

Review Article

A CRITICAL REVIEW AND SIGNIFICANCE OF LIPID-BASED AYURVEDIC DOSAGE FORMS GHRITA AND TAILA: PART I-REVIEW AND STATUS

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ABSTRACT

This review discusses in detail one of the oldest lipid-based dosage form, *Sneha Kalpana* as described in Ayurved, one of the ancient medical systems. Here the vital constituents of plants are extracted as assimilates in lipid forms, *ghrita*–the clarified butter or *taila*–the oil. These dosage forms are administered through different routes for specific therapeutic benefits varying from topical nourishment, anti-inflammatory activity, and healing of tissue systems or even to treat serious neuro-muscular or neurological conditions. This review highlights the basic concepts of Ayurved behind the drug delivery approach and provides details of different processes of preparation or manufacture.

Lipid-based drug delivery systems (LBDDS) are one of the emerging technologies designed to address the challenges of solubility and bioavailability of poorly water-soluble ingredients. Understanding the principles behind the processes–the right amount of heat, time, and intensity is important for standardization to ensure the availability of bio constituents. Also, it is essential to understand the relevance of therapeutic principles behind these dosage forms to choose an appropriate technological adaptation for its optimum clinical effectiveness.

Keywords: Ayurvedic dosage forms, Sneha Kalpana, Standardization, Lipid-based drug delivery

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INTRODUCTION

The word '*Sneha*' as defined in Sanskrit-'*snih dhatu ghajptayay*', '*Snih Preetau*'–represents an attribute of getting attached or unification as characterised by oleaginous or fat or fatty material of natural animal or plant origin. *Kalpana* originated from '*krupusamarthe*'–represents a process to transfer a natural substance into a specific therapeutic form [1, 2]. Origin of the word lipid is from the Greek word *lipos* meaning fats that implies any class of organic compounds that are fatty acids or their derivatives obtained from different sources. Accordingly, '*sneha kalpana*' is the process of coalition of these lipids. *Sneha Kalpana* is an Ayurvedic process of formation of a lipid-based therapeutic dosage form obtained by coalition of the oleaginous or fat substances and aqueous materials under well-defined conditions like duration and quantum of heat. This review provides comprehensive knowledge and information of Ayurvedic principles, processes of two main lipid-based dosage forms comprising of *ghrita*-clarified butter and *taila*-oils and their similarities and variances in therapeutic uses. Further this review attends to the progression of modern pharmaceutical requirements.

Need for the review of ayurvedic dosage forms

Ayurveda, the Indian System of medicine, offers a wide range of classical pharmaceutical dosage forms. These include specific guidelines for the selection of raw materials, meticulous methods of processes and various methods of administration to derive specific therapeutic benefits. This is the fourth in a series of reviews undertaken by the authors to provide all-inclusive information and knowledge of ingredients synergistic understanding of the preparation, processes, the mode of administration that are vital to adapt to new technologies to ensure safe and desired therapeutic effects of Ayurvedic products [3].

Review of the classics

Ghee, clarified butter obtained after boiling the butter on low flame is used for religious, gastronomic and medicinal purposes in India, while *Taila*, oil is used to preserve and provide many benefits. *Ghee* is among the five constituents of the ancient ritualistic recipe '*panchamrit*' (five nectars) the others being curd, sugar, honey and

milk which is prescribed in Ayurved for a variety of therapeutic properties. Natural ageing of ghee is considered to enhance its properties.

Vedic period (1500-500 B. C.)

Ghee is frequently mentioned as a part of ritualistic worship with fire in *Yagnas* [4] in *Yajurveda* as *Havi* and *Ajya* [5, 6], amongst one of the four ancient most written scriptures. *Ajya*, *sarpi*, *navaneetaandaayuta* are synonyms of *ghrita* in ancient Sanskrit scriptures, namely *Shathapatha Brahmana* [7]. *Atharvaveda* mentioned about *pivaspaka* and *tailapaka*, where toxic drugs are used in the processing [8]. *Pauranik* (Ancient Indian Texts of Knowledge and Wisdom) texts refer to various uses of oil and even preservation of dead body in a vessel containing oil [9]. In *Kautilya Arthashastra*, *Chanakya* explains that for *Sneh* preparation, one should pay 1/20th part as tax [10].

