, thereby improving patient compliance and therapeutic outcomes.

Keywords: Esomeprazole, Solubility, Ball Mill, SLH (Silica Lipid Hybrid), Parteck SLC and Neusilin US2

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Formulation, Evaluation and Optimization of Quercetin loaded Transferosome

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Quercetin is a vital exogenous antioxidant commonly used in cosmetics, nutraceuticals, and pharmaceuticals due to its protective effects against oxidants and inflammation. In these studies, have shown that hydrophobic compounds like quercetin, improving their efficacy and stability in topical application. Here, Transferosomes is a carrying body for targeted transdermal drug delivery system. These are special types of liposomes, consisting of phosphatidylcholine and an edge activator. Therefore, present study was planned of Quercetin (Qc)-loaded transferosomes (TFs) for transdermal application. Quercetin-loaded transferosome were prepared by thin-film hydration technique using optimized based on particle size, PDI, zeta potential, and entrapment efficiency, Soya lecithin, tween 80 ratio and sonication time had a significant influence on TFs formulation. These formulations were characterized by Differential Scanning Calorimetry (DSC), Transmission electron microscopy (TEM). Evaluation parameter for the quercetin loaded transferosome including polydispersity index, zeta potential, particle size using particle size analyser and morphology were executed using a transmission electron microscope. The particle size of the transferosome was found to be 205.7 nm to 481.2 nm with polydispersity index of 20.3%, while zeta potential was -19.4 to -50.1 mV. The Percentage yield values of transferosome formulation were considerably less. Overall, QT-TFs formulation could be considered as an alternative delivery approach for enhanced skin delivery. Transferosomes offering enhanced permeability through biological barriers like the skin.

Keywords: Quercetin, Topical Formulation, Antioxidant, TFs

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A Review on Development of Gum-Blended Microsphere for Controlled Release of Antidiabetic Drug

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Diabetes, a global health concern, necessitates precise and sustained drug delivery for optimal glycemic control. Gum-blended microspheres have emerged as a promising strategy to achieve this goal. This review delves into the development and characterization of these systems, focusing on their potential to enhance therapeutic efficacy and patient compliance. Natural and synthetic gums, such as guar gum, xanthan gum, and alginate, serve as biodegradable, biocompatible, and mucoadhesive matrices for drug encapsulation. Various techniques, including emulsion solvent evaporation, ionotropic gelation, and spray drying, are employed to fabricate microspheres with controlled release profiles. In-vitro and in-vivo studies have demonstrated the efficacy of these systems in achieving sustained drug release and improved therapeutic outcomes. However, challenges such as scale-up production, long-term stability, and precise control over release kinetics remain. Future research should focus on optimizing formulation parameters, exploring novel drug delivery strategies, and conducting rigorous clinical trials to translate these promising findings into clinical practice.

Keywords: Diabetes, Gum-Blended, Mucoadhesive Matrices, Emulsion Solvent Evaporation, Ionotropic Gelation, Novel Drug Delivery

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Review on a Thermodynamically Stable Nanolipoidal Drug Delivery System

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The poor pharmacokinetics of numerous pipeline drug candidates hinder their progress to market approval. One significant challenge in drug development is the declining bioavailability of newly studied New Molecular Entities (NMEs). To overcome these issues, formulators often employ nano-lipoidal colloidal systems, which facilitate the formation of micro-emulsions and nano-emulsions, particularly for delivering drugs classified under BCS Class II, III, and IV. These systems offer a promising solution by improving bioavailability. Due to the presence of surfactants and a combination of hydrophilic and lipophilic domains, nanolipoidal colloids enhance drug solubility and permeability across various biological environments. Micro-emulsions, comprising water, oil, surfactants, and co-surfactants, are known for being thermodynamically stable and isotropically transparent. These systems present several advantages, including minimizing inter-patient variability in drug absorption and therapeutic response, protecting unstable drug compounds, controlling release rates, and improving solubility, which subsequently enhances absorption and bioavailability. Furthermore, they allow for dose reduction and limit toxicity, contributing to improved drug safety profiles. A specialized application of these systems is through Self-microemulsifying Drug Delivery Systems (SMEDDS), which offer oral drug delivery solutions. SMEDDS prevent drug hydrolysis during storage, enhancing the shelf life of sensitive compounds. Additionally, their compact formulation reduces bulk, making them more convenient for large-scale production and storage. These features collectively position nano-lipoidal colloids as an innovative platform for overcoming bioavailability challenges in modern drug development.

Keywords: Micro Emulsion, Winsor-Classification, Thermodynamics, Surfactant Pseudo Ternary Diagram

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Nanotechnology in Pharmaceutical Formulation: Revolutionizing Drug Delivery Systems

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The integration of nanotechnology into pharmaceutical formulation has catalyzed a paradigm shift in drug delivery systems, enhancing therapeutic efficacy and patient compliance. This review explores the latest advancements in nanomedicine, focusing on the innovative strategies employed to overcome traditional pharmaceutical challenges such as poor solubility, bioavailability, and targeted delivery. Nanotechnology facilitates the development of diverse nanoformulations, including liposomes, polymeric nanoparticles, and nanoemulsions, which are engineered to optimize drug release profiles and enhance stability. These formulations leverage unique nanoscale properties—such as increased surface area and the ability to penetrate biological barriers—to achieve precise targeting of drugs at cellular and tissue levels. Consequently, they minimize systemic toxicity and improve therapeutic outcomes. Recent trends indicate a significant rise in the approval of nanomedicine-based products by regulatory agencies, reflecting their growing importance in treating complex diseases like cancer and neurological disorders. This review will discuss various nanocarrier systems, including ligand-targeted nanoparticles, pH-responsive systems, and magnetic nanoparticles, highlighting their mechanisms for controlled release and active targeting. Furthermore, we will address the challenges faced in the commercialization of nanomedicines, including scalability, regulatory hurdles, and safety concerns. By synthesizing current literature and ongoing research efforts, this review aims to provide a comprehensive overview of the transformative role of nanotechnology in pharmaceutical formulation, paving the way for future innovations that promise to revolutionize drug delivery paradigms.

Keywords: Nanotechnology, Nanomedicine, Drug Delivery Systems, Formulation Development, Targeted Therapy

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Comparative Study of Carbon Dots Synthesis from Different Plant Roots

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Carbon dots (CDs) are known as the rising star of carbon-based nanomaterials and, by virtue of their unique structure and fascinating properties, they have attracted considerable interest in different fields such as biological sensing, drug delivery, photodynamic therapy, photocatalysis, and solar cells in recent years. This study investigates that synthesis of carbon dots from different plant roots, comparing the efficiency, yield, and quality of CDs produced from various botanical sources. Roots from plants such as turmeric, beetroot, and ginseng are selected based on their distinct biochemical compositions. The synthesized CDs are characterized using UV-VIS spectroscopy, fluorescence spectrophotometry, Fourier-transform infrared spectroscopy (FTIR), and transmission electron microscopy (TEM) to evaluate particle size, structure, and optical properties. Key findings reveal that the type of plant root significantly affects CD size, fluorescence intensity, and stability. For instance, CDs from turmeric roots demonstrate strong fluorescence and smaller sizes. The comparative analysis suggests that specific plant roots yield CDs with distinct properties suited to different applications. This study highlights the potential of plant roots as renewable and sustainable sources for carbon dot production, paving the way for environmentally friendly nanomaterial synthesis and tailored applications in bioimaging, drug delivery, and sensing.

Keywords: Nanomaterial Carbon dots Plant roots, Optical properties, Sustainable sources

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Development and Evaluation of a Mucoadhesive Aristoflex-Based Delivery System of Mupirocin for Targeted Periodontitis Treatment

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Periodontitis is a common oral infection often treated with antibiotics; however, the need for high oral doses and the risk of antibiotic resistance limits their effectiveness. The study aimed to develop a mucoadhesive delivery system for potential periodontitis treatment, incorporating Aristoflex into a combined base of PVA and Carboxy Methyl Starch. Mupirocin was used as the model drug. The mucoadhesive films were prepared using solvent-casting methods. Different characterizations of the film, such as its physicochemical properties, microscopic, XRD, DSC, swelling, adhesion, releases, and microbial properties, were investigated. The prepared films were flexible and transparent, with good folding endurance. Fabricated films showed good pharmaceutical attributes in terms of drug content (94-98%), solubility profile (30 min-60 min), and mucoadhesive strength (maximum strength 1.17-3.96 N). Microscopic study confirms the presence of Aristoflex and CMS in cluster form. Molecular characterization shows the amorphous nature of the drug molecule. An in-vitro diffusion study reveals that prepared films sustained the drug release with an increased Aristoflex concentration. The fabricated film showed good antimicrobial activity against both gram-positive and gram-negative bacteria. From the above discussion, it can be assumed that developed film may be successfully used in the treatment of Periodontal disease.

Keywords: Aristoflex, Carboxy Methyl Starch, Mupirocin, Periodontitis

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Bilayer Matrix Tablets: Advances in Controlled and Sustained Drug Release Systems

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Bilayer matrix tablet is an innovative drug delivery system for the successful development of controlled release formulation along with various features to provide a way. A bilayer matrix tablet is providing a dual layer that enables controlled-release drug delivery system consisting of two distinct layers: one for immediate release delivering a rapid onset of the drug , using hydrophilic polymer like hydroxypropyl methylcellulose (HPMC) and another one is sustained release , utilising hydrophobic polymer like ethyl cellulose. The bilayer matrix tablets were prepared through direct compression techniques, with subsequent evaluation of their physical properties, including hardness, thickness, and friability. This approach has several advantages including – reduce pill burden, minimise side effects from steady drug levels , enhance patient compliance. Bilayer matrix tablets have been effectively utilized in managing chronic conditions, such as hypertension, diabetes, and pain, where controlled drug delivery is critical. Applications of bilayer tablets span various therapeutic areas, particularly in chronic conditions such as hypertension, diabetes, and pain management. In conclusion, bilayer matrix tablets represent a versatile and efficient approach to drug delivery, offering improved patient outcomes, compliance, and manufacturing advantages.

Keywords: Control Release, Hydroxypropyl Methylcellulose, Sustained Release, Hydrophobic Polymer

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Acetazolamide Loaded Gel-Forming Composite Film for Improved Ocular Delivery

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This study investigates the creation of composite films using Polyvinyl Alcohol (PVA) combined with various polysaccharides, incorporating Acetazolamide through a solvent casting technique. The films were extensively evaluated for attributes such as weight uniformity, surface pH, thickness, gelling time, gelling capacity, percentage hemolysis, transparency, mechanical properties, Fourier Transform Infrared (FTIR) spectroscopy, impedance analysis, in vitro drug release, ex vivo drug permeation, and ocular irritation assessments. The resulting films were clear and colorless. FTIR results indicated no significant interactions between the polymers. Stress relaxation tests demonstrated that the addition of polysaccharides enhanced the PVA films properties while diminishing their elastic characteristics. Moreover, the residual elastic energy (P0) of the polysaccharide-enhanced films was notably higher than the initial elastic energy (F0). Hemolysis percentages across all films were below 5%, indicating excellent biocompatibility. Ocular irritation testing via the Draize method confirmed that the synthesized composite films were non-irritating to ocular tissues. Ex vivo transcorneal permeation studies for Acetazolamide exhibited a non-Fickian diffusion pattern, with the exception of formulation F4.

Keywords: Acetazolamide, In-situ film, Controlled release, Residual elastic energy

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Advances in Oral Insulin Delivery: A Pathway to Needle-Free Diabetes Management

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Achieving optimal insulin coverage remains crucial for diabetes management, yet the reliance on subcutaneous injections presents challenges, particularly for children and the elderly, often leading to treatment delays and discomfort. Oral insulin delivery has emerged as a potential alternative, offering a needle-free solution that mimics the natural insulin release pathway by reaching the liver through the portal circulation. This liver-first delivery could improve glucose regulation by enhancing glycogen storage, reducing peripheral hyperinsulinemia, and potentially minimizing systemic side effects. Over nine decades of research have aimed to develop a viable oral insulin formulation; however, commercial availability remains out of reach due to barriers such as gastrointestinal enzymatic degradation and limited intestinal absorption. Recent advancements in drug delivery technology, including enteric coatings, enzyme inhibitors, and mucoadhesive systems, are under investigation to address these limitations and improve insulin stability and bioavailability. This poster summarizes the latest developments in oral insulin research, emphasizing both the physiological benefits of portal delivery and the challenges involved in transitioning these technologies from research to practical applications. If achieved, oral insulin could offer a more physiologically aligned and accessible approach to diabetes care, transforming treatment for patients who struggle with injections.

Keywords: Oral Insulin, Diabetes Management, Insulin Delivery Systems, Portal Circulation, Needle-Free Insulin

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Applications of Nanotechnology in Diagnosis and Treatment of Diabetes

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Diabetes remains a global health challenge, necessitating innovative approaches for diagnosis and treatment. Recent advancements in nanotechnology offer transformative solutions for managing this chronic condition. This poster presentation explores the latest trends in diabetes diagnosis and treatment utilizing nanotechnology, highlighting the significant role of nanoparticles in enhancing therapeutic efficacy and monitoring. In diagnosis, nanotechnology-driven biosensors provide rapid, non-invasive methods for glucose monitoring, leveraging nanoparticles to facilitate real-time tracking through sweat or saliva. This advancement reduces the reliance on traditional finger-prick methods, improving patient compliance and comfort. For treatment, nanoparticles are being developed for targeted insulin delivery systems, enabling controlled release that maintains stable blood sugar levels while minimizing injection frequency. Additionally, nanocarriers are promising for oral insulin formulations, protecting insulin from degradation and enhancing its bioavailability. Furthermore, emerging research is focused on using nanoparticles to modulate immune responses in Type 1 diabetes, potentially safeguarding insulin-producing cells from autoimmune attacks. This presentation aims to illuminate the multifaceted applications of nanotechnology in diabetes care, emphasizing ongoing research efforts, practical challenges, and future directions. By integrating nanotechnology into diabetes management, we can pave the way for more effective and patient-friendly therapeutic strategies, ultimately improving quality of life for individuals living with diabetes.

Keywords: Glucose Monitoring, Nanotechnology, Nanoparticles, Insulin Patches, Nanocarriers

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Gold Nanoparticles' Advancements and Relevance in the Therapy of Cancer

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Cancer is a global challenge with a high incidence and fatality rate. Cancer causes around 10 million deaths annually, with a projected increase to 30 million by 2030. Surgery, chemotherapy, and radiotherapy are commonly utilized as primary treatments for cancer patients at various stages. Chemotherapy is a frequent treatment for cancer, often administered before or after surgery. Traditional therapies including surgery, radiation, and chemotherapy can cause significant side effects such as physical deformity, functional loss, and systemic toxicity. The in-depth review looks at several applications of gold nanoparticles in numerous areas, emphasizing their unique qualities in electrical conductivity, optical properties, thermal conductivity, catalysis, and biological interactions. This study highlights the vital role that gold nanoparticles play in the advancement of cancer treatment by showcasing their versatility in drug delivery, photothermal therapy, bioimaging, and diagnostic applications. Due to their special qualities, they might work as highly efficient contrast agents in complicated imaging techniques, such as computed tomography (CT) scans and photoacoustic imaging, enhancing the visibility of particular tissues and organs. This innovation could drastically change how diseases are detected and monitored, enabling early intervention, and significantly enhancing patient outcomes. Gold nanoparticles may minimize harm to healthy cells while assisting patients in enduring the terrible consequences of cancer. However, the study also addresses important issues, such as concerns about toxicity, the impact of nanoparticle size, and possible environmental consequences.

Keywords: Cancer, Chemotherapy, Targeted Therapy, Gold nanoparticles, Photo thermal effect, Bioimaging

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Quantum Dots: Nanocarriers for Targeted and Controlled Drug Release

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Due to their distinct optical and electrical characteristics, semiconductor nanoparticles known as Quantum dots (QDs) hold great promise as drug delivery vehicles. It is possible to precisely manipulate their size, surface chemistry, and fluorescence to transport them to particular tissues or cells. With polymeric encapsulation, QDs' size can rise from 2 to 10 nm to around 5 to 20 nm, thereby enabling the creation of biocompatible carriers with comparable properties for clinical application. QDs as carriers and the labelling of therapies or drug carriers with QDs are the main current uses of QDs in drug delivery. Their capacity to provide real-time imaging while administering medication offers a significant benefit in monitoring the effectiveness of treatment. Specifically, gene therapy uses quantum dots to transport DNA, which can help change or track the course of genetic illnesses. Although QDs have a lot of potential, there are worries about their long-term toxicity and biocompatibility, which calls for more study to guarantee safety. However, QDs provide new avenues for sophisticated drug delivery in nanomedicine.

Keywords: Quantum Dots, Fluorescence, Encapsulation, Biocompatibility, Gene Therapy

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General outlook on Osmotic Drug Delivery System

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This presentation contains a comprehensive review of the various osmotic drug delivery systems (ODDS) designed for the controlled release of drugs via the oral route- an administration route that is often preferred. In long-term treatment courses repeat dosing is usually required which presents a challenge that ODDS alleviates by reducing the frequency of the administration. This evaluation focuses on the science behind the development of ODDS systems and explains their classification supported with specifics of controlled porosity osmotic pumps. Concerning the above aspects, the following topics are treated: The principle of osmosis, suitable drug profiles, methods of preparation and improving, agents that produce osmotic pressure, agents that create pores in membranes, materials used for coatings, products available in the market. With knowledge on these factors, the scientists and formulators will be in a position to set optimized ODDS for the formulation of the drugs that pose challenges in the conventional forms. The purpose of this review is to be useful regarding the creation and use of new dosage forms that are acceptable for the patients thus improving the management of chronic diseases. Presentation of this information will allow for the provision of modification of the release characteristics of different classes of drugs against the constraints of usual dose forms.

Keywords: Osmotic Drug Delivery System, Controlled Release, Oral Route, Chronic Disease Management, Drug Formulation, Pharmaceutical Technology

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Formulation and Evaluation of Hydrogel Network Based Microbeads Containing Antiviral Drug

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This study investigates the effects of natural gums and polymers in the development of microbeads as nanocarriers for the antiviral drug. Antiviral drug (Valacyclovir)-loaded microbeads were prepared using the ionotropic gelation method, incorporating natural polysaccharides/gums such as sodium alginate and gellan gum. Aluminum chloride served as a cross-linking agent at various concentrations. Evaluation of the formulations revealed that the F5 batch exhibited the highest swelling properties and maximum drug entrapment efficiency. The microbeads primarily displayed a round to oval shape, with particle sizes ranging from 0.62 ± 0.03 to 0.89 ± 0.04 mm. Scanning electron microscopy (SEM) was employed to analyse the surface morphology of the optimal microbead formulation. *In vitro* release studies indicated that the F3 batch demonstrated the highest drug release rate, while the F5 batch showcased the most effective swelling behavior. Kinetic release analysis showed that the F1 batch followed zero-order release kinetics, whereas batches F2, F3, F4, F5, and F6 adhered to the Higuchi model, suggesting that these microbeads function as swellable matrix systems for controlled drug diffusion. In summary, the F3 batch emerged as the most suitable formulation for the sustained delivery of valacyclovir. This formulation allows for prolonged drug release over time, reducing the frequency of dosing and enhancing the overall bioavailability of the antiviral drug. Consequently, this improvement can lead to better patient compliance, making the treatment regimen more effective and manageable.

Keywords: Microbeads, Antiviral drug, Ionotropic gelation. Valacyclovir

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Photo-responsive Hydrogel Base Self-Healing Wound Packing Material

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Topical wounds represent a significant global health challenge, enhanced by common comorbidities such as diabetes and infection. The process of wound closure involves a coordinated series of cellular events that regenerate the scar tissue, which is influenced by various topical and systemic factors, making the enhancement of wound healing challenging. Light is a powerful tool that has a significant influence on contemporary medicine. Nowadays, phototherapy has shown promising responses in hydrogel polymerisation and the treatment of bacterial infections. Because of their high efficiency, low irritation, and strong antibacterial properties, hydrogels and phototherapy can synergistically and effectively address the drawbacks of conventional wound treatment techniques. Photodynamic Therapy and Photothermal Therapy exhibit promising possibilities in promoting wound healing and preventing infection. Furthermore, because of their superior biochemical effects, biocompatibility, and mechanical properties, hydrogels have proved appealing advantages in the field of wound treatments. As a result, multifunctional photo-responsive hydrogels provide a synergistic therapy that combines the benefits of hydrogels and light to alter bacterial microenvironments and prevent infection. These are becoming more and more popular in biomedicine, particularly in the field of wound repair, because of their capacity to regenerate tissue. Using visible light irradiation to initiate a photo-crosslinking reaction is a unique approach to the fabrication of hydrogel. Remaining inert to other physiological parameters (like temperature and pH), these hydrogels are controllable in time and space by photo polymerisation to generate a rapid adhesive barrier for protection and adaptation to irregular-shaped wounds.

Keywords: Photodynamic Therapy, Photothermal Therapy, Photo-crosslinking Reaction, Photo-responsive hydrogel

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Nanotheranostics Application in the Treatment of Lung Cancer

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One of the leading causes of cancer-related mortality worldwide is lung cancer. Patients with lung cancer have a worse prognosis and a lower overall survival rate due to the ineffectiveness of traditional therapy and the absence of early detection. Nanotheranostics, a synergistic combination of nanotechnology, therapeutics, and diagnostics, has become a viable strategy for treating lung cancer. This novel approach uses nanoparticles to deliver tailored medicines and allows for real-time therapy effectiveness monitoring. Nanoparticles have special physical and chemical properties that make it easier for drugs to dissolve, control their release, and get to tumour sites, reducing their systemic toxicity. The integration of imaging modalities including MRI, CT, and fluorescence with recent developments in nanotheranostic devices has made it easier to diagnose lung tumours early and evaluate the effectiveness of treatment. Moreover, the use of biomarker-specific targeting enhances the precision of treatment, improving patient outcomes. The current study offers a thorough summary of the latest developments in the use of nanoparticles, such as liposomes, polymeric, metal, and bio-nanoparticles, in the field of theranostics. By providing individualized, efficient, and least-invasive therapy options, the application of nanotheranostics in clinical practice has the potential to completely transform the management of lung cancer. Further, we also discuss the merit and demerit of each strategy considering the advancement of lung cancer theranostics.

Keywords: Nanotheranostics, Lung Cancer, Nanoparticle, Diagnostic, Therapeutics

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Hydrogel Based Drug-Eluting Contact Lenses for Sustained Ophthalmic Drug Delivery

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The usage of electronics has led to an increase in the number of persons suffering from eye disorders. However, due to the ocular barrier's presence as well as other factors, the bioavailability of eye drops is still low. Despite the fact that numerous medication delivery systems have been created to address these issues, they are not without their limits. The use of contact lenses for medication administration has gained in favour in recent years because to the development of lenses that have high bioavailability, can deliver medications for extended periods of time, and do not impair eyesight. Therefore, it is therefore essential to assess the present status of research on medication delivery contact lenses. This article examines the key physical and chemical properties of drug-laden contact lenses, development and classification of contact lenses, and features of the regularly used materials. And there has also been a study of the techniques frequently employed in recent research to produce contact lenses. An overview of the solutions for high burst and short release duration issues with drug-filled contact lenses has been covered. In general, the analysis concentrates on medication delivery techniques utilising smart contact lenses and forecasts the course of investigation into contact lenses.

Keywords: Bioavailability, Contact Lenses, Drug Delivery, Imprinting, Nanoparticles, Vitamin E

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Nanoemulsion as an Alternative to Liposomes and Vesicles

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Nanoemulsions are emerging as a promising alternative to liposomal and other vesicular drug delivery systems due to their enhanced stability, ease of production, and unique properties. Characterized by their nanoscale droplet size, typically between 20 and 200 nm, nanoemulsions offer high surface area and improved drug bioavailability, which are crucial for therapeutic efficacy. Unlike liposomes, nanoemulsions bypass stability issues related to fusion and aggregation, allowing a more controlled and sustained release of active pharmaceutical ingredients. They are formulated using biocompatible surfactants that improve solubility and permeability, making them suitable for oral, topical, and parenteral applications. The potential of nanoemulsions extends to delivering poorly water-soluble drugs, with applications in antimicrobial, anticancer, and cosmetic formulations. Given their ability to encapsulate both hydrophilic and hydrophobic substances and their enhanced absorption profile, nanoemulsions offer a versatile and effective approach for targeted drug delivery compared to traditional liposomal systems.

Keywords: Nanoemulsion, Liposome Alternative, Bioavailability, Controlled Release, Hydrophobic Drugs

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Interpenetrating Polymeric Network as Novel Drug Delivery System

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An interpenetrating polymer network (IPN) is a blend of two or more polymers in which at least one is synthesized in the presence of another, forming a physically cross-linked network. This occurs when the polymer chains of the second system entangle with or penetrate the first polymer's network, retaining their individual properties while synergistically enhancing strength and toughness. Advances in polymer science have led to IPNs being superior in drug delivery, offering biocompatible, nontoxic, and biodegradable options for controlled and targeted drug delivery of various bioactive molecules. IPN often exhibits improved mechanical properties compared to single-network hydrogels, making them more suitable for in vivo applications. IPN hydrogels can be formulated as injectable materials for localized drug delivery, such as for tissue engineering or cancer therapy. IPN hydrogels that respond to external stimuli, such as pH, temperature, or light, can be used for triggered drug release or controlled tissue engineering. IPNs represent a promising class of materials with wide-ranging applications in biomedicine and beyond. Their unique properties, including swelling capacity, mechanical strength, and specificity, make them highly suitable for diverse applications.

Keywords: Interpenetrating Polymer Network, Hydrogels, Polymers, Stimuli, Drug Delivery

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Advances in Type-2 Diabetes Management Using Solid Lipid Nanoparticles

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Nanoparticles are small, spherical particles made of natural or synthetic polymers, with sizes typically ranging from 1 to 100 nm. Solid Lipid Nanoparticles (SLNs), on the other hand, are colloidal drug carriers with diameters from 50 nm to 1 µm and contain a solid lipid core. Due to their non-toxic characteristics, SLNs are highly effective for controlled delivery of various therapeutic agents. Insulin, essential for modulating carbohydrate, lipid, and protein metabolism, can be efficiently delivered using SLNs, which are a safe and adaptable drug delivery system. The encapsulation of insulin within SLNs has shown to enhance its effectiveness and pharmacokinetic properties. This advanced system is valuable for controlled release, gene therapy, and for maintaining physical and chemical stability.In recent years, SLNs and lipid-drug conjugates have also been applied to carry both lipophilic and hydrophilic drugs for both invasive and non-invasive delivery routes. Research has shown that, for managing diabetes, Dipeptidyl Peptidase-4 (DPP-4) inhibitors are among the most effective treatment options, leading to their widespread use in clinical practice. However, DPP-4 inhibitors have limited oral bioavailability, around 29.5%, due to first-pass metabolism, low absorption, and P-glycoprotein (P-gp) efflux. Shah and colleagues found that when SLNs are given orally, they primarily utilize lymphatic transport for drug absorption, effectively bypassing first-pass metabolism. These lipid-based nanoparticles move through digestion and absorption phases before entering circulation, thereby enhancing the bioavailability of the drug within them. Increased bioavailability can reduce dosage needs, frequency of administration, and potential side effects. Consequently, SLNs show great potential as carriers for oral delivery of innovative anti-diabetic medications.

Keywords: Solid lipid Nanoparticle, Insulin, dipeptidyl-peptidase, First-Pass Metabolism, P-gp Efflux

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Smart Nanoparticles for Targeted and Controlled Breast Cancer Therapy: overcoming Challenges and Advancing Clinical Applications

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Smart nanoparticles represent a promising frontier in the targeted and controlled therapy of breast cancer, offering solutions to longstanding challenges in oncology. The present study discusses the design and functionalization of nanoparticles that enhance drug delivery efficiency while minimizing systemic toxicity. By utilizing various materials such as lipids, polymers, and inorganic substances, these nanoparticles can be engineered to achieve specific targeting of cancer cells, thereby improving therapeutic outcomes. Current advancements in smart nanoparticle technology include the incorporation of stimuli-responsive systems, which allow for the controlled release of therapeutic agents in response to specific environmental triggers, such as pH, temperature, or magnetic fields. This capability not only enhances the precision of drug delivery but also reduces side effects associated with conventional chemotherapy. Despite these advancements, several challenges remain, including issues related to biocompatibility, stability, and the scale-up of manufacturing processes for clinical applications. Additionally, the heterogeneity of breast cancer and its microenvironment complicates effective targeting and treatment. This finding also highlights recent clinical trials that have explored the application of smart nanoparticles in breast cancer therapy, showcasing both successes and areas requiring further investigation. Ultimately, the integration of smart nanoparticles into clinical practice holds the potential to revolutionize breast cancer treatment by offering tailored therapeutic strategies that improve patient outcomes while addressing the limitations of traditional therapies. Continued research and development in this field are essential to overcoming existing barriers and realizing the full potential of smart nanoparticles in oncology.

Keywords: Nanoparticles, Oncology, Conventional Chemotherapy, Biocompatibility

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Mucoadhesive Tablets in the Treatment of *Helicobacter pylori* infection: Design, Development and Optimization

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Helicobacter pylori (H. pylori) infection which ultimately leads to gastric discomforts and gastric ulcer is one of the major concerns throughout the world. In most of the cases, *H. pylori* infections are untreated which ultimately leads to gastric ulcer and bleeding. Antibiotics, Proton pump inhibitors (PPIs), H2-receptor antagonists and lifestyle modifications are the line of treatments available in the infection and gastric ulcer. However, the current line of treatment of *H. pylori* infection leads to severe side effects and in most of the cases the disease is untreated. The idea of creating a mucoadhesive tablet containing a model drug of natural flavonoid source is encouraged by the way flavonoids balance aggressive and protective components to provide anti-ulcer actions. Mucoadhesive formulation, which comes under Gastro retentive drug delivery system (GRDDS) has the advantage of holding the tab in the mucus layer of stomach for a longer time and ensures releasing the drug for the prolonged time. In the current research study, the effort was made to prepare tablet to have mucoadhesive and gastro retentive drug delivery effects. The tablets were made in wet granulation method, after the optimisation with the polymers. Hydroxypropyl methylcellulose (HPHC) and chitosan ensures mucoadhesiveness property and enhances the effectivity of the model drug. After performing the various characteristic evaluation studies of different formulations; the optimised formulation was further evaluated for its gastro retention, mucosal adhesive time, which found satisfactory after 24 hours. The preparation ensures sustain release property till 24 hours which is confirmed by *ex vivo* experiment.

Keywords: *Helicobacter pylori*, Mucoadhesive, Gastric Ulcer, Flavonoids, Gastro Retentive Drug Delivery

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Hydrogels in Wound Care: Innovations, Challenges, and Clinical Applications

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One of the profound challenges in the field of health care, especially regarding patients with chronic and non-healing wounds, is the process of wound healing. Hydrogels are a promising solution in wound healing due to their unique properties such as moisture retention, biocompatibility, and the ability to act as carriers for bioactive molecules. Recent advancements in drug delivery systems using hydrogel include smart and bioactive hydrogels. Smart hydrogels react to environmental stimuli such as pH, temperature, and enzymes providing localized drug release to suit the particular need of a wound, improving wound management. Bioactive hydrogels have natural extracts, growth factors, and antimicrobials incorporated in them to help in tissue engineering and infection management. Furthermore, hydrogels which are designed for prolonged release of drugs have shown beneficial outcomes when treating chronic wounds since they provide therapeutic action for a long time with less dosing frequency. Though hydrogels have significant advantages, their limitations such as poor mechanical properties, high manufacturing costs, and scalability must be addressed to implement hydrogels in clinical practice. The literature expressed that in the last few years, several ongoing research are being focused to overcome these limitations through the development of hybrid materials, cost-effective production methods, and long-term clinical trials. In conclusion, hydrogels can significantly transform wound care, particularly with targeted and personalized treatment options, particularly through smart and bioactive hydrogels which represent key future prospects in this field.

Keywords: Hydrogels, Wound Care, Advantages, Limitations, Future Prospects

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Oral Insulin Delivery: Scope, Challenges, and Future Prospects

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Oral insulin delivery presents a promising alternative to traditional injectable insulin therapies, with the goal of enhancing the quality of life and adherence for diabetes patients. This method could replicate the natural route of insulin secretion, delivering insulin directly to the liver through the portal vein, which may help reduce peripheral hyperinsulinemia and its related complications. However, creating an effective oral insulin solution faces significant challenges, including the harsh conditions of the gastrointestinal tract and the difficulty of crossing the intestinal epithelium to enter systemic circulation. To tackle these issues, strategies such as enzyme inhibitors, absorption enhancers, and protective encapsulation technologies are being explored. Additionally, research is investigating the use of polymeric micelles and hydrogel-based carriers to improve insulin stability and bioavailability. Current research on oral insulin delivery encompasses formulation chemistry, bioengineering, pharmacokinetics, and studies focused on patient experiences. While preclinical models have shown promising results, clinical trials have not consistently yielded reliable outcomes due to variations in absorption and inadequate bioavailability. Innovative methods like ligand-mediated targeting and peptide-based carriers are being studied to enhance intestinal permeability and refine the pharmacological profile of insulin. The future of oral insulin hinges on overcoming several obstacles, including the development of a stable, scalable, and cost-effective formulation, while also prioritizing long-term safety, efficacy, and real-world patient outcomes.

Keywords: Enzyme Inhibitors, Bioengineering, Bioavailability, Pharmacokinetic

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Curcumin and EGCG Co-Encapsulated Self Nano Emulsifying Drug Delivery System (SNEDDS) For Effective Management of Diabetes Mellitus

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In the current scenario, diabetes is a major problem worldwide. Diabetes mellitus, commonly referred to as diabetes, is a chronic metabolic disorder characterized by elevated blood glucose levels (hyperglycaemia) either, due to failure of insulin secretion from the β-cells of pancreas or due to insulin resistance. Curcumin and EGCG are potent, naturally derived substances which are more effective against various types of diabetes related complications. Self-nano emulsifying drug delivery system (SNEDDS) is a trending and most effective formulation for better management of diabetes mellitus. The current study was to design, develop and evaluate SNEDDS. The solubility of the poorly water-soluble drug; Curcumin and EGCG was improved by encapsulating them in SNEDDS. In-vitro evaluations and characterization studies of optimized formulations were done like Particle size analysis, Polydispersity index, Zeta potential, TEM, FESEM and XRD. In vivo study on Swiss Albino mice was done. Additional research on cell lines will be done to assess the formulations safety and uses in the future.

Keywords: SNEDDS, Diabetes Mellitus, Curcumin, EGCG

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Challenges in Formulation Technologies of Bilayer Tablets to Improve Therapeutic Outcome

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Bilayer tablets are a new era in the development of controlled-release solutions, and their many features provide a great way to improve the design and manufacture of bilayer (and multilayer) tablets to improve drug delivery and problem-solving. They have attracted attention with their form and manufacture. Bilayer tablets provide controlled and sustained release; one layer provides immediate release and the second layer provides sustained release, making them especially useful for drugs that require initial release, such as vaccines and antibiotics. This bilayer also provides separation of different components, improving the safety and efficacy of the API. However, manufacturing these complex tablets presents unique challenges, such as managing thickness, weight, and force to avoid issues such as layer overlap, cross-contamination, and inadequate hardness. This article discusses how specialized tablet presses (aside from replacing a press set) are often critical to achieving Good Manufacturing Practice (GMP) quality, consistency, and size. In addition, the production of bilayer tablets is still very difficult due to the complexity of the process, which requires good understanding and the use of special equipment with reliable quality products. Overall, bilayer tablet technology is positioned as a breakthrough in the controlled release drug delivery industry, providing significant clinical benefits. This article presents a business plan that summarizes best practices in design, material selection, and non-standard methods for obtaining bilayer tablets.

Keywords: Bilayer Tablets, Controlled Release, Pharmaceutical Manufacturing, Tablet Presses, Combination Therapy

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A Brief Review on Different Methods for Preparation of Transdermal Drug Delivery System

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A transdermal drug delivery system is a unique technique to deliver drugs through the skin or mainly the dermal layer to treat local or systemic conditions in a manner of sustained release. The drug diffuses through the different skin layers to reach the capillary and migrate to the affected area for procurement. It is used as a patch for advantages such as sustained release and minimizing dose frequency thus minimizing the chances of deposited drugs in tissues. There are various preparation methods for preparing transdermal patches; first the Asymmetric TPX membrane method, where TPX membrane or the poly- 4methyl-1-pentene is used as the backing layer. In the second one, the Circular Teflon mould method and the API solution are stirred for 12 hours and then poured into the circular Teflon mould. Another procedure is the Mercury Substrate method where drug solution is poured into the leveled mercury surface after the stirring process. The fourth one, the IPM membrane method, where after the preparation of a gel containing drugs and polymers, is incorporated in the IPM membrane. The EVAC membrane method, where EVAC acts as a rate-controlling membrane, is the fifth method. Finally, Aluminium backed adhesive film method, is the sixth method where a custom-made aluminium former is lined with aluminium foil and ends blanked off with tightly fitting cork blocks. This article spreads an important improvised technique of this innovative drug delivery system and its benefits in our social therapeutic field.

Keywords: Transdermal Drug Delivery, Techniques, Advantages, Transdermal Patches

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Curcumin Nanoparticle: Benefits and Significant Methods of Preparation

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Curcumin, the active compound found in turmeric, is widely recognized for its potent antioxidant, anti-inflammatory, antimicrobial, and anticancer properties. However, its clinical applications are limited due to its poor solubility, rapid metabolism, and low bioavailability. To reduce these therapeutic limitations nanoparticles have been formulated, enhancing their pharmacokinetic profile and therapeutic efficacy. Curcumin nanoparticles offer increased stability, improved bioavailability, and targeted delivery, making them ideal for several medical and therapeutic applications. This review discusses the significant benefits of curcumin nanoparticles, including their enhanced absorption and retention in the bloodstream, prolonged release, and reduced systemic toxicity. The nanoparticles facilitate crossing biological barriers, enabling curcumin to reach targeted tissues effectively, which is particularly valuable in cancer therapy and chronic inflammatory conditions. Various methods have been employed in the formulation of curcumin nanoparticles, including nanoprecipitation, emulsification-solvent evaporation, and coacervation. Advanced techniques like polymeric encapsulation and liposomal formulation have further improved the drug stability and release profile of this active phytochemical. Each method presents unique advantages and challenges, such as control over particle size, loading efficiency, and scalability. This curcumin nanoparticles as a versatile platform for enhancing curcumin's therapeutic potential.

Keywords: Curcumin, Nanoparticles, Bioavailability

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Transdermal Nano patches of Ibuprofen: Benefits on the Therapeutic Activity in the Pharmaceutical field

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The transdermal patch for ibuprofen offers a promising alternative to oral and topical formulations for delivering this non-steroidal anti-inflammatory drug (NSAID). Oral administration of ibuprofen can lead to gastrointestinal side effects and variable bioavailability due to first-pass metabolism, Therefore, transdermal delivery aims to provide consistent, localized, and controlled drug release directly through the skin. This study investigates the formulation, characterization, and efficacy of an ibuprofen-loaded transdermal patch designed for sustained pain relief. Key parameters such as drug permeability, patch adhesiveness, and release kinetics were analyzed to optimize the delivery system. In vitro and in vivo studies demonstrated effective ibuprofen absorption, reduced systemic side effects, and a sustained therapeutic effect compared to conventional oral administration. The findings highlight the potential of ibuprofen transdermal patches as a patient-friendly, non-invasive approach to pain management, along with applications for chronic and acute conditions respectively.

Keywords: Ibuprofen, Nano Patches, Benefits, Novel Delivery System

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Lipid-Based Nanocarrier System for the Effective Delivery of Nutraceuticals

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Lipid-based nanocarrier systems have gained prominence as effective vehicles for the delivery of nutraceuticals, significantly enhancing their bioavailability and therapeutic impact. This paper reviews various lipid nanocarrier technologies, including solid lipid nanoparticles (SLNs), nanostructured lipid carriers (NLCs), and liposomes, which offer unique benefits in the encapsulation and stabilization of bioactive compounds. These systems exploit the biocompatibility of lipids and their ability to improve the solubility of hydrophobic nutraceuticals, thereby facilitating better absorption and distribution within the body. Recent advancements in nanotechnology have allowed for the optimization of these carriers to overcome limitations associated with traditional delivery methods, such as gastrointestinal degradation and poor permeability. Furthermore, surface modification techniques, including polymer coatings and targeted ligand attachment, enhance cellular uptake and promote site-specific delivery, maximizing the therapeutic potential of nutraceuticals. This review discusses formulation strategies, characterization methods, and both in vitro and in vivo studies that demonstrate the efficacy of lipid-based nanocarriers. Additionally, it highlights regulatory challenges and future directions for the commercialization of these innovative delivery systems. Ultimately, lipid-based nanocarrier systems represent a significant advancement in the field of nutraceutical delivery, offering improved efficacy and safety profiles and opening new avenues for applications in functional foods, dietary supplements, and pharmaceuticals.

Keywords: Lipid-Based Nanocarrier, Nutraceuticals, Bioavailability, Solid Lipid Nanoparticles, Liposomes, Targeted Delivery

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Liquid Crystal Nanoparticles: Next-Generation Carriers for Efficient and Controlled Drug Delivery

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Between traditional solids and liquids, there is a state of matter known as liquid crystals (LCs). They are essential to life because they are found in various essential components of living things, including biochemical fluids and cell walls, which are inherently liquid and crystalline. LC-based drug delivery is a broad area of study. The use of LCs has seen a sharp increase in popularity in recent years, particularly lyotropic liquid crystals (LLCs) as drug delivery nanoparticles (cubosomes and hexosomes) applications. Such medication delivery methods based on nanoparticles offer effective, regulated, and target selective release of pharmaceuticals. This essay examines the theories and methods of LLC-based medication administration. The impact of LCs' physical characteristics on drug carrier efficiency and design, as well as important facets of the techniques used to detect, characterize, and analyze lyotropic nanoparticles and their feasibility of producing nanoparticles for broad application is examined. The research indicates that the medication delivery industry might be revolutionized by LC-based nanoparticles, but a It is necessary to investigate more dependable methods for producing nanoparticles on a large scale.

Keywords: Liquid Crystals, Nano particles, Cubosome, Hexosome

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Aerogel – Based Materials for Biomedical applications

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Aerogel is currently one of the most intriguing materials in the world. Aerogel has a network of pores with nanometer-sized openings, which results in a wide range of functional properties and uses. Inorganic, organic, carbon, and biopolymer aerogels can all be altered by mixing in cutting- edge ingredients and nanofillers. In this review, the basic process for making aerogel from the sol-gel reaction is critically discussed. A standard approach is derived and modified to create a variety of aerogels with arrange of functionalities. Additionally, details on the biocompatibility of several aerogel varieties were provided. As a drug delivery vehicle, wound healing agent, antioxidant, anti-toxicity, bone regenerative, cartilage tissue activities, and in dentistry domains, aerogel's biomedical uses were then the focus of this review. It is demonstrated that aerogel's clinical position in the biological field is also woefully inadequate. Aerogels are also preferred for usage as tissue scaffolds and medication delivery systems because of their outstanding features. The importance of Aerogel research in the fields including selfhealing, additive manufacturing (AM) technology, toxicity, and fluorescent-based aerogel is further discussed.

Keywords: Aerogel, Biopolymer, Drug delivery, Wound healing, Biomedical application

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A Successful Evolution of Atorvastatin loaded Stearic Acid Nanoparticle by the Dynamic Double Emulsion Solvent Evaporation Technique

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The present study formulated a nano-dosage form with excellent hydrophobic and hydrophilic properties consisting of polymer stearic acid to improve the pharmaceutical potential of novel atorvastatin (AT). Basically, Atorvastatin is in a class of medications called HMG-CoA reductase inhibitors (statins) which belongs to BCS Class II with very low water solubility. It works by slowing the production of cholesterol in the body to decrease the amount of cholesterol that may build up on the walls of the arteries and block blood flow to the heart, brain, and other parts of the body. Atorvastatin is used together with a proper diet to lower cholesterol and triglyceride (fats) levels in the blood. Hence, this low solubility of AT deprives all benefits of its. Stearic acid is an excellent amphiphilic polymer that is used to prepare nanoparticles of AT by double emulsion solvent evaporation technique to emphasize the bioavailability and solubility of this multitasking active pharmaceutical ingredient. Dissolve Atorvastatin and polymer in Chloroform and prepare nanoparticles in 173nm diameter with 0.3 Ploy Dispersity Index (PDI) in the presence of stabilizing agent Tween 20. Nanotechnology can be used to design pharmaceuticals to improve their potency and bioavailability that can target specific organs or cells in the body such as cancer cells, and enhance the effectiveness of therapy.

Keywords: Stearic Acid, Atorvastatin, Double Emulsion Solvent Evaporation Technique, Nanoparticles

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Preparation and Characterization of Valacyclovir Loaded Polycaprolactone Nanoparticles against *Herpes zoster* Virus Infection

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The primary purpose of the valacyclovir-loaded polycaprolactone (PCL) nanoparticles is to treat adult shingles, cold sores, and genital herpes. Valacyclovir, the model drug, is an antiviral medication that works against the Herpes Zoster Virus (HSV II). In case of hydrophilic drugs, the drug loading in NPs is found to be poor. Our main aim for this research is to evaluate this drug loading efficiency in NPs by a suitable method. Due to its high-water solubility, the double emulsion solvent evaporation process has been selected as one of the most suitable approaches. One stabiliser that is utilised is polyvinyl alcohol (PVA). In vitro drug release, surface morphology using field emission scanning electron microscopy (FESEM), zeta potential and size distribution using a Zetasizer (Litesizer 500) and particle size analyser, and drug-excipient interaction using Fourier transform infrared spectroscopy (FTIR) are the next studies conducted. The drug and excipients do not appear to interact chemically. Valacyclovir nanoparticles are smooth, have a negative surface charge, and range in size from 250 to 1000 nm. The manufactured particles had drug loadings of 0.871%. Over the course of the trial, or up to five days, a consistent medication release pattern from the nanoparticles is seen. Thus, the preparation of Valacyclovir loaded PCL Nanoparticles is successfully done.

Keywords: Double Emulsion Solvent Evaporation Technique, Nanoparticles, Genital Herpes

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Gastroretentive drug delivery systems for the treatment of *Helicobacter pylori*

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In recent years, researchers have become interested in gastro retentive drug delivery systems (GRDDS) as a means of oral drug delivery. Several different methods can be employed to store the drug in the stomach and release it gradually over an extended period of time. There are different ways to create GRDDS, such as using floating systems, bioadhesive systems, swelling and expansion systems, and high-density systems. For instance, flotation systems enable the drug to remain suspended in the gastric fluid, ensuring prolonged interaction with the absorption site. *Helicobacter pylori* (*H. pylori*) is a bacterium that causes gastritis and peptic ulcers. *H. pylori* is one of the most prevalent bacteria found in the stomach of approximately half of the world's population. It is the primary cause of gastritis, gastroduodenal ulcers, and stomach cancer. Nevertheless, the utilization of combination drugs is a prevalent approach in the eradication of *H. pylori*. Oral drug delivery systems that are tailored to specific sites in the body can prolong the drug's presence at the target, enhancing treatment outcomes and reducing unwanted side effects. Gastric retention drug delivery systems will extend the time the stomach spends with the drug, ensuring a consistent and controlled release, which will increase the drug's concentration in the body, enhance its effectiveness, and decrease the need for frequent dosing. In this review, we concentrate on several significant aspects in the advancement of intestinal drug delivery, including improvements in existing models and the introduction of new models, particularly their utilization in the treatment of *H. pylori* infection.

Keywords: *Helicobacter pylori*, Gastroretentive Drug Delivery Systems, Floating Systems, Bioadhesive Systems, Expansion Systems

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Self-Cross -Linked Hydrogel: An Innovative Approach for Wound Healing

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Self-cross-linking and biocompatible hydrogels are highly valued in various biomedical applications, including tissue engineering, controlled drug release, contact lenses, and wound healing. Their natural hydrophilicity, suitable permeability, biodegradability, and compatibility with biological tissues make them ideal for these purposes. To enable self-cross-linking, polysaccharides such as guar gum, cellulose, starch, xanthan gum, and sodium alginate are oxidized with agents that introduce dialdehyde groups. These groups facilitate the formation of cross-linked network structures through interactions with adjacent hydroxyl and amine groups. Research by Sarmah et al. highlights that functionalized starch serves as a macro-cross-linker, enhancing the hydrogel's structural stability, while chitosan provides pH-sensitive, stimuli-responsive swelling properties. In particular, increasing the chitosan content within the hydrogel network enhances repulsion forces, creating more space within the three-dimensional matrix for water retention. By evaluating the hydrogel's formation time, mechanical properties, swelling behavior, biodegradability, controlled drug release, and antimicrobial properties, this study presents a novel approach to developing self-cross-linking hydrogels derived from natural polysaccharides. Creating such hydrogels with in-situ injectability, stable cross-linking, resilience, and self-healing properties is essential for advancing effective biomedical applications.

Keywords: Biocompatibility, Macro-Cross-Linker, One-Pot In-Situ Reaction, Biomedical, Swelling Dynamics

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Recent Advancement in Pharmaceutical Nanotechnology for Enhancing the Solubility and Also Bioavailability of Poorly Soluble Drugs

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This study thoroughly examines the role of nanotechnology in improving the solubility and bioavailability of poorly soluble drugs, with a focus on drugs in BCS Class II and IV. It discusses a range of nanoscale drug delivery systems (NDDSs), including lipid-based and polymer-based systems, nano emulsions, nanogels, and inorganic carriers. These NDDSs not only enhance drug efficacy and targeting but also help reduce potential side effects. In nanotechnology-driven drug delivery, two main approaches are used: Direct Nanonization and Encapsulation in Nanocarriers. Furthermore, modifying the surfaces of nanocarriers by adsorbing or covalently attaching ligands can alter key properties, such as surface charge, tendency to aggregate, hydrophilicity, and fluidity. This review emphasizes the critical role of nanoparticle size and surface modifications, while also considering challenges related to production costs and safety. Overall, NDDSs represent a transformative advancement in pharmaceutical engineering, offering substantial promise for enhancing medical applications and improving patient care.

Keywords: Nanotechnology, Solubility and Bioavailability, Poorly Soluble Drugs, Drug Delivery Systems, Pharmaceutical Engineering

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Exploring the Recent Advancement in Granulation Techniques (PDG and MADG) in the Pharmaceutical Industry: Development, Significance, and Limitations

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Granulation is one of the most important step in the production of pharmaceutical oral dosage forms. Granulation is used mainly to improve flow, compressibility of powders, and to prevent segregation of the blend components, improve content uniformity, and eliminate excessive amounts of fine particles. However, granulation poses numerous challenges due to high quality requirement of the formed granules in terms of content uniformity and physicochemical properties such as granule size, bulk density, porosity, hardness, moisture, compressibility, etc. together with physical and chemical stability of the drug. The results will be improved yields, reduced tablet defects, increased productivity, and reduced down time. Particle size of the granules is mainly affected by the quantity and feeding rate of granulating liquid. Pharmaceutical granules typically have a size range between 0.2 and 4.0 mm, depending on their subsequent use. The type of process selection requires thorough knowledge of physicochemical properties of the drug, excipients, required flow and release properties, to name a few. This review focuses on the recent progress in the granulation techniques and technologies such as Pneumatic Dry Granulation and Moisture-Activated Dry Granulation. Among all granulating techniques, Moisture Activated Dry Granulation (MADG) technology is widely used in granulation of moisture sensitive active pharmaceutical ingredients. The objective of present work is to focus on the novel granulation technologies. This review gives an overview of these with a short description about the development along with its significance and limitations.

Keywords: Granulation, Content Uniformity, Moisture Activated Dry Granulation (MADG) Technology, Granulation Technique and Technology, Pneumatic Dry Granulation

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Natural Polysaccharide Based, Fluorescent Active and REDOX-responsive Functional Microgels for the Anticancer Drug Delivery

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A natural polysaccharide (sodium alginate) (Alg) based rhodamine activated and REDOX- responsive microgel was fabricated and synthesized via water in oil (w/o) mini-emulsion polymerization method. Microgels were crosslinked with a disulfide crosslinker by synthesizing and subsequently tailored with rhodamine derivative by ionization to get the pH- responsive fluorescent characterization. This biobased unique microgel was analyzed using different characterization techniques. REDOX-responsive disulfide crosslinkers in the microgels facilitate the release of an anti-cancer drug in the reducing domain of the cancer cells. Microgel shows pH-dependent fluorescence properties by fluorescence emission at 565- 580 nm at acidic pH (cancer cell pH). Cytotoxic behavior of the biopolymer-based microgel was conducted over both cancerous (IC_{50} 95-100 µg/mL) and non-cancerous (IC_{50} 220 µg/mL) cells by MTT assay which manifested the synthesized microgel is non-toxic whereas drug- loaded microgels demonstrated significant toxicity. Cell uptake (in vitro) and FACS analyses were conducted to understand the cell apoptosis cycle and behavior of the cancer cells in the presence of drug-loaded microgels. This pH-activated fluorescent triggered polysaccharide- based biomaterial could be a favourable nano-composite for anti-cancer drug delivery and other biomedical applications.

Keywords: Sodium Alginate, Microgels, pH Responsive, Anti-Cancer, Biocompatible

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Simultaneous Estimation of Dapoxetine Hydrochloride and Tadalafil as API in Tablet Dosage Form by Simultaneous Equation Method

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A method was developed and validated to estimate Dapoxetine Hydrochloride and Tadalafil in tablet form using a simultaneous equation approach. This technique takes advantage of each drug's unique wavelength of maximum absorbance as DPX HCl at 210 nm and TDL at 285 nm. By plotting calibration curves for each drug and applying simultaneous equations based on absorbance wavelength, the concentrations in mixed samples were accurately calculated. The method showed strong accuracy, precision, and specificity, meeting all standards set by ICH guidelines. In the linearity study at respective wavelengths, the linear regression equation for DPX HCl , calibration curve at 285 nm was calculated by y = 0.088x +0.005 (r^2 = 0.999), where y is absorbance and x is the value of various concentrations of standard solutions and the linear regression equation for DPX HCl, calibration curve at 210.0 nm was calculated by y =0.073x + 0.002 (r^2 = 0.999). Moreover, in the linearity study at of the other API at consecutive wavelengths, the linear regression equation for TDL, calibration curve at 285.0 nm was calculated by y = 0.022x+0.035 (r^2 = 0.996) and the linear regression equation for TDL, calibration curve at 210 m was calculated by y = 0.034x - 0.013 (r^2=0.998). The simultaneous equation method provided a reliable and accurate means of quantifying DPX HCl and TDL in tablet formulations. The calibration curves were linear, and the method complied with ICH guidelines for specificity, accuracy, and precision. This method is advantageous for quality control in pharmaceutical formulations, offering simplicity and efficiency.

Keywords: Tadalafil, Dapoxetine, Simultaneous Estimation Method, Beers Law, Wavelength

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Injectable Hydrogel-based Drug Delivery System for Cancer Therapy

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Hydrogels have been employed in a diverse range of applications, including the treatment of burns, wounds, a variety of dressings, contact lenses, and tissue engineering. Numerous studies have been conducted to study the potential application of hydrogels in treating cancer in a targeted manner. Because of their ability to deliver drugs locally and sustainably at the tumour site, injectable hydrogel-based drug delivery devices have become promising vehicles for cancer therapy. As a result of its ability to demonstrate a sol-gel phase transition upon injection in response to variations in temperature, the injectable thermosensitive hydrogel is regarded as an attractive drug delivery strategy. In this review paper, a synopsis of current developments in the design and execution of injectable hydrogel-based drug delivery systems for the treatment of cancer is described. Hydrogels are attractive possibilities for the administration of chemotherapeutic drugs, targeted therapies, and immunotherapeutic because of their particular qualities, which include Biocompatibility, which refers to the capacity of encapsulate therapeutic molecules, and the ability to change the mechanical characteristics of the hydrogel. Injectable hydrogel-based drug delivery systems provide significant potential for enhancing treatment results and quality of life for cancer patients by enabling targeted and controlled drug administration while reducing systemic toxicity and adverse effects.

Keywords: Hydrogel, Cancer Therapy, Sol-Gel Phase, Chemotherapeutic

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Enhancing Solubility of Poorly Soluble Drugs through Solid Dispersion Technology

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Solid dispersion technology is an innovative approach to enhance the solubility of poorly water-soluble drugs, leading to enhanced bioavailability and efficacy. This innovative technique involves dissolving a drug in a hydrophilic polymer matrix, creating a uniform, amorphous, or semi-amorphous solid system. Various polymers like PVP, HPMC, and Eudragit, along with solvents like ethanol and acetone, are utilised to prepare solid dispersions. Sophisticated analytical techniques, including DSC, XRD, SEM, and solubility studies, are employed to analyse the properties of solid dispersions. A wide variety of hydrophilic and hydrophobic carriers, encompassing natural, synthetic, semisynthetic, and modified natural polymers, are available for formulating solid dispersions. The selection of carrier depends on the desired release profile, allowing for immediate or controlled release of Drugs. Solid dispersions have demonstrated significant enhancements in solubility (up to 10-fold) and dissolution rate (up to 5-fold) for model drugs like ibuprofen and felodipine. The improved solubility is attributed to polymer-drug interactions and amorphous state formation. Recently, there has been a move towards the using of natural carriers, replacing or rather than synthetic ones. This review provides a comprehensive overview of various hydrophilic carriers used for formulating solid dispersions. Solid dispersion technology offers a promising strategy to overcome solubility limitations, enabling enhanced bioavailability and therapeutic efficacy. By harnessing this technology, pharmaceutical scientists can develop more effective drugs with improved patient outcomes, revolutionizing the field of drug development.

Keywords: Hydrophilic Carriers, Solid Dispersions, Solubility Enhancement, Enhanced Bioavailability

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Formulation and Evaluation of Metformin Hydrochloride Loaded Floating Microspheres

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Metformin hydrochloride is a widely used oral antihyperglycemic agent for managing Type 2 diabetes mellitus. However, its short biological half-life and limited absorption in the upper gastrointestinal tract reduce its bioavailability and necessitate frequent dosing. To address these limitations, floating microspheres of metformin hydrochloride have been developed as a promising gastro-retentive drug delivery system. Floating microspheres are spherical particles designed to remain buoyant in the gastric environment, enabling prolonged gastric residence time, sustained drug release, and enhanced absorption. These floating microspheres are typically prepared using polymeric materials such as hydroxypropyl methylcellulose (HPMC), DCM with ethanol, Eudragit, tween 80. By adjusting the formulation and processing parameters, these microspheres can achieve a is attributed to the low-density polymers and air- filled cavities formed during preparation. Studies on metformin hydrochloride-loaded floating microspheres have shown improved bioavailability, reduced dosing frequency, and better glycemic control compared to conventional formulations. Additionally, this delivery system minimizes gastrointestinal side effects by reducing drug release in the lower digestive tract. The floating microspheres provide a feasible approach for enhancing the therapeutic efficacy of metformin hydrochloride by ensuring a steady plasma concentration and prolonging drug release in the stomach. This approach holds significant potential for improving patient compliance and optimizing the management of diabetes mellitus through a novel drug delivery mechanism.

Keywords: Diabetes, Gastroretentive, Floating Microspheres, Air Filled Cavities, Bioavailability

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Formulation and In-Vitro Characterization of Atenolol Transdermal Filmwith Natural Polysaccharide

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The objective of this research work targeted to create a mechanism for transdermal drug delivery containing atenolol with natural polysaccharide and modified natural polymeric combinations, using solvent evaporation technique and to analyse how polymers affect the transdermal patches' physicochemical and drug-release characteristics. Solvent casting method has been used toformulate transdermal film. Chia seed mucilage, Carboxymethylated chia seed mucilage, Hydroxypropyl methylcellulose (HPMC) and Gelatin in different combination ratios were used asthe polymer. Dibutyl phthalate was chosen as a plasticizer. Result showed that the thickness of all film varied from 0.0546±0.0048 to 0.073±0.0032 mm with uniformity of thickness in each formulation. The average moisture content is found to be ranging between 4.8±0.13 to 5.67±0.14%. All batches had drug contents varying between 96 to 98 percent. All batches showedfolding endurance grades exceeding 120. In comparison to formulation samples F1 to F4 (62.39%, 63.03%, 41.90%, and 23.68%, respectively), formulation samples F5 and F6 showed slower cumulative drug release of 35.26% and 34.27% at 480 minutes, According to the study's findings,modifying the polymer has an impact on the transdermal film's physicochemical and drug-release characteristics, and formulating an efficient transdermal film requires an optimum ratio of polymerto plasticizer combination. Higher proportion of modified polymer and plasticizer in the formulation of transdermal film, gives lower percentage drug release from prepared film. Thus, it can be concluded that the increase in the ratio of plasticizer and modified CSM polymer in comparison to unmodified CSM polymer will result in retarding drug release rate.

Keywords: Transdermal Drug Delivery Systems (TDDS), Chia Seed Mucilage, Atenolol, HPMC, Carboxymethylation, Dibutyl Phthalate, Drug Release

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Floating Drug Delivery System (FDDS)

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Floating drug delivery systems (FDDS) maintain the buoyancy property of the drug to the gastric fluids and it helps to action for long period of time. It helps in minimizing the doses of frequency. It may effervescent or non-effervescent system. The process of drug absorption from the Gastrointestinal tract (GIT) is very complex and influenced by many variables. It is commonly recognized by the degree of drug absorption in the GIT and it correlates with the duration of contact with the mucosa of the small intestine. Therefore, the transit time through the small intestine is a critical parameter for drugs that experience incomplete absorption. Although it is well accepted fact that it is very difficult to know the real time of release of solid or oral dosage forms. Thus, drug absorption in the Gastrointestinal (GI) tract may be very short and highly different in certain circumstances. Many technologies are used in the research and development of rate-controlled of the oral drug delivery systems (ODDS) to overcome physiological diversities, as short gastric residence times and unpredictable gastric empty times using the gastro Retentive drug delivery system (RDDS).

Keywords: Floating, Gastro-Retentive Drug Delivery System, Gastrointestinal Tract

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A Review on Formulation and Evaluation of Floating Drug Delivery System of Famotidine

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Famotidine is a Histamine H2 receptor blocker. This work is based on the extensive literature review done on manufacture of famotidine floating beads, and its in-vitro assessment of the Floating Drug Delivery System (FDDS), drug release, and polymer ratio adjustment to get the intended release profile. Using the Emulsion Gelation Method, floating beads were produced by combining sodium alginate (SA) as a thickening agent with the rate-controlling polymers hydroxyl propyl methylcellulose (HK), polycarbophil (PC), and carbopol (CP). Particle size analysis, drug entrapment efficiency, surface topography, buoyancy percentage, and release studies were among the analyses that were carried out. When compared to other formulations, the beads created using a mix of SA and PC showed the greatest drug content and entrapment. Drug release depended on the drug's breakdown and diffusion through the polymer matrix, as evidenced by the beads' notable lack of swelling or erosion in the dissolution media. According to buoyancy experiments, the beads needed at least 20% w/w of cod liver oil to be buoyant enough. The results showed that, out of all the tested formulations, the beads made with the SA and PC combination (F4) had the maximum drug release. As a result, formulation F4 was selected for stability tests over a three-month period in compliance with ICH criteria, and the formulation (F4) with a 9:1 SA to PC ratio worked well. Hence this work showed remarkable success in the increase in drug release pattern.

Keywords: Floating Drug Delivery System, Gastroesophageal Reflux Disease, Carbopol

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Modification of Natural Mucilage for Better Biological Activity and Its Usage in Various Drug Delivery System

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Mucilages are typical metabolic byproducts (physiological substances) that develop within the cell (intracellular synthesis). Mucilage are plant-based hydrocolloids that produce a mixture of sugars and uronic acid when hydrolyzed. Chia (Salvia hispanica L.) is an annual plant from Lamiaceae family, native to Mexico. Chia seeds are rich in fiber, omega-3 fatty acids, proteins, and a variety of essential minerals and antioxidants. Recent research emphasizes the chemical alteration of polysaccharides for use in biomedical applications. Chia mucilage is an anionic heteropolysaccharide with high viscosity, even at low concentrations. This natural polymer is primarily composed of D-xylose, L-arabinose, D-mannose, D-glucose, galacturonic acid and glucuronic acid residues. It also contains hydroxyl groups that can attach to biologically active compounds. Chia mucilage was extracted using a hot extraction process. However, no studies have been found on the modification of chia mucilage and its application in drug delivery system. Carboxymethylation of polysaccharides typically enhances the bioactivities of native polysaccharides. Hence, modification was carried out through carboxymethylation based on Williamson synthesis utilizing sodium hydroxide and monochloroacetic acid solutions. This process introduces carboxymethyl groups in the mucilage, expanding the applications of carboxymethylated chia mucilage.The resulting samples of both chia mucilage and carboxymethylated chia mucilage were characterized by FTIR spectroscopy.The carboxymethylated chia mucilage can significantly enhance its properties for use in controlled delivery systems, showcasing its versatility in developing innovative delivery system and offering a sustainable, natural alternative to synthetic polymers.

Keywords: Chia Mucilage, Carboxymethylation, Controlled Delivery System, Synthetic Polymers, Modification

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Development and Characterization of Aceclofenac Tablets by the Development of Ternary Hydrotropic Solid Dispersion with the Dairy Product

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Solid dispersion (SD) using water-soluble and/or hydrophilic carriers and simultaneous compression into tablets seems to be a developable, economically easy option to enhance the solubility, bioavailability and dissolution of poorly soluble drugs, among the significant strategies.The main objective of this study was to explore the feasibilities of skimmed milk (SM)-urea (UR)-crospovidone (CPD) as a novel ternary mixture of carrier- hydrotrope - superdisintegrant in the solid dispersion of poorly water-soluble drug aceclofenac (AF) and assess the probability of developing into tablets from the formulations. Solid dispersions of AF-SM, AF-SM-UR and ternary hydrotropic SD, AF-SM-UR-CPD were prepared in varying ratios of 1:1 to 1: 5 for AF-SM; 1:5:0.5, 1:5:0.75 and 1:5:1 for AF-SM-UR and 1:5:0.75:0.25 to 1:5:0.75:1 for AF-SM-UR-CPD by solvent evaporation technique and were characterised for their solubility enhancement at 25 ºC and drug dissolution profiles in double distilled water (DDW). Based on the data of solubility enhancement (82.11%) and maximum drug release of 88.44% in 9 mins in DDW, AF-SM-UR (1:5:0.75) was found to the best among AF-SM which was used for studying the effect of adding CPD. AF: SM: UR: CPD (1 : 5 : 0.75 : 0.50) shown maximum solubility enhancement of 83.91% and cumulative percentage release of 98.54 % in 9 mins. The optimised ternary hydrotropic SD of aceclofenac (AF) was thus compressed into tablets by direct compression method but shown retarded drug release of 65.41 % in 15 mins. Altered dissolution profile of tablets may be attributed to change in physical characteristics such as inter-particle arrangement, bond formation, defragmentation of solid dispersions as an impact of compression force.

Keywords: Hydrotrope, Skimmed Milk, Solid Dispersion, Superdisintegrant, Tablet

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Formulation, Characterization, *In-Vitro* and *In-Silico* Study of Controlled Release Microbeads Containing Antidiabetic Drug

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In this study, antidiabetic drug-loaded microbeads were developed using an ionotropic gelation technique, which utilized a combination of sodium alginate and gellan gum as base materials. The cross-linking agents included maleic anhydride, aluminium chloride, and calcium chloride, while metformin hydrochloride served as the model drug. The resulting alginate-gellan gum microbeads demonstrated high percent yields (ranging from 81.67 ± 1.82% to 93.33 ± 1.02%) and significant drug entrapment efficiencies (from 75.16 ± 1.58% to 97.86 ± 3.17%). The particle sizes of the microbeads averaged between 620 ± 20 µm and 810 ± 30 µm, with swelling indices recorded between 74% and 82%. These microbeads showed a controlled release profile, with drug release extending over a 4-hour period. Surface morphology of the optimal formulation was assessed through scanning electron microscopy (SEM). Kinetic studies further indicated that the microbeads followed a matrix release model. In silico analysis, carried out using PKSim® version 11.3, provided a physiologically based pharmacokinetic (PBPK) assessment, which revealed a maximum bioavailability of 44% at 4 hours within the simulated biological system. These alginate-based microbeads, formulated through ionotropic gelation, may offer benefits for enhanced patient compliance by reducing dosing frequency and improving the oral bioavailability of antidiabetic drugs.

Keywords: Microbeads, Drug Release, Antidiabetic Drug, Ionotropic Gelation. PBPK Modelling

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Effect of Mango Butter on the Physicochemical Properties of Beeswax-Moringa Seed Oil-Based Oleogels for Topical Application

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The pharmaceutical, cosmetic, cosmeceutical, nutraceutical, and food sectors have recently shown increased interest in semi-solid products. They have been used in various forms, including gels, lotions, creams, ointments, and jellies. Most of these items have a shorter shelf life since their long-term stability is a significant issue. It has been shown that gel-based semi-solid products are more reliable than others. Oleogels are popular among gel-based products due to their simple preparation and inherent long-term stability. The lipophilic nature of surfactants, phospholipids, glycols, and lecithin have been used to improve the stability of the oleogels. The purpose of this research was to determine any connections between the characteristics of oleogels made of beeswax and the impact of mango butter. Oleogel was prepared through inverted tube methods, and optimized through oil binding capacity. Other evaluations like bright field and polarized microscopy, Fourier-transform infrared (FTIR) spectroscopy, crystallization kinetics, mechanical study, and X-ray diffractometry (XRD) were performed. The drug release kinetic studies and in vitro antibacterial studies were performed. FTIR study reveals that the gelation process does not significantly alter the chemical composition of the individual components. Prepared gel exhibiting fluid-like behaviour or composed of brittle networks is particularly vulnerable to disruptions in their network design. The incorporation of mango butter increases the drug permeation. *In vitro* microbial efficacy study was found to be excellent. The studies revealed that mango butter can be used to modify the physio-chemical properties of the oleogels.

Keywords: Mango Butter; Moringa Seed Oil; Beeswax Oleogel; Linezolid; Antimicrobial Efficacy

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Dosage Form Development of New Drug

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Dosage Form Development is always a massive challenge before the marketing of a drug. Without a proper dosage form, it is not possible to administer a drug. Novel pharmaceutical dosage forms include dosage forms like tablets, capsules, cachets, parenteral (injectables) etc. This whole process to make a suitable dosage form needs a lot of tests and approvals to get permitted for marketing. For that initially, pre-formulation studies is done with the help of biopharmaceutical classification system (BCS) and other parameters (pH, Pk). Regulatory Affairs and Out-licensing follows in the next step. These steps are done by Regulatory Affairs Professionals Society (RAPS) and Indian-CDSCO (Central Drug Standard Control Organisation) respectively. This process is very important and time consuming. But without these tests and steps a drug won't be worthy of consumption.

Key-words: Biopharmaceutical Classification System (BCS), Regulatory Affairs, Out-licensing, Novel pharmaceutical dosage forms, Dosage Form Development, Pre- formulation Studies

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Poly (lactic-co-glycolic acid) (PLGA) Based Smart Nanoparticle: A Promising Carrier for Oral Insulin Delivery

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Diabetes Mellitus is a chronic health issue that is causing mortality and also posing severe economic burden. Application of injectable insulin is a major problem with the patients as it has several drawbacks. In this context, it is a vital task to develop a nanocarrier based system for the delivery of insulin through oral route. Research articles were searched in PubMed, Scopus, Google Scholar, Web of Science, etc. and articles published between 2015 to 2024 were considered for this work. Keywords such as oral insulin delivery, diabetic therapies, and nanoparticles in diabetes management were used to search the articles. We have collected 40 articles. Poly (lactic-co-glycolic acid) (PLGA) nanoparticles (NPs) have emerged as a promising strategy to overcome these hurdles. PLGA nanoparticles can enhance insulin stability, protect it from gastric enzymes, and promote its absorption in the intestine. Modifying the surface of PLGA nanoparticles with targeting ligands, further improves their uptake by intestinal cells, facilitating efficient insulin absorption. Furthermore, using smart nanoparticles, which respond to pH changes or enzymes in the gastro-intestinal tract, allows insulin release, specifically in the intestine, bypassing the stomach's acidic environment. This comprehensive review aims to provide a thorough understanding regarding PLGA nanoparticles for oral insulin delivery including challenges & future direction which aims to guide clinicians and researchers working towards innovative diabetic therapies.

Keywords: PLGA Nanoparticles, Insulin Delivery, Diabetic Therapies, Smart Nanoparticles, Challenges

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Current Research Perspective on Antidiabetic Therapy Using TDDS

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Diabetes mellitus is a chronic illness in which the pancreas either produces insufficient amounts of insulin or the body cannot properly use the insulin that is generated. Patients who suffer from diabetes develop social, mental, and physical problems. About 422 million people worldwide suffer from diabetes, and by 2045, it is predicted by The International Diabetes Federation's (IDF) projects that 783 million adults would be affected. There are issues with oral drugs, such as frequent dosage, adverse effects, and non-patient compliance. Another issue with insulin therapy is its injectable delivery method. The benefits that transdermal systems provide over intrusive injectable and oral dose forms have drawn more attention to them and made them seem like a promising option for managing diabetes. According to studies, these transdermal methods offer improved bioavailability over oral delivery because they prevent first-pass hepatic metabolism and provide a sustained drug release. If the manufacturing issues with the transdermal drug delivery systems are fixed, a major shift in the treatment of diabetes is anticipated, as transdermal drug delivery systems are regarded as a promising strategy for managing the disease, providing a better clinical outcome than traditional dosage forms. This study highlights a number of controlled and novel drug delivery systems that have been studied by various researchers in order to achieve controlled and sustained drug delivery of oral hypoglycaemics. However, the use of transdermal delivery in the management of diabetes has opened a new opportunity for a wearable technology that is more accurate and disposable for easy administration and storage.