Samhita period

In *Bruhatryee*, the three ancient most Ayurveda treatises [*Charak Samhita*, *Sushrut Samhita* and *Ashtang Sangraha*], describe extensive use of *Sneha Kalpana*-this dosage form both for internal administration and external applications through different routes for a wide range of therapeutic purposes. The *Charaka samhita* mentions source and types of fats, ghee essentially of cow's ghee and sesame oils, [11] for various therapeutic uses with different methods of preparation and even the indicators of process optimization, the *siddhi Lakshna* [12]. The *Sushruta Samhita*, under *Ghrivatavarga* has grouped therapeutic variances of three types as *Purana Sarpi*-old ghee, *Maha Ghrita*-potent ghee and *Kumbha Ghrita*-ghee made in earthen pot [13]. *Sushrut* further signifies lipid-based dosage forms in milieu of its types, uses, methods of preparation and process optimization [14]. Methods of preparation and various options to obtain the relative quantity of heat-*snehapaka*-are explained in *Ashtang Hridaya* [15] and *Ashtang Sangraha (kalpasthan)* [16] *Kashyap Samhita*, a text with focus on paediatrics has elaborated on *snehdravya*, source, classification and properties of lipid substances [17]. *Harita Samhita* has signified on the seven-and fifteen-day process required for clarified butter-*ghrita* and oils-*taila* respectively for therapeutic optimization [18]. Another ancient text,

Bhelsamhita, endorses use of *taila* for massages as the main therapy for *vataroga*–neuromuscular and musculoskeletal disorders [19].

Compendia

Bhavaprakash–a compendium of Ayurvedic therapeutics, gives details of many lipid-based dosage forms [20]. *Sharangadhara Samhita* another classic on therapeutics has a separate chapter on *Sneha Pakavidhi Adhyaya* [21] elaborately describes methods of preparation and uses of ghee and oil formulations. *Yogaratanakara* [22], a major text on formulations, describes properties of oil, optimal choice of sesame oil in particular, methods of preparation, refinement procedures and indicators of the rightly completed process of preparation. *Bhaishajya Ratnavali*, a later period compilatory text suggests a procedure for fortification of *ghee* and oil under chapter *Jwarachikitsa* for the treatment of fevers [23].

Definitions of terms

Sneha Kalpana or *Snehapaka* may be defined as "An Ayurvedic pharmaceutical process to prepare lipid-based remedies from the *kalka* [paste of freshly prepared ingredients] mixed in a predefined proportion with *Kwatha* [an infusion or a decoction of parts or whole of medicinal plant or a group of medicinal plants], or any other liquid such as milk, self-expressed juice, meat juice; and subjecting this composite to precise amount and duration of heat of indicated pharmaceutical parameters to achieve desired therapeutic efficacy" [24].

Snehayoni–two sources

The main sources of lipid-based substances are categorized into two, *sthavara* meaning immovable as of plant origin like sesame, mustard, castor, and safflower and of *jangama*, mobile animal origin like milk, yoghurt, rendered animal fat and marrow of birds, fishes and quadrupeds [25].

Sneha types [26]

In Ayurveda the, lipid-based products based on origin are classified into four major categories.

Ghritakalpa-Ghee based, *Taila kalpa*-Oil based, *Vasa kalpa*-Rendered animal fat, *Majjakalpa*-Bone marrow fat

Sneha Guna-Attributes and significance of lipid-based substances [27-30]

Ghrita is considered the best lipid medium being able to assimilate the properties of other substances without losing or rather enhances its own attributes; this is described as '*Samskarasya Anuvartanam*'. Eight types of ghee having variable characteristics are used in Ayurveda as obtained from eight milk-producing animals; *Goghrita*, *Cow's ghee is considered the best* and hence sacred. Though Sesame, Mustard and Castor oils are commonly used the *sesameoil is considered the best*.