Keywords: Diabetes, Transdermal drug delivery, Antidiabetic, sustained drug release, wearable technology

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Identification of Promising Hits against Resistant *Pseudomonas* Strains from Natural Sources: A Combined Machine Learning and Rational Drug Design Approach

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Despite advances in modern medicine, bacteria like *Pseudomonas* species continue to pose significant health risks due to their rapid development of antibiotic resistance. To address this, our work chiefly focuses on designing new entities derived from Ayurvedic drug ingredients. To identify promising compounds from Ayurvedic ingredients. Using a machine-learning model, we selected fragments from Ayurvedic drugs with known antimicrobial properties. We constructed and optimized a chemical database, validated an AI-guided molecular docking protocol, and conducted virtual screening to identify top ligands. The stability of protein-ligand complexes was evaluated through molecular dynamics simulations. We identified the top 100 molecules with docking scores below -8.5 kJ/mol. Molecules with favorable ADMET profiles were chosen for further molecular dynamics (MD) simulations. Key pharmaceutical properties such as pKa and logP were prioritized. Selected molecules showed lower RMSD values and reduced RMSF fluctuations post-binding. MMPBSA data indicated binding energies of -80 kcal/mol, -60 kcal/mol, and -50 kcal/mol, with specific protein-ligand contacts maintained for 70% of the simulation time, up to 100 ns. A novel technology was developed for the automated identification and preparation of target ligands. An in-house database of chemical compounds derived from Ayurvedic drug ingredients was created. Following the validation of the molecular docking protocol, virtual screening, and lead optimization were performed using molecular dynamics simulations. The identified ligands demonstrate strong binding affinity and stable interactions with PA-elastase, suggesting their potential as effective therapeutic agents against Pseudomonas infections

Keywords: *Pseudomonas*, Molecular Dynamics, Ayurvedic Drugs

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Thiazolidinedione An Emerging Scaffold as PPAR-γ Agonist: Its Possible Mechanism to Cure against Insulin Resistant Diabetes Mellitus

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Insufficiency of insulin or less often, decreased insulin sensitivity (insulin resistance) is the underlying cause of most common endocrine illness diabetes mellitus (DM). In order to prevent insulin resistant diabetes mellitus, heterocyclic moiety thiazolidinediones (TZD) play a crucial role for activating the PPAR- γ receptor, which binds to DNA and forms a complex with retinoid receptors. TZD derivatives are sulphur and nitrogen bearing heterocyclic compounds with a diverse range of pharmacological actions; these molecules have a huge influence on synthetic chemistry. For those patients suffering with type II diabetes mellitus, TZD acts through reducing blood glucose levels by oxidising carbohydrates and improving insulin resistance. Among many potential sites in the TZD nucleus, N-3 and C-5 locations provide the most attractive positions for the structural modification. The TZD scaffold is a pentacyclic sulfur-containing complex with two carbonyl groups and an alpha hydrogen, making it a very flexible molecule with great biological activity. By providing a concise summary of the antidiabetic activity, mechanism of action, structure-activity connection, and different synthetic approaches of the key pharmacophore TZD, we believe that this concise presentation will assist future researchers in developing ideas regarding this moiety.

Keywords: PPAR- γ, Thiazolidinediones, Diabetes Mellitus, Heterocyclic Moiety

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Exploring Copper-Metal Organic Frameworks (Cu-MOFs): Synthesis, Applications, and Future Directions

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Recent interest in copper-based metal-organic frameworks (Cu-MOFs) has surged due to their unique structural characteristics, tunable properties, and extensive applications across various fields. Composed of copper atoms or clusters coordinated with organic ligands, Cu-MOFs demonstrate remarkable structural diversity, facilitating customization for specific applications. Advances in the synthesis and modification of Cu-MOFs have significantly enhanced their stability, surface area, and catalytic efficiency. Innovative methods, such as solvothermal and microwave-assisted techniques, have yielded Cu-MOFs with improved structural integrity and higher porosity, which are crucial for their performance in catalytic processes, including CO_2 reduction and hydrogen production. Cu-MOFs are particularly promising for environmental applications due to their high surface area and selective adsorption properties, making them excellent candidates for CO_2 capture and methane storage. Furthermore, they are actively being researched for various biomedical applications, including drug delivery, bioimaging, and biosensing, owing to their biocompatibility and functional versatility. Despite their potential, Cu-MOFs face several challenges, including stability under varying conditions, toxicity concerns, and scalability issues. Addressing these challenges is essential for their practical applications. Future research is expected to concentrate on enhancing the design and synthesis of Cu-MOFs to overcome these obstacles, focusing on the development of more robust frameworks and the optimization of production methods. In summary, Cu-MOFs hold significant promise for advancements in both environmental and biomedical fields. Continued research and development are crucial for unlocking their full potential and fostering innovation across diverse scientific disciplines. This abstract provides an overview of Cu-MOFs and Cu-MOF-derived materials, highlighting their various biological applications.

Keywords: Cu-MOFs (Copper-Based Metal-Organic Frameworks), Catalysis, Biomedical Applications, Synthesis, Stability

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Green Synthesis of Silver Nanoparticles from *Sarcochlamys pulcherrima*: Enhanced Antimicrobial and Anti-biofilm Activity

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Sarcochlamys pulcherrima (Roxb.) Gaud., a small evergreen tree from the Urticaceae family, is widely found in the hilly regions of northeastern India. The plant holds significant medicinal value, traditionally utilised by various tribal communities in Assam for treating ailments and as a source of food. This study explores the potential of *S. pulcherrima* in synthesising silver nanoparticles (AgNPs) to enhance antimicrobial and anti-biofilm activity. The synthesis of AgNPs was carried out using leaf extracts of the plant, employing heat techniques to optimize the biological activity of the nanoparticles. The characterisation of the synthesized AgNPs was performed using UV-Vis and FT-IR spectroscopy, with UV-Visible spectra displaying characteristic surface plasmon resonance bands between 403 and 431 nm, indicating the nanoparticle formation as per the literature survey. The further study of the characterization of AG-NP formations is in process. The antimicrobial efficacy of the synthesized AgNPs was tested against Gram-positive (Bacillus) and Gram-negative (*E. coli*) bacteria. In the antibacterial assessment, comparable zones of inhibition were observed when using Penicillin as a reference antibiotic, with promising results at varying concentrations of AgNPs against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. Furthermore, the study examined the antibiofilm activity of the synthesized AgNPs against the same pathogens. The results demonstrated that the AgNPs exhibited significant anti-biofilm activity, suggesting their potential in preventing biofilm formation, which is a key factor in persistent infections. In conclusion, the leaf extracts of *Sarcochlamys pulcherrima* were successfully used to synthesise silver nanoparticles with enhanced antimicrobial and antibiofilm properties, highlighting their potential for future development in antibacterial therapies and medical applications.

Keywords: Traditional Medicine, Antimicrobial Activity, Zone of Inhibition, Anti-biofilm.

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Upgraded Scheme of Biosafe Metallic Nanoparticle Derived from Fruit Wastes and its Application against Neurodegenerative Disorders

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The prevalence of neurodegenerative diseases, particularly dementia and Alzheimer's disease, has increased dramatically in the modern period. According to WHO, 55 million people are suffering from dementia present and future projection of an increase of 10 million cases every year. Progressive impairment of the motor, cognitive, and psychiatric systems is associated with these disorders. Despite several clinically approved medications for treating neurodegenerative disorders, the associated symptoms are suppressed. The lack of comprehensive treatment is due to the complex pathophysiology and the restrictive nature of the blood brain barrier (BBB). The demand of plant bioactives as therapeutics have increased exponentially over the past few years. Fruits being one of the staple components of a balanced diet, are a rich source of phytochemicals. The consumption of fruits generates a huge amount of wastes, which are a rich source of phytochemicals. Recently, recovering the bioactive compounds from fruit wastes have appealed to the researchers from pharmaceutical, nutraceuticals and the food industries. The sustainable utilization of fruit wastes extracts, could be a promising strategy in optimizing the therapy for neurodegenerative disorders. Nevertheless, to bypass the bioavailability issues of these bioactive compounds, the reducing properties of these bioactive compounds are utilized for synthesizing biosafe metallic nanoparticles for better targeted delivery. Additionally, nanoformulation of the fruit wastes extracts could possibly execute easy penetration through blood brain barriers. In this study, we have thus summarized the etiopathological factors for neurodegeneration, highlighted the possible therapeutic efficacies of bioactive compounds from fruit wastes and discussed how these compounds could exert their neuroprotective effects.

Keywords: Neurodegeneration, Fruit Wastes, Plant Bioactives, Biosafe, Nanoparticles

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Bioautography Technique: To Identify the Phytoconstituents, Anti-Microbial, Antioxidant and Enzyme Activity of the Extract of Plant *Abroma Augusta*

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Planar chromatographic analysis hyphenated with biological detection method is termed as Bioautography. It is a powerful analytical technique used in the study of natural products, pharmaceuticals, and other biological samples. It combines thin-layer chromatography (TLC) with biological assays to detect bioactive compounds directly on the chromatogram. It is an effective and inexpensive technique for the phytochemical analysis, antioxidant, antimicrobial activity and enzymatic activity of plant extract to identify bioactive lead/scaffolds. *Abroma augusta* is a medicinal shrub belonging to the family Malvaceae, widely distributed across Northern India, Bhutan, Indonesia, Malaysia, Micronesia, Myanmar, Nepal, Solomon Islands, Southern China, Sumatra, and Thailand. Traditionally, it has been utilized for various therapeutic purposes. The objective of this study was to identify the phytochemical constituents and evaluate the antioxidant, antimicrobial, and enzyme inhibitory activities of the total methanolic extract of *Abroma augusta.* The dried plant material was extracted using the maceration method with methanol. Phytochemical screening was conducted using standard qualitative tests and Thin Layer Chromatography (TLC), which revealed the presence of alkaloids, flavonoids, glycosides, and phenolic compounds. TLC further confirmed the presence of flavonoid and phenolic compounds. The methanolic extract exhibited significant antioxidant activity, as measured by DPPH radical scavenging assays. Additionally, antimicrobial activity was observed against *Staphylococcus aureus* (Gram-positive) and *Escherichia coli* (Gram-negative), evaluated by diffusion and agar overlay bioautography methods. The study aims to develop a cost-effective, simple, and rapid method for identifying phytochemicals and assessing bioactivity, which can serve as a foundation for further pharmacological investigations.

Keywords: Bioautography, Chromatography, *Abroma augusta*, TLC, Antioxidant

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Advancing Antimicrobial and Anticancer Applications: Silver Nanoparticles Synthesized by *Artemisia annua*

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The rise in antibiotic resistance necessitates alternative broad-spectrum therapeutic agents. Silver nanoparticles (AgNPs) show promise as antimicrobial and anticancer agents. Green synthesis using plant extracts offers a sustainable production method. In comparison to raw plant extracts, green-synthesized silver nanoparticles offer enhanced stability, bioavailability, and regulated release of active chemicals, as well as increased efficacy and uniformity for a range of industrial and biomedical applications. This study aimed to synthesize and characterize AgNPs using *Artemisia annua* extract as a bio-reductor, assess their antibacterial efficacy, and investigate their cancer cell-specific cytotoxicity. AgNPs were synthesized using *A. annua* extract. Characterization employed UV-Vis spectroscopy, FTIR, XRD, TGA, SEM, and EDX analysis. Antibacterial activity against *Staphylococcus aureus* and *Klebsiella pneumoniae* was evaluated via MIC, SEM and MBEC. Anticancer activity was assessed through MTT and Trypan Blue dye exclusion assay on K562 leukemia cell-line, compared to healthy h-PBMCs. Characterization confirmed successful AgNP synthesis. Low MIC and MBEC values demonstrated significant antibacterial activity against planktonic and biofilm-forming bacteria. AgNPs exhibited substantial cytotoxicity against K562 cells while showing minimal toxicity to hPBMCs, indicating selective targeting of cancer cells. The study effectively demonstrated green synthesis of AgNPs from *A. annua* extract, confirming their dual antibacterial and anticancer efficacy. The AgNPs showed high antimicrobial activity against drug-resistant pathogens and selective cytotoxicity towards cancerous cells, presenting potential as dual-purpose therapeutic agents. Further research is needed to fully realize the clinical applications, safety, and therapeutic potential of these green-synthesized AgNPs.

Keywords: Green-Synthesis, Nanoparticles, Antibacterial efficacy, Antibiofilm agent, Antibiotic resistance, Anti-cancer

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Eco-Friendly Production of Silver Nanoparticles: Harnessing the Power of Sweet Basil Leaves

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The green synthesis of silver nanoparticles (AgNPs) using plant extracts has gained significant attention due to its eco-friendly and cost-effective approach. This review focuses on the synthesis of AgNPs from *Ocimum basilicum* (sweet basil) leaves, a plant renowned for its rich phytochemical composition, including flavonoids, phenolic compounds, and essential oils. These bioactive compounds serve as reducing and stabilizing agents in the nanoparticle synthesis process, enabling the formation of silver nanoparticles without the use of harmful chemicals. The review examines various methods employed in the green synthesis of AgNPs, highlighting parameters such as temperature, pH, and concentration of plant extract, which influence nanoparticle size and morphology. Characterization techniques, including UV-Vis spectroscopy, transmission electron microscopy (TEM), and X-ray diffraction (XRD), are discussed to confirm the formation and stability of the synthesized AgNPs. Furthermore, the antimicrobial, antifungal, and antioxidant properties of AgNPs synthesized from sweet basil are explored, emphasizing their potential applications in medicine, agriculture, and environmental remediation. In conclusion, the green synthesis of silver nanoparticles from sweet basil leaves presents a sustainable alternative to conventional methods, yielding nanoparticles with significant biological activities. This review underscores the potential of using *Ocimum basilicum* not only as a source of AgNPs but also as a stepping stone toward developing environmentally friendly nanomaterials for various applications. Future research should focus on optimizing synthesis parameters and exploring the broader implications of these nanoparticles in diverse fields.

Keywords: *Ocimum basilicum*, Silver, Antioxidant, Wound Healing, Nanoparticles

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Platinum Nanoparticles (PtNPs) in Synthesis, Characterization, and Biomedical Applications: Advances in Green Synthesis and Therapeutic Potential

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This review addresses platinum nanoparticles in synthesis, characterization, and biomedical applications. PtNPs have been valued for their surface area and catalytic behaviour. They are synthesized through physical, chemical, and biological methods. Physical methods consume much energy and are very costly. The chemical synthesis method employs dangerous agents; thus, the method is not applicable. Hence, biological synthesis is the green, low-cost, and biocompatible method of synthesis. Biological approaches that include plant extracts, fungi, and bacteria enhance the biomedical applications of PtNPs through favourable morphology, stability, and size parameters achieved with controlled synthesis. It employed various analytical techniques like UV-Visible spectroscopy, FTIR spectroscopy, and TEM to confirm synthesis along with the study of PtNP properties. These ascertain proper control of PtNP properties; a critical point toward its utility in biomedical settings. Roles in promising antimicrobial, antioxidant, and anticancer therapy based on unique properties that provide selective cytotoxicity without harmful effects in targeted therapies could be anticipated. Also, compatibility with drug delivery systems and diagnostics underlines possible application of PtNPs in advanced medical technologies. Therefore, the need for further advancement in the field of sustainable synthesis methods with maximized safe and effective utilisation of PtNPs in healthcare applications forms a review of this discussion.

Keywords: Platinum Nanoparticles (PtNPs), Green synthesis, Biomedical applications, Cytotoxicity

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From Synthesis to Therapy: The Transformative Role of Functionalized Gold Nanoparticles in Modern Medicine

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This review discusses the extraordinary properties and the vast biomedical potential of functionalized gold nanoparticles. Functionalized gold nanoparticles are particularly recognized for their biocompatibility, stability, and extraordinary optical behavior, giving them a potential position for multifunctional use in medicinal and biological applications. Gold nanoparticles are known to be stabilized and biocompatible along with having optical and electrical characteristics that can be well-suited for use in certain medical applications like drug delivery, hyperthermia, and photothermal therapy. This review discusses synthesis methods for AuNPs, including chemical reduction approaches and eco-friendly "green" synthesis techniques using biological agents. Surface functionalization, such as polymer coating and self-assembled monolayers, are highlighted in the context of enhancing nanoparticle stability and preventing aggregation. Surface modifications allow for precise control over nanoparticle properties, which improves their compatibility in biological environments. The review also discusses analytical techniques for characterizing the size, shape, and surface properties of AuNPs, which are crucial for their efficacy in biomedical applications. With advances in AuNP synthesis and functionalization, the paper predicts their growing role in fields ranging from biosensing and diagnostics to therapeutic delivery, underscoring the importance of ongoing research to optimize their design and application in healthcare. This review is, therefore, concluded by summarizing the promising future of AuNPs in theragnostic: their role in targeted therapy and sensors, which underpin the transformative potential in clinical settings.

Keywords: Gold Nanoparticles, Stability, Biomedical Potential, Green Synthesis, Biocompatibility

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Optimization of Ketoconazole Loaded Hydrogel Synthesized from Natural Polymer

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A class of polymeric materials known as hydrogel products can retain a lot of water in their crosslinked network that is three-dimensional due to their hydrophilic structure. Widespread use of such materials across a range of application-specific industrial and environmental sectors is regarded as being quite important. Nonetheless, several engineering-focused papers and technical studies about hydrogel products were analyzed to provide an overview of the technological features of this expanding interdisciplinary field of study. Crosslinking is a stabilizing mechanism in polymer chemistry that makes the polymer chain stretch in several dimensions and forms a network structure along with the joining of two polymer chains together using a bond. It could be ionic or covalent. Crosslinking turns the liquid polymer into a "solid" or "gel," which limits its mobility. When polymer chains are cross-linked together, their motion is somewhat reduced. Crosslinking the molecules allows a liquid polymer, where the chains flow freely, to become a "solid" or "gel". Cross-linking of the polymer causes high molecular weight. Cross-linked polymers are important due to their robust mechanical nature and resilience to heat, abrasion, and chemicals. To formulate ketoconazole-loaded Carboxymethyl chitosan (CMC) based hydrogels is the moto of this study. Additionally, the study sought to understand how the polymeric and crosslinking ratio affect the formulations' physico-mechanical characteristics to find out the best formulation. Optimization was done by “Design of Expert” software. Enhanced Swelling Index and spreadability were the parameters set for determining the optimized formulation to achieve the best formulation. The optimized formulation obtained was further used for enhanced drug delivery of ketoconazole for the treatment of topical wound healing.

Keywords: Hydrogel, CMC, Crosslinking, Swelling, Spreadability

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A Brief Discussion of the Benefits of NSAIDs Nanoparticles rather than the Traditional Dosage Form of NSAIDs

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NSAIDs are a very common drug nowadays, as their different analgesic action. Among these, nano dosage formulation with this group of drugs is a very novel application and results in our therapeutic world with more benefits. Nanoparticles increase the bioavailability of the drug in our body rather than the traditional drug delivery system which provides moderate bioavailability in our system. Depending on their specification Nanoparticles have a faster onset of action of controlled release and they reach the tissue. Therefore, the cellular uptake of the drug by nano delivery dosage form is rather improved from traditional drug delivery systems. Nanoparticles can work in a lower dose due to better targeting of the workplace and better bioavailability but the traditional dose needs a high dose to achieve effective concentration which leads to side effects. Nanoparticles reduce the side effects due to their very small amount of drug and targeted application specifically there is no tissue toxicity but the traditional dose needs so high dose which is why it leads to side effects and in oral application toxicity effect affects the biological system.

Keywords: Nano dosage form, Traditional dosage form, NSAIDs

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Development, Validation & Quantification of Posaconazole by using UV Spectrophotometric Methods

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An antifungal is a medication used to treat infections caused by fungi, including yeasts and molds. Posaconazole is a broad-spectrum antifungal that belongs to the triazole class, designed to prevent and treat invasive fungal infections, especially in immunocompromised patients. It works by inhibiting the enzyme lanosterol 14α-demethylase, disrupting fungal cell membrane synthesis, which leads to fungal cell death. The present study introduces a validated, economical UV-spectrophotometric method for quantitatively analyzing posaconazole, a broad-spectrum triazole antifungal widely used in treating fungal infections in immunocompromised patients. Limited spectrophotometric techniques are available for posaconazole quantification, making this method a practical, reliable alternative. Methanol was used as the solvent, revealing a maximum absorption wavelength (λmax) at 260 nm. Validation followed ICH Q2R1 guidelines, covering essential parameters such as linearity, precision, accuracy, and robustness. The method exhibited strong linearity over a concentration range of 0.25–10 µg/mL, with a correlation coefficient close to unity ($R^2 \approx 0.999$). Intra-day and inter-day precision showed %RSD values within acceptable limits, ensuring method reproducibility. Recovery studies confirmed accuracy, establishing the method's suitability for posaconazole in pharmaceutical formulations. Compared to complex techniques like HPLC, this UV-spectrophotometric method is simpler, cost-effective, and adaptable for routine quality control across various formulations. This validated approach offers a practical tool for ensuring dosage accuracy, therapeutic reliability, and quality assurance of posaconazole, aligning with industry standards for pharmaceutical analysis and regulatory compliance.

Keywords: Posaconazole, UV-Spectrophotometry, Method Validation, Antifungal, Quality Control

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Comparative Study of Carbon Dots Prepared from Different Botanical Origins

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Carbon dots (CDs) are a class of nanoparticles made of carbon, characterized by their small size (less than 10 nm) and categorized into subgroups based on morphology and crystallinity. Their chemical, physical, and optical properties can be fine-tuned through simple, one-pot synthesis methods. CDs offer numerous advantages, including biocompatibility, non-toxicity, chemical and photostability, adaptability, and cost-effectiveness, making them suitable for a broad range of applications. These nanoparticles are increasingly employed in biomedical fields for targeted drug delivery, especially for treating neurological disorders, vision impairments, cancer, and infectious diseases. CDs are also effective in imaging tumours, providing insights into their size, structure, and location. Additionally, they have the capability to differentiate between healthy and cancerous cells. Due to their brightness and photostability, CDs serve as reliable probes in analytical applications. Two primary strategies are used to synthesize CDs: top-down and bottom-up methods. Several natural sources have been explored to obtain CDs through different processes. For instance, a hydrothermal approach yielded 26% CDs from orange juice, 6.9% from pomelo peel, 50.78% from the *Jinhua bergamot* plant, and 7.1% from bamboo leaves. In addition, pyrolysis provided a 9.91% yield from peanut shells, while a microwave-assisted method resulted in a 14% yield from eggshell membranes. This review aims to identify novel, low-cost sources with high yields for the production of CDs, contributing to the advancement of sustainable and scalable nanoparticle synthesis.

Keywords: Carbon Dots, Biocompatibility, Tumour Imaging, Hydrothermal Synthesis, Natural Carbon Sources

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Unveiling Chemical Space, Scaffold Diversity, and Activity Landscape of DPP-4 Inhibitors: Structural Insights for Enhanced T2DM Therapy

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Dipeptidyl peptidase-4 (DPP-4) inhibitors are essential agents in managing type 2 diabetes mellitus (T2DM), working by blocking enzymes that degrade incretin hormones, such as glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). This enzyme inhibition promotes glucose homeostasis by increasing insulin secretion and reducing glucagon levels, particularly postprandially. Although DPP-4 inhibitors are increasingly recognized in T2DM treatment, exploration of chemical space, scaffold diversity, and activity landscape for this class remains limited. This study addresses this gap by employing chemoinformatic analysis to explore the chemical space, scaffold diversity, and structure-activity relationships (SAR). By utilizing ECFP4 fingerprints, the relationships among chemical compounds were analysed and visualized these networks with RDKit and NetworkX. Additionally, compound clustering and chemical space visualization further clarify structural diversity. The study provides insights into the molecular features that most significantly influence DPP-4 inhibitory activity, offering valuable guidance for future drug design. Ultimately, these findings establish a foundation for enhancing DPP-4 inhibitors, potentially leading to improved therapeutic strategies for T2DM management through more targeted drug design.

Keywords: DPP-4, Type-2 diabetes, Chemical Space Network, Fingerprint, Scaffold Diversity

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Recent Advances of Metal-Organic Frameworks (MOFs) and MOFs-Derived Materials: And Their Potential Antifungal Activities

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Fungal infection is one of the most serious problems to global public health, so antifungal therapy has become a vital part of the research field. Metal-organic frameworks (MOFs) play a significant role in treating fungal infections. MOFs are porous crystalline structures synthesised by metal ions and organic linkers. Nowadays, MOFs earn great attention due to their low density, high porous surface area, and their three-dimensional (3D) crystallinity structure. For this marked characteristic, MOFs have potential applications in drug delivery, bioimaging, and biosensing, besides serving as antibacterial and most specifically as antifungal agents. MOFs are generally synthesised by metal ions or salts like copper nitrate ($CuNO_3$), ferric chloride ($FeCl_3$), silver nitrate (AgNO3), etc. by using various organic linkers or ligands like benzene tricarboxylate (BTC), 4,4'-azopyridine (AZPY), benzene dicarboxylate (BDC), 4,4'-bipyridine, etc. There are some common methods used for the synthesis of MOFs, which are solvothermal or hydrothermal methods, microwave-assisted synthesis, stereochemical, electrochemical, ultrasound synthesis method, etc. MOFs contribute to their effectiveness as antifungal agents by facilitating controlled release of bioactive molecules, generation of reactive oxygen species (ROS), or disrupting fungal cell walls. In recent years, researchers developed MOFs that have the potential inhibition action of various fungal pathogens, including *C. albicans*, *A. niger*, *A. oryzae*, *F. oxysporum, Saccharomyces cerevisiae, Aspergillus flavus,* etc. Scientists have approached new modified MOFs that treat fungal infections due to their low cytotoxicity and minimal resistance, with significant potential for future development. This abstract highlights the overall review of MOFs and MOF-derived materials for potential antifungal activities.

Keywords: Metal-Organic Frameworks, Reactive Oxygen Species, Antifungal Agents, Cytotoxicity

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Anti-inflammatory Bioactivity-Guided Isolation Followed By ADME, Network Pharmacology and Molecular Docking Reveals A Novel O-Methylated Flavonol, Ombuin from the Whole Plant of *Ipomoea batatas*

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Inflammation is a critical factor in the progression of various chronic diseases, necessitating the exploration of novel anti-inflammatory agents from natural sources. *Ipomoea batatas*, commonly known as sweet potato, is widely recognized for its medicinal properties, yet the bioactive compounds responsible for its anti-inflammatory effects are not fully characterized. This study utilized bioactivity-guided isolation techniques to identify and purify anti-inflammatory compounds from the whole plant extract of *I. batatas*. Among the isolated compounds, an O-methylated flavonol, Ombuin, emerged as a promising candidate with potent anti-inflammatory properties. Following isolation, an ADME (Absorption, Distribution, Metabolism, Excretion) analysis was conducted to evaluate Ombuin's pharmacokinetic properties, indicating high oral bioavailability and favourable pharmacokinetics. To further elucidate the underlying molecular mechanisms, a network pharmacology approach was employed to identify potential anti-inflammatory targets and pathways associated with Ombuin. This analysis highlighted key signalling pathways, including NF-κB and MAPK, as well as several pro-inflammatory cytokines as primary targets. Molecular docking studies validated the interaction between Ombuin and key target proteins, including COX-2, IL-1β, and TNF-α, demonstrating high binding affinity and stability. These findings support the role of Ombuin as a potent modulator of inflammatory processes, providing insights into its molecular action and potential therapeutic benefits. This study represents a significant step toward the development of Ombuin as a lead compound for anti-inflammatory therapies, promoting further investigation into its clinical applications in inflammation-related diseases.

Keywords: *Ipomoea batatas,* Inflammation, Ombuin, NF-Kb

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Unlocking the Potential of Fe-MOFs: Recent Progress and Future Challenges

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Metal-organic frameworks (MOFs), composed of metal centres and organic linkers, have gained significant interest due to their porous structures and tunable properties. Among these, iron-based metal-organic frameworks (Fe-MOFs) stand out for their versatility, offering a wide range of potential applications across industries. However, challenges related to stability, scalability, and cost-effectiveness have hindered their large-scale practical use. This paper aims to address these issues by exploring recent advancements in the synthesis and functionalization of Fe-MOFs. Fe-MOFs exhibit unique properties, such as diverse structures, low toxicity, excellent stability, and customisable functionality, making them suitable for applications in catalysis, gas storage, drug delivery, and environmental remediation. In catalysis, Fe-MOFs have demonstrated high efficiency in oxidation and hydrogenation reactions. Their adjustable pore sizes enable effective capture and separation of gases, particularly CO2 and H2. Additionally, Fe-MOFs have shown promising potential in biomedical applications, especially in drug delivery and imaging, due to their biocompatibility and ability to be functionalized with active molecules. Environmental science is increasingly using Fe-MOFs to remove heavy metals, organic pollutants, and other contaminants from water, demonstrating their value in environmental remediation. Despite these advancements, the scalability of Fe-MOFs for industrial applications remains limited, requiring further research into their long-term environmental stability and cost-effective production methods. This review provides a comprehensive overview of Fe-MOFs, highlighting recent progress in their development and the need for solutions to existing challenges to unlock their full potential application in catalysis, gas storage, drug delivery, and environmental remediation.

Keywords: Iron-based Metal-Organic Frameworks (Fe-MOFs), Catalysis, Environmental Remediation, Drug Delivery, Scalability and Stability

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Decoding Bacterial Biofilm Formation: Resistance Mechanisms and Novel Therapeutic Approaches

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Biofilm formation is a process where an extracellular polymeric (EPS) substance matrix produced by the arranged group of microorganisms and are adhered to each other on living or non-living surfaces. Formation of biofilm gives advantages to bacteria, especially enhancing their ability to last in harsh environmental conditions and contributing significantly to antibiotic resistance and accelerating the spread of antibiotic resistance genes. According to the reports most of the chronic infections are caused by microbial biofilms infecting both tissues and medically implanted devices. So, keeping in view the prevalence of biofilm-associated microorganisms and inefficiency of conventional antibiotics, the situation requires a transition towards the formation of non-toxic and potent antibiofilm agents targeting signaling pathways regulating quorum sensing (QS), EPS synthesis, biofilm-related genes and many more. Antibiofilm approaches includes the using of small molecules like anti-virulence compounds, antibiofilm compounds and metal ion chelators including calcium chelators, e.g., trisodium citrate (TSC) and ethylene glycol tetraacetic acid (EGTA). Using of silver nanoparticles is a versatile approach for preventing medical device associated biofilms. Attachment occupies the first step in virtually all type of biofilm formation thus recent studies have focused on ablating bacterial adherence by the help of antiadhesion agent. Plant product-based approach is also a new strategy to inhibit, reduce, or eradicate biofilm formation. Besides ablating adherence, bacterial aggregation can be targeted by disrupting components of the extracellular matrix. These approaches aim to either prevent biofilm formation or target biofilm integrity to combat biofilm-related infections and conventional antibiotic resistance.

Keywords: Biofilm, Antimicrobial resistance (AMR), Nanoparticles, Bacterial adhesion, Antivirulence

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Comparative Study of Carbon Dot Synthesis from Different Leaves

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Carbon dots (CDs) are one of the most recent members of the carbon nanomaterial family, attracting attention for their distinctive optical properties, low toxicity, and biocompatibility. This study explores the synthesis of CDs using extracts from various plant leaves, including spinach, neem, and tulsi, emphasizing the potential of natural sources in producing environmentally friendly nanomaterials. The CDs were synthesized through eco-friendly methods and characterized using techniques such as UV-Vis spectroscopy and transmission electron microscopy (TEM). The results demonstrated that the choice of leaf precursor significantly affected the size, fluorescence intensity, and quantum yield of the synthesized CDs. The findings highlight that plant-derived CDs offer excellent photostability and low cytotoxicity, which make them suitable for diverse biomedical applications, including bioimaging and drug delivery. Their ability to emit bright fluorescence under UV light makes them promising candidates for imaging cancer cells and tracking biological processes in real-time. In addition to their biomedical potential, CDs from natural sources align with sustainable practices by reducing the environmental impact associated with synthetic materials. This study emphasizes the versatility of various plant-based extracts in CD synthesis and their potential role in developing functional nanomaterials. The biocompatibility and optical properties of these CDs position them as valuable tools for safe, sustainable applications in medicine, bioimaging, and diagnostics. The insights from this research contribute to the growing efforts toward eco-friendly technologies and the development of customized nanomaterials for specific medical needs.

Keywords: Carbon Dots, Plant-Based Synthesis, Nanomaterials, Biocompatibility, Fluorescence

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Phytochemical Profiling and Evaluation of the Pharmacological Activities of *Piper chaba* Stem by Using GC-MS and HPTLC-based Bioassay

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Piper chaba, belonging to the Piperaceae family is a native of West Bengal, India. In the research work, we aimed to investigate the antioxidant, antidiabetic, and anti-inflammatory activities and phytochemical profiling of *P. chaba* stem extracts. The methanolic and aqueous extracts show significantly higher amounts of total phenolic and total flavonoid contents. Further, revealed that the methanolic extract has good antioxidant, antidiabetic, and anti-inflammatory activities compared to the aqueous extract of the *P. chaba* stem. The GC-MS analysis shows the presence of seventeen phytochemicals like 2-hydroxycyclopent-2-en-1-one (21.78%), 3-hydroxy-dihydro-2 (3H)-furanone (24.96%), 3-hydroxy tetrahydrofuran (11.38%), and hydroxymethyl cyclopropane (14.59%) and many others. On the other hand, the HPTLC identified the presence of polyphenols such as chlorogenic acid, gallic acid, quercetin, and naringenin in the *P. chaba* stem extracts. This study evidence that the methanolic extract of *P. chaba* stem has the potential to treat oxidative stress-related diseases and aid in drug development for human health.

Keywords: *Piper chaba*, Phytochemical Profiling, Antioxidant; Antidiabetic, Anti-Inflammatory

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Molecular Docking Analysis of Biosurfactant Interactions with Quorum Sensing Proteins in *Pseudomonas aeruginosa*

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Pseudomonas aeruginosa is a prominent opportunistic pathogen that uses quorum sensing (QS), a method of cell-to-cell communication facilitated by small signaling molecules, to control its virulence and biofilm production.Targeting QS systems is a promising strategy for controlling infections, particularly in antibiotic-resistant strains. This study employed an in-silico approach to screen over 80 biosurfactant molecules from various microbial sources as potential QS inhibitors in P. aeruginosa. Four key QS proteins, LasR, LasI, nucP, and QuiP, were selected as targets. The protein preparation and docking simulations were performed using AutoDock Tools, AutoDock Vina, and Chimera, while Marvin Sketch and ChemDraw Ultra were employed for ligand preparation. The docking results were visualized using Discovery Studio Visualizer.Multiple docking analysis revealed that Tricyclo[20.8.0.0(7,16)]triacontane1(22),7(16)-diepoxy-, a biosurfactant molecule derived from *Halobacterium jilantaiense*, exhibited the strongest binding affinities to all four QS proteins, with binding energies of -8.0 kcal/mol (LasR), -8.0 kcal/mol (LasI), -9.0 kcal/mol (nucP), and -9.1 kcal/mol (QuiP). Additionally, Stigmast-5-en-3-ol showed significant binding to LasR, and Quip with energies of -8.0 kcal/mol, -7.6 kcal/mol, respectively. Other biosurfactants, such as Tetraneurin A, ethyl cholate, Surfactin 1d-03 and Surfactin 2d-03, also displayed favorable binding profiles. Following docking, molecular dynamics (MD) simulations using NAMD were conducted to assess the stability and dynamics of the biosurfactant-QS protein complexes. These findings suggest that biosurfactants, particularly Tricyclo[20.8.0.0(7,16)]triacontane1(22),7(16)-diepoxy-, hold potential as QS inhibitors in the treatment of P. aeruginosa infections. Further experimental validation is required to confirm their efficacy in vivo.

Keywords: *Pseudomonas aeruginosa*, Quorum Sensing, Biosurfactants, Molecular Docking, Molecular Dynamics, QS Inhibition, Biofilm Formation

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A Review of Phytochemical Diversity and Bioactivities of *Aegle Marmelos*

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Aegle marmelos (Rutaceae), also known as Bael, is a prominent medicinal plant in traditional Indian medicine, revered for its therapeutic applications. It has been utilized for over 5000 years in Ayurveda to treat a wide range of ailments. The aim of this review is to provide a comprehensive overview of the phytochemical diversity and bioactivities of *Aegle marmelos*. Many phytochemical researches revealed that *Aegle marmelos* contains a variety of bioactive compounds, including alkaloids (aegeline, fragrine, aegelenine, dictamine, haplopine, tembamide, and γ-fagarine), coumarins (marmin, marmelide, psoralen, imperatorin, aegelinol, marmesin, umbelliferone, xanthotoxin, alloimperatorin, scopoletin, marmelosin, scopolentin, and marmesin), terpenoids (cineol, caryophyllene, D-limonene), carotenoids (β-carotene), tannins (skimmianine), and flavonoids (rutin, quercetin). These compounds have been isolated from different parts of the plant, such as leaves, bark, fruits, roots, and seeds. The plant exhibits diverse biological activities, with various phytoconstituents contributing to its medicinal properties. Alkaloids such as aegeline show antidiabetic effects, while coumarins like imperatorin possess anticancer and antiulcer properties. Terpenoids, particularly d-limonene, have demonstrated antiulcer activity, and flavonoids like rutin exhibit antioxidant and anti-inflammatory effects. The plant is also known for its antibacterial, antifungal, antimalarial, hepatoprotective, and cardioprotective activities. Future research can be focused on detailed mechanistic studies, and isolation of the novel compounds from *Aegle marmelos* to further explore its pharmacological potential and also for the development of plant-based pharmaceuticals for modern healthcare.

Keywords: *Aegle marmelos*, Rutaceae, Phytochemical Diversity, Bioactivities, Pharmacological Potential

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Pharmacognostical, Phytochemical and Pharmacological Evaluation of *Melastoma malabathricum* Linn. Flower

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This study investigates the pharmacognostical, phytochemical, and pharmacological properties of *Melastoma malabathricum* Linn. flowers. Microscopic analysis and physicochemical evaluation were conducted to establish quality control parameters, revealing distinct anatomical features and acceptable purity indices. Phytochemical screening of different extracts identified substantial amounts of flavonoids, tannins, and saponins. Pharmacological assessments demonstrated potent antioxidant activity, significant inhibitory effects on α-amylase for antidiabetic potential, marked anti-inflammatory effects, but with broad-spectrum antibacterial efficacy found to be negative. The methanolic extracts showed good efficacy in every pharmacological activities. The methanolic extract of *Melastoma malabathricum* showed various chemical compounds in LCMS analysis. These findings support the traditional use of *Melastoma malabathricum* in various therapeutic applications, suggesting it as a valuable source of natural antioxidants, antidiabetic, anti-inflammatory meriting further research for clinical applications. Overall this results highlight that the flower of *Melastoma malabathricum* showed good efficacy in pharmacological parameters.

Keywords: *Melastoma malabathricum,* Pharmacognostical, Anti-Oxidant, Anti-Inflammatory, Anti-Diabetic

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Machine Learning (ML), Molecular Docking Ensembles (MDE) and Molecular Dynamics (MD) Simulation Studies to Explore the Fingerprints of Non-Hydroxamates as HDAC3 Inhibitors

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This study highlights the relationship between the molecular structures of histone deacetylase 3 (HDAC3) inhibitors and their biological activities. Bayesian classification and recursive partitioning (RP) analyses were applied to a dataset of HDAC3 inhibitors with diverse scaffolds, revealing key substructural features that modulate HDAC3 activity. Molecular docking further validated the importance of these identified features, confirming their role in HDAC3 modulation. Additionally, molecular dynamics (MD) simulations demonstrated the stability of the complexes formed between HDAC3 and the investigated non-hydroxamate inhibitors. Collectively, this combination of computational approaches uncovered critical structural motifs essential for HDAC3 inhibition, providing valuable insights for the future development of effective modulators.

Keywords: HDAC3, Bayesian Classification, Docking Ensembles, MD Simulation, Fingerprint.

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Molecular Docking Aided Study of Transient Metal Inclusion and Tertiary Complexation of Fenofibrate: Effect on Solubility

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Fenofibrate is widely used in patients with primary hyperlipidemia However, being a BCS class II drug; its poor aqueous solubility limits its effective bioavailability. The present study focuses on molecular docking-based screening of transition metal complexes and inclusion complex in addition with beta- cyclodextrin to improve the dissolution or solubility and there by bioavailability of fenofibrate. At a molar ratio of 1:10 of drug and metal shows a transition complex of drug and cupper acetate in the presence of methanol and water in 2:1 ratio. And at molar ratio of 1:1 of metal complex and beta-cyclodextrin are physically mixed by mortar and pestle with methanol and water (2:1) and the slurry was dried in a desiccator in the presence of silica. The interaction predicted by the docking analysis and various physico-chemical characterization tests such as DSC, XRD, FTIR and SEM study. The possible complex confirmations were studied through molecular docking and the probable interaction between the complexes has been observed. In the experiment it was found that the aqueous solubility of fenofibrate has been increased up to 17 and 25 fold in metal and inclusion complex forms respectively as compared to the pure drug. The solubility of fenofibrate has been substantially increased by the complexation out of which the beta-cyclodextrin, transition metal and the drug tertiary complex depicted promising solubility enhancement due to interaction of drug with the complex resulting in amorphization of the crystalline drug.

Keywords: Fenofibrate, Beta-Cyclodextrin, Molecular Docking, Transition Metals

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Para-Cumaroyltyramine An α,β-Unsaturated Amide From *Fumaria Indica* Showed Binding Affinity towards Enoyl-ACP(COA) Reductase from *Mycobacterium tuberculosis In Silico*

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Tuberculosis is one of the deadliest bacterial diseases that affect the lung and other part of the body. Enoyl-ACP(COA) reductase is a protein which is responsible for the survival of the causative microorganism of tuberculosis i.e. *Mycobacterium tuberculosis*. Consequently, this is an attractive site as a target for drug development. Fortunately, the 3D structure of protein was obtained from the Proten Data bank (PDB). 10 molecules from IMPPAT database that shows high rate of Gl absorption and pass Lipinski's rule, were shortlisted. Energy minimization of these molecules was carried out with the help of Chem-BioDraw software. The ΔG value was obtained after docking with the active site of the target protein with the help of CB-Dock2, an web-based tool. The molecule *p*-Coumaroyl tyramine obtained from *Fumaria indica*, exhibited lowest ΔG value (-8.9 Kcal/mol) and hence, it is considered as the best binder among all the molecules we assessed. On the basis of our findings, we may conclude that more research may give us more insights on the suitability of this phytoconstituent as an anti-tubercular agent. We hope that wet lab experiments with this plant product may give us important clue for an effective drug development against tuberculosis.

Keywords: Tuberculosis, Enoyl-ACP(COA), PDB, CB-Dock2, *Fumaria indica*

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Identification of Lead Antimicrobial Agents from Phenylpropanoids Through ADMET Screening and Molecular Docking

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To identify lead antimicrobial agents from phenylpropanoids by screening a natural library of compounds based on their ADMET properties and evaluating their binding affinities through molecular docking studies. A diverse range of phenylpropanoids were collected from a natural library then the compounds were screened in silico, focusing on ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) properties to identify those with optimal drug-like characteristics. Compounds that met the ADMET criteria were subjected to molecular docking studies to assess their binding affinities with specific microbial targets. The compound with the highest docking score was identified as the lead ligand, representing the most promising candidate for further antimicrobial development. The screening of phenylpropanoids using ADMET properties identified several candidates with desirable drug-like characteristics. Molecular docking studies further evaluated these compounds, and the one with the highest docking score was established as the lead ligand. This lead compound demonstrated strong potential as an antimicrobial agent, suggesting its suitability for further experimental validation and optimization in the development of new antimicrobial treatments.

This study highlights the potential of phenylpropanoids as effective antimicrobial agents. Through systematic screening based on ADMET properties and subsequent molecular docking analysis, a lead compound with high binding affinity was identified. This lead ligand represents a promising candidate for the development of new antimicrobial therapies, warranting further experimental validation and optimization. The research lays a strong foundation for advancing phenylpropanoid-based antimicrobial treatments.

Keywords: Phenylpropanoids, Antimicrobial Agents, ADMET Screening, Molecular Docking, Lead Compound Identification, In Silico Analysis

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Green Synthesis and Antibacterial Potential of Silver Nanoparticles from *Typhonium trilobatum*

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Green synthesis of metallic nanoparticles has gained significant attention due to its cost-effectiveness, simplicity, and environmental compatibility. *Typhonium trilobatum,* a small tuberous herb from the family *Araceae*, was investigated in this study for its phytochemical and antioxidant properties and as a source for green-synthesized silver nanoparticles (AgNPs). Phytochemical screening revealed the presence of flavonoids, alkaloids, steroids, triterpenoids, and tannins. High-Performance Thin-Layer Chromatography (HPTLC) identified three polyphenolic compounds—chlorogenic acid, kaempferol, and caffeic acid. Antioxidant studies demonstrated effective DPPH scavenging activity (IC_{50} = 25.74 µg/ml), along with total phenolic (10.975 mg/ml) and flavonoid contents (9.512 mg/ml), relative to standards. The formation of AgNPs was visually observed and further confirmed using UV–Visible spectroscopy. Characterization of AgNPs by Fourier-Transform Infrared (FTIR) spectroscopy and zeta potential analysis revealed a spherical morphology, mean particle size of 290.5 nm, and a zeta potential of −12.3 mV, indicating moderate colloidal stability. AgNPs exhibited strong antibacterial activity against both gram-positive bacteria *Bacillus Subtilis* (ATCC-6633) and gram-negative bacteria *Escherichia Coli* (ATCC-8739), highlighting their potential as a viable antibacterial agent. This study emphasizes the multifunctional applications of *T. trilobatum* in green nanoparticle synthesis and potential biomedical applications.

Keywords: *Typhonium trilobatum*, Green Synthesis, Silver Nanoparticles, Antioxidant Activity, Antibacterial Potential

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Mannich Base and It's Significance in Drug Synthesis

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The Mannich reaction is frequently used to add N atoms to compound compounds and is hence frequently employed in the production of pharmaceuticals. A beta-amino-ketone, or Mannich base, is created when an amine, formaldehyde, and carbonic acid combine. Since more than a century ago, the Mannich bases discovered by Professor Carl Mannich have been the most thoroughly investigated scaffolds. A percentage of natural product structural alterations are attributed to the Mannich reaction. Mannich bases can dramatically enhance a compound's activity, hydrophilicity, and therapeutic qualities. As a result, the Mannich reaction is frequently employed to change the structure of natural compounds. The adaptable multicomponent Mannich reaction holds a prominent place in organic chemistry and pharmaceutical development. For the development and enhancement of medications for diverse diseases, a thorough understanding of their range and variations as well as the biological actions of Mannich bases is essential. The current review emphasizes the use of Mannich bases as cytotoxic agents, classifies them into classes of synthetic, semisynthetic, and prodrugs, and provides a thorough description of the research that has been reported over the previous two decades. These cytotoxic compounds' methods of manufacture, their anti-cancer activity in diverse cell lines, and intriguing candidates for new drug development have also been covered.

Keywords: Mannich Reaction, Mannich Bases, Drug synthesis, Bioavailability, Cytotoxicity

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Exploring the Synthesis and Biological Effects of Substituted Imidazole Derivatives: A Review on Their Anti-microbial and Anti-viral Evaluations

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Imidazole is a five-membered heterocyclic compound with nitrogen atoms at positions 1 and 3, known for its broad range of biological activities, including anti-viral and anti-microbial properties. Its chemical structure allows for various modifications, enabling the synthesis of diverse imidazole derivatives with enhanced biological activities. The present study revealed a series of compounds: (substituted phenyl)-[2-(substituted phenyl)-imidazol-1-yl]-methanone, and evaluated their anti-microbial activity against Gram-positive and Gram-negative bacteria, as well as fungal species. The anti-bacterial results revealed that compounds *2(2-chlorophenyl)-1-(4-nitrobenzoyl)-1H-imidazole*, *2-(2-carboxyphenyl)-1-(4-nitrobenzoyl)-1H-imidazole*, and *2-(4-chlorophenyl)-1-(2-bromobenzoyl)-1H-imidazole* exhibited significant activity, while compound *2-(4-nitrophenyl)-1-(2-bromobenzoyl)-1H-imidazole* demonstrated the strongest anti-fungal effect. Structure-activity relationship (SAR) studies suggested that the presence of electron-withdrawing groups is crucial for enhancing the anti-microbial properties of these compounds. Compounds *2(2-chlorophenyl)-1-(4-nitrobenzoyl)-1H-imidazole*, *2-(2-carboxyphenyl)-1-(4-nitrobenzoyl)-1H-imidazole*, and *2-(4-nitrophenyl)-1-(2-bromobenzoyl)-1H-imidazole* showed anti-bacterial efficacy comparable to the standard drug norfloxacin, highlighting their potential for further exploration as new anti-microbial agents. Additionally, the anti-viral evaluation of (substituted phenyl)-[2-(substituted phenyl)-imidazol-1-yl]-methanones against a range of viral strains identified compounds *1-(4-nitrobenzoyl)-2-(4-chlorophenyl)-1H-imidazole* and *2-(4-nitrophenyl)-1-(4-nitrobenzoyl)-1H-imidazole* as promising leads for the development of novel antiviral agents.

Keywords: Imidazole, Anti-viral, Anti-microbial, Anti-fungal, Anti-bacterial

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Phytochemicals in Neurodegenerative Diseases: A Pharmacognostic Perspective

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Neurodegenerative diseases (NDDs) like Alzheimer's, Parkinson's, Huntington's, and ALS present significant global health challenges, characterized by progressive neuronal loss and complex pathophysiology. This study explores the potential of phytochemicals as therapeutic agents in NDD management by examining key molecular mechanisms in neuro-degeneration, including oxidative stress, mitochondrial dysfunction, protein misfolding, and neuroinflammation. Phytochemicals, such as polyphenols, flavonoids, and alkaloids, demonstrate neuroprotective properties through antioxidant, anti-inflammatory, and protein aggregation inhibitory activities. Compounds like curcumin, resveratrol, epigallocatechin gallate, and extracts from *Ginkgo biloba* and *Bacopa monnieri* show promise in modulating NDD pathways. The study addresses pharmacognostic considerations, including standardization, bioavailability challenges, and potential synergistic effects. Current clinical evidence is evaluated, and future research directions are explored, including advancements in extraction techniques and drug delivery systems. Challenges in translating preclinical findings to clinical applications are discussed, emphasizing the need for rigorous research and standardized protocols. The potential for personalized phytotherapy in NDD treatment is considered. This comprehensive analysis underscores the significant potential of phytochemicals in developing multi-targeted approaches to combat NDDs, while highlighting the necessity for further investigation to fully realize their therapeutic potential in clinical settings.

Keywords: Neurodegenerative Diseases, Phytochemicals, Neuroprotection, Pharmacognosy, Clinical Trials

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Polyphenols in Diet Protect Cardiomyopathy: On Laboratory to Clinical Trials

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Polyphenols are part of the antioxidant family and they come mainly from grapes, berries, nuts etcetera and tea leaves who have gained much attention for their cardioprotective effects in cardiac myopathy. In summary, this study explores the lab-to-clinic utility of polyphenols through its potential to prevent and mitigate cardiomyopathy. Indeed, the lab tests showed that polyphenols reduced oxidative stress and inflammation while improving mitochondrial health in cardiac muscle cells. All processes implicated in advancing heart myopathy. Based on such promising preclinical results, clinical trials followed using patients at risk for heart muscle disease. Polyphenols supplementation enhanced cardiac function markers, decreased inflammatory cytokine, and ameliorated early-stage symptoms of cardiomyopathy indicating its therapeutic potential. These results provide evidence for the effectiveness of polyphenols in diets to prevent cardiomyopathy while also providing a strong case for further trials on dosage and its long-term effects.

Keywords: Polyphenols, Oxidative Stress, Cardiomyopathy, Preclinical Result, Clinical Trials

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Design and Synthesis of Microwave Assisted Thiazolidinedione Derivatives

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This research article delves into the innovative design and synthesis of thiazolidinedione (TZD) derivatives using microwave-assisted methods, marking a significant advancement in medicinal chemistry. Thiazolidinedione derivatives are well-regarded for their anti-diabetic, anti-inflammatory, and anti-cancer properties. However, traditional synthesis of these compounds through conventional heating methods presents limitations, including prolonged reaction times, higher energy consumption, and lower product yields. To address these challenges, this study investigates microwave-assisted synthesis as a highly efficient alternative, leveraging rapid heating and enhanced reaction kinetics. The research emphasises the optimisation of microwave-assisted protocols tailored to synthesise various TZD derivatives, focusing specifically on parameters such as microwave power, reaction duration, and solvent choice. These parameters were systematically adjusted to determine their effects on yield, reaction speed, and purity of the synthesised compounds. The findings reveal that microwave-assisted synthesis significantly reduces reaction times while producing high-purity TZD derivatives, demonstrating its potential to enhance both the efficiency and output quality of synthetic processes. Furthermore, the biologically active TZD derivatives synthesised in this study exhibit promising pharmacological properties, positioning them as valuable candidates for drug development. The integration of microwave technology into synthetic protocols not only optimises reaction conditions but also facilitates a more sustainable and cost-effective approach to the production of medicinally important compounds. This research underscores the potential of microwave-assisted methods to streamline the synthesis of biologically relevant compounds, paving the way for advancements in therapeutic agent development and contributing to the broader field of green chemistry in drug design.

Keywords: Thiazolidinedione (TZD) Derivatives, Microwave-Assisted Synthesis, Medicinal Chemistry, Biologically Active Compounds, Reaction Optimization

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Eco-friendly Synthesis of Silver Nanoparticle-Antibiotic Conjugates for Enhanced Antibacterial Activity: A Review

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Research on the green synthesis of nanoparticles with low toxicity and antibiotic conjugation has gained significant interest for various medicinal applications. When nanoparticles are conjugated with two or more distinct molecules, they form a "nano conjugate" structure designed to enhance therapeutic and diagnostic functions. In nanomedicine, nano conjugates are increasingly used for targeted drug delivery and imaging, improving disease detection and treatment efficacy. This study focuses on an aqueous extract of *Mukia maderaspatana* leaves as a natural, green medium for synthesizing silver nanoparticles, which are then conjugated with the antibiotic ceftriaxone. This approach leverages the unique antibacterial properties of both silver nanoparticles and ceftriaxone, aiming to create an enhanced antibacterial agent with broad-spectrum activity. The biosynthesis mediated by *Mukia maderaspatana* leaf extract not only promotes eco-friendly nanoparticle synthesis but also potentially amplifies the antibacterial efficacy through combined effects. By integrating these nanoparticles with ceftriaxone, the study explores the possibility of reducing the side effects associated with conventional antibiotics while maintaining, or even enhancing, bacterial inhibition. Through this novel combination, the research aims to produce a more effective antibacterial agent with reduced toxicity and improved therapeutic impact for addressing bacterial infections. The findings could open pathways to safer, more sustainable antibacterial treatments and provide valuable insights into the application of green chemistry in nanoparticle synthesis for medical use.

Keywords: Green synthesis, Nanoparticles, Nano conjugates, Antibacterial agent, *Mukia maderaspatana*

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Development of Metal Nanoparticles of Naturally Occurring Phytochemicals

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Metal nanoparticles are eco-friendly and cost effective. They have high drug loading capacity and can encapsulate both hydrophobic and hydrophilic drugs. The flexibility in formulation of these nanoparticles allows for customisation according to the desired release kinetics and biocompatibility requirements along with possessing significant antimicrobial and antioxidant property. The aim of the work was to formulate nanocarriers of poorly soluble phytochemicals such as ellagic acid into silver and copper nanoparticles to overcome their bioavailability issues owing to poor absorption, metabolism in gastrointestinal tract and rapid elimination. In vitro studies confirmed that these metal nanoparticles retained the antioxidant activities of ellagic acid, highlighting their potential for therapeutic applications. Incorporation of silver improved the properties of the nanoparticles as they may serve as antimicrobial making them a highly promising in vitro encapsulation and controlled release system. The size distribution analysis of around 90-300 nm and surface morphology studies verify the characteristics of the formed nanoparticles. The successful encapsulation of ellagic acid with around 80-90% encapsulation within copper and silver-based nanoparticles resulted in improved stability and controlled release of about 50-65% in 6 hours. In vitro studies confirmed that these nanoparticles retained the antioxidant activities of ellagic acid, with synergistic action of metal nanoparticles highlighting their potential for therapeutic applications. Overall, the research demonstrates that these metal nanoparticles can significantly improve the therapeutic benefits of ellagic acid.

Keywords: Metal Nanoparticles, Antioxidant, Antimicrobial, Ellagic acid

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In-silico screening of potential phytoconstituents of *Morus spp.* against diabetes

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Diabetes is a type of metabolic disorder responsible for high blood glucose level. This leads to various types of serious conditions such as kidney damage, retinopathy, and diabetic neuropathy. The most efficient approach to reducing postprandial hyperglycemia (PPHG) in diabetes mellitus is α- glucosidase, particularly insulin-independent or type 2 diabetes mellitus. α- glucosidase inhibitor is mainly responsible for the increase in postprandial glucose levels. Various anti-diabetic medications are now introduced with inhibitory capabilities of α-glucosidase such as acarbose, voglibose, miglitol which inhibit the carbohydrate absorption from the intestine. These medications selectively block enzymes which helps to transform multifaceted non-absorbable carbohydrates towards easily absorbed carbohydrates. Many bioactive compounds are well known to treat various pathophysiological states. Our study intends to identify the potent phytocompounds from the Mulberry Plant, a wildly popular species in some countries. Overall, 70 phytoconstituents were distinguished and screened from these species. The top five phytocompounds (Kuwanon S-9.40 kcal/mol, β-Sitosterol-9.18 Kcal/mol, Gallocatechin gallate-8.49 kcal/mol, Moacin N-8.44 kcal/mol, and cynaroside-8.38 kcal/mol) were selected among all the phytoconstituents based on the binding affinity against the target Protein (PDB CODE:3L4W). After that LigPlot+ was implemented to evaluate the relative intensity of binding interactions. With addition, the ADME property & Toxicity was performed to determine the suitability of these five phytoconstituents as effective candidates for developing active and non-toxic antidiabetic agents.

Keywords: Type 2 diabetes Mellitus, Carbohydrates, A- Glucosidase, Phytoconstituents

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Role of Artificial Intelligence in Computer-Aided Drug Design for Discovering Pharmacologically Active Small Molecules

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Computer-aided drug design (CADD) is a discipline in which new chemical entities are designed to achieve certain interactions with biomolecular targets and, indeed, bind with them. Uniquely, stereo-arrangement and stereo-selectivity are determinants of the generation of small molecules' therapeutic footprint. More recently there has been a new trend where academicians and the pharmaceutical industry prefer computational-based methods. Data and Artificial intelligence (AI) have helped in drug development, cutting the time taken, and the cost involved and it also eliminates the use of animals for testing purposes. This shift is due to the presence of large data sets in molecular property, target binding, and 3D structures recently available. Pharmacodynamics, pharmacokinetic, and clinical outcome-related properties are considered the key factors in molecule optimization for a successful drug discovery program. The use of constant virtual libraries whereby customers can demand billions of drug-like small molecules and the discovery of abundant computing capacities has boosted drug discovery and development. To achieve high throughput ligand screening, rapid computational tools like structure-based virtual screening as well as deep learning algorithms are necessary. Small molecule drug discovery is said to benefit from the increased emphasis on the role of AI. The presence of lots of strong, target-selective, and drug-like ligands for protein targets can facilitate drug discovery and can make it easy to form safe and effective drugs economically.

Keywords: Drug, Small molecule, Artificial intelligence

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QbD approach to HPLC method development and validation of ceftriaxone sodium

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The study outlines a Quality by Design (QbD) approach for the development and validation of a robust high-performance liquid chromatography (HPLC) method to quantify ceftriaxone sodium in pharmaceutical formulations. A central composite design, was used to optimize key parameters, such as pH and mobile phase composition. Design Expert software (v11.0) was used to improve the method conditions using a Phenomenex ODS C18 column (250 mm × 4.6 mm, 5 µm). The mobile phase was made up of acetonitrile and water with 0.01% triethylamine at a pH of 6.5 (70:30 v/v), flowing at a rate of 1 mm per minute, and being retained for 4.15 minutes at a wavelength of 270 nm for detection. For doses ranging from 10 to 200 µg/ml, the technique showed high linearity (r2 = 0.991). A tailing factor of 1.49 and 5236 theoretical plates were obtained from suitability testing, and the intraday and interday precision (% RSD) varied from 0.70 to 0.94 and 0.55 to 0.95, respectively. Assay findings were 99.73 ± 0.61%, and robustness was validated with fluctuations under 2%. Coeluting peaks were absent from the chromatographic purity analysis. Reliability and reproducibility were guaranteed by validation that followed ICH guidelines. The method's accuracy and dependability for quantifying ceftriaxone sodium were confirmed by the experimental design, which provided comprehensive insights into the effects of pH and mobile phase on crucial parameters like retention duration, theoretical plates, and peak asymmetry.

Keywords: Quality By Design, HPLC, Ceftriaxone Sodium, Design Approach

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Green Chemistry – Today and Tomorrow

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Green chemistry is defined as the "design of chemical products and processes to reduce or eliminate the use and generation of hazardous substances". This definition and the concept of green chemistry were first formulated at the beginning of the 1990s nearly 20 years ago. Green Chemistry has a framework of a cohesive set of Twelve principles. Paul Anastas and John Warner developed the 12 principles i.e. - 1. Design for Energy Efficiency, 2. Use of Renewable Feedstocks, 3. Reduce derivatives, 4. Designing Safer Chemicals, 5. Safer Solvents and Auxiliaries, 6. Prevention, 7. Anatomy economy, 8. Less Hazardous Chemical Syntheses, 9. Catalysis, 10. Design for Degradation, 11. Inherently Safer Chemistry for Accident Prevention, 12. Real-Time Analysis for Pollution Prevention. Most recent approaches of green chemistry like organocatalyzed reaction, solvent-free reactions, ionic liquids (IL), Transition metal (TM) free reaction, flow chemistry, etc. are new hope to the scientific community.

Keywords: Green Chemistry, TM Free Reaction, Organocatalyst, Flow Chemistry, Ionic Liquid

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Green Synthesis of Silver Nanoparticles Using *Luffa aegyptiaca* Seed Extract and Assessment of Antioxidant, Antidiabetic, Cytotoxic Activities

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Silver nanoparticles (AgNPs) produced through green synthesis using medicinal plants have gained significant attention in natural product research due to their cost- effectiveness and environmentally friendly. In this study, AgNPs were biosynthesized utilizingan aqueous extract from *Luffa aegyptiaca* seeds. The UV-visible spectrum shows the λ_{max} at 410 nm and FTIR spectral analysis confirms that the functional groups in the seed extract act as reducing and stabilizing agents to reduce the silver nitrate while the formation of AgNPs. The prepared AgNPs exhibited an average particle size of 168.8 nm and spherical morphology. Additionally, the pharmacological properties of the AgNPs were assessed through evaluations of their antioxidant, antidiabetic, and cytotoxic activities. Notably, these nanoparticles demonstrated significant antioxidant activity, with a DPPH radical scavenging capacity of 50.14 µg/ml. Furthermore, they showed potential in diabetes prevention by inhibiting α-amylase, as evidenced by an IC_{50} value of 119.58 µg/ml in the α-amylase inhibitory assay. The AgNPs also exhibited effective cytotoxicity against human kidney cancer cells, with an IC_{50} of 233.51 µg/ml. Our results indicate that the green-synthesized silver nanoparticles from *Luffa aegyptiaca* seed extract possess strong antioxidant, antidiabetic, and cytotoxic properties, suggesting their potential application in drug development within biomedical and pharmacological domains.

Keywords: *Luffa aegyptiaca*, Green Synthesis, Antioxidant, Antidiabetic, Cytotoxicity

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Green synthesis of copper nanoparticles by using *Typhonium trilobatum* leaf extract: in vitro characterizations and antibacterial activity

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The green synthesis of metal nanoparticles from leaf extract may be a novel, cost-effective, and environmentally friendly alternative to conventional procedures. *Typhonium trilobatum* is an edible plant from the Araceae family that is extensively spread in India, China, Bangladesh, and Malaysia. The current work aimed to assess or identify the phytochemical ingredients and synthesize Copper nanoparticles (CuNPs) utilizing *Typhonium trilobatum* as a reducing powder. Standard phytochemical identification tests detected flavonoids, alkaloids, and glycosides in the plant extract, and TLC revealed five phenolic compounds: p-coumaric acid (Rf-0.51), chlorogenic acid (Rf-0.51), quercetin (Rf-0.65), apigenin (Rf-0.675), and caffeic acid (RF-0.53). The antioxidant investigation revealed that the IC50 for DPPH scavenging activity is 25.74 mcg/ml. The production of CuNPs was clearly observed and detected using UV-Visible spectroscopy. CuNPs were also analyzed using Fourier-transform infrared (FTIR) spectroscopy and a particle size analyzer, respectively. CuNPs antibacterial activities were tested in gram-positive *Bacillus Subtilis* (ATCC-6633) and gram-negative bacterium *Escherichia coli* (ATCC-8739). The results indicated that the CuNPs were spherical in form, with a mean particle size of 290.5 nm. The FTIR analysis showed the presence of phytochemical peaks in the nanoparticles, which supports the use of *Typhonium trilobatum* as a stabilizing, reducing, and capping agent. However, the produced CuNPs shown substantial inhibitory activity against both gram-positive and gram-negative test organisms.

Keywords: *Typhonium trilobatum,* Green synthesis, Copper Nanoparticles, Antioxidant Activity, Antibacterial Activity

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Design of a Vitamin K-Conjugated Enzalutamide Derivative using Pharmacophore Modelling for Enhanced Cellular Internalization and Efficacy Against Castration-Resistant Prostate Cancer (CRPC)

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Castration-Resistant Prostate Cancer (CRPC) is a complex and dynamic disease state characterized by the persistence of prostate cancer cells that have developed adaptive resistance to androgen deprivation therapy (ADT) and other systemic treatments, leading to continued growth and progression of the disease despite low levels of testosterone. It remains a significant clinical challenge due to the limited efficacy of current treatments. Enzalutamide, a potent androgen receptor (AR) antagonist, has shown promise in treating CRPC. To overcome these limitations, we designed a novel Vitamin K-conjugated Enzalutamide derivative (VK-Enz) using pharmacophore modelling. Our study employed a combination of molecular docking, pharmacophore modelling, and molecular dynamics simulations to design VK-Enz. The resulting compound showed enhanced cellular internalization and efficacy against CRPC cells compared to Enzalutamide. VK-Enz also demonstrated improved resistance to efflux pumps, leading to increased intracellular concentrations and enhanced AR antagonism. Our findings suggest that VK-Enz represents a promising candidate for the treatment of CRPC, offering improved efficacy and reduced resistance development. The design of VK-Enz serves as a paradigm for the development of next-generation AR antagonists, leveraging the synergy between pharmacophore modelling and conjugation chemistry to enhance therapeutic efficacy. VK-Enz, a Vitamin K-conjugated Enzalutamide derivative, demonstrates enhanced efficacy and cellular internalization against CRPC, offering a promising approach for the treatment of this aggressive disease.

Keywords: Enzalutamide, Vitamin K Conjugation, Pharmacophore Modelling, Castration-Resistant Prostate Cancer, Cellular Internalization, AR Antagonism.

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Natural Polysaccharides: A Substitute to Synthetic Antihyperlipidemic Drug with Less Side Effects

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Natural polysaccharides have emerged as promising alternatives to synthetic antihyperlipidemic drugs, offering therapeutic benefits with reduced side effects. The first antihyperlipidemic drug, cholestyramine, introduced in the 1970s, effectively lowers cholesterol levels but is associated with adverse effects such as gastrointestinal disturbances, constipation, and nutrient malabsorption. Other commonly used synthetic drugs, such as statins (e.g., atorvastatin, simvastatin) and fibrates (e.g., fenofibrate), can cause side effects including muscle pain, liver damage, and increased risk of diabetes. In contrast, polysaccharides like psyllium, guar gum, and pectin have shown significant potential in managing hyperlipidemia with fewer side effects. These natural polysaccharides act through multiple mechanisms, including the binding of bile acids in the intestines, which promotes their excretion and leads to reduced cholesterol levels. Additionally, they enhance gut microbiota composition and promote the production of short-chain fatty acids, contributing to lipid metabolism regulation. Clinical studies have demonstrated that polysaccharides not only lower total cholesterol and low-density lipoprotein (LDL) levels but also improve overall lipid profiles without the gastrointestinal discomfort commonly associated with synthetic medications. As interest in natural health products grows, polysaccharides present a viable option for those seeking safer and more sustainable approaches to managing hyperlipidemia. Further research is warranted to explore the full therapeutic potential and optimize the application of these natural compounds in clinical settings.

Keywords: Natural Polysaccharides, Antihyperlipidemic Agents, Cholestyramine, Statins, Guar Gum, Pectin, Cholesterol Reduction

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Design, Synthesis and Anticonvulsant Evaluation of Indoline Aryloxadiazole Amine Derivatives

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In epilepsy, voltage-gated ion channels are the strategic target for treatment. A lot of marketed drugs are available for the treatment of epilepsy but all come with chronic or acute adverse effects. Indoline moiety is associated with sympathetic or parasympathetic activation that leads to seizures. A novel series of indole derivatives have been designed and synthesized as an anti-convulsant agent. All the synthesized compound meets the key pharmacophoric feature. MSE test and scPTZ seizures were employed for screening the anti-convulsant effect of the synthesized compounds in mice. (Z)-3-(5-phenyl-1,3,4-oxadiazol-2-ylimino) indolin-2-one emerges as the most potent derivative with a median dose of 40.77 mg/kg (MES ED50), 88.15 mg/kg (scPTZ ED50) and a toxic dose (TD50) was found to be > 500mg/kg. Molecular docking was performed with the most active compound in voltage-gated sodium channel receptor (PDB ID: 6J8G) and the docking score was found to be -6.322 kcal/mol. Predicted pharmacokinetic parameters establish the drug-likeness property of the compound.

Keywords: Anti-convulsant, Oxadiazole Amine, Indoline, Synthesis, Molecular Docking

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Highly Efficient and Green Method for the Synthesis of Bioactive Chiral Nonracemic Aminobenzylnaphthols over Uncapped SnO_2 Quantum Dot Involving via Modified Mannich Type Reaction

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Chiral nonracemic aminobenzylnaphthols were created using a multicomponent synthesis including 2-naphthol, aryl aldehydes, and enantiopure arylethylamine. Furthermore, some novel aminobenzylnaphthols were produced using a similar procedure involving 2-naphthol, aryl aldehydes, and prolinol. These aminobenzylnaphthols, which were produced from various components and hence have distinct structural properties, were previously investigated as anti-yeast drugs that inhibit Candida albicans. In this study, uncapped SnO_2 quantum dot is offered as a novel ecologically benign and recyclable catalyst for the synthesis of aminonaphthols in ethanol-water solvent conditions, without the need for an extra co-catalyst or additive in air. The synthesized SnO2 QDs were characterized by X-ray diffraction (XRD), transmission electron microscopy (TEM), and Fourier transformed infrared spectroscopy (FT-IR) and all the synthesized compound were characterized by FTIR, Nuclear Magnetic Resonance (NMR) and melting point.

Keywords: Aminobenzylnaphthols, Uncapped SnO_2 Quantum Dot, Mannich Type Reaction, Ethanol-Water Solvent, No Co-Catalyst

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Antifungal Activity of Medicinal Plant Extracts Preliminary Screening Studies

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Herbal Medicine are long time source of therapeutic agents. With Various species representing antifungal properties. The increasing resistance of synthetic antifungal agents led's to exploring herbal alternatives. Patients requires drugs with latest mechanisms of action to overcome resistance, better safety profiles, and improved pharmacology to shorten treatment duration and increase efficacy. Fungal infections caused by different type of Pathogens, resulting in significant health issues, specially to immune deficient individuals. This abstract reviews on various Herbal plants known for their antifungal activity, targeting on their Therapeutical active compounds, mechanisms of action, and potential applications in treating fungal infections. Common plants like *Allium sativum* (garlic), *Azadirachta indica* (neem), and *Curcuma longa* (turmeric), Aloe Vera, Henna, Oregano Oil, Rose Mary, Tea Tree Oil etc. contain bioactive Constituents such as alkaloids, flavonoids, terpenoids, and phenolic compounds, which show broad-spectrum antifungal effects. The mechanisms by which these medicinal compounds inhibit fungal growth include disrupting cell membrane integrity, inhibiting ergosterol biosynthesis, and inducing oxidative stress. In spite of promising results in vitro studies, future research, including clinical trials, is required to evaluate the safety, efficacy, and pharmacokinetics of these medicinal plant-based antifungal agents. The collection of medicinal plants against fungal infection treatment regimens should provide an effective, rational, and less toxic alternative to conventional synthetic antifungal drugs.

Keywords: Herbal Medicine, Biosynthesis, Pharmacokinetics, Drug Resistance

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Identification of Lead Antimicrobial Agents from Phenylpropanoids through ADMET Screening and Molecular Docking

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To identify lead antimicrobial agents from phenylpropanoids by screening a natural library of compounds based on their ADMET properties and evaluating their binding affinities through molecular docking studies. A diverse range of phenylpropanoids were collected from a natural library then the compounds were screened in silico, focusing on ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) properties to identify those with optimal drug-like characteristics. Compounds that met the ADMET criteria were subjected to molecular docking studies to assess their binding affinities with specific microbial targets. The compound with the highest docking score was identified as the lead ligand, representing the most promising candidate for further antimicrobial development. The screening of phenylpropanoids using ADMET properties identified several candidates with desirable drug-like characteristics. Molecular docking studies further evaluated these compounds, and the one with the highest docking score was established as the lead ligand. This lead compound demonstrated strong potential as an antimicrobial agent, suggesting its suitability for further experimental validation and optimization in the development of new antimicrobial treatments. This study highlights the potential of phenylpropanoids as effective antimicrobial agents. Through systematic screening based on ADMET properties and subsequent molecular docking analysis, a lead compound with high binding affinity was identified. This lead ligand represents a promising candidate for the development of new antimicrobial therapies, warranting further experimental validation and optimization. The research lays a strong foundation for advancing phenylpropanoid-based antimicrobial treatments.