Table 1: Attributes of lipid based substances

Lipid substances and origin	Attributes	Actions	Indications
<i>Ghrita</i> -Ghee <i>GoGhrita</i> [Cow's ghee]	Sweet, Heavy to digest, Unctuous, Soft, Cooling	Promotes memory, intelligence, digestion, semen, <i>ojas</i> , Alleviates <i>vata</i> , <i>pitta</i> , toxicity, insanity, phthisis, inauspiciousness and fever Bestows long life, prosperity, Rejuvenating	Epilepsy, mal-absorption syndrome, chronic fever, otalgia, ksataksina, debility due to chest injury, intoxication, syncope, headache, loss of memory, cachexia, mania/psychosis, intermittent fever, erysipelas, disorders due to poison, pain in the female genital tract
Other Ghee <i>Mahisha Ghrita</i> [Ghee from buffalos' milk] <i>Aja Ghrita</i> [Ghee from goats' milk] <i>AavikaGhrita</i> [Ghee from ewes' milk]	Sweet, Heavy to digest Cooling Astringent, Sweet, Light, Cooling Hot, light, salty, sweet, unctuous, heavy	Mitigates <i>pitta</i> , <i>rakta</i> and <i>vata</i> , increases <i>kapha</i> , Pleasant Increase digestive power, good for vision, increases strength, Increase <i>kapha</i> , <i>pitta</i>	Aphrodisiac, useful in insomnia, increase heaviness Useful in diarrhoea, tuberculosis, fever, cough, dyspnoea, Useful in cough and <i>vataroga</i>
<i>OushtraGhrita</i> [Ghee from camels' milk] <i>Ashwa Ghrita</i> [Ghee from mare milk] <i>HathiniGhrita</i> [Ghee from Elephant-Cows] <i>Maanushi Ghrita</i> [Human Mother's Milk]	Pungent, salty, light, hot, Salty, Light, dry, hot Heavy, sweet, astringent Sweet, light,	Anti-poisonous increases digestive power mitigates <i>kapha</i> and <i>vata</i> , Increases digestive fire, light after digestion, mitigates poison, nourishing Nourishing to all tissues Beneficial in aggravation of <i>Kapha</i> , <i>Vata</i>	Cures worms useful in leprosy, abdominal tumours and enlargement of the abdomen Cures eye diseases and burning sensation, cure all <i>vata</i> types disease Providing strength and stability Gynaecological disorders, good for eyes and it is like nectar
Oils <i>Tilataila</i> Sesame oil	Sweet, astringent, pungent minutes strong, piercing, hot	Balance <i>vata</i> dosha, increase <i>pitta</i> slightly, improve memory, and intelligence, anti-aging, aphrodisiac, improves vigor, good for skin and hair, cleanse the body channels, improve appetizer, improve strength and immunity	Useful for food preparation, massage and base for oil preparation, and useful to cure all types of diseases, wound, amenorrhoea
<i>Erand tail</i> -Castor oil	Sweet, pungent, astringent, sharp strong, piercing,	Appetizer, digestive, age promoter, improve memory purgative, expel faeces removes toxin, cleans excess <i>doshas</i> out of the body	Relieves body aches, cathartics, forcibly, moistening cures dryness, cooling and reduce swelling, useful in fever, abdominal disorders, lumps, rectal disorders, gout, abscess and various types of <i>vata</i> diseases
<i>Sarshap tail</i> -Mustard oil	Pungent, hot, nutty taste	Pacifies <i>vata</i> kapha and aggravates <i>pitta</i> externally, mustard is applied as paste (<i>pradeha</i>), fumigant (<i>dhupana</i>), diaphoretic (<i>svedana</i> massage powder (<i>udvartana</i>), scraping agent (<i>praghar shana</i>), poultice (<i>upanaha</i>)	Leukoderma, cracked skin, fever, leprosy, wasting, insanity, epilepsy, swelling, rheumatoid arthritis, neurological disorders, gynecological disorders, earache, wounds, flatulence, splenomegaly
<i>Vasa</i> -Rendered Animal Fat			It is prescribed for the treatment of injury, fracture, trauma, prolapsed uterus, earache, headache, improves virility of the person and is useful for the person with physical exertion.
<i>Majja</i> -Bone Marrow			<i>Vasa</i> and <i>Majja</i> are neither too hot nor too cold. <i>Majja</i> enhances strength, <i>Sukra</i> , <i>Rasadhatu</i> , <i>Kapha</i> , <i>Medodhatu</i>

Puran ghrita [Old ghee]