Keywords: Phenylpropanoids, Antimicrobial Agents, ADMET Screening, Molecular Docking, Lead Compound Identification, In-Silico Analysis

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Ethylene Oxide Sterilization of Medical Devices - What Comes next?

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In microbiology, sterilization can be defined as the complete removal of all forms of viable microorganisms, both vegetative and spore forms, from a surface of an object. Ethylene Oxide (EtO) gas is one of the most common ways to sterilize medical devices. Ethylene oxide (EtO) sterilization is a process that uses a flammable, colourless gas to sterilize medical devices like Heart Valve, Pacemaker, Surgical Kits, Syringes, Catheters and other items. The FDA (Food and Drug Administration) is committed to reducing the use of ethylene oxide (EtO) for sterilizing medical devices while ensuring a continued supply of sterile devices for patients and providers. In addition, the U.S. Environmental Protection Agency (EPA) reviews and enforces the Clean Air Act regulations for sterilization facilities that emit ethylene oxide to ensure that they protect the public from significant risk. A safer technique, with non-toxic sterilizing agent, is the need of the hour in pharmaceutical biotechnology laboratories and industries. Some upcoming, novel alternatives like nitrogen dioxide, supercritical carbon dioxide etc. may be an answer to the future sterilization limitations.

Keywords: Medical Devices, Ethylene Oxide, Sterilization, FDA, EPA

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Introduction to Heavy Metal Contamination in Water and Soil: A Review on Source, Toxicity and Remediation Method

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Heavy metal contamination in water and soil represents a growing issue that causes risks to the environmental integrity and human well-being. Heavy metal poisoning can bind to cellular structures, impairing cellular function and potentially leads to life-threatening symptoms. Various heavy metals include lead (Pb), cadmium (Cd), arsenic (As), mercury (Hg), chromium (Cr). Sources of heavy metals are both natural and anthropogenic; it includes weathering of rocks, coal mining, leather production, agriculture, smelting and industrial waste disposal. Heavy metals are the metallic agents having high atomic weight and density which can be toxic to humans as well as the environment. Heavy metal poisoning can lead to many health issues such as liver and renal dysfunction and malignancies, respiratory problems etc. Heavy metals have impacts on the environment such as soil degradation, water pollution, bioaccumulation in food chains, and harm to aquatic life. Heavy metals having high toxicity and tendency to accumulate in organisms, they induce oxidative stress in cells resulting in organelle damage. This toxicity can lead to genetic mutations. Various exposure routes include ingestion, inhalation and through the dermal route. The heavy metal toxicity depends on dose, route of exposure. Remediation methods for heavy metal contamination include ion exchange, adsorption, chemical precipitation, oxidation, and membrane filtration. This review aims to provide an overview of the sources, toxicity, and remediation method for heavy metal contamination in water and soil.

Keywords: Heavy Metal Contamination, Soil Pollution, Water Pollution, Remediation Method

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Eco Friendly Method to Extract Keratin from Various Keratinous Wastes and Their Effect on Wound Healing: Current and Future Scenario

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Keratin, a robust biopolymer found in keratinous materials like feathers, wool, and hair, has enormous potential for biomedical applications-most importantly, concerning wound healing. Typical extraction techniques include chemical and enzymatic hydrolysis, which are unsustainable due to high energy intensity, toxic by-products, and poor recovery processes. Sustainable variants of ionic liquids, deep eutectic solvents, and microbial fermentation have been produced, following the principles of green chemistry, which are significantly less ecotoxic and maximize yields of keratin. These technologies confer a variety of benefits regarding waste generation and bioactivity; thus, the full potential of keratin can be exploited in wound healing applications. Among them, keratin-based wound dressings seem very promising, as they demonstrate excellent biocompatibility, stimulate cell proliferation, and exhibit intrinsic antimicrobial activity. These dressings create a moist environment, which favours healing and supports tissue repair. Concepts that can be developed include more efficient extraction techniques, bio-restorable keratin composites, and keratin-based hydrogels for different types of wounds-between chronic wounds and burn wounds-and the exigency in the search for biomedical replacements with environmental responsibility will be much more based on setting up sustainable methods of keratin extraction in framing the future advancements of wound care technologies.

Keywords: Liposome, Keratin, NDDS, Wound Healing

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Diet Management: The promising Way to Prevent Early Aging of Skin

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The skin serves as the main barrier that shields the body from external threats. Aging of the skin is a natural part of the body's process influenced by intrinsic (genetics, age) and extrinsic factors (sun exposure, pollution, lifestyle). Recent studies have shown that people have increasingly recognized the importance of diet, as it is the primary source of energy and nutrients for the body, in maintaining healthy skin. Nutrient-rich foods, particularly those high in antioxidants which is found in fruits, vegetables and nuts, help neutralize free radicals, cause oxidative stress and cellular damage, which contribute to the aging process, vitamins (A, C, E) which boost collagen production, maintaining skin firmness, minerals (zinc, selenium) helps in skin repair and collagen synthesis, promoting wound healing and reduce the appearance of wrinkles, and omega-3-fatty acids, present in fatty fish, reduce inflammation and support skin elasticity. The poster highlights how a balanced diet, including fruits, vegetables, nuts, seeds and fatty fish can boost skin elasticity, hydration and overall appearance. The findings suggest that dietary choices can serve as a cost-effective and natural strategy to support skin health, delay early aging.

Keywords: Skin Aging, Diet Management, Antioxidants, Hydration, Collagen, Skin Health

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Chromatic Cleansing: A Novel Approach to Attenuate Environmental Crisis Using Mesophilic Bacteria Isolated from Kashmir Soil

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Mesophilic microbes have shown promise in bioremediation, particularly in Simple and Azo dye decolorization. While effective, the enzymatic mechanisms require further investigation. *Lysinibacillus sp*., a mesophilic bacterium producing multiple extracellular enzymes, was isolated from Kashmir soil for dye decolorization studies. This research explored *Lysinibacillus sp.*'s capability to decolorize various commercial Simple and Azo dyes, aiming to mitigate environmental pollution caused by these substances. The study employed Simple dyes (Malachite green, Methylene blue, Crystal violet, Safranin, Eosin) and the Azo dye Congo red. The experimental protocol involved adding 1% dye solution to Nutrient Broth medium, followed by bacterial inoculation. Decolorization was quantified by measuring optical density (OD) at dye-specific absorbance wavelengths. Incubation periods of 24 and 48 hours were utilized. Within 24 hours, over 50% decolorization was observed for most dyes, with maximum decolorization at 48 hours. OD values were recorded at both time points. Decolorization percentage was calculated using the formula: Decolorization (%) = (Control - Treated) / Control × 100. *Lysinibacillus sp.* demonstrated significant decolorization activity against both Simple and Azo dyes, likely through reductase and oxidase enzyme actions. These findings support the potential of soil microbes in bioremediation strategies for industrial pollutant reduction. The study underscores the promise of *Lysinibacillus sp.* in addressing environmental concerns related to dye pollution. Further research is needed to elucidate the specific enzymatic mechanisms involved in the decolorization process, which could optimize this bioremediation approach.

Keywords: *Lysinibacillus sp*., Bioremediation, Dye Decolorization, Simple and Azo dye

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The Impact of Pharmaceutical Biotechnology on the Pharma Industry

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Pharmaceutical biotechnology has driven profound changes in the pharmaceutical industry, revolutionizing processes in drug discovery, development, and production. Early advancements, like the use of fermentation technology for antibiotic production, laid the foundation for today's innovations. The development of recombinant DNA technology has further expanded the industry's capabilities, enabling the production of therapeutic proteins and genetically engineered variants. These technologies have reshaped drug discovery by allowing high-throughput screening and enhancing assay technologies, thus accelerating access to essential proteins in quantities suitable for research. With biotechnology accounting for roughly 15% of industry revenues, particularly in high-impact areas such as oncology and metabolic disorders, its importance is clear. Over 25% of substances in preclinical testing now rely on biotechnology-driven approaches, highlighting its role in advancing novel therapeutics. Emerging technologies, such as RNA interference, though nascent in commercial applications, represent promising new directions. By fostering innovations in products, processes, and services, biotechnology strengthens international competitiveness within the pharmaceutical sector. The industry, however, faces high R&D costs and fluctuating success probabilities across therapeutic categories. These challenges are shaped by technology push and demand-pull factors, with biotechnology positioned as a vital driver of future growth. This study identifies key R&D costs affecting the industry and emphasizes biotechnology as essential for sustainable innovation, making it indispensable to the future of big pharma.

Keywords: Pharmaceutical Biotechnology, Drug Discovery, Genetic Engineering, Recombinant DNA, Therapeutic Proteins

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Digital Healthcare and Telemedicine

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The field of digital health integrated digital care programs, technologies, and life with health, healthcare, and society to increase the efficiency of healthcare delivery and the precision and individualization of medicine. Telemedicine is the practice of delivering medical care remotely. Patients can schedule virtual medical visits with this feature, even if they are unable to visit the doctor in person. Digital care is, in short, the use of digital tools that allow patients and doctors to communicate in real time. Telemedicine, on the other hand, is the concept of treating patients over large distances. Mobile health apps, wearable technology, electronic medical records, telehealth, and telemedicine are all examples of digital health. Data and information from every social activity are gathered in real time by digital health. Digital health interventions aimed at reducing disease risk and enhancing quality of life have been around for some time, enabled by advancements in information and communications technology. Even yet, given the pervasive problems of aging, childhood illness and death, pandemics and epidemics, exorbitant costs, and the influence of poverty and racial discrimination on healthcare access. Digital health platforms, associated technology, and health systems are all evolving and becoming more significant. The ongoing transition of the healthcare sector to digital technology has been expedited by the COVID-19 pandemic. The digital health industry is projected to grow at a compound annual growth rate of 27.9% between 2020 and 2027, reaching $833.44 billion, according to precedence research.

Keywords: Digital Health, Telemedicine, Virtual Medical Visits, Wearable Technology, Telehealth

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Obstructive Sleep Apnea Challenges & Management

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Obstructive sleep apnea (OSA) is a common disorder mostly found in obese people where breathing repeatedly stops and starts during sleep due to the throat muscle intermittently relaxing and blocking the airways. It often leads to poor sleep quality & daytime drowsiness also can be caused by a combination of factors including Obesity, age, gender, family history, smoking, nasal congestion, neuromuscular conditions, and hormonal factors. Common symptoms include loud snoring, gasping for air during sleep & morning headaches. In most cases, the patient with OSA is asymptomatic thereby posing a risk in the development of cardiovascular and neurological disorders. Treatment options range fromlifestyle changes to continued positive air pressure & the challenges with OSA lie in its potential to significantly impact quality of life. However effective management strategies exist to address this condition like lifestyle changes (weight loss, regular exercise & sedatives before bedtime), continuous positive airway pressure therapy, oral appliance, positional therapy,behavioral therapy, surgery regular monitoring. Pharmacologic therapy is generally not a part of the primary treatment recommendations. Acetazolamide, medroxyprogesterone, fluoxetine, and protriptyline modafinil have been used to treat obstructive sleep apnea (OSA); however, these medications are not recommended. Obstructive sleep apnea affects an estimated 936 million people globally, with up to 80% of cases undiagnosed. However, diagnosis and managing OSA in asymptomatic patients is of major challenge in untreated scenarios. The development of medical biosensors in detecting the treatment of cardiovascular &neurological disorders from OSA can be a promising approach to managing OSA.

Keywords: Obstructive Sleep Apnea, Causes, Symptoms, Treatment

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Anti-Leprotic Drug Resistance: A Growing Threat to Eradication Efforts

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Leprosy, caused by *Mycobacterium leprae*, remains a major public health concern in India, with around 114,000 new cases reported in 2022. Multi-drug therapy (MDT) using dapsone, rifampicin, and clofazimine has effectively reduced leprosy prevalence. However, resistance to dapsone and rifampicin is rising, posing a threat to MDT efficacy and leprosy eradication. India accounts for nearly 60% of global leprosy cases, with recent data showing resistance rates of approximately 8-15% for dapsone and 3-5% for rifampicin, particularly in areas with limited healthcare access. Contributing factors include inconsistent treatment adherence, poor monitoring, and socio-economic challenges that limit proper dosing. Genetic mutations in the folP1 and rpoB genes are the primary mechanisms behind resistance to dapsone and rifampicin, respectively. Surveillance studies from 2015 to 2020 show an alarming rise in primary resistance, underscoring the need for improved diagnostics and drug susceptibility testing. This rise in drug-resistant leprosy calls for urgent public health measures, including enhanced diagnostic tools, better adherence monitoring, and educational initiatives on MDT completion. Additionally, new treatment strategies with adjunctive therapies are under consideration to counter resistance. In conclusion, anti-leprosy drug resistance significantly challenges India's leprosy elimination goals. Strengthened surveillance, improved patient compliance, and advanced molecular diagnostic tools are essential to curb resistance and maintain MDT effectiveness in leprosy control.

Keywords: Leprosy, *Mycobacterium leprae*, Dapsone, Resistance, MDT

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Isolation, Identification, Growth Optimization, Compound Variation of Different Microalgae from South Bengal

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This study aims to isolate, identify, and optimize the growth conditions of different microalgae species from South Bengal. Additionally, it seeks to analyze the variation in compound production across the isolated species under different growth conditions. Microalgae samples were collected from various aquatic environments in South Bengal. The isolation of microalgae was carried out using serial dilution and streak plate methods. Morphological and molecular identification of the isolated species was performed using light microscopy and authenticated. Growth optimization was conducted by varying parameters such as light intensity, temperature, pH, and nutrient concentration in controlled laboratory conditions. The variation in the production of key bioactive compounds, including pigments, lipids, and polysaccharides, was analyzed using spectrophotometric and chromatographic techniques (HPLC and GC-MS). Several microalgae species were successfully isolated and identified, belonging to different genera such as *Chlorella*, and *Crucigenia*. Growth optimization revealed significant differences in biomass yield and compound production across species, with specific conditions favoring the accumulation of certain bioactive compounds. For example, higher lipid content was observed under nitrogen-limited conditions, while pigment production was enhanced under high light intensity. The study provides valuable insights into the isolation, identification, and growth optimization of microalgae species from South Bengal. The observed variation in compound production highlights the potential of these microalgae as sources of valuable bioactive compounds. These findings could contribute to the development of microalgae-based biotechnological applications, including biofuels, nutraceuticals, and pharmaceuticals. Further studies are recommended to explore the large-scale cultivation and commercial exploitation of these microalgae.

Keywords: Microalgae, GC-MS, Growth media, Column chromatography

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Enhancing Drug Discovery: The Role of AI in Precision Molecular Docking and Dynamics

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Molecular docking, a critical step in drug design, predicts the preferred orientation and interaction between a ligand and a protein to form a stable complex. Traditionally, computational tools such as AutoDock Vina and LigandFit have been used for this purpose. However, recent advancements in artificial intelligence (AI) have significantly enhanced molecular docking by increasing the precision and efficiency of ligand-protein interaction predictions. AI, particularly through machine learning (ML) and deep learning (DL), enables the analysis of large datasets of chemical structures and biological targets, improving scoring functions, exploring complex conformational spaces, and predicting binding affinities with high accuracy. AI-based models can rapidly screen vast libraries of compounds, accelerating key stages in drug discovery, including hit identification and lead optimization. By iteratively refining docking poses, AI reduces false positives, which minimises the need for extensive laboratory validation, thereby lowering the overall costs of drug discovery. These advantages increase the likelihood of identifying effective drug candidates and improve the success rates of subsequent clinical trials. AI-driven molecular docking is particularly valuable in the discovery of treatments for complex diseases, such as cancer and neurodegenerative disorders, where conventional drug discovery approaches often face limitations. By offering more accurate, efficient, and cost-effective solutions, AI is transforming molecular docking, ultimately accelerating the development of new therapeutics and improving patient outcomes. This integration of AI into molecular docking signifies a promising advancement in drug discovery, with potential for widespread impact in precision medicine.

Keywords: Molecular docking, Artificial Intelligence, Machine Learning, Lead Optimization, Drug Discovery

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Nature to Nanomedicine: Snail Mucus as A Chemotherapy Enhancer

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Snail mucus, particularly snail mucin, has attracted attention for its promising applications in enhancing chemosensitivity. This natural secretion is a complex mixture containing high levels of glycosaminoglycans, proteoglycans, and hyaluronic acid, which contribute to its unique physicochemical properties. These components support enhanced bioavailability, cellular adhesion, and drug delivery efficiency, making snail mucin an ideal candidate for biomedical applications. The present review highlighted the role of snail mucin as a natural bioactive substance with significant potential to enhance chemosensitivity in cancer treatment while offering protective effects in various therapeutic contexts. Snail-derived nanomedicine in cancer offers innovative therapies by utilizing bioactive compounds for targeted drug delivery, immune modulation, and reduced side effects, enhancing treatment outcomes. A remarkable property of snail mucin is its potential anti-neoplastic activity, primarily attributed to its ability to induce cell cycle arrest and apoptosis in certain cancer cell lines. By enhancing cell membrane permeability, snail mucin improves the efficacy of chemotherapeutic agents, thus promoting chemosensitivity. Snail mucus is used in ethnomedicine to treat conjunctivitis, arthritis, and other inflammatory disorders. Research suggests snail mucin exhibits anti-inflammatory and antioxidant properties that help reduce the adverse effects commonly associated with chemotherapy. Snail mucin, featured in skincare brands like Mizon All-In-One Snail Repair Cream and Benton Snail Bee High Content Essence, is expanding into medical research for its bioactive properties. Further investigation is required to fully understand the mechanisms and to develop optimized formulations that can harness these benefits effectively in clinical applications. Ongoing clinical trials aim to harness snail mucin's anti-inflammatory effects for conjunctivitis treatments and its bioadhesive potential to improve drug delivery in cancer therapies. Snail mucus could provide an innovative, natural approach to cancer treatment that supports and amplifies conventional therapies.

Keywords: Polysaccharides, Snail mucus, Anti-cancer, Anti-inflammatory, Nanomedicine

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Impact of Artificial Intelligence (AI) on Discovery of Drugs and Their Products

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Artificial intelligence is a science discipline whereby machines can find different forms of drugs within pharmaceutical sectors. Machine learning (ML) and AI have drastically impacted different fields out there, and the super-wide industry of pharmaceuticals is not a popular exception. As diseases are becoming more widespread, the need for discovering new drugs has become more acute, as existing ones are usually insufficient. Applying AI in drug development is anticipated to advance the process in the pharmaceutical sector to enhance the clinical result. This transformation is seen throughout the pipeline, at which point all AI can reduce timelines and improve practice. Most of the pharma industry and biotech are incorporating AI solutions to deal with a number of diseases and different therapeutic areas from chronic Parkinson's, diabetes, and Alzheimer's diseases to new nanomedicine and nanorobot technologies. If the AI-based drugs elevated to the clinical trials' stage signify a breakthrough of the AI in creating a revolutionary change in the system of drug discovery, and product development in the pharmaceutical markets. Some examples of AI discovery molecules DNA helicase WRN, Procaspase MALT1 etc.

Keywords: Drug Delivery, Machine learning, Diseases, Nanorobot Technology, Algorithm

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The Role of Fragrance in Enhancing Pharmaceutical Products and Patient Compliance

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Fragrance plays a vital role in the pharmaceutical industry, significantly enhancing patient compliance and the overall user experience. In pharmaceutical products such as oral syrups, topical creams, and even tablets, fragrances are often added to mask the unpleasant smells or tastes of active ingredients, making medications more palatable and pleasant to use. This is particularly important in pediatric and geriatric care, where sensory acceptance can strongly impact adherence to medication regimens. In addition to masking unpleasant odors, fragrances in pharmaceuticals can provide therapeutic benefits. For example, certain essential oils used in fragrances, such as lavender or eucalyptus, are known for their calming and stress-relieving properties, which may aid in patient relaxation and recovery. Fragrances can also contribute to product differentiation in the competitive over-the-counter medication market, giving products a unique identity and appeal. Beyond sensory enhancement, some fragrances may act as functional agents in pharmaceutical formulations. Certain fragrance molecules have been shown to act as penetration enhancers, improving the absorption of active ingredients in transdermal drug delivery systems. However, the incorporation of fragrances into pharmaceuticals must be approached with care to avoid potential allergic reactions or interference with the medication's therapeutic effectiveness. In conclusion, fragrance serves multiple purposes in the pharmaceutical field, from improving patient adherence by enhancing the sensory appeal of medications to potentially boosting drug efficacy in some formulations. The careful selection and application of fragrances can greatly benefit both patient satisfaction and therapeutic outcomes, underscoring its importance in pharmaceutical product development.

Keywords: Fragrance in pharmaceuticals, Patient compliance, Sensory enhancement, Therapeutic benefits, Penetration enhancers

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Toxic Chemicals in Packaged Food and Beverages: Consumer Awareness and Potential Health Risks

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The presence of toxic chemicals in packaged food and beverages has emerged as a growing concern for consumer health and safety. These chemicals, including bisphenol A (BPA), phthalates, pesticides, and heavy metals, are often introduced during food processing, packaging, and agricultural practices. Prolonged exposure to such contaminants has been linked to serious health risks, including endocrine disruption, developmental and reproductive issues, and an increased risk of chronic illnesses such as cancer. Despite regulatory efforts, these chemicals remain prevalent in many food products, raising alarm about the adequacy of current safety standards. Consumer awareness regarding the potential risks posed by these chemicals remains insufficient, resulting in widespread exposure to harmful substances. This calls for improved labelling practices, stricter regulatory controls, and more effective consumer education initiatives. Increased public awareness can drive demand for safer alternatives and put pressure on manufacturers to adopt more transparent and health-conscious production methods. Recent research has also focused on the cumulative effects of toxic chemicals in the food supply, emphasising the need for long-term studies on their impact on human health. The environmental persistence of these chemicals and their ability to bioaccumulate in the food chain further exacerbate the risks. In conclusion, addressing the presence of toxic chemicals in food and beverages requires concerted efforts from regulatory bodies, manufacturers, and consumers alike. Enhanced consumer education, stricter regulations, and ongoing research are essential to mitigate the health risks associated with these chemicals and ensure food safety. Informed consumers can make better choices, ultimately leading to a healthier and safer food system.

Keywords: Toxic chemicals, Packaged food, Health risks, Consumer awareness, Food safety

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Sunscreens in Focus: Navigating Health Risks and Environmental Sustainability

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Recent advancements in sunscreen formulations have sparked increased examination of their safety and potential toxicity. While sunscreens are crucial for shielding against harmful ultraviolet (UV) rays and reducing the risk of skin cancer, they produce a long-term effect of certain chemical components on human health and the environment. Innovations in formulation technology have led to the use of both chemical and physical UV filters. However, chemical filters like oxybenzone and octinoxate have been associated with endocrine disruption and allergic responses, alarming both consumers and health professionals. Studies suggest they can enter the bloodstream, leading to concerns about their possible systemic effects, especially with extended use. It led to a noticeable shift towards mineral-based sunscreens containing zinc oxide and titanium dioxide, regarded as safer options with a reduced risk of skin irritation and systemic absorption. Recent research has underscored the effectiveness of these formulations in delivering broad-spectrum UV protection without the risks linked to chemical filters. Moreover, the environmental ramifications of sunscreen have also been scrutinised, particularly concerning the health of coral reefs. Growing awareness has resulted in the creation of "reef-safe" sunscreens that avoid harmful chemicals associated with coral bleaching. Consumer education has also progressed, highlighting the significance of understanding ingredient safety as well as correct application and reapplication methods. As research continues to shed light on the intricacies of sunscreen safety and efficacy, the industry is set to adapt, focusing on formulations that safeguard both skin health and environmental welfare. The abstract offers a summary of sunscreen formulations, emphasising health risks and environmental factors.

Keywords: Sunscreen Safety, Chemical Filters, Mineral-Based Formulation, Environmental Impact, Consumer Education

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Generic Drugs Manufacturing: Scope and Challenges

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The production of generic drugs has been on the rise in recent years, as more and more people look for cheaper alternatives to brand name medications. Generics are often less expensive than their brand name counterparts and provide patients with a much cheaper cost of treatments. However there are some challenges associated with generic drugs manufacturing, for example the process of making generics. is often more complex than making branded drugs. Producing generic drugs can be more complicated than manufacturing brand-name medications. This complexity stems from the need to replicate the formulation and production processes of established drugs while ensuring bioequivalence. Generic drug manufacturers face stringent regulations set by the FDA. They must demonstrate that their products are therapeutically equivalent to the branded versions, which requires extensive testing and documentation. Maintaining consistent quality is crucial. Any deviation can lead to variations in efficacy or safety, raising concerns among consumers and healthcare providers. Policy existing in India for generic medicines is "Pradhan Mantri Bhartiya Janaushadhi Pariyojana" (PMBJP), Making quality medicines available at affordable prices for all particularly the poor and disadvantaged outlets. "Jan Aushadhi Medical store", so as to reduce out of pocket expenses in healthcare. However, there are also several obstacles that could impede growth of the drugs market.

Keywords: Generic Drug, Branded Drugs, Bioequivalence, Low Cost

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From Diagnosis to Recovery: Transforming Cancer Care with Digital Health

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Digital health technologies are transforming cancer care, providing unprecedented tools for early detection, personalized treatment, and long-term management. Currently, over 65% of oncology clinics globally incorporate digital health solutions, including telemedicine, artificial intelligence (AI)-driven diagnostics, and wearable devices. These tools enable real-time patient monitoring, predicting adverse events with up to 90% accuracy and improving early intervention. Telemedicine, for example, increased accessibility to oncology specialists by 70% during the COVID-19 pandemic, a trend that continues to grow, especially in underserved areas. Artificial intelligence and machine learning algorithms are advancing cancer detection rates. Studies show that AI-assisted radiology achieves up to 94% accuracy in breast cancer detection, compared to 88% with traditional methods. Genomic testing and digital pathology are also making personalized treatment options more accessible, with patients receiving tailored therapies 40% faster, reducing treatment side effects and increasing survival rates. Compared to conventional methods, digital health reduces time and costs, enhances patient engagement, and allows data-driven decision-making. Moreover, wearable technology, now adopted by 48% of oncology patients in developed nations, provides continuous health data, enabling physicians to adjust treatments dynamically. In conclusion, digital health technologies in cancer care present transformative advantages, providing more accurate diagnoses, efficient treatments, and improved patient outcomes. As digital health adoption rises, particularly in emerging economies, these technologies promise a more equitable and effective global cancer care ecosystem.

Keywords: Digital, Cancer, Health, Pandemic, Patient

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COVID-19: Its Impact on Education, Healthcare, and Social Life

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COVID-19 was designated a public health emergency of worldwide concern by the World Health Organization (WHO). This paper looks into COVID-19 and how it affects social life, healthcare, education, and the economy. Under the tremendous strain of the worldwide epidemic, the Indian healthcare system suffered greatly, revealing serious flaws and difficulties in its structure. Any country's health is a top priority, and the government has a basic duty to ensure the welfare of its people. Around 5 million COVID-19-related deaths were reported worldwide as of October 2021. The pandemic exposed flaws in both curative and preventive methods of treating infectious and non-communicable diseases. Most nations had to close educational institutions including colleges and schools as a result of COVID-19. It seemed like the educational system was falling apart at the moment. Approximately 320 million pupils in India alone ceased going to school, which put an end to all educational initiatives in the nation. The COVID-19 pandemic showed us that change is unavoidable, which is why teachers almost immediately switched to online instruction. In the end we can conclude that COVID-19 pandemic sent shockwaves through the global economy, sparking one of the largest economic crises in history. In 2021, 51 countries, including 44 emerging global leaders, experienced significant government setbacks along with the setback in the education system which the students are also experiencing in recent days.

Keywords: COVID-19, Healthcare, Economy, Pandemic, Education

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Robotic Innovations in Pharmacy: Transforming Drug Dispensing and Patient Care

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Robotics is the design, construction, use, and operation of robots for information processing and sensory feedback. Robots do jobs significantly more quickly than people in pharmaceutical applications. Traditional pharmaceutical processes are being transformed by the incorporation of robotics into pharmacy practice, which improves patient safety, accuracy, and efficiency. Nowadays, complex compounding processes, inventory management, and drug distribution are all automated by robotic equipment, which lowers human error and frees up pharmacists to concentrate on their clinical responsibilities. The robotic technologies used in pharmacies, including automated dispensing cabinets, robotic compounding systems, and delivery robots, are examined in this paper along with their uses, advantages, and disadvantages. Important developments in robotic processing have simplified operations in high-volume environments, greatly cutting down on turnaround times and drug errors. In addition to conventional robotics, artificial intelligence (AI) enabled robots are also improving medicine management by anticipating inventory requirements and making real-time stock adjustments. Some recent studies showed that the post pandemic era has a considerable increase in the use of robotics in the field of pharmacy practice. Although robotics in pharmacy has a lot of promise, problems including start-up costs, upkeep, and labor adaption need to be addressed. Ultimately, it is anticipated that robots will play an increasingly significant role in pharmacy, transforming the management of pharmaceuticals and promoting a patient-centred approach to healthcare. This report emphasizes the importance of pharmacists and technicians collaborating to maximize the benefits of robots while upholding a high quality of patient care.

Keywords: Robotics, Pharmacy Practice, Artificial Intelligence, Health Care

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Extraction and Characterization of Cellulose Nanofibers from Coconut Husk and its Industrial Application

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Coconut husk, an abundant agricultural by-product, presents a promising source of cellulose nanofibers (CNFs) with potential for various industrial applications. This study explores the extraction and characterization of CNFs from coconut husks, with the aim of utilizing these nanofibers as a sustainable alternative for diverse industries. The extraction process involves alkali-acid hydrolysis, bleaching and homogenization, leading to the isolation of high-purity CNFs with nanoscale dimensions. The structural properties of the extracted CNFs were characterized using FT-IR, XRD, SEM and TEM. FT-IR confirmed the removal of non-cellulosic components, whereas XRD revealed a crystallinity index of over 70%, indicating strong crystalline structures in the CNFs. TEM imaging further demonstrated the uniformity of the nanofibers with diameters ranging from to 5-40 nm. The thermal stability and mechanical properties of the CNFs were also evaluated, showing significant improvement over conventional cellulose fibers, thus making them suitable for applications that require robust mechanical strength and high thermal resistance. In addition, the extracted CNFs were tested in polymer composites, resulting in materials with enhanced tensile strength, reduced density and increased biodegradability. Because of their unique properties, these coconut husk-derived CNFs show considerable potential in various industries, such as the packaging, nanocomposites, and biomedical fields, where environment friendly and high-strength materials are in demand. This research not only provides a sustainable use for coconut husk waste, but also advances the development of eco-friendly materials with competitive properties for industrial applications and also as an economically viable and renewable resource, contributing to waste reduction and promoting sustainable materials.

Keywords: Coconut Husk, CNFs, Extraction, Biodegradable

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Yoga: A Complementary Therapy for Mental Illness

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Yoga, an ancient practice from India, has gained international recognition for its holistic benefits to physical, mental, and emotional health. Recent research has explored its role as a complementary therapy for mental illnesses such as depression, anxiety, PTSD, and schizophrenia. This paper aims to investigate yoga's potential to improve mental health outcomes by enhancing conventional treatments, reducing symptom severity, and improving overall quality of life. A comprehensive review of randomized controlled trials (RCTs), meta-analyses, and qualitative studies was conducted to examine the therapeutic effects of yoga. The review focused on yoga's integration of physical postures (asanas), controlled breathing (pranayama), and meditation and their neurochemical impacts, including the release of GABA and endorphins, which contribute to mood stabilization and stress reduction. Evidence from RCTs and meta-analyses supports yoga's effectiveness as an adjunct therapy, showing significant reductions in symptoms of anxiety and depression. Qualitative findings further indicate improvements in self-awareness, emotional regulation, and resilience, with patients reporting enhanced self-perception and stress management capabilities. However, challenges include individual variability in responses and the need for standardized therapeutic protocols. Integrating yoga into conventional mental health care models could enhance the effectiveness of standard treatments, contributing to more comprehensive mental health support. This paper advocates for further research to develop standardized practices and validate yoga's role within an integrative care framework, potentially transforming approaches to mental health treatment.

Keywords: Complementary Therapy, Mental Health, Yoga, Depression and Anxiety

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Mango (*Mangifera indica* L.) Leaves: Nutritional Composition, Phytochemical Constituents, and Health-Promoting Bioactivities

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Mango (*Mangifera indica* L.) leaves, an often-overlooked part of the plant, contain a variety of bioactive compounds that contribute to numerous health benefits. This review explores their nutritional composition, phytochemical profile, and therapeutic properties. Mango leaves are rich in essential nutrients such as vitamins A, C, and E, along with minerals like calcium, potassium, and magnesium. Additionally, they provide dietary fiber and natural antioxidants. Their phytochemical content includes flavonoids, phenolic acids, alkaloids, tannins, and terpenoids, which exhibit significant biological activities. Research indicates that mango leaves possess antioxidant and anti-inflammatory properties, making them useful in combating oxidative stress and inflammation-related diseases. Furthermore, they show potential in regulating blood glucose levels, aiding in diabetes management, and improving lipid metabolism. Cardioprotective and neuroprotective effects have also been noted, suggesting their role in maintaining cardiovascular health and preventing neurodegenerative disorders. The antimicrobial and antiviral properties of mango leaves further enhance their therapeutic value. Various extraction techniques, such as aqueous and ethanol-based methods, improve the bioavailability of these beneficial compounds, increasing their potential applications in functional foods and herbal medicines. Preliminary studies confirm the safety of mango leaf extracts when used in appropriate doses. Overall, mango leaves offer a promising natural resource for developing nutraceuticals aimed at promoting health and preventing chronic diseases. Further research is required to explore their full therapeutic potential and applications in modern medicine.

Keywords: *Mangifera Indica*, Phytochemicals, Antioxidants, Diabetes, Nutraceuticals.

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Eichhornia crassipes: An Advantageous Source of Shikimic Acid

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A study has revealed that shikimic acid, an important compound for the synthesis of the antiviral drug Tamiflu, is found in the renewable source of water hyacinth (*Eichhornia crassipes)*. The many ecological problems it carries is turned into a rich and valuable resource with this invasive aquatic weed. Higher quantities of aerial parts of shikimic acid (0.03-2.70% w/w) compared with roots (0.05-0.90% w/w) are seen in the water hyacinth. More shikimic acid was obtained from methanol extraction compared to water. This is the first report of the existence of shikimic acid in the family Pontederiaceae, and therefore means the hope for the sustainability of water hyacinth as a source is well and good. Shikimic acid does not rely on the pharmaceutical industry using existing sources alone. General implications of this research are wide. Large-scale culture and harvesting of water hyacinth could provide a renewable source of supply of shikimic acid for the production of pharmaceuticals of eco-friendly nature. The invasive character of this plant can easily be exploited to mitigate some of the environmental costs of its growth. Future research avenues lie in large-scale culture and harvesting experiments, optimum growth conditions, efficient methods of extraction, and the identification of other valuable compounds that may be present in the plant. This pioneering study discusses water hyacinth as an effective resource for drugs, thus being a novel approach toward sustainable production of pharmaceuticals and environmental sustainability.

Keywords: Shikimic Acid, Water Hyacinth, Pontederiaceae**,** *Eichhornia crassipes*

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Alternanthera brasiliana, A Journey from Shrub to Drug: A Composite Review

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Traditional medicine plays a significant role in daily life, especially in developing countries where medicinal plants are widely used for their safety, availability, and accessibility. One such plant is *Alternanthera brasiliana*, commonly known as Brazilian joy-weed or Penicillin, which belongs to the Amaranthaceae family. Found across Brazil, Australia, and India, this herbaceous perennial plant is used in traditional medicine for its numerous therapeutic benefits. It has various names, including large purple alternanthera, parrot leaf, and metal weed. The conventional medicinal system values almost every part of *Alternanthera brasiliana*, particularly its leaves, which are noted for their strong medicinal properties. Morphologically, the plant is prostrate and dendritic, with circular to polygonal stems, elongated internodes, and inflated nodes where opposite leaves attach. Its cymose inflorescence consists of actinomorphic, hermaphrodite, and monocyclic flowers. The plant is rich in bioactive compounds, including six types of flavonoids, and is noted for its anti-inflammatory, analgesic, wound-healing, lymphocyte-proliferation, antioxidant, antimicrobial, and antiviral properties. *Alternanthera brasiliana* is traditionally used to treat infections, coughs, and inflammatory conditions. It also has digestive, decontaminating, and diuretic properties. Cultivars like Purple Prince and Little Ruby make it popular as an ornamental plant. Additionally, extracts of *Alternanthera brasiliana* demonstrate anti-herpes simplex virus activity. Its aerial parts are applied as an antibiotic for cystitis, throat infections, and general inflammation, highlighting its significance in both traditional medicine and ornamental horticulture.

Keywords: *Alternanthera brasiliana*, Amaranthaceae, Antioxidant, Wound Healing, Anti-Inflammatory

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Enhancing Cleaning Validation Processes in Pharmaceutical Manufacturing: Challenges and Best Practices

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Cleaning validation provides documented evidence of a high degree of assurance that systems or equipment can be consistently cleaned to predetermined acceptable limits. This process is particularly essential in the pharmaceutical industry for cleaning manufacturing equipment due to stringent regulatory requirements. Effective cleaning programs are necessary to prevent contamination of pharmaceutical products and active pharmaceutical ingredients (APIs) by other products, cleaning agents, microorganisms, and airborne particles such as dust and lubricants. Cleaning primarily aims to remove both product-related and non-product contaminants. Inadequate cleaning can result in adulterated products due to residues from previous batches or other extraneous materials introduced during processing. Given that the same equipment may be used for multiple products, it is vital that cleaning procedures adhere strictly to established and validated methods. Cleaning is crucial in pharmaceutical and biopharmaceutical manufacturing as it minimizes the risk of contamination from batch-to-batch residues or the unintended transfer of materials into subsequent products. A clean environment and operations are at the heart of pharmaceutical activities, directly impacting the safety and purity of products. Regulatory authorities, including the FDA, have issued guidelines on cleaning procedures, emphasizing the need for validated methods to meet current Good Manufacturing Practices (cGMP). Companies are required to have written standard operating procedures (SOPs) detailing cleaning processes, assigned responsibilities, and documentation for validation, ensuring accountability and compliance within the manufacturing process.

Keywords: Cleaning, Validation, GMP, FDA, Regulatory

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Brain-Heart Infusion (BHI) Agar with Blood as A Potent Media in Antimicrobial Studies

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Brain-Heart Infusion (BHI) agar with blood is an advanced medium used in antimicrobial research, providing an enriched environment to support the growth of fastidious microorganisms, including anaerobes and pathogenic bacteria. Derived from calf brain and beef heart infusions, BHI offers nutrients essential for culturing a wide range of bacteria, fungi, and yeasts. The addition of 5-10% animal blood further enhances the growth of organisms with complex nutritional needs, such as *Streptococcus pneumoniae* and *Haemophilus* species. BHI with blood plays a crucial role in antimicrobial susceptibility testing (AST) and biofilm research, areas central to microbiology. Biofilms, which contribute to chronic infections and antibiotic resistance, can be effectively studied using this medium, as it replicates in vivo conditions. It also supports bacteriostatic and bactericidal testing by accommodating both aerobic and anaerobic bacteria. Another benefit of BHI with blood is its ability to reveal haemolytic properties, aiding in the identification of pathogens and their virulence factors. The medium is widely used in pharmaceutical research to validate disinfectants and evaluate new antimicrobial agents. Compared to simpler media, its nutrient-rich composition helps detect resistant strains that may otherwise go unnoticed, promoting the development of more effective therapies. In summary, BHI agar with blood is a valuable tool in modern microbiology, facilitating studies in susceptibility testing, biofilm formation, and pharmaceutical research. Its versatility and ability to detect resistant pathogens make it essential in the fight against antibiotic resistance.

Keywords: Antimicrobial Research, Biofilm Studies, Antibiotic Resistance, Susceptibility Testing, Pharmaceutical Validation, Fastidious Bacteria

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Moringa oleifera Flowers and Leaves: A Natural Source of Therapeutic Potential

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Moringa oleifera, commonly known as the drumstick tree, is widely recognized for its significant medicinal properties, especially in its leaves and flowers. Rich in essential nutrients, vitamins (A, C, and E), and minerals (calcium, potassium, and iron), *M. oleifera* holds notable antioxidant, anti-inflammatory, and antimicrobial potential. The leaves are particularly valued for their high protein content and amino acids, making them a nutrient-dense addition in combating malnutrition. Phytochemical analysis reveals the presence of flavonoids, phenolics, and glucosinolates, which contribute to its diverse pharmacological effects. Recent studies suggest that extracts from *M. oleifera* leaves and flowers show promising results in reducing oxidative stress, inhibiting bacterial growth, and improving immune responses. The antioxidant properties help in neutralizing free radicals, potentially reducing the risk of chronic diseases like cancer and cardiovascular disorders. Additionally, its anti-inflammatory effects may be beneficial for managing inflammatory conditions such as arthritis. The leaves and flowers have also demonstrated hepatoprotective properties, which support liver health and detoxification processes. In traditional medicine, Moringa is used for treating digestive ailments, hypertension, and skin disorders. Furthermore, its antimicrobial action against various pathogens makes it a potential natural alternative for infection management. This review explores the therapeutic applications of *Moringa oleifera* leaves and flowers, emphasizing its potential as a natural remedy with minimal side effects. The findings highlight the scope for further research into *M. oleifera*'s bioactive compounds and their role in novel drug development.

Keywords: *Moringa oleifera*, Anti-Inflammatory, Flavonoids, Flower, Leaves

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Nanotechnology in Skin Cancer Diagnosis and Treatment

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Cancer is a disease in which some of the body cells grow uncontrollably and spread to other parts of the body. According to the World Health Organization (WHO) and World Cancer Research Fund International skin cancer is the 17th most common cancer in the worldwide. Skin cancer is a disease that occurs when skin cells grow out of control. In 2022, there were estimated 1.5 million new case of skin cancer diagnosed. In this context, nanotechnology is a strategy for cancer treatment, because in this treatment the drug is show it's effect to the targeted cancer cell, in this treatment the other healthy cells are not affected by the drug to this drug delivery system using liposomal and polymeric nanoparticles (NPs) to rich the targeted cancer cell directly. In the treatment of skin cancer there are many therapies like radiotherapy, chemotherapy, targeted therapy and immunotherapy, which have various side effects. In treatment, of skin cancer is use of nanoparticles (NPs) have many advantages like drug delivery system, lower dose, reduce biodegradation. Many of drug use in skin cancer based on nanoparticles (NPs) like the drugs are Dabrafenib, Trametinib etc. Skin cancer therapy is the magnetic-based core cell particles and electro spun mats are use in skin cancer treatment. In this way we can target the cancer cells and design nanoparticles which may yield the greatest returns in clinical skin cancer therapy.

Keywords: Nanotechnology, Targeted drug delivery, Chemotherapy, Immunotherapy

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Unlocking Health: A Comprehensive Review of Drug Utilization Patterns in India

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Drug utilization studies (DUS) are essential for understanding prescribing patterns, medication use, and patient adherence in healthcare systems. This review analyzes drug utilization in India, focusing on prescription patterns, polypharmacy, and the impact of socio-economic factors. Recent studies reveals over 70% of patients receive at least one prescription, with 30-40% of them experiencing polypharmacy, defined as the concurrent use of five or more medications. Notably, a study conducted in a tertiary care hospital showed that antibiotics constituted 40% of prescribed drugs, raising concerns about antibiotic resistance. The analysis highlights demographic influences on drug utilization, like rural populations exhibit a higher reliance on traditional remedies and limited access to essential medicines, leading to a disparity in healthcare outcomes. In contrast, urban settings shows trend towards higher polypharmacy, particularly among elderly patients. The review also discusses the regulatory framework in India, emphasizing the need for standardized guidelines to ensure rational drug use. Statistically, the WHO's ATC/DDD (Anatomical Therapeutic Chemical/Defined Daily Dose) methodology was utilized to evaluate drug consumption, revealing that the average daily dose of essential medications was below the recommended levels in many regions, particularly in rural areas. In conclusion, this review underscores the critical need for ongoing monitoring of drug utilization patterns in India. Effective strategies, including educational programs for healthcare professionals and patients, policy interventions, and improved access to essential drugs, are necessary to optimize medication use, enhance patient safety, and minimize adverse drug reactions. Addressing these challenges will enhance health outcomes and efficiency in India's healthcare system.

Keywords: Drug, India, Utilization, Polypharmacy, Antibiotic

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Comparative study of Manganese content in Acanthaceae family plants

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Manganese is an important trace element responsible for regulating different enzymes present in the body. The different enzymes regulated by manganese are Glutamine Synthase, Superoxide Dismutase, Pyruvate Carboxylase. Glutamine Synthase is an enzyme essential for the assimilation of nitrogen in the cells. Manganese plays a crucial role by activating the enzyme and helps in the conversion of Ammonia and glutamate to glutamine. Manganese Superoxide Dismutase protects the cells from oxidative stress by neutralizing the superoxide radicals into hydrogen peroxide and molecular oxygen. Manganese aids in this process by alternating between different oxidation states of Mn^{+2} and Mn^{+3}. Pyruvate Carboxylase performs the conversion of Pyruvate to Oxaloacetate, a key step in the process of gluconeogenesis and citric acid cycle. Manganese helps in this process by assisting in the addition of oxygen molecules to pyruvate. Acanthaceae family of plants is a vast family of flowering shrubs and herbs mostly found in the tropical and subtropical regions of India. These Acanthaceae family plants contain a wide range of essential minerals. The aim of the current study was to compare the manganese content of different medicinal plants of the Acanthaceae family. Experiments have been done with Atomic Absorption Spectroscopy on Acanthaceae family plants like *Andrographis paniculata*, *Barleria lupulina*, *Hygrophila auriculata, Justicia adhatoda* and *Thunbergia grandiflora*. The manganese content was found maximum in *Hygrophila auriculata* followed by *Andrographis paniculata* and *Justicia adhatoda*. Thus, the study reveals that these plants are a great source of manganese and can be prepared into different dietary supplements for future prospects.

Keywords: Acanthaceae, Manganese, Superoxide Dismutase, Atomic Absorption Spectroscopy

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Artificial Intelligence in Clinical Trials: Opportunities and Obstacles

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Clinical trials are undergoing a transformation through the application of Artificial Intelligence (AI), which enhances the efficiency, precision, and decision-making throughout the drug development process. Machine learning and natural language processing, which are key components of AI, have the potential to expedite patient selection, forecast trial outcomes, and rapidly analyse complex datasets. These advanced tools facilitate the identification of suitable study participants, optimization of dosage regimens, and the development of personalized treatment strategies. Furthermore, AI enables continuous data surveillance and predictive analytics, thereby reducing the duration and expense associated with conventional trial methodologies. Although artificial intelligence remains an active field of study and innovation, the main obstacles they face are primarily ethical. These challenges stem from issues surrounding data accessibility, the establishment of standards, and, most crucially, the absence of regulatory guidelines. The absence of well-defined guidelines hinders the broad implementation of AI technologies in pharmaceutical research and development. The anticipated future impact is considerable, with expectations of improved success rates, reduced trial burden, and accelerated research and regulatory approval processes. Although AI utilization in clinical trials is still in its nascent stage, it represents a rapidly advancing field. As regulatory agencies provide further guidance on AI acceptability in specific domains, the scope of its applications is expected to expand, leading to a swift increase in the implementation volume.

Keywords: Artificial intelligence (AI), Clinical trials, Drug Development, Dose Regimens.

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Microgreens as A Superfood and Functional Component of Human Diet: An Updated Review

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Food shortages are the consequence of a number of factors, including our planet's fast expanding population pre- and post-harvest food losses, climate change, pandemic problems (such as COVID-19) and other issues. The aims of this review have been to show that microgreens have beneficial impacts on human health and immune system, including cancer, cardiovascular, diabetes, kidney and also other disease's prevention. Consequently, microgreens are an ideal choice for nutrient-rich food sources that may be grown locally and rapidly, helping to feed around the world and reducing health risks and malnutrition. Microgreens are distinguished by an immature true leaf, central stem, and well-developed cotyledonary leaves. These immature greens provide a concentrated amount of minerals, vitamins and important phytocompounds (4-40 times higher), making them suitable alternatives and replacements to mature veggies. Microgreens have potential pharmacological activity (antioxidant, antimicrobial, antidiabetic, antiobesity activity) and they have gained popularity as functional foods, particularly considering their ready-to-eat properties and high amount of nutrients and physiologically active compounds. Furthermore, this study examines the potential of microgreens in addressing nutritional challenges, like nutrient deficiencies disorder, chronic diseases and the increasing prevalence of lifestyle-related diseases. This review demonstrated to inform nutritionists, researchers, and health professionals about the importance of this novelty food as a "functional food" or "superfood" in modern daily dietary practices and encourage further evaluation and exploration of their function, significance in human health. As a result, for a complete comprehensive analysis of the significance of microgreens for human health, more research will be required.

Keywords: Microgreens, Functional food, Superfood, Health benefits, Bio-active compounds.

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Newer Approaches of Nanosilver- Polysaccharide Conjugates as A Potent Wound Healer

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Chronic wound healing has drawn attention of researchers as management of wound care in proper way has become a significant challenge. Improper care of wound possesses serious implications in the form of inflammation, exudates formation causing microbial proliferation and ultimately leading to sepsis which leads to 20% of all global death every year. Therefore, it has paved way to design efficient treatment strategies to formulate advanced wound dressing materials for obliterating the issue. Silver, for its wide antimicrobial spectrum and wound healing property, is being used in nanoform and can easily permeate through bacterial biofilms but shows toxicity at the cellular and subcellular level, therefore recent development includes encapsulation of natural polysaccharide like chitosan, starch in nanosilver form to form nanocomposite with improved therapeutic potential as polysaccharide itself possesses wound healing capability and shows synergistic effect. Apart from that, polysaccharide reduces the cytotoxic effect of silver by reducing its dose. Nanocomposite, as wound dressing material deposits collagen in wounded area, enhances proliferation and migration of keratinocytes and effectively re-epithelizes causing vasculogenesis and fibroblast differentiation, increasing wound healing rate and regeneration of skin cells. The review includes the latest information of several clinical trials on Nanocomposites like Silver-Gelatin-Chitosan-Tannic Acid Nanocomposite film, Alginate-Silver Nanocompsite Sponge and currently available marketed nanocomposites of Chitosan (ChitoSil), Calcium Alginate (Algicell) and their wound healing potential. The current review also discusses the future potential and analyzes the currently available formulation aspects, conjugation process to identify the therapeutically potent wound healing agent.

Keywords: Wound, Nanosilver, Natural Polysaccharide, Nanocomposite, Cytotoxicity

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Potential of Phytochemicals and Nanotechnology in Herbal Medicine for Drug Development

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Herbal therapies, which encompass a wide range of plant-based treatments, have long been used to manage global health. These natural therapies use a variety of bioactive phytochemicals to deliver both therapeutic and preventative health benefits. However, the scalability, consistency, and bioavailability limitations associated with traditional extraction and processing processes for these phytochemicals prevent their widespread industrial application. Improved phytochemical productivity is currently being enabled by advances in metabolic engineering and systems synthetic biology, which may provide solutions to these constraints. Furthermore, the use of nanotechnology in herbal therapy is cutting-edge. Nanomaterials, particularly those synthesised using environmentally benign processes, can improve phytochemical stability, solubility, and cellular uptake, thereby resolving difficulties associated with traditional herbal formulations. "Green" nanotechnology, which employs microbial synthesis techniques, generates nanomaterials with high biocompatibility and little environmental effect. This method permits the creation of nanoparticles that improve the pharmacokinetics of plant-based medicines, hence increasing their therapeutic efficacy. This study investigates how phytochemicals and nanotechnology might be combined to get around some of the drawbacks of herbal medicine. The use of biologically produced nanoparticles to improve the stability, bioavailability, and drug delivery of herbal compounds is covered. The study also discusses safety and regulatory issues with the goal of suggesting a viable course for the creation of nano-enabled phytochemical formulations in medication development. These technologies' convergence has the potential to advance industrial pharmacy, address important global health issues, and align with Drug Development and Industrial Pharmacy's (DDIP) priority topics.

Keywords: Phytochemicals, Herbal Medicine, Nanotechnology, Drug Development, Green Synthesis

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Predicting Verapamil Disposition across Age Groups using PBPK Modeling: A Comprehensive Approach

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Verapamil is derived from a compound originally isolated from the plant *Veratrum viride,* also known as Indian poke or American hellebore. It is an antiarrhythmic agent of class IV. The PBPK model was developed using the open-source PK-Sim® software, and physiochemical properties, ADME data of drugs from literature were incorporated. Additionally, plasma concentration-time profiles from published literatures on clinical trials were included. The oral daily dose was 120 mg for all age groups. The results of the study showed that the maximum plasma concentration (Cmax) of verapamil was higher in adults (10.91 µmol/L) compared to children (6.30 µmol/L) but lower as compared to old-aged individuals (12.27 µmol/L). The time to reach maximum concentration (Tmax) was reported as 4 hours for adults and children, but slightly longer for the elderly (4.25 hours).Total body clearance was significantly lower in adults (48.22 ml/min/kg) compared to children (108.39 ml/min/kg), but slightly higher in old-aged individuals (38.44 ml/min/kg). The half-life of verapamil in adults was 6.10 hours, which was double that of children (3.82 hours), but similar to that of old-aged individuals (6.51 hours). In conclusion, this study demonstrates that the pharmacokinetics of verapamil vary with age, with different Cmax, Tmax, total body clearance, and half-life values observed in adults, children, and old-aged individuals.

Keywords: PK-Sim Software, Verapamil, Antiarrhythmic Agent, Pharmacokinetic Profile, PBPK Modelling

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Revolutionizing Pharmaceutical Quality Control: The Power of Automation

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The pharmaceutical industry is undergoing a transformative shift with the increasing adoption of automation in quality control processes. This abstract explores the impact of automation on enhancing quality control in pharmaceutical manufacturing, highlighting its benefits in terms of accuracy, efficiency, and compliance. Automation technologies, including robotics, process analytical technology (PAT), advanced data analytics, and real-time monitoring systems, are revolutionizing traditional quality assurance practices. These technologies reduce human error, streamline operations, and enable instant deviation detection against Good Manufacturing Practices (GMP) standards. Automated systems provide real-time monitoring and data management, facilitating rapid identification and correction of deviations. This allows for proactive quality control, ensuring consistent product quality and reducing the risk of product recalls. Automation also supports predictive analytics, enabling the prediction of potential issues and accelerating decision-making processes. This abstract presents a case study demonstrating the effectiveness of automated quality control systems in real-world industrial settings. The results highlight the significant improvements in product integrity, regulatory compliance, and operational efficiency achieved through automation. As the pharmaceutical industry continues to evolve, automation will play a crucial role in ensuring the production of high-quality, safe, and effective medicines for patients.

Keywords: Pharmaceutical Quality Control, Automation in Pharmaceuticals, Quality Assurance, Analytical Techniques, Process Optimization

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Assessing The Efficacy of HPTLC in the Simultaneous Quantification of Marmin, Psoralene, Umbelliferone and Skimmianine from *Aegle marmelos (L.) Corr.*: A Comprehensive Study

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Aegle marmelos (L.) Corr. is renowned for its traditional therapeutic applications. *Aegle marmelos (L.) Corr*. contains several coumarin alkaloids like marmin, psoralene, umbelliferone and skimmianine. This review presents a comparative analysis of method development for simultaneous quantification and estimation of umbelliferone, marmin, skimmianine and psoralene by High-Performance Thin Layer Chromatography of methanolic extracts of *Aegle marmelos (L.) Corr*.TLC analysis of the extract was performed using different solvent systems. The best analytical results were obtained for the solvent system Toluene: Ethyl Acetate: formic acid that show the observed Rf values of Marmin, Umbelliferone, Psoralene and Skimmianine in the extract comparable to their standard Rf values. Literature review on HPTLC analysis with precoated silica gel 60 F254plateswas performed using different solvent system like Toluene: Ethyl Acetate: Formic acid; Toluene: Ethyl Acetate: Acetic acid; Chloroform: Methanol; Chloroform: Methanol:Formic acid; Toluene: Methanol; Ethyl Acetate: Petroleum Ether: Formic acid. Best analytical outcomes were obtained with the solvent system Toluene: Ethyl Acetate: Formic acid; with the Rf values of Marmin, Umbelliferone, Psoralene and Skimmianine comparable to the Rf values of the standard compounds. This therefore demonstrates the validated approach for the simultaneous estimation of these compounds in *Aegle marmelos (L.) Corr* by HPTLC.

Keywords: *Aegle marmelos*, Psoralene, Umbelliferone, Skimmianine, HPTLC.

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Gender-Dependent Pharmacokinetic Variability of Montelukast: Implications for Dosing and Treatment using PBPK modelling

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Montelukast, a widely prescribed leukotriene receptor antagonist for asthma and allergic rhinitis, exhibits significant pharmacokinetic variability between genders, potentially impacting therapeutic efficacy and safety. The aimed of this study is to develop a physiologically based pharmacokinetic (PBPK) model for Montelukast using PK-Sim® software to predict gender-dependent pharmacokinetic changes in humans. The PBPK model incorporated essential physiological parameters, including blood flow rates, organ weights, and tissue composition, to simulate the drug's absorption, distribution, metabolism, and excretion (ADME) processes. The model was validated against published clinical data, demonstrating its accuracy in predicting drug behaviour in different populations. The model revealed notable differences in Montelukast pharmacokinetics between males and females. Females had a higher peak plasma concentration (In female Cmax 0.30 µmol/l, inmale Cmax 0.26 µmol/l)and greater total systemic exposure compared to males. The half-life was slightly shorter in females[In females t1/2 5.19 and in males t1/2 5.64], while the volume of distribution (Vd) was higher in males[In males 308.54 ml/kg and in females 333.64 ml/kg]. These results highlight the relevance of gender-specific data in advancing personalized medicine. This study successfully developed a PBPK model for Montelukast, providing valuable insights into the pharmacokinetics of this drug and its potential interactions, especially in different genders. The findings emphasize the importance of considering gender-related differences in drug metabolism and clearance when prescribing Montelukast. The model can be further utilized to optimize dosing regimens and minimize adverse effects in different patient populations.

Keywords: Montelukast, PBPK Modelling, Pharmacokinetics, Gender Differences, Personalized Medicine.

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Early Detection and Tracking of Insulin Aggregation: A Novel Approach Using Carbon Nanomaterial-Based Biosensors

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The rising prevalence of diabetes underscores the urgent need for early detection and monitoring of insulin aggregation, a key factor in disease pathogenesis. This review explores the development and application of innovative fluorescence-based biosensors utilizing the unique properties of carbon nanomaterials for sensitive and specific detection of insulin aggregation. Carbon nanomaterials, including graphene oxide, carbon nanotubes, and fullerenes, exhibit exceptional optical and electrical properties, enabling the creation of highly effective biosensing systems. These materials facilitate Förster resonance energy transfer (FRET) processes, significantly enhancing fluorescence signals and enabling the detection of aggregated insulin at low concentrations. Functionalization of carbon nanomaterials with insulin-specific aptamers or antibodies further enhances selectivity, providing a robust platform for real-time monitoring in complex biological environments. This review comprehensively examines recent advancements in sensor design, emphasizing key factors such as stability, sensitivity, and response time. It highlights strategies for mitigating common challenges like nonspecific binding and signal interference from endogenous biomolecules. The integration of fluorescence-based biosensors with microfluidic devices is also discussed, enabling multiplexed detection capabilities for simultaneous monitoring of multiple diabetes-related indicators. These cutting-edge biosensors have applications beyond diagnosis, offering potential for personalized medicine strategies in diabetes management. Continuous monitoring capabilities provided by these sensors can guide treatment decisions and improve patient outcomes. In conclusion, this review showcases the transformative potential of carbon nanomaterial-based fluorescence biosensors for early detection and management of insulin aggregation, paving the way for further research and practical applications.

Keywords: Insulin Aggregation, Fluorescence Biosensors, Carbon Nanomaterials, Förster Resonance Energy Transfer (FRET), Diabetes Diagnostics, Microfluidics

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Targeting DNA Repair to Combat Cancer Chemoresistance

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Cancer cells frequently develop resistance to chemotherapy by exploiting DNA repair mechanisms. This review explores the potential of targeting DNA repair pathways to enhance the efficacy of cancer treatment. DNA repair pathways, including homologous recombination (HR), non-homologous end joining (NHEJ), and base excision repair (BER), are essential for maintaining genomic stability. However, cancer cells often exploit these pathways to repair DNA damage caused by chemotherapy, leading to chemoresistance. By inhibiting these pathways, cancer cells become more susceptible to DNA-damaging agents. For example, PARP inhibitors target HR, and DNA-PK inhibitors target NHEJ. While targeting DNA repair holds promise, it is crucial to carefully balance the inhibition of these pathways in cancer cells with potential side effects on normal cells. Further research is needed to develop targeted therapies that effectively exploit this vulnerability in cancer cells.

Keywords: Cancer, Chemoresistance, DNA Repair, DNA Damage

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Comparative Analysis of Different Marketed Brands of Pantoprazole Tablets

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Recent CDSCO (Central Drugs Standard Control Organisation) reports reveal that various marketed brands of pantoprazole and other drugs fail to meet regulatory standards. Issues identified include inconsistencies in active ingredient potency, impurities(causing cancer), and inadequate labelling. These findings raise concerns about quality control and patient safety, prompting calls for stricter oversight and improved manufacturing practices in the pharmaceutical industry.The effectiveness, safety, and quality of many commercially available brands of pantoprazole tablets -a proton pump inhibitor that is frequently given to treat GERD and other acid-related conditions - are assessed in this study. Weight variation, thickness, diameter, hardness, dissolution profile, impurity testing, bioavailability, and testing of various commercially available formulations of pantoprazole (40 mg) were among the physiochemical parameters that were the focus of the current work. A thorough investigation was carried out, which included contrasting the active component concentrations, dissolution profile and pharmaceutical characteristics of several brands. To evaluate side effect profiles and therapeutic efficacy, clinical data and patient outcomes were examined. Results indicate significant variations in dissolution profile and bioavailability among brands, impacting clinical efficacy. The findings underscore the importance of brand selection in therapeutic management and suggest a need for regulatory oversight to ensure consistent quality in marketed formulations. This evaluation aims to provide healthcare professionals with insights to guide prescribing practices and improve patient outcomes.

Keywords: Quality, Pantoprazole, Regulatory, Efficacy

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Nanotechnology in Pharmacy

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Nanotechnology in pharmacy is revolutionizing drug development and delivery, offering targeted, efficient, and personalized treatment options. This technology manipulates materials at the nanoscale to create drug carriers, enhancing solubility, bioavailability, and controlled release. Nanoparticles, liposomes, and Nano emulsions are common vehicles used to deliver drugs directly to diseased cells, reducing side effects and minimizing damage to healthy tissues. In cancer therapy, for example, nanoparticles can selectively target tumors, improving therapeutic outcomes. Nanotechnology also facilitates crossing biological barriers like the blood-brain barrier, opening new possibilities for treating neurological disorders. Furthermore, nanostructured materials are being used in diagnostics, enabling early disease detection and precise monitoring of treatment responses. The small size and unique properties of nanomaterials allow for innovative designs in vaccine delivery, gene therapy, and regenerative medicine. However, challenges remain, such as understanding long-term safety, potential toxicity, and regulatory concerns. As research advances, nanotechnology holds promise to address complex health issues and improve patient outcomes in ways previously unattainable in pharmaceutical science.

Keywords: Nanoparticles, Gene therapy, Regenerative medicine, Blood brain barrier

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Revolutionizing Diabetes Management through Digital Integration

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The emerging burden of diabetes in the 21st century presents a major concern for the healthcare system worldwide. Uncontrolled diabetes and its associated complications have compromised the quality of life of the patients and also increased the chance of mortality. As a result, diabetes self-care education and adherence to treatment plans are considered essential elements in managing diabetes. The advancement of mobile applications, smartphones, cloud-based data platforms, and wearable devices has transformed digital health as far as glycemic control is concerned. Clinical studies revealed that digital interventions, including continuous glucose monitoring, diet management, and physical activity tracking, significantly improved the glycemic parameters of diabetic patients. A randomized controlled trial evaluated the effect of a smartphone app on glycated hemoglobin (HbA1c) levels in diabetes management, emphasizing significant HbA1c reductions in the intervention group after six months. The findings highlight the potential of digital tools to enhance glycemic control and patient care quality in diabetes management. Research also claimed that digital health interventions could effectively reduce the use of medication and the frequency of outpatient appointments, thereby lowering the healthcare cost for the patients. Adaptation of digital innovations, including connected glucose monitors and health apps has also revolutionized diabetes management in India. Nonetheless, challenges remain in technology accessibility, data privacy, and policy, underscoring the need for stronger adaptation and supportive policies in India's healthcare system. This article provides an overview of the integration of digital technologies in diabetes management, emphasizing both the benefits and limitations.

Keywords: Diabetes Management, Digital Health, Glycemic Control, Mobile Health Apps, India

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Role of Gut Microbiota in Migraine Pathophysiology: Exploring the Gut-Brain-Migraine Connection

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Migraine is a major cause of disability among adults and places a considerable economic strain worldwide. Various internal factors, like genetic variants and hormones, along with external influences, such as diet and medication, impact migraine intensity and frequency. Common triggers include stress, fatigue, skipping meals, sleep deprivation, and weather changes. Studies show that gut microbiota imbalance may impact migraine risk, with differences in microbial diversity observed in migraine sufferers, particularly among elderly women. Research reveals the increase in specific bacteria strains in migraine patients, while reducing the load of beneficial species, indicating shared migraine and gastrointestinal disorder pathways through inflammation and microbiota imbalances. Nitrates are common migraine triggers, and migraine patients show higher levels of nitrate-reducing bacteria, such as *Haemophilus* and *Rothia* species, in oral and fecal samples. Furthermore, migraine sufferers are found to exhibit reduced microbial diversity and gut metabolic functions, with an increase in certain *Clostridium* species (e.g., *C. asparagiforme, C. clostridioforme, C. bolteae*). Nitrates in food are broken down by bacteria in the mouth and gut, they are eventually converted into nitric oxide in the blood stream. Nitric oxide plays a vital role in the pathophysiology of migraine. It has been hypothesized that chocolate, one of the triggers for migraine attack, contains flavanols that stimulate endothelial nitric oxide synthase (eNOS) activity, resulting in nitric oxide-mediated vasodilation. This present review will try to explore the association of migraine with the gut microbiome. Understanding this pathophysiological correlation can aid in the prophylaxis of this condition.

Keywords: *Clostridium*, Gut-Brain Axis, Gut Microbiota, Migraine, Nitric Oxide

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Transforming Rheumatoid Arthritis Care: New Pathways to Precision and Relief

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Rheumatoid arthritis (RA) affects approximately 1% of the global population and is characterized by joint inflammation, pain, and potential disability. In the last decade, significant strides have been made in the management of RA through early diagnosis and targeted treatments, reducing long-term joint damage. Current treatments include conventional synthetic disease-modifying antirheumatic drugs (csDMARDs) like methotrexate, which remains a first-line treatment, alongside emerging biological and targeted synthetic DMARDs (bDMARDs and tsDMARDs) that target specific inflammatory pathways to achieve better disease control. In 2023, the integration of these therapies has shown a nearly 50% reduction in severe RA cases among patients with early intervention. Advancements include Janus kinase (JAK) inhibitors, a new class of oral tsDMARDs, and biologics targeting interleukin pathways, both effective in patients unresponsive to csDMARDs. The "treat-to-target" strategy—tailoring treatment to reduce disease activity—has improved remission rates, promoting better quality of life and reducing disability. In conclusion, while RA remains incurable, these advancements are revolutionizing its management. The focus on early intervention, alongside targeted therapies, is transforming RA from a potentially debilitating condition to one that is manageable with proactive treatment strategies, offering patients enhanced mobility and improved life quality. Ongoing research into personalized medicine is expected to further optimize treatment outcomes, offering hope for more precise and effective therapies in the near future.

Keywords: TNF, DMARD, Rheumatoid, Inflammation, Joint

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Typhoid Under the Lens: India's Journey Towards Control and Cure

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Typhoid fever, an acute systemic infection caused by Salmonella Typhi, is a major public health challenge in India. In 2021, an estimated 3.7 million cases and over 41,000 deaths were reported in the country, with a significant impact on children under 15, accounting for around 64% of cases. Poor sanitation and contaminated water remain key factors driving transmission, particularly affecting under-resourced communities. India also faces a notable rise in drug-resistant typhoid strains, further complicating treatment efforts. Recent advancements in typhoid prevention and treatment include the development of Typhoid Conjugate Vaccines (TCVs), which offer long-lasting immunity with a single dose. Introduced in Navi Mumbai's public sector in 2018, TCV campaigns have shown high efficacy and safety, preventing up to 85% of cases in children and demonstrating strong potential to reduce reliance on antibiotics. Furthermore, TCVs have gained support from global health organizations like WHO and GAVI, with efforts underway to include them in India's routine immunization program, especially for high-risk populations. In conclusion, while the burden of typhoid in India remains substantial, the introduction of TCVs represents a promising step toward comprehensive control. Expanding access to vaccines and improving sanitation infrastructure will be critical to reducing the typhoid incidence and mitigating economic and health burdens on vulnerable communities in India.

Keywords: *Salmonella typhi,* TCVs, Antibiotics, Immunization

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Review on Telemedicine: A Glimpse into the Future of Healthcare

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Growth rates of telemedicine, offering remote delivery of healthcare, have been high in recent times. This review examines where telemedicine is at and where it might be moving toward, including the inherent bottlenecks. Through modern digital technologies, telemedicine allows for remote consultations and observation and diagnosis, which promote access to healthcare services within underserved areas. As such, it has positively been used in managing the chronic conditions, mental disorder, and acute illness in patients. Still, technological and regulatory barriers and reimbursement issues will continue to plague telemedicine. But the future of telemedicine is bright indeed, especially with the advent of artificial intelligence, virtual reality, and wearable devices that promise to revolutionize healthcare delivery. AI diagnostic tools can make diagnoses more precise and faster, while virtual reality promises an immersive and interactive experience for the patient. Wearable devices allow for the continuous monitoring of vital signs and early warning signs for disease. Achieving the full exploitation of what telemedicine can offer may require a combined effort involving healthcare providers, policymakers, and technology experts. That potential could be leveraged toward overcoming challenges and embracing new innovations in making the system truly accessible, efficient, and patient-centered.

Keywords: Telemedicine, Technological Barriers, AI-Powered, Patient-Centered System

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Influence of Diet and Sedentary Lifestyle on Type 2 Diabetes Mellitus: A Call for Public Health Action

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Diabetes Mellitus (DM) is a disease of improper metabolism of carbohydrates, proteins, and lipids, due to lack of insulin hormone or insensitivity of cells to insulin, causing increased blood glucose levels. The global upsurge in type 2 diabetes mellitus (T2DM) is strongly correlated with lifestyle factors, including dietary patterns and physical activity levels. Sedentary lifestyles coupled with increased consumption of fast foods, have predisposed individuals to obesity, insulin resistance, and metabolic syndrome, all of which are risk factors for T2DM. Epidemiologic studies claim that the inclination for fast-food consumption contributes to increased susceptibility of individuals towards insulin resistance that ultimately results in the onset of T2DM. Besides these dietary habits, a lifestyle devoid of physical activity accompanied by a sedentary habit like prolonged sitting aggravates the risk for the disorder as it also perturbs glucose metabolism and lowers the level of sensitivity towards insulin. Effective dietary interventions with limited intake of processed foods and increased consumption of whole grains, lean proteins, and vegetables can restore insulin sensitivity and glycemic control. Clinical studies further highlight the effectiveness of physical activity in reducing the risk of developing T2DM through improved muscle glucose uptake and metabolic health improvement. This review hints at the need for public health interventions targeting active lifestyles and healthy dietary practices in bringing down the prevalence of T2DM linked to modern sedentary lifestyles. Therefore, exploiting the dual effect of dietary habits and physical inactivity is essential in alleviating the T2DM burden.

Keywords: Diabetes Mellitus, Insulin Resistance, Lifestyle Factors, Physical Inactivity, Type 2 Diabetes

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Antimicrobial Resistance: The Impact of Antibiotic Misuse and the Urgent Need for Public Awareness

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The development of antimicrobial resistance (AMR) is a natural process that occurs over time and it has become a global health issue. AMR stands for when microorganisms like viruses, fungi, and bacteria are no longer responding to antimicrobial medicines, thereby complicating the treatment outcome. Epidemiological studies have highlighted the higher prevalence of AMR in low- and middle-income countries (LMICs) as compared to high-income countries. India has a significant burden of AMR cases. Antibiotic misuse is the driver of AMR. The dominating force behind the rapid emergence and dissemination of AMR is the overall quantity of antibiotic use, which serves as an unnatural selective pressure on bacteria and enhances the possibility of the development of AM. According to the WHO, more than 50% of all antibiotic prescriptions worldwide are inappropriate. Furthermore, two-thirds of antibiotics available at pharmacies are used for self-medication, and it has become common in LMICs due to easy access through over-the-counter (OTC) purchases. Patients consume the antibiotics without consulting with a physician. Patients are unaware of the proper dose of antibiotics. This irrational use of antimicrobials is a significant contributor to AMR. It should be highly prohibited to keep any antibiotics as OTC drugs in the pharmacies. The unnecessary use of new-generation antibiotics is another factor for AMR. Public education along with strict regulations is needed to address the misuse of antibiotics to tackle the increasing threat of antimicrobial resistance and protect the health of the world.