The Ghrita, stored for 1 to 15 y 10 to 100 y and 100 y are termed as *purana*, *pra-purana Kumbha* or *Maha Ghrita*, respectively by scholastic authors Arunadatta [31], Bhavaprakash [32], Chakradaata [33], Charak [34], Sushrut [35], and in Yogaratnakar [36]. The aged ghee is explained to have enhanced qualities for the treatment of *Unmada-psychiatric disorder like Schizophrenia*. It is administered orally as well as nasal, eye, massage and enema administration. *Puran ghee* alleviates all three *doshas*. It acquires a pungent taste and pungent post-digestive effect. It improves intelligence, vision, voice, the liver, kidneys, and brain function. It cures internal dryness and improves weight, luster, and digestion. It gives strength to brain, nerves, eyes, rectum and other body organs and relief from constipation. It nourishes gastrointestinal mucosa, lubricates it, enhances the absorption of fat-soluble vitamins and strengthens the colonic flora of useful microbes. It increases marrow, semen, and ojas. It is especially useful in brain disorders, general weakness, insomnia, night blindness, brain disorders, fever, pneumonia and excess cough. This old age ghee is used in different ways such as *nasya* [nasal drops], *akshipooran* [a procedure-where in black gram paste compound is made around eye and ghee is filled in it and kept for 5-10 min], *abhyang* [massage or external application, *basti* [enema] and *pana* [oral intake]. Attributes, actions and Indications of lipid based substances are illustrated in table 1.

Salient features

The water soluble and fat-soluble constituents of the substances are assimilated into *sneha*, [the lipid base], thereby providing potent, enhanced and effective therapeutic attributes to the *sneha*.

Snehas, the lipid-based products are used for enhancement of *jivana-life*, *varnya-complexion* promotion, *bala-strength* and *shariraupachaya-nourishment* of body. These formulations could be administered variably for different therapeutic purposes. The lipid dosage forms have longer shelf life of around 3 y for medicated oils and 2 y for medicated ghee.

Pharmaceutical processes

Pharmaceutical process of *Sneha kalpana* involves following steps-

Preparation

Collection of crude drugs [37]

The raw materials must be authenticated, free of any extrinsic matter, should be collected and stored under hygienic conditions

and in present times the care should be taken for it being free of any contaminants or residual pesticides.

Vessels for sneha [38]

Clean, sterilized and a high temperature bearing inert vessel should be used. The bottom of vessels should have an outside coating with wet soil or *vajralepa* to maintain a uniform temperature throughout the vessel. The *darvi*-spatula should be made of strong inert metal, long enough with a broad end for stirring.

Three main constituents [39]

Ayurvedic lipid-based products have three main constituent groups.

Sneha dravya-functional lipid based substances

These lipid substances, mostly *ghee* [clarified butter] or *taila* [oil] acting as a solvent medium for fat soluble active and water-soluble active portion gets entrapped to form a single phase without separation. The amount of lipid substance [*snehadravaya*] utilized is four times to that of the *kalka* [grind paste], if not specified.

Kalka dravya-fresh wet grind paste

A fresh smooth wet grind paste of fresh plants or coarse dry powder with water is prepared. It is noteworthy that the proportion of the paste to the lipid substance is 1/4th for other parts of the herb and 1/8th for flowers, except flowers of *Adhatodavasika*, *Bauhinia variegata* and *Terminalia chebula*, it is 1/4th [40].

Drava dravya-liquid medium [41]

Different types of liquid substances used for the paste are selected in accordance with the herbs used for preparation of paste, the type of lipid material to be used and therapeutic indications. The proportion of paste to the liquid used varies as per nature of the liquid. Quantity of paste used for water is 1/4th of the lipid base used; for decoction it is 1/6th and for Milk, yoghurt, buttermilk and expressed juice it is 1/8th. The proportion of water, which is a universal medium, expressed juice, decoction and milk when used as liquid medium is 4 times of *sneha* (the lipid substance). If milk added with other liquids, cow's urine and yoghurt is the same as that of *sneha*, the lipid base and for meat broth or sugarcane juice it is half of the lipid base [42]. More than one liquid is also used for *Ghee* or *Taila* preparations. For more than 5 types of liquids, the amount should be equal to that of the *ghee* or *taila* but for 5 or less the amount, equal quantity of each but total liquid used should be 4 times more than the amount of *ghee* or *taila* or other lipid base substance [43, 44]. Specific Liquid media used in preparation of different ghee and oil based formulations are listed in table 2.