Keywords: Antibiotic, Antibiotic Misuse, Antimicrobial Resistance, Over-The-Counter Drug, Self-medication

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Comprehensive Review on Prognostic Biomarker Ki-67 in Triple-Negative Breast Cancer

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Triple Negative Breast Cancer (TNBC), a diverse and aggressive subtype, represents a significant portion of the global breast cancer burden, with approximately 170,000 cases annually, accounting for about 10–20% of invasive breast cancers. TNBC is particularly aggressive, often presenting in younger women, with larger, higher-grade tumours. Immunohistochemical (IHC) analysis shows TNBC lacks estrogen (ER), progesterone (PR), and human epidermal growth factor 2 (HER2) receptors, and it is commonly associated with BRCA1 mutations. This review highlights the importance of Ki-67 as a biomarker for predicting and detecting tumour proliferation in TNBC. The Ki-67 Labeling Index (LI), expressed in all phases of the cell cycle except G0, correlates with tumour cell proliferation, where high Ki-67 levels in breast cancer are associated with rapid proliferation and poor prognosis. TNBC is also associated with epithelial-mesenchymal transition (EMT), a process that promotes metastasis in breast cancer, with EMT markers serving as significant indicators of metastatic potential. Clinical studies show high Ki-67 LI expression correlates with factors like the absence of ductal carcinoma in situ (DCIS), positive sentinel lymph node (SN) status, higher nuclear grade, invasive tumour diagnosis, advanced clinical stage, and worse survival outcomes. Ki-67 LI is now being explored as a predictive and prognostic biomarker for achieving pathological complete response (pCR) following neoadjuvant chemotherapy (NAC) in TNBC patients. Given the lack of targetable receptors in TNBC, traditional therapies face limitations. However, biomarkers like Ki-67 could lead to personalized treatment approaches, allowing for targeted drug delivery and overcoming resistance. This biomarker-driven approach may improve outcomes and reduce side effects in treating this challenging breast cancer subtype.

Keywords: Triple-Negative Breast Cancer, Ki-67, Metastasis, Adjuvant Chemotherapy, Targeted Therapy

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Self-Medication Surge: Unpacking India's Growing Trend and Its Implications

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Self-medication has become increasingly common in India, with individuals opting for over-the-counter drugs without professional guidance. This review examines the prevalence of self-medication across various Indian states, shedding light on trends, potential benefits, and associated risks. Recent data suggests that self-medication rates are as high as 60% in urban centers like Delhi and Mumbai, whereas in states such as Bihar and Jharkhand, the rate remains close to 40%, primarily driven by limited healthcare access and lower health literacy. Southern states like Kerala report 55% self-medication prevalence, often due to high literacy levels and easier access to drug information. The advantages of self-medication include convenience, reduced burden on healthcare facilities, and lower costs, which make it an appealing option for many. However, the practice also comes with significant drawbacks, including the risk of incorrect diagnosis, adverse drug reactions, antibiotic resistance, and possible misuse or overuse of medications. This trend poses a serious public health challenge, particularly in regions with limited regulatory oversight and high medication availability. In conclusion, while self-medication offers a level of autonomy for individuals, it requires strict regulatory control and public education to mitigate risks. Increasing awareness about the potential dangers of unsupervised medication use, along with promoting access to affordable healthcare, is essential for curbing the growth of this practice. Ensuring safe self-medication practices could support a more balanced healthcare approach in India, aligning self-care with professional oversight for better public health outcomes.

Keywords: Self-Medication, India, Healthcare, Pharmacy, Over-The-Counter

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Pharmacist: An Integral Part of Healthcare

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Pharmacists play a vital role in healthcare by ensuring the safe and effective use of medications. Their responsibilities extend beyond dispensing drugs; they act as a bridge between patients and physicians, offering expert advice on medication use, dosage, and potential side effects. Pharmacists also promote patient education, counselling individuals on chronic disease management, adherence to prescriptions, and preventive care, such as vaccinations. In hospitals and clinical settings, pharmacists collaborate with other healthcare providers to develop treatment plans and monitor patient outcomes, ensuring drug therapies are optimized and adjusted according to individual needs. Community pharmacists, on the other hand, are often the most accessible healthcare professionals, providing immediate consultations and addressing over-the-counter medication queries without appointments. Moreover, pharmacists play a crucial role in public health by contributing to immunization programs, managing drug shortages, and advising on lifestyle changes that promote wellness. Their involvement in pharmacovigilance—monitoring the safety and effectiveness of drugs—helps reduce medication errors and adverse events. With the rise of personalized medicine, pharmacists now engage in pharmacogenomics, tailoring drug regimens based on genetic profiles. In conclusion, pharmacists are integral to the healthcare system, enhancing patient care by ensuring medications are used effectively, safely, and efficiently. Their diverse roles, from direct patient care to public health advocacy, demonstrate their indispensable contribution to improving health outcomes at both individual and community levels.

Keywords: Pharmacist, Medication Safety, Pharmacogenomics, Public Health, Immunization, Accessible Healthcare

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The Rise of Edible Water: A Revolutionary Solution to Plastic Pollution

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Edible plastic water is a sustainable and eco-friendly alternative to traditional plastic bottles, encapsulating water within a thin membrane made from seaweed extracts or plant-based polymers. This method reduces single-use plastic pollution and addresses health concerns related to microplastic contamination. The gelation process ensures portability and flexibility, and its absence of petrochemicals or synthetic polymers addresses microplastic contamination risks. Edible water blobs are transparent sachets made from brown algae extract and calcium salt, containing water inside. They are made using ice mold, melting into liquid water and forming a watertight seal. The gelation process ensures portability and flexibility, and its absence of petrochemicals or synthetic polymers addresses microplastic contamination risks. Future research aims to improve scalability, affordability, and consumer acceptance, promoting a circular economy and a sustainable future. The Skipping Rocks Lab introduced 'ooho! Bubbles' to reduce plastic bottle usage by encapsulating water within an edible seaweed membrane. The membrane can be consumed with the encapsulated water or decomposed naturally. Plastic pollution is increasing, making the environment vulnerable. Edible water balls offer environmental and health benefits, but acceptance is a major concern. Marketing strategies should focus on environmental sustainability and corporate social responsibility for society and the environment. They can compete with plastic water bottles and are low-priced due to their easy manufacturing process. They can be used at large events to reduce pollution and promote sustainability.

Keywords: Edible Water, Biodegradable Plastic, Microplastic Pollution, Gelation Process, Circular Economy

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A Review on Transforming Shell Waste into Sustainable Chitosan for Enhanced Enzyme Immobilization

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Shell trash is a major environmental risk, but it also presents an opportunity for the production of commercially viable goods like chitin. N-deacetylation transforms chitin into chitosan, a substance that is highly valuable in the food and bioengineering sectors for uses like controlling drug delivery, immobilising enzymes, encapsulating active food ingredients, and stimulating plant growth in agriculture. The special qualities of chitosan, such as its non-toxicity, biodegradability, biocompatibility, and bioactivity, make it perfect for a variety of uses. It has potential for sustainable agriculture and food preservation, particularly as an antibacterial agent and defence elicitor. When compared to free enzymes, chitosan-based materials (such as films, nanoparticles, and nanocomposites) also improve enzyme immobilisation, which results in higher biocatalytic activity, significant operational stability, and reusability. This strategy promotes industrial innovation and environmental sustainability by showcasing an efficient way to recycle trash and developing bioprocessing technologies. Additionally, the creation of chitosan nanofibers and nanoparticles was presented. The future potential of nano-structured chitosan carriers for enzyme immobilisation and bioactive chemical encapsulation were examined, along with some of the issues that have been encountered. However, due to their expense and storage issues, immobilised enzymes are still not being commercialised at the same rate. In order to broaden the scope for all-around use, research should concentrate on overcoming the present immobilisation technique restrictions. Immobilised enzymes will be essential in the future for a number of industries, including fuel, chemicals, food, and pharmaceuticals.

Keywords: Chitin, Chitosan, Enzyme Immobilization, Reusability, Drug Delivery

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A Review on the Role of 3-D Printing in Pharmaceutical Industry

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This review talks about the change that 3-D printing technology has brought on the pharmaceutical manufacture, especially as its application on the development of drugs, personalized medicine, and manufacturing of dosage forms. It has offered a potential towards personalization of drug formulations, optimization of drug delivery systems, and more patient-specific treatment. 3-D printing of pharmaceuticals is revolutionizing by making every individual receive their own personalized drug product. This is a turning point in 3-D printing technology, and it directly benefits patients, pharmacists, and the industry since it allows on-demand designing and production of flexible formulation with personalized dosages in shapes, sizes, drug release, and multiplicity of drug combinations. The integration of 3-D printing into clinical practice shall require healthcare staff, including but not limited to, physicians, nurses, pharmacists, and pharmacy technicians to take the lead. This article is about 3-D printing in pharmacy in terms of additive manufacturing, clinical trials, digital health, patient-centric formulations, and precision medicine. It has opened up more options in personalized medicine that makes it possible to print customized dosages based on patients' needs and even their genetic makeup. Pharmaceutical industries are investing in 3-D printing technologies, as pharma companies work to make drug discovery and development processes faster and shorter.

Keywords: Additive Manufacturing, Clinical Trials, Digital Health, Patient-Centric Formulations, Personalized Medicine, 3D Printing

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An Evaluation of "Banana Peels" as A Plastic Substitute

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The plastics are used for packaging accoutrements because of their strength, inflexibility, and low cost. Still, it is one of the topmost environmental issues and a serious mortal health issue due to its non-biodegradable nature. Lignocellulosic residue from biowaste can be considered as a volition due to its robust structure, biocompatibility, biodegradability, low viscosity, and on-toxicity. With an adding demand for food products, the quantum of fruits and vegetables waste produced is tremendous. There are multitudinous forms of plastic wastes, panels, and flicks. It is affordable, commercially feasible, and plastic flicks can be produced by banana peels as light weight, strong material visually seductive with flexible size and shape for biodegradable plastics. Biodegradable plastics also contribute to bridling plastic pollution, which is an adverse effect on lands, aqueducts, and the abysses. This exploration will develop and produce biodegradable plastic using banana peels, thereby reducing environmental pollution, and replacing synthetic plastics. The banana peel fibre could help design and develop biodegradable flicks and give a sustainable result to limit the adverse goods of plastics. Experimenters have now come up with the concept of using food waste to develop biodegradable plastic flicks, which would reduce environmental pollution and replace synthetic plastics. Synthetic plastics contain dangerous chemical composites that are not biodegradable, therefore making waste banana peels an implicit raw material to produce a new value- added biodegradable plastic.

Keywords: Biodegradable Plastic, Lignocellulosic Residue, Commercially Feasible

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Revolutionizing Healthcare: The Impact of 3D Printing on Health Care System

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3D printing technology is transforming the healthcare system with innovative, patient-specific personalized solutions in many medical applications. Advanced 3D manufacturing techniques enable the production of customized prosthetics and implants based on the individual anatomy of patients, thereby greatly improving comfort functionality and production time. It even has improved surgical planning and practice with the use of patient-specific imaging in 3D-printed models as they allow exact pre-operational preparation and training in practice. Applications of bioprinting are advancing regenerative medicine and allowing the creation of tissues and organs with high promise for transplantation of various organs. 3D printing is also simplifying the production of medical devices and tools, and customized surgical instruments can be produced very quickly and precisely, which reduces costs. In the pharmaceutical field, it can develop innovative drug delivery systems that will enable personalized dosing and formulation designs. The adoption of 3D printing in dental care, especially for manufacturing patient-specific orthodontic appliances and dental restorations, demonstrates its great ability to improve treatment success. Equally, for orthopaedics, with bone scaffolds and spinal implants manufactured via 3D printing, healing and acceptance into the body are generally enhanced. Although challenges and issues still exist in trying to ensure biocompatibility, and meeting regulatory standards in mass production. 3D printing is very likely to revolutionize and improve surgical precision, reduce the complexity of developing new drugs, and have a transformative impact on the future of healthcare.

Keywords: 3D Printing, Healthcare Innovation, Bioprinting, Personalized Medicine

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Wearable Biosensors for Monitoring Hypertension Drug Levels: A Brief Review on the Development of Personalized Therapy

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Hypertension, a chronic condition of persistently elevated blood pressure, poses a major health risk worldwide, often leading to heart disease, stroke, and significant mortality worldwide. Early detection, through cardiac biomarker and heartbeat monitoring, is essential for effective management. Conventional monitoring techniques, which require drawing blood periodically, are hindered by their intrusive nature, delays, and difficulties in adjusting medication dosages on the spot. Innovations in nanotechnology and bioelectronics, wearable biosensors have emerged as a game-changing technology, offering a non-invasive, quick, and continuous way to track drug levels, opening up new avenues for tailoring treatments for chronic conditions. This review study explores how advanced sensor technology enables wearable biosensors to continuously track concentrations of blood pressure-lowering drugs by detecting biomarkers present in sweat, interstitial fluid, or saliva. The collected data is relayed to a connected smartphone, where advanced machine learning algorithms analyze drug pharmacokinetics, predict fluctuations, and provide recommendations for personalized dosage adjustments. This ongoing information flow empowers doctors to make precise, individualized treatment choices, enhancing treatment success while minimizing adverse effects. It is anticipated that wearable biosensors can transform hypertension management by facilitating frequent measurements across diverse settings, making it possible to identify high-risk individuals with hidden hypertension or irregular blood pressure patterns. Such technology represents a major advancement in chronic disease care, enabling highly personalized treatment strategies. In sum, wearable biosensors offer a promising, patient-friendly approach to managing hypertension and related cardiovascular diseases, setting new standards for improved health outcomes on a global scale.

Keywords: Hypertension, Biomarkers, Wearable Biosensors, Drug Levels, Personalized Treatment

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Recent Outlook on Yoga to Prevent Osteoarthritis in Respect of Medicinal Cost

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Yoga is essential for a spiritual discipline and focuses on bringing rhythm between mind and body. It is a way of living healthy. This is a series of body postures and poses that we do with breathing techniques. Regular yoga practice creates mental peace and calmness and keeps our bodies healthy. Meditation along with yoga increases body awareness and relieves stress. Hence, with yoga, we can relax our minds and increase the concentration of the mind. In osteoarthritis, yoga also helps by reducing joint pain by improving joint flexibility and function and lower stress and tension to promote better sleep for patients. In osteoarthritis, the medication cost is too high and it is taken for a long duration of time which is very painful and cost-effective for patients. Through some experiments, it is proved that yoga reduces a lot of troubles in osteoarthritis besides usual treatments and medications to improve the condition of the patient and helps by reducing the cost of medication during treatment. So many yoga postures can reduce the pain of osteoarthritis like breathing practices, loosening practices like twisting, side bending, knee cap tightening, knee bending, cycling, straight leg raising, bhujangasana, salabhasana, etc. Pranayama (yoga breathing), meditation like AUM-Kara chanting, Om meditation, cyclic meditation, and mind sound resonance techniques are also helpful to get benefits in osteoarthritis like diseases and with that, helps in calmness of mind as well. Hence can conclude that yoga reduces patient compliance related to pain as well as the cost of medicine.

Keywords: Osteoarthritis, Yoga, Cost of Medication

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Transformational Automated Treadmill: An Innovative Approach in Future Research

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The most common changes to the body caused by diseases and disorders such as diabetes, ischemic stroke, and cancer can be treated with active pharmaceutical molecules that incorporate exercise ergometry into their treatment study phases for improved results. These molecules aid in rehabilitation procedures, automating the use of sensors such as treadmills. This approach aligns with the 5R concept in preclinical research and clinical trials, providing patients with adaptable treatments that aid in restoring their movement and cognitive abilities. It also facilitates remote sensor processing with a single click, significantly enhancing both physical and mental health outcomes. With the assistance of sensors such as dual-tone multi-frequency (DTMF), infrared, speed control, touch and motion sensors, and a transformative treadmill that alters its shape, users can utilize it in various ways. This transformation also enables it to compactly store various items.

Keywords: Transformational gadget, DTMF sensor, Ischemia, Diabetes

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E-Learning Evolution: Assessing India's Post-COVID Education Shift

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The COVID-19 pandemic triggered a rapid shift to e-learning, transforming educational systems across India. This review examines the impact of this transition on Indian students and teachers, highlighting both statistical insights and critical evaluations of e-learning benefits and limitations. Post-COVID, India has seen significant growth in digital education, with states like Maharashtra, Uttar Pradesh, and Tamil Nadu leading in online course enrolments, showing increases of 70%, 65%, and 60% respectively in 2021. However, disparities in digital access remain prominent; while urban areas report 80% online learning access, rural regions lag at 30%, revealing the digital divide within states like Bihar and Jharkhand. The benefits of e-learning are clear, including flexibility, broader access to resources, and the convenience of remote education, which collectively enhance learning experiences for both students and educators. Yet, disadvantages like limited social interaction, increased screen time, and inadequate digital infrastructure pose serious challenges. A shortage of digital devices and reliable internet access continues to hinder participation in underdeveloped areas, contributing to learning inequities across the country. In conclusion, while e-learning post-COVID has revolutionized education by making it accessible and adaptable, there is a need to bridge the digital divide and address infrastructural constraints to maximize its potential. Government initiatives and investments in digital literacy and infrastructure can make e-learning a sustainable, inclusive, and equitable mode of education for India's diverse population.

Keywords: COVID-19, India, Pandemic, Learning, Education

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Precision Unveiled: Advances in Pharmaceutical Method Validation via Reverse Phase HPLC

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Method validation is a cornerstone of quality assurance in pharmaceutical analysis, ensuring the reliability, accuracy, and reproducibility of analytical data essential for regulatory compliance. Among various chromatographic techniques, Reverse Phase High-Performance Liquid Chromatography (RP-HPLC) has emerged as a preferred method for the quantitative and qualitative assessment of complex pharmaceutical compounds. This review explores recent advancements and best practices in method validation for RP-HPLC, highlighting key parameters such as specificity, linearity, accuracy, precision, limit of detection, and limit of quantitation. Emphasis is placed on validation requirements defined by ICH, FDA, and USP guidelines, providing insights into the standardization processes that underlie method robustness and reliability. The review also discusses the influence of matrix components, analyte stability, and system suitability tests on the validation of RP-HPLC methods, with a focus on challenging compounds like peptides, small molecules, and biologics. Furthermore, it addresses modern trends in validation protocols, including the use of chemo-metrics and automated data analysis, which streamline method development and reduce validation timelines. By analysing these advances, this review aims to guide researchers and quality analysts in optimizing their approach to RP-HPLC validation, ultimately contributing to more efficient, compliant, and innovative pharmaceutical analysis.

Keywords: Analytical method, Validation, RP-HPLC, Pharmaceutical, Analysis

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Effect of Taro Bio-Wax as Edible Coating on the Improvement of Shelf-Life of Fruits

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Taro (*Colocasia esculenta*), a traditional herbal plant from the Araceae family, has been used for centuries in traditional medicine and food due to its carbohydrates, antitumor, anti-diabetic, antimicrobial, and anti-hepatotoxic properties. The surface of taro leaf is covered with a highly hydrophobic layer of bio wax which has various applications such as coating element, preparing hydrophobic paper bags, fruit coating edible film used as a packaging material etc. The aim & objective of extracting taro leaf wax using a simple methodology and to analyze the wax yield , hydrophobicity and to judge the potential of it to apply as a surface coating element on fruits. Samples of taro leaves were immersed in chloroform for three minutes at room temperature in order to extract the bio-wax. The process was then repeated for the same sample using fresh chloroform. The raw bio-wax solution was prepared using a rotary evaporator to evaporate the solvent. After dissolving the bio-wax in hot acetone, it is cooled to room temperature to obtain its crystalline form. The sample of bio-wax was characterized by some techniques such as ATR-FTIR , DSC , TLC, Contact angle measurement, hydrophobicity test etc. It is easy to find hydrophobic surfaces in biological form, particularly on plant leaves. The results unequivocally demonstrated that 1-octacosanol, the primary constituent of taro wax and the cause of its hydrophobic qualities, is present. Taro wax, a plant-based hydrophobic substance, can be a sustainable and renewable resource to preserve for fruit surface edible coating components.

Keywords: Taro Leaf, Bio-Wax, Hydrophobicity, Coating, 1-Octacosanol

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Nutrition and Its Relation with Human Body

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Nutrition is the science that deals with the interaction of food in relation to the well-being of the person. It is the process of ingestion, consuming food or breaking down food particles to convert it into energy and absorbed by the body for further body functioning. Proper nutrition and a balanced diet are important for the human body. For proper nutrition, the human body needs proper nutrients such as proteins, carbohydrates, fats, vitamins, minerals, water and fibres. Such nutrients help to promote good health, provide energy to the body, and regulate body function and the total well-being of a person. The nutrients required by the body are macronutrients and micronutrients. Macronutrients are the nutrients that the body needs in large amounts to function properly and remain healthy. They are classified into carbohydrates, fats, proteins, and water. Whereas micronutrients are the nutrients that the body requires in less amounts to aid growth and development. They include vitamins and minerals. Types of nutrient sources include carbohydrates [cereals, banana, bajra], proteins [egg, meat, dry fruits, nuts], fats [milk, butter, curd, ghee], vitamins [A, D, E, K, B Complex, C], minerals [calcium, potassium, sodium, magnesium, chromium, iron, etc.], fibre and water. Therefore, nutrition is important for every human being and should be taken as a properly balanced diet regardless of age, body type, and gender. Nutrition is an indispensable part of a healthy lifestyle, and its importance can't be overlooked. But every individual should maintain it to remain free from crucial diseases.

Keywords: Nutrition, Nutrients, Body, Energy

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Precision Medicine- A Tailored Made Medicine for Future Healthcare System

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In the field of human genome research the development and advancement have explored a newer avenue which directs modern medicinal practices to transform healthcare. The data of human genomic sequencing leads to the discovery of tailored medicine known as precision medicine. It is a new approach to optimizing health treatment through genomic profiling, DNA Sequencing strategies and analysis of AI based algorithms. It needs both genomic tools that are "precise" and "accurate". It deals with the etiology of disease at molecular levels to identify potential drug targets and markers to fight against the disease. The precision medicine concept attributes a paradigm shift in the healthcare system moving away from one-size-fits all concept to pharmacogenomics-based tailoring of therapy, one in the science of DNA and the other is in the science of management of large data sets. The development of precision medicine is on the rise. The drugs which can target specific genetic, molecular and cellular markers and provide patients with personalized and targeted treatments are highly attractive to each and every drug developer. Precision medicine makes an effort to understand the underlying causes of the disease in individual patients. The application of personalized medicine is found in certain oncological disorders, genetic disorders, epilepsy, cystic fibrosis and certain Mendelian disorders. The approach of precision medicine will become a part of routine health care in the near future with better treatment strategies. Thus, the understanding of genomic anatomy and whole–genome sequencing will be capable of developing some pharmacogenomics-based molecular markers, which can revolutionize patient care by personalizing or tailoring the therapy.

Keywords: Precision Medicine, Genomic Sequencing, Tailored Medicine, Pharmacogenomics, Personalized Treatments

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Beyond the Pandemic: Unlocking Digital Potential for Medical Professionals in India

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The COVID-19 pandemic accelerated the adoption of digital platforms among medical professionals in India, reshaping healthcare delivery and fostering new opportunities. Telemedicine, e-learning, and digital consultations became vital, with a 60% increase in telemedicine consultations nationwide. Maharashtra, Karnataka, and Tamil Nadu led with adoption rates of 75%, 68%, and 66%, respectively, showing the significant state-wise variance driven by infrastructure and digital literacy. These platforms enhance access to healthcare in remote and underserved areas, reducing patient travel by 40% and saving up to 30% of time for healthcare providers. Digital platforms offer multiple benefits for medical professionals, including remote patient monitoring, continuous professional development, and ease of collaboration. Around 85% of Indian doctors surveyed post-COVID-19 believe that digital tools enhance patient engagement, with 72% favoring their continued use. However, there are challenges, including data security concerns, internet access disparities (especially in rural areas), and reduced physical interactions, which can impact patient rapport and diagnosis accuracy. Despite these drawbacks, digital platforms have transformed Indian healthcare, making it more accessible and resilient. In conclusion, while certain barriers remain, the post-pandemic era presents an opportunity to build on the digital foundation, enhancing healthcare quality and equity across India. Strategic investments in digital infrastructure and cyber security can support sustainable growth, ensuring that all regions benefit from this digital evolution in healthcare.

Keywords: COVID-19, Healthcare, Digital, India, Telemedicine

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Development of Biodegradable Antibacterial Films Containing Nicotinamide and Ofloxacin

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A wound is defined as a defect that results from physical or thermal damage or as a result of any basic medical or physiological conditions. Wounds can be categorized as either acute or chronic. For doctors, patients, and their families, chronic wounds present significant complications. Dressings are used to manage chronic wounds and non-healing wound causes. Even though there are many different kinds of dressings, each kind of wound requires a specific type. Wound dressing films are currently being used extensively for the treatment of various types of wounds. This film dressing not only provides a protective barrier against external contaminants but also reduces the risk of wound infections. More importantly, moisture vapor and oxygen-permeable properties of dressing films are exclusively required for minor burns and superficial wounds with no or a small amount of exudates. This study aimed to prepare and evaluate a novel film wound dressing based on an Alginate, Nicotinamide, and Ofloxacin blend. The most promising possibility is the combination of Nicotinamide and Ofloxacin used in the preparation of films plays a vital role where Nicotinamide acts as a tissue regenerating agent to speed the skin recovery and Ofloxacin, an antibiotic has beneficial effects on the wound healing process.

Keywords: Wound Dressings, Nicotinamide, Ofloxacin, Collagen Synthesis, Fibroblast Proliferation

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A Brief Review on Antimicrobial Activity of Eucalyptus Oil Extracted from *Eucalyptus globulus* Leaves

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Eucalyptus globulus a widely observed plant has a tremendous application in terms of medicinal uses. *Eucalyptus globulus* plant from the family Myrtaceae, commonly known as blue gum. Its rich sources of phytochemical constituents contain flavonoids, alkaloids, tannin, and Phenylpropanoids, which are present in the leaves, stems, and roots of this plant. Eucalyptus oil contains 1,8-cineole, Citronellyl acetate, and other compounds that express medicinal properties such as antiseptic, anti-inflammatory, antibacterial, antifungal, and numerous other properties. However, we will discuss the antimicrobial activity of Eucalyptus oil extracted using hydro distillation. The essential oil extract from eucalyptus leaves consisted mainly of oxygenated monoterpenes, monoterpenes, and oxygenated sesquiterpenes. Of these, 1, 8-cineole (72.71%), α- terpineol (2.54%), Terpiene-4-ol (0.34%), and linalool (0.24%) were the main oxygenated monoterpenes, while α-eudesmol (0.39%), Globulol (2.77%) and epiglobulol (0.44%) were the main sesquiterpene. The MIC assay (minimum inhibitory concentration) analyses the eucalyptus oil's antimicrobial activity. The Minimum Inhibitory Concentration Assay requires the minimum dose to kill bacteria. Oil extracted from *Eucalyptus globulus* exhibits high antimicrobial activity against all microorganisms like bacteria. Hydro distillation is a traditional method for extracting essential oils from plants by boiling plant material in water. This study demonstrates the efficacy of eucalyptus oil as a sustainable, natural solution for combating microbial infections. Future research can explore synergistic effects with other antimicrobials and optimize extraction conditions.

Keywords: *Eucalyptus globulus*, Antimicrobial Activity, MIC

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Qbd Approach on Analytical Method Development and Validation of Polyphenolic Compounds by RP-HPLC from Kiwi Fruit Extraction

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Kiwi fruit (*Actinidia chinensis Planch.*) seeds, often considered a by-product in the food and pharmaceutical sectors, are underutilized despite their rich content of phytochemicals, primarily phenolic compounds and ascorbic acid. Key phytochemicals include caffeic acid, gallic acid, syringic acid, salicylic acid, ferulic acid, and protocatechuic acid. This study focuses on developing a bioanalytical method using reverse-phase high-performance liquid chromatography (RP-HPLC) to accurately estimate syringic acid and chrysin acid from kiwi fruit extracts. Kiwi fruit is known for its extensive biological activities, such as antioxidant, anti-inflammatory, anti-microbial, anti-viral, anti-diabetic, anti-tumor, and anti-ulcer properties, along with beneficial effects on glycemic and lipid levels. While kiwi peels and cores are abundant in these phytochemicals, they are typically discarded. Chrysin acid is noted for its anti-inflammatory and anti-cancer properties, while syringic acid is utilized in various industrial applications, including bioremediation and detoxification processes. The aim of this research is to enhance the extraction of these beneficial compounds for improved human health applications. The method developed will be applicable for pharmacokinetic studies and bioavailability evaluations, promoting a more effective use of kiwi fruit by-products. Overall, this work highlights the potential health benefits and industrial applications of phytochemicals derived from kiwi fruit.

Keywords: Analytical method development, validation, kiwi fruit, RP-HPLC, polyphenolic compounds

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The Role of Pharmacogenomics in New Drug Development

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With the arrival of pharmacogenomics, the face of contemporary drug development has changed, and it is now possible to design new drugs specific to individual genotypes. This new paradigm, departing from the old 'one-size-fits-all' model, has ramifications for increasing drug efficacy, minimizing side effects, and maximizing patient outcomes. Incorporating pharmacogenomics into drug development will enable researchers to discover genetic biomarkers that predict drug response, toxicity, and metabolism. This information makes it possible to develop treatments that attack only the bad cells, maximizing therapeutic benefits and reducing unwanted side effects. In addition, pharmacogenomics enables the creation of companion diagnostics, enabling the specific selection and stratification of patients. In clinical trials, pharmacogenomic-led approaches can help to optimize dosing regimens, minimize sample sizes, and speed up review times. Furthermore, this approach can also inform drug repurposing initiatives, unlocking new therapeutic potential from existing compounds. As the discipline matures, integrating pharmacogenomics into drug development pipelines will likely change the pharmaceutical industry forever, ushering in a new era of more effective, efficient, and personalized patient care around the globe.

Keywords: Pharmacogenomics, Drug delivery, Pharmaceutical Applications.

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A Systematic Review of Packaging Technologies Utilized in the Pharmaceutical Industry

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Pharmaceutical packaging is essential to healthcare because it maintains the purity of medications, guarantees patient safety, and complies with regulations. In addition to giving precise information on dosage, expiration dates, and safety warnings, it protects medications from environmental elements including moisture, light, and air that can compromise stability and efficacy. Smart solutions that enhance medication distribution and patient adherence have been made possible by advancements in packaging technology. Real-time tracking and monitoring are made possible by technologies like temperature indicators, NFC tags, and QR codes, which guarantee that pharmaceuticals are transported and stored properly. Features that are tamper-evident and child-resistant provide additional security by avoiding ingestion and preserving the integrity of the product. With a growing trend toward environmentally friendly products and procedures to cut down on plastic waste and improve recyclability, sustainability is currently a top priority. This brings pharmaceutical packaging into line with more general environmental objectives. Pharmaceutical packaging essentially promotes patient compliance, medication safety, and efficacy. Pharmaceutical packaging promises to further improve healthcare outcomes in the future as sustainability and technology spur additional innovation.

Keywords: Packaging, Safety, Compliance, Sustainability

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Development and Validation of A HPLC Bio Analytical Method with Qbd Approach for Determination of Polyphenolic Compounds of *Curcuma caesia* in Human Plasma

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Curcuminoids, such as curcumin, de-methoxycurcumin, and bisdemethoxycurcumin, are non-toxic polyphenolic compounds known for their diverse biological activities. Key phytochemicals in Curcuma oils include sesquiterpenoids and monoterpenoids. *Curcuma caesia*, or Black Turmeric, is a perennial herb native to Northeast and Central India, recognized for its bluish-black rhizomes. Traditionally, it has been used to treat conditions like muscle relaxation, hemorrhoids, leprosy, asthma, cancer, and epilepsy. *Curcuma caesia* offers numerous therapeutic benefits, including antioxidant and antimutagenic effects, anti-inflammatory properties, and efficacy against bacterial and fungal infections. It acts as a laxative and serves as a tonic for the brain and heart. Research indicates that its methanolic extract can mitigate toxicity from cyclophosphamide, protecting bone marrow, liver, and kidney cells in mice. Furthermore, extracts and synthesized gold nanoparticles (GNPs) from the plant have shown potential against breast cancer cell lines. In traditional Indian medicine, *Curcuma caesia* is utilized for various ailments, including asthma, tumors, bronchitis, and wounds. This highlights its importance in herbal medicine and the necessity for further research into its pharmacological properties. Additionally, the study aims to develop a bioanalytical method using reverse-phase high-performance liquid chromatography (RP-HPLC) for the precise estimation of curcuminoids. This method is intended to be sensitive, rapid, and straightforward, supporting pharmacokinetic studies and bioavailability assessments, thereby enhancing the understanding of curcuminoids' therapeutic applications.

Keywords: Method development, validation, *Curcuma caesia*, RP-HPLC, polyphenolic compounds

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From Sea to Science: Analyzing the Nutritional Potential of Fish Oil in *Marine Setipinna phasa*

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The marine environment is a rich source of nutritional compounds, with fish oil being a prominent example. Among various fish species, *Setipinna phasa*, commonly known as Indian oil sardine, holds significant potential due to its high oil yield and nutritional benefits. The present study investigates the nutritional potential of fish oil derived from *Setipinna phasa*, commonly known as Indian oil sardine. The research focuses on the isolation of fish oil, its physicochemical properties, and characterization through Gas Chromatography-Mass Spectrometry (GC-MS). Fish oil was extracted using the solvent extraction method, yielding a high-quality oil rich in essential fatty acids, primarily eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Physicochemical analyses, including density, viscosity, and acid value, were conducted to assess the oil's stability and quality. The GC-MS analysis revealed a comprehensive profile of fatty acid composition, confirming the predominance of omega-3 and omega-6 fatty acids, along with trace amounts of other beneficial compounds such as antioxidants and vitamins. These findings highlight the significant nutritional benefits of *Setipinna phasa* fish oil, emphasizing its potential applications in nutraceuticals, food products, and cosmetics. The study underscores the importance of sustainable practices in harvesting and processing this marine resource, paving the way for further exploration of its health benefits and commercial viability. Overall, this research contributes to the understanding of marine resources in nutrition and promotes the utilization of fish oil in various industries.

Keywords: Fish Oil, Essential Fatty Acids, Anti-Obesity, Nutraceuticals, Gas Chromatography-Mass Spectrometry

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Cissus Quadrangularis: A Natural Solution to Accelerate Bone Healing

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The perennial climbing herb known as *Cissus quadrangularis* (CQ), commonly referred to as "hadjod," is native to warmer regions, particularly in India, and has been utilized in Ayurvedic medicine for many years. This particular herb has gained much focus as a potential agent toward promoting bone health and helping the healing process. Originally a product of ancient practices from Ayurveda, this particular *Cissus quadrangularis* (CQ), referred to as "Asthishrunkhala," was used as one of the oldest remedies that had been used to deal with broken bones and even other diseases related to bone issues. The hypothesis behind its osteoprotective and anti-osteoporotic properties is related to the influence of different biological pathways involved in bone metabolism. Although bone fractures spontaneously repair, mineral deficiencies, old age degeneration, various diseases, or diminished blood flow can delay healing. CQ recently revealed stimulation of the repairing bone mechanisms, which may overcome the complications from these factors. Though its exact mechanisms of action are not fully elucidated, CQ's multifaceted properties of the compound as an antioxidant, anti-inflammatory agent, analgesic, and antimicrobial may contribute to its therapeutic potential. In modern scientific research, deepening knowledge about bone health, CQ has appeared as a promising natural compound that could complement conventional treatments.

Keywords: *Cissus quadrangularis,* Hadjod, Anti-inflammatory, Analgesic Asthishrunkhala, Osteoprotective

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Regulatory Gaps in the Cosmeceuticals Industry: Protecting Consumers from Misleading Claims

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The cosmeceuticals industry, blending cosmetic and pharmaceutical properties, has grown exponentially, yet it faces significant regulatory gaps that expose consumers to misleading claims. This paper examines the current landscape of cosmeceutical marketing and the inadequacies in regulatory frameworks that fail to adequately protect consumers. Unlike pharmaceuticals, cosmeceuticals are not subject to rigorous pre-market testing or approval processes, leading to a proliferation of products with exaggerated efficacy claims and ambiguous ingredient labelling. The lack of clear definitions and standards for what constitutes a cosmeceutical complicates consumer understanding and enables misleading advertising practices. Additionally, the influence of social media and celebrity endorsements exacerbates the issue, often promoting products without adequate scrutiny of their claims. The present study highlights the need for stricter regulations and oversight to ensure that cosmeceuticals are accurately represented and that consumers are not misled by false promises. By analysing existing regulatory frameworks and their shortcomings, the study proposes suitable recommendations for policymakers to enhance consumer protection. These include the establishment of clear labelling requirements, mandatory clinical evidence for efficacy claims, and the implementation of educational initiatives aimed at informing consumers about their rights and the realities of cosmeceutical products. Addressing these regulatory gaps is crucial for fostering trust in the industry and ensuring that consumers can make informed choices in their pursuit of beauty and skincare.

Keywords: Misleading Claims, Cosmeceuticals, Regulatory Frameworks, Advertising Practices

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Blood Coagulation Disorders and Herbal Interventions: The Role of *Allium sativum*

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Blood coagulation disorders, which encompass a range of conditions affecting the body's ability to clot effectively, pose significant health risks, including excessive bleeding or thrombosis. The present study explores the potential of herbal interventions, specifically focusing on *Allium sativum* (garlic), known for its medicinal properties. *Allium sativum* has been traditionally used for its cardiovascular benefits, and emerging evidence suggests its efficacy in modulating blood coagulation pathways. This study synthesizes current literature on the anticoagulant and antiplatelet effects of *Allium sativum*, highlighting its active compounds, such as allicin and ajoene, which are believed to contribute to its therapeutic effects. Experimental studies demonstrate that garlic can inhibit platelet aggregation, enhance fibrinolysis, and improve endothelial function, thereby reducing the risk of thrombotic events. Despite promising findings, the need for standardized dosages and further clinical trials is emphasized to establish effective protocols for using *Allium sativum* in the management of blood coagulation disorders. This study underscores the potential role of *Allium sativum* as a complementary therapeutic option in treating coagulation disorders, paving the way for integrating herbal remedies into conventional medical practices for better patient outcomes.

Keywords: Anticoagulant, Phytochemicals, Natural Anticoagulants, Prothrombin Time

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Coconut Chronicles: Unlocking the Healing Secrets of Nature's Versatile Super fruit

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Coconut (*Cocos nucifera*), often termed the "Tree of Life," has long been valued for its diverse therapeutic applications. This review explores the various parts of the coconut like fruit, oil, water, shell, and leaves focusing their rich phytoconstituents, which are increasingly utilized in healthcare and pharmaceutical products. Coconut oil, derived from the kernel, is high in lauric acid, capric acid, and caprylic acid, known for their antimicrobial and anti-inflammatory properties, making it ideal for skincare formulations and wound healing products. Coconut water, rich in cytokinins, potassium, and L-arginine, serves as a natural rehydration solution with antioxidant and cardioprotective benefits. The coconut shell contains lignin and tannins, which have potential applications in dental care products for their antimicrobial effects. Additionally, coconut leaves are known for flavonoids and alkaloids, which exhibit anti-diabetic and anti-inflammatory properties, suitable for complementary treatments in metabolic health. Coconut husk fibre, containing phenolic acids, is explored in wound dressings and antimicrobial pads due to its resistance to microbial growth. In conclusion, the coconut and its derivatives hold immense promise as pharmaceutical ingredients, combining natural efficacy with wide availability. This review highlights how each component's phytoconstituents contribute to health-enhancing applications, underscoring coconut's role as a versatile and sustainable resource in healthcare. With further research and standardization, coconut-based products can expand into new therapeutic areas, providing accessible, natural healthcare options worldwide.

Keywords: Coconut, Cardioprotective, Skincare, Natural, Healthcare

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Taro Leaf: A Rich Source of Essential Nutrients for Health and Immunity

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Taro leaves, widely available in tropical and subtropical regions, are gaining recognition as a valuable component of a balanced diet due to their rich nutritional profile and ease of consumption. As a low-calorie, fat-free food, taro leaves provide an impressive array of essential nutrients, including vitamins A, C, and E, which are known for supporting immune function, vision, and skin health. Additionally, taro leaves are high in dietary fiber, contributing to digestive health and aiding in the prevention of certain chronic diseases. Notably, taro leaves are abundant in antioxidants, which help neutralize free radicals and may reduce the risk of inflammation-related conditions, such as heart disease and cancer. Their mild flavor and versatile culinary applications make taro leaves an easy addition to various dishes, allowing them to enhance the nutritional density of meals without significant preparation demands. This accessibility, combined with their health-promoting benefits, underscores the potential of taro leaves as a functional food for global populations. Integrating taro leaves into daily diets could contribute to meeting nutritional needs while promoting overall health, positioning them as a natural choice for individuals seeking nutrient-rich, plant-based options.

Keywords: Taro Leaves, Antioxidants, Low Calorie, Vitamin-Rich, Immune Support, Dietary Fiber, Heart Health, Anti-Inflammatory, Functional Food

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Wearable Biosensors: A Modern technique and Approach in Healthcare and Disease Monitoring

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Smart wearable sensors are becoming increasingly common and have the ability to non-invasively monitor human health, which has piqued the interest of biochemical and biological research fields. These sensors allow for the continuous screening of biomarkers in biological analytes, which, in comparison to traditional healthcare systems, provides real-time diagnostic tools and time-sensitive information. Present study evaluated the various types of smart wearables and their applicabilities. Due to its ability to continuously measure biomarkers for use in disease monitoring, medical diagnostics, and evaluation, wearable sensors have been commonplace in healthcare and biomedical monitoring systems since the turn of the century. For improved wearability, mobility, and dependability, new smart wearable sensors have surfaced, combining microfluidic sampling, data gathering systems, and multiplexed biosensing with flexible substrates and physical attachments. In order to diagnose, treat, and control medical diseases in a timely manner, improved knowledge of the correlations between analyte concentrations in blood or non-invasive biofluids is essential, and these wearables show promise in this regard. Clothing, belts, headsets, armbands, spectacles, rings, shoes, and mouth guards are just a few examples of the many kinds of accessories and equipment that can be worn. Smart clothing employs fibers and filaments that communicate with both the outside world and the wearer's internal systems, while nosepad-integrated eyeglasses track potassium and perspiration levels in real time. In the days to come, all of the aforementioned devices will deliver excellent results thanks to their diverse disease monitoring mechanisms.

Keywords: Wearable Sensors, Monitoring, Biomarkers

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Exploring the Role of Medicinal Plants in Cancer Biology Research

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Cancer remains a leading cause of morbidity and mortality worldwide, necessitating the identification of novel therapeutic strategies. Medicinal plants, having evolved over millions of years, possess a vast array of bioactive compounds with potential anti-cancer properties. This project aims to explore the role of medicinal plants in cancer biology research, bridging the gap between traditional knowledge and modern science.Through a comprehensive review of existing literature and experimental approaches, we will investigate the anti-proliferative, anti-inflammatory, and pro-apoptotic effects of select medicinal plants on various cancer cell lines. We will also examine the molecular mechanisms underlying their anti-cancer activities, including modulation of signaling pathways, induction of cell cycle arrest, and inhibition of angiogenesis. Furthermore, we will assess the potential of medicinal plants to synergize with conventional cancer therapies, enhancing their efficacy while minimizing adverse effects. This study will provide valuable insights into the therapeutic potential of medicinal plants in cancer treatment and prevention, paving the way for the development of novel, plant-derived anti-cancer agents. Ultimately, our research seeks to contribute to the global effort to combat cancer, improving patient outcomes and quality of life.

Keywords: Medicinal Plants, Anti-Cancer Agents, Cancer Therapies, Improving Patient Outcomes, Experimental Approaches

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Advances in Diagnosing Pancreatic Cancer: Challenges and Innovations

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Pancreatic cancer remains one of the most aggressive and deadly cancers due to its typically late diagnosis, rapid progression, and resistance to conventional treatments. Despite advancements in oncology, early-stage detection remains a critical challenge, as symptoms often manifest only in advanced stages. This poster presentation explores recent developments in the diagnosis of pancreatic cancer, focusing on novel biomarkers, imaging techniques, and non-invasive diagnostic methods. Emerging biomarkers, such as circulating tumor DNA (ctDNA) and exosomal proteins, show promise in detecting cancer at earlier stages, offering a potential breakthrough in patient survival rates. Advanced imaging technologies, including endoscopic ultrasound (EUS) and contrast-enhanced MRI, are being utilized to enhance the precision of diagnosis and tumor localization. Moreover, artificial intelligence (AI) is increasingly applied to improve diagnostic accuracy by analysing complex imaging data, potentially enabling earlier and more accurate diagnosis. This presentation also discusses the clinical challenges and limitations in the current diagnostic landscape and proposes future directions for research and technology development. By enhancing early detection and diagnostic accuracy, these advances offer hope for better prognosis and personalized treatment strategies for pancreatic cancer patients.

Keywords: Pancreatic Cancer, Early Diagnosis, Biomarkers, Imaging Techniques, Artificial Intelligence

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Smart Pills to Help Diagnose Gut Disorder

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Smart pills technology offers a non-invasive approach to diagnosing and monitoring gastro intestinal (G.I) disorders. It is a small ingestible or swallowable device. A survey published in Drug Delivery Letters in 2022 indicated that around 78% of patients surveyed would feel comfortable ingesting a smart pill if prescribed by their healthcare provider. It tracks various health conditions from digestive system, such as temperature, pH level, drug absorption and capture images of G.I tract. Smart pills show great potential in diagnosing common gut disorders like irritable bowel disease (IBD), Crohn's disease or ulcers, and small intestinal bacterial overgrowth. This device contains sensors, cameras, circuit and other electronic components. This device can transmit data wirelessly to smartphones and offer early diagnosis of G.I disorders. Magnetic field technology is used to track its movement through the digestive tract with millimetre-level accuracy. Tracking of smart pills or real time movement relied on radio frequency (RF) triangulation. It is an easy-to-use device compared to x-ray, MRI with good patient compliance. It has been designed to detect key biological molecules, such as nitric oxide and by-products of hydrogen sulphide, which are important signals and mediators of the inflammation associated with IBD. Smart pills represent a transformative innovation in GI healthcare, offering a promising solution for diagnosing and managing gut disorders more comfortably and accurately than traditional methods.

Keywords: Smart Pills, Non-Invasive, Biomarker, RF Triangulation

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Chemical Modification of Starch and Its Application: A Review

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Starch is a naturally occurring storage copolymer which has unique physicochemical properties. Sources of starch are like corn, rice, wheat, potatoes etc. The structure of starch possesses some unique and important properties which can be modified in order to meet specific requirements by functionalizing the copolymer. Structural modification of starch through some chemical treatments provides various physicochemical benefits. Modified starch beneficially used in drug delivery systems. Some important chemical methods are used, like esterification, etherification, oxidation and Schiff's base formation. These methods and the formed modified starch have the wide-ranges of applications in the different sectors. It can be used as excipient, water resistant adhesive agent, in the formation of nanoparticle and films etc. Surface chemical modification contains more physicochemical properties that enhance overall drug delivery system efficacy and applicability. These techniques are used in many purposes such as adsorption, adhesive formulations, pharmaceuticals, nanoparticle synthesis, etc. In pollutant adsorption process modified starch is used. Starch modification process is under in clinical trials. Modified starch contains many beneficial properties and can generate novel polymer which can be used successfully in pharmaceutical industry. This review highlighted the different types of starch modifications and their corresponding beneficial applications.

Keywords: Starch, Starch Modification Process, Chemical Modification, Use in Drug Delivery System

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Development of Transgenic Tobacco Plants for Edible Vaccines: An Innovative Strategy for Global Disease Prevention and Eradication

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Immunization has been revolutionized by the development of biotechnology, particularly through the use of transgenic plants to produce affordable and widely accepted vaccines. Edible vaccines, also known as subunit vaccines, are created by inserting specific genes into plants, leading to the production of encoded proteins. This innovative approach to immunization was pioneered in the 1990s by Arntzen and his team. For instance, they successfully integrated the 's' gene from the hepatitis B virus (HBV) into transgenic tobacco plants, resulting in the production of the hepatitis B surface antigen (HBsAg). The leaves and seeds of these plants yielded optimal amounts of the recombinant protein suitable for vaccine formulation. Additionally, researchers have worked on expressing heat-labile enterotoxin (LT-B) in tobacco as a potential edible vaccine against acute watery diarrhoea caused by enterotoxigenic E. coli and Vibrio cholerae, pathogens known to infect the small intestine and produce enterotoxins. Furthermore, tobacco plants have been engineered to produce the gastrointestinal carcinoma antigen along with an immunoglobulin Fc region (GA733-Fc) for a colorectal cancer vaccine. Notably, throughout the plant's growth cycle, all biomass—including leaves and stems—consistently produces the recombinant protein until flowering occurs. In summary, the generation of edible vaccines from transgenic tobacco plants represents a groundbreaking method in the battle against global health challenges, offering a viable and cost-effective solution that has the potential to enhance public health worldwide.

Keywords: Edible Vaccines**,** Transgenic, Recombinant, Enterotoxins, Colorectal Cancer

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3D Printing as a Scientific Tool in Drug Discovery

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3D printing technology relies on computer-aided design to achieve the most flexibility, time-saving, and exceptional manufacturing capability of pharmaceutical medicines. It is also called additive manufacturing a process that creates 3D objects by layering materials depending on digital model. This 3D technology has many applications, from prototyping and manufacturing to creating customized medicines.it is also used as a personalized dosage form-built layer by layer. This technology has a high production rate due to a fast operating system and reduction of waste materials that saves production expenses. Some current 3D printing technologies are Inkjet printing, Zip dose, and Thermal inkjet Printing. In Inkjet printing powder is used as a substrate for spreading ink which converts into solid dosage form. In Thermal inkjet printing ink fluid is used to create a vapor bubble and forced through a nozzle for 3D printing. Multiple dosage forms are produced by applying polymer in Fused depositing modelling. This is useful for the target section where disease models can be studied to understand disease pathophysiology Personalized medicines are gaining popularity day by day as they empower patient genomics and assist in improved drug design with minimum side effects. For patients needing various medicines, a 3D printer can be used to design and manufacture only one dosage incorporating different medicines. This technology is used for Tissue and organ fabrication, in pharmaceutical research in drug discovery, dosage form, and designing complex drugs.

Keywords: Three-Dimensional Printing, Drug Delivery, Pharmaceutical Applications, Additive Manufacturing

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Pharmaceutical Water

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Water is essential in the pharmaceutical industry. It is serving as a raw material, ingredient of different formulations and solvent of choice widely in the production of pharmaceutical products and analytical purposes. It can play also serve key role in synthesis and production of API as well, and function as a cleaning agent for equipment and packaging materials. Various grades of water are specified in different pharmacopeias, which outline their quality attributes. Different pharmaceutical uses necessitate distinct type of water depending on the specific purpose in a pharmaceutical industry. This review examines various types of pharmaceutical water, including purified water (DW), water for injection (WFI), and sterile water for injection (SWFI), bacteriostatic water for injection focusing on their applications, quality attributes, and regulatory requirements. The pharmaceutical waters play crucial roles in ensuring product quality. Thus, it is very essential to have a clear knowledge and understanding on different types of water in pharmaceutical application purposes with their preparation method and specific use.

Keywords: Pharmaceutical Water, Purified Water, Water for Injection, Quality Standard

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The Therapeutic Activity of Flavonoids-special emphasises on Quercetin and its biological Importance

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Phytochemicals have entered a considerable attention in the present- day world. Epidemiological studies have established that phytochemicals contribute more qualitatively to the total antioxidant exertion of foods than nutrient antioxidants. Among the six subclasses of flavonoid compounds Quercetin is an important flavanol for its therapeutic activity. The name quercetin was derived from quercetum. It has been named as 3,3′,4′,5,7 pentahydroxy flavone by the International Union of Pure and Applied Chemistry. Quercetin is also known as 3,3′,4′,5,7-pentahydroxy-2-phenylchromen-4-one by its chemical structure. Among the foods that contain quercetin are apples, tea leaves and green onions, onions (tea), nuts and berries, cauliflower, cabbage and cabbage. This article presents an overview of recent developments in pharmacological activities of quercetin including antioxidant, anti-inflammatory, antibacterial, antiviral, radical-scavenging, gastroprotective, and immune-modulatory activities. The main aim of this review is to obtain advantageous health effects of Quercetin, its pharmacological effects, clinical application and also to evaluate its safety. Likewise, it's important to know the quantum present in different diets and its bioavailability. Quercetin exhibits a wide range of natural conditioning and remedial operations, which are of interest to the medicinal, ornamental, and food diligence. Then, we epitomize the recent studies that large sample clinical studies are demanded to determine the applicable lozenge and form of quercetin for the treatment of the complaint.

Keywords: Quercetin, Flavonoid, Antioxidant, Phytochemicals

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Antibiotic Resistance: A Global Crisis Endangering Public Health

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Antibiotic resistance has a fatal effect throughout the world like more than 25000 deaths occurred per year in the European union due to Antibiotics resistance as per the researches. In countries like India where population is approx 142 crores where more than 11% people having poor hygiene background and the rate of infections is touching the pick point, more than 58000 child deaths by antibiotics resistance. But at the same time the development of conventional antibiotics along with strategies of combinational or multi drug therapy. previously it has ability to control the rate of infections by its bactericidal and bacteriostatic effect, however in the long run the combinational drug therapy is failing to control the microbial infections because of the antibiotics resistance. The etiology of antibiotics resistance can be classified in two types. One is which is extrinsic factor which is man made for example taking overuse and misuse of antibiotics in healthcare and agriculture, lack of maintenance of expired antibiotics, leading to the survival of resistant strains along with the intrinsic factors which are the un controllable that is continuous mutations among the microorganisms generate the efflux pump. So, owing all the things the global challenges faced by the scientist highly or very crucial disease like tuberculosis, pneumonia, bronchitis, and some time cancer induced by the microorganisms on the long-term effect of cancer. So, in this review we aim to discuss the various mechanism of development of various antibiotics resistance and strategies and approaches that has been taken and future prospects or novel approached can be taken to combat this challenge.

Keywords: Antibiotic, Antibiotic Resistance, Mechanisms, Future Prospects

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Herbal Colour Pigments: Sustainable Applications in Cosmetics, Textiles, and Beyond

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The presentation titled "Herbal colour pigments, sustainable application in cosmetics, textiles, and beyond" holds the purpose in cosmetics useful for making products like lipsticks, blushes, nail polish, used in textile industry to dye fabrics and fibres. They are also used to add natural colours in food and beverage products. These are also used by artisans and crafters for painting and creating handmade products. Plants approximately produce 2,00,000 compounds among which few compounds are said to be colored compounds. Source of natural colours like yellow-orange, deep red-brown, blue, orange-red, green is obtained from turmeric, beet roots, heena, indigo, anatto, Chlorophyll pigments. Natural dyes provide numerous advantages like environment friendly products produceleast side effects, improved bioavailability, as they are safe for body contact. The toxic and allergic reactions of synthetic dyes are compelling people to think about natural dyes. They are renewable source of colouring material. Additionally, herbal dyeing supports local agriculture and promotes biodiversity, as it often relies on locally sourced plants. Furthermore, herbal dyes offer health benefits, particularly in hair dyeing. They are less likely to cause allergic reactions compared to synthetic dyes, making them a preferred choice for individuals with sensitive skin or scalp. In summary, herbal dyeing represents a holistic approach to sustainable textile practices, preserving cultural heritage, supporting local economies, and offering healthier alternatives in dyeing. This ancient art continues to inspire modern artisans and designers seeking to minimize environmental impact while embracing natural beauty.

Keywords: Herbal Colour, Pigment, Natural Dye, Application in Cosmetics, Environmental Impact

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Antibiotic Resistance- A Global Health Threat

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The antibiotics bring the revolution in the treatment of bacteria, fungi and infectious diseases. Antibiotic resistance occurs when a drug is used too quickly and randomly, resulting in increased tolerance to the drug and the drug fails to kill the germs. As a result, the germs continue their growth. Nowadays antimicrobial resistance has become a major threat to public health. Anyone of any age can be affected by it anywhere. The defense mechanism that bacteria develop against antibiotics to survive is called resistance mechanism. Microbes contain a specific type of DNA that tells the microbe how to make certain proteins, which determine the microbe's immune system. Causes of Antibiotic resistance are over prescribing of antibiotics, patients not taking antibiotics as prescribed, unnecessary antibiotics are used in agriculture, poor infection control in hospitals and clinics, poor hygiene and sanitation practices, lack of rapid laboratory tests. These factors lead to longer hospital stays, higher medical costs, mild or severe illness and may lead to death. To prevent this problem, you should only use antibiotics when prescribed by a certified health professional, never use dates over antibiotics, never share antibiotics with others, regularly wash your hands, keep distance with sick people, maintain your vaccination dates etc. Antimicrobial resistance of pathogens poses a significant challenge to humans. It has a strong tendency to cause high morbidity and mortality. In this review the mechanism and the factors of antibiotic resistance is being discussed. Collaborative coordination from all parts of the society is required to fight against antibiotic resistance.

Keywords: Antibiotic Resistance, Drug Tolerance, Over Prescribing, Morbidity, Mortality

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Use of citrate buffer as a pharmaceutical stabilizer: A comprehensive review

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Citrate buffer, made from citric acid and sodium citrate, maintains pH between 3.0 and 6.2. It's widely used in labs for antigen retrieval in immunohistochemistry, enzyme assays, and DNA extraction. From many studies we know that the photolysis of riboflavin (RF) in the presence of citrate species across pH 4.0 to 7.0, utilizing a multicomponent spectrophotometric method to measure RF in the presence of photoproducts. The observed first-order rate constants (kobs) for RF photolysis range from 0.42 to 1.08 × 10^{-2} min^{-1} in this pH range, with a notable decrease in kobs as citrate concentration increases, demonstrating an inhibitory effect on the photolysis rate. Second-order rate constants for the inhibitory interaction between RF and total citrate species vary between 1.79 and 5.65 × 10^{-3} M^{-1} min^{-1}. Log k–pH profiles at citrate concentrations of 0.2–1.0 M reveal a gradual decline in kobs, with the rate at 1.0 M reduced by more than half compared to buffer-free conditions at pH 5.0. Divalent citrate ions significantly quench RF fluorescence, primarily by deactivating the excited singlet state, thereby slowing the reaction and stabilizing RF solutions, with maximal quenching observed at pH 4.0, where divalent citrate is most prevalent (99.6%). Trivalent citrate ions further inhibit RF photolysis by quenching the excited triplet state, exerting a more substantial stabilizing effect compared to divalent ions, as reflected in the second-order rate constants for divalent and trivalent citrate interactions, 0.44 × 10^{-2} and 1.06 × 10^{-3} M^{-1} min^{-1}, respectively. Thus, trivalent ions provide superior stabilization of RF solutions, highlighting their enhanced inhibitory potential.

Keywords: Citrate Buffer, Riboflavin Photolysis, Citrate Inhibition, First-Order Rate Constant, Second-Order Rate Constant, Fluorescence Quenching

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A systematic review on the therapeutic and commercial benefits of *Bauhinia Variegata* (L.)

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Bauhinia variegata, commonly referred to as Kanchnara or Mountain Ebony, has been utilized for ethnomedicinal purposes for a long time throughout the Indian subcontinent. This moderate-sized deciduous tree features a greyish stem and thrives in the Sub-Himalayan region, extending from the Indus River eastward into the forests of India and Burma. Various parts of *Bauhinia variegata*, including the flowers, stem, bark, roots, and seeds, are highly regarded for their medicinal and therapeutic properties. Research shows that this plant offers a wide range of health benefits, including antitumor, hepatoprotective, anti-inflammatory, antioxidant, antibacterial, hypolipidemic, wound healing, antiulcer, nephroprotective, antidiabetic, astringent, anticataract, and cytotoxic properties. The stem bark is traditionally used to treat ailments such as galaganda, gandamala, arbuda, and imbalances of kapha-pitta and ashthila. Meanwhile, the flowers are utilized for conditions like pitthaghna and rakta pradaraghna. The buds and roots are noted for their strong antioxidant effects. Key chemical components of the plant include hentriacontane, octacosanol, β-sitosterol, stigmasterol, lupeol, and various amino acids. Additionally, *Bauhinia variegata* contains a range of tannins, phenolic compounds, phytosterols, flavonoids, and other beneficial substances. Beyond medicinal uses, the plant is also applied commercially in mosquito control, fiber production, dyeing, and agriculture. This review explores the pharmacological effects and commercial advantages of *Bauhinia variegata*, highlighting its potential as a valuable ethnomedicine for human health.

Keywords- *Bauhinia variegata*, Mountain Ebony, Hepatoprotective, Anti-Inflammatory

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EPR Effect: A New Wave of Nanomedicines for Tumor- Targeted Drug Delivery

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Cancer is the foremost cause of mortality worldwide. While many anticancer agents have been identified, effectively delivering these drugs to solid tumors remains a significant challenge. Sustaining therapeutic drug concentrations over time is essential for achieving optimal drug-tumor interactions. A key mechanism In this process is the Enhanced Permeability and Retention (EPR) effect. This phenomenon enables larger macromolecules, such as albumin and polymer-conjugated drugs (typically exceeding 40 kDa), to accumulate in tumor tissues due to the distinctive characteristics of tumor vasculature. Tumor blood vessels exhibit increased permeability and irregular gaps between endothelial cells, which facilitate the entry of nanoparticles and liposomes into the tumor microenvironment more readily than into healthy tissues. This principle underpins the development of drug delivery systems designed to target cancer cells while sparing normal tissues, commonly referred to as "passive targeting." Nonetheless, the EPR effect is not uniform; it varies significantly across different tumor types and among individual patients, impacting its overall efficacy. Current research is focused on optimizing drug delivery strategies that harness the EPR effect to enhance cancer treatment outcomes.

Keywords: Proliferation, Lymphatic Drainage, Tumor, Nanoparticle, Liposomes, Drug Delivery

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Key Role of Probiotics in Disease Prevention and Treatment

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Now-a-day people are consuming various processed food and living a irregular life style which is causing impact on their health and suffering with various problems like acne, allergy, diabetes, digestion related problem, cancer and many more issue. There probiotics, consumed in daily life, play a key role. Probiotics are living organisms that are intended to have health benefits when consumed on applied to the body in adequate amount. Probiotics acts through various mechanism such as – the inhibition of bacterial adhesion, enhance mucosal barrier function, modulation of the innate and adaptive immune systems; secretion of bioactive metabolites. The most common type of these probiotics are Lactobacilli and Bifidobacteria. Probiotics treat diarrhea, inflammatory bowel disease, ulcerative colitis. Bacteria can reduce the risk of cardiovascular disease by maintaining hyper cholesterol. It can treat allergy by degenerating or modifying internal antigens. Probiotics prevent the breakdown of enzymes that helps to grow cancer causing agents. It decreases the pH by letting the toxins absorb less in the blood which can prevent hepatic encephalopathy. Probiotics has many beneficial roles without the risk of any side effect. It provides many health benefit without the of any side effect or risk of overdosing that need attention from any physician, that is why it is called good bacteria.

Keywords: Probiotics, Health benefits, Lactobacilli, Bifidobacteria, Digestive health

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Application of Artificial Intelligence in Health sciences

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Now a days, artificial intelligence is playing a major role in healthcare. It greatly influences the lives of patients, doctors and hospital administrators by showing the potential towards the tasks that are typically performed by humans, but in less time and at a fraction of the cost. The field of artificial intelligence (AI) holds great potential to transform the process of developing and discovering new medications. The purpose is to make artificial intelligence more useful in solving problematic healthcare challenges and by which we can interpret the data easily obtained by diagnosis of various chronic diseases like Alzheimer, Diabetes, many cardiovascular diseases. An AI computer algorithm using high quality data consistent and accurate. Pathology is the medical specialty that that is concerned with the diagnosis of disease based on the laboratory analysis of such as blood, urine and tissues. In the future robotic surgery is considered generally safe. A robot has the same expertise as a surgeon; even if it takes a longer time for surgery, precision, and uniformity. This review paper addresses how artificial intelligence (AI) is revolutionizing drug discovery, including its uses in drug design, robotic surgery. It discusses ethical issues and data quality issues while emphasizing AI's promise to expedite pharmaceutical research and increase the effectiveness of drug development.

Keywords: Artificial Intelligence, Medical Imaging, Diabetes, Drug Discovery, Robotic Surgery

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Benefits of AI in Pharmaceutical Research

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The COVID-19 pandemic has emphasized on the urgent requirement for the manufacturing of Artificial Intelligence (AI) based drugs. This article critically investigates the important role of AI in new drug development, and discovery, highlighting its potential for revolutionizing the process through enhanced efficiency, accuracy, and speed of manufacture. In this work, the focus has specifically been on ChatGPT, an AI language model based on GPT-3.5, and its capabilities in this context has also been evaluated. Various algorithms, including regression, support vector machines, and neural networks are examined here. Then, the discussion has shifted to the process of drug discovery, addressing the challenges of the real world such as ethical concerns, lack of data availability and harmonization of AI based applications. Databases and AI tools that facilitate drug design, along with the issues related to molecular representation, data collection, labelling, and inconsistencies among datasets have also been reviewed. A significant portion of the article analyses AI techniques, including model architectures and learning paradigms, and reviews the current status of AI in chemoinformatics. Here, the potential of AI to accelerate the drug development process is highlighted, particularly accentuating its ability to analyse large datasets and reduce the costs and time associated with bringing new drugs to the competitive market. AI holds the promise of transforming drug development, yielding significant benefits for patients and society. Finally, the recent developments and investments in AI-driven biotech startups has been discussed in this review, highlighting their progress and potential impact on drug design.

Keywords: Artificial Intelligence, ChatGPT, Databases, Chemoinformatics, Biotechnology, Drug Discovery

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Artificial Intelligence in Pharmacometrics

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Pharmacometrics plays a vital role in quantitative analysis, decision making in drug development and personalized medicine. It has alliance with clinical pharmacokinetic practice (PK) through population pharmacokinetic modelling (popPK) and physiologically based pharmacokinetic approaches. Artificial Intelligence (A.I.) is described as the machine for fourth industrial revolution. It helps in providing efficiency in drug development methods and can be applied in pharmacometric approaches such as in model development validation, data integration and visualization, simulation and prediction, personalized medicine, dose optimization in clinical settings. Machine learning, Deep learning, Natural learning processing are examples of various A.I. Techniques. These techniques provide great help in drug development, pharmacometric modelling and drug reprofiling. Machine learning algorithms provides higher computational efficiency, strong predicting capabilities in pharmacometrics models by enabling information in diverse sources of big data e.g. Population based public database. Deep learning requires learning of different multiple layers for its algorithm. Natural learning process focuses on providing efficient results to patient's, in accordance to their standardized health reports and helps in saving time. Recent growth in A.I. And machine learning language led The Innovation and Quality Consortium to initiate the Artificial Intelligence / Machine learning group in 2021 to advance scientific technology developments to provide transformational solutions to patient's, researches, and development community.

Keywords: Pharmacometrics, Artificial Intelligence, Machine Learning, Drug Development, Deep Learning

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Solid state characterization in pharmaceutical research

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The solid-state properties of pharmaceutical materials are critical throughout the drug development process, from initial discovery to final formulation. Solid forms are preferred for pharmaceutical products due to patient preferences and the relative ease of manufacturing solid dosage forms that meet quality and performance standards. Pharmaceutical materials typically exist in two primary states: crystalline and amorphous. Additionally, various types of solids, such as dispersed solids, solvates, hydrates, and nanoparticles, exhibit distinct physicochemical properties, processability, solubility, bioavailability, and commercial implications. To compare these different solid forms, several characterization techniques are commonly employed. These include X-ray diffraction (XRD), scanning electron microscopy (SEM), differential scanning calorimetry (DSC), Raman spectroscopy (RS), nuclear magnetic resonance (NMR), thermal analysis (TA), and atomization anti-solvent (AAS). Through this comprehensive analysis, researchers can identify the most suitable solid form for developing safe and effective pharmaceutical dosage forms, ensuring optimal product performance and patient satisfaction. Utilizing multiple characterization methods typically yields the most thorough understanding of the materials involved.

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Keywords: Solid, Solid Characterization, Solvate, Nanoparticles, Solid Dispersion

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Development and Validation of RP-HPLC Assay Method for Estimation of Rucaparib in Active Ingredient and Marketed Formulation

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Rucaparib is an anti-cancer PARP inhibitor that is marketed under the Rubraca brand. Rucaparib is available in the market as a tablet. A susceptible HPLC method is required to quantify rucaparib as an active ingredient and formulation. The study aimed to develop a novel reverse phase-HPLC stability indicating technique for Rucaparib quantification. Utilizing a Symmetry ODS (C18) column (250 mm x 4.6 mm, 5 µm) and a mobile phase consisting of phosphate buffer (0.02M, pH 2.8) and acetonitrile (48:52% v/v), an isocratic, RP-HPLC technique was developed. This method was developed at a flow rate of 1.0 ml/min, with detection at 248 nm using a UV detector. ICH guideline was followed for validation of this method. This method was highly sensitive and reproducible. Accuracy was in passed the range of 98-102%. The method was robust and rugged in different conditions. The suggested RP-HPLC approach offers simplicity and robustness for pharmaceutical applications and is effective, economical, and appropriate for regular Rucaparib analysis in quality control under stability circumstances.

Keywords: Rucaparib, RP-HPLC, PARP Inhibitor, Validation, Assay Method

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Antimicrobial Property of Water for Oral Formulation

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The antimicrobial assessment of water in oral pharmaceutical formulations is essential to ensure product safety and efficacy. To prevent microbial contamination, water is subjected to purification processes, such as reverse osmosis, followed by rigorous testing. This process ensures that oral formulations remain safe, stable, and effective for consumption. Waterborne diseases—like cholera, diarrhea, typhoid, and giardiasis—pose a significant global health risk, particularly in regions lacking adequate sanitation and water treatment facilities. Each year, an estimated 829,000 people die from diarrheal diseases, primarily cholera, dysentery, and typhoid fever, due to unsafe drinking water and poor sanitation practices. Waterborne diseases, caused by microorganisms such as bacteria, viruses, and protozoa, can result in severe illness and death. Antimicrobial testing is a key approach for monitoring water quality in oral formulations, involving the detection and quantification of harmful microorganisms like *E. coli*, *Salmonella typhi*, and *Giardia intestinalis*. Traditional culture-based methods, which have been widely used for decades, help identify potential health risks through colony counting and other techniques. Routine antimicrobial testing is crucial for multiple reasons: it enables early outbreak detection, facilitates timely interventions, assesses the effectiveness of water treatment processes, and helps in identifying antibiotic-resistant bacteria.

Keywords: Waterborne Diseases, Antimicrobial Testing

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Optimization of Forskolin HCl Sustained-Release Formulation Using Design Expert Software and Central Composite Design

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The optimization of Forskolin HCl's sustained-release formulation was carried out to enhance its therapeutic efficacy, bioavailability, and patient compliance. Design Expert software (version 7.0.3) and a Central Composite Design (CCD) methodology were utilized for a systematic approach to optimize formulation variables. Soy Lecithin and Cholesterol were selected as the key independent variables (X1 and X2), and their ratios were fine-tuned to achieve desired release profiles for Forskolin. Three levels were tested for each variable across thirteen experimental runs. Each formulation was evaluated based on response variables, including the percentage of Forskolin released at specified time intervals (1 and 8 hours) and the time required to release 50% of the drug (t50%). Response Surface Methodology (RSM) was applied to develop polynomial models for each response variable, and statistical significance was validated through Analysis of Variance (ANOVA). The interactions between Soy Lecithin and Cholesterol, along with their impact on drug release kinetics, were visualized using 3D response surface plots and 2D contour plots. Seven optimal checkpoints were identified through a grid search, and formulations were prepared and assessed to ensure validity and reliability. The study demonstrated that the CCD approach in Design Expert is effective for optimizing Forskolin HCl's sustained-release formulation, providing a robust framework for production scale-up with controlled release properties, improved therapeutic outcomes, and reduced side effects.

Keywords: Phyto-liposome, Forskolin, Percent Drug Entrapped, Drug Release

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Stem Cell Therapy in Cancer Treatment

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Cancer is the most dangerous disease by causing millions of deaths worldwide. Despite of rapid advancement in research of diagnostics and therapeutics, the death rate by cancer only declined ~1.5% annually in the period of 2006–2015 worldwide. Stem cell therapy, which involves all procedures using stem cells, has provided a hopeful option in the fight against cancer. It could improve the therapeutic efficacy of other therapies due to its enhanced target on tumors, thereby reducing off-target events. Stem cell therapy has emerged as a promising approach in cancer treatment, offering novel ways to target and eliminate cancer cells while potentially minimizing the harmful side effects associated with traditional therapies. Stem cells, particularly mesenchymal stem cells (MSCs), possess unique homing abilities that allow them to migrate toward tumor sites. Leveraging this characteristic, researchers are exploring the use of stem cells as delivery vehicles for anti-cancer agents, gene therapies, or immune-modulating factors. This approach aims to localize treatment precisely within tumor microenvironments, enhancing efficacy and reducing damage to surrounding healthy tissues. Moreover, advancements in induced pluripotent stem cells (iPSCs) provide a personalized medicine option, as these cells can be derived from the patient, genetically modified, and reintroduced to elicit specific anti-tumor immune responses. Although still in experimental stages, preclinical and clinical studies have shown promise in applying stem cell therapy for cancers like leukemia, brain tumors, and solid tumors. Challenges remain, including risks of tumor formation from stem cell differentiation, immune rejection, and ethical considerations. Nonetheless, with ongoing research, stem cell therapy holds transformative potential in oncology, potentially revolutionizing the way we approach and treat cancer.

Keywords: Mesenchymal Stem Cells (MSCs), Pluripotent Stem Cells (iPSCs), Leukemia, Brain Tumors