Table 2: Liquid media used in different ghee and oil-based formulations

Liquid Medium	Formulations	
	Ghee formulations	Taila formulations
Castor oil	---	<i>Pinda</i> [45]
Cow's milk	<i>Pippalyadi</i> [46], <i>Phala</i> [47]	<i>Narayana</i> [48], <i>Baladi</i> [49], <i>Yashtimadhu</i> [50], <i>Chandanbalalakshadi</i> [51]
Cow's urine	<i>Hingusauvarchaladi</i> [52]	<i>Marichyadi</i> [53], <i>Dhatura</i> [54]
Decoction	<i>Panchatikta</i> [55]	<i>Erimedadi</i> [56]
Expressed juice	<i>Mahapanchatikta</i> [57], <i>Triphala</i> [58]	<i>Bhringaraja</i> [59]
<i>Laksha Rasa</i>	---	<i>Chandanadi</i> [60]
<i>Mamsarasa</i> (Meat broth)	<i>Maayur</i> [61]	<i>Mashadi</i> [62]
Mustard oil	---	<i>Arka</i> [63], <i>Kshra</i> [64], <i>kiratadi</i> [65]
Sheep's milk	---	<i>Bilva</i> [66]
<i>Snuhiksheer/Arkaksheer</i> (Latex distillate)	<i>Shadabindu</i> [67]	<i>Kassisadi</i> [68], <i>Vajri</i> [69]
Sour gruel	---	<i>Angaraka</i> [70], <i>Prasarani</i> [71]
Sugarcane juice	<i>Kamadev</i> [72]	---
Water	<i>Paneeyakalyanaka</i> [73]	---
Yoghurt	<i>Changeri</i> [74]	<i>Prasarani</i> [75]

Preparation of the principal components

Preparation of sneha kashaya (Decoction)

For preparing a decoction, usually 4 times water is taken and reduced up to 1/4th. *Acharya Dalhanam* mentions the use of 8 times water which is reduced up to 1/4th for lipid-based dosage forms. Another classic

mention that the raw material should be taken double the amount of oleaginous material by adding 8 times water and reducing it to 1/4th. *Acharya Sushruta* suggests that for 1 *Tula* (4800 gm) of raw drug 1 *Drona* (13468 ml) of water has to be added or vice versa [76]. The quantity of water depends upon the nature of the drug used i.e., 4 times for soft parts (*mrudu*), 8 times for hard parts (*Madhyama*) and

16 times for very hard (*Atikathina*) which is also reduced up to $\frac{1}{4}$ th of the quantity [77]. Similarly the quantity of water also depends upon the quantity of decoction drug i.e., 16 times water for 1 *Karsha* to 1 *Pala* [10 grams to 40 grams] and 1 *Prastha* [640 grams] to 1 *Tula* [4800 grams] and 8 times for 1 *pala* to 1 *Kudava* [40 grams to 192 grams] which is reduced to $\frac{1}{4}$ th of the quantity [78].

General ratio for sneha paka [79]

If not specified, quantity of the fresh wet grind, oleaginous material and liquid medium to be taken in the proportion of 1:4:16. The ratio of *kalka*, *sneha* and *dravadravya* mentioned in different classics is illustrated in table 3.

Table 3: General and specific ratios of fresh wet grind, lipid material and liquid media [80]

Ratio	Paste	Lipid material	Liquid media
General	1/4th Part	1 Part	4 Parts
Specific	1/4th Part	1 Part	4 parts Water
	1/6th Part	1 Part	4 parts <i>Kwatha</i> [decoction]
	1/8th Part	1 Part	4 parts <i>swarasa</i> [juice], <i>mansarasa</i> [meat juice], <i>dadhi</i> [yogurt], <i>ksheera</i> [Milk], <i>takra</i> [Butter Milk]
	1/4th Part	1 Part	Up to four <i>dravya</i> , 4 Part
	1/4th Part	1 Part	More than four, all equal to <i>sneha</i>

Sneha Kalpana (Main pharmaceutical process)

The process has been divided in two phases i.e., *Snehamurcchana* and *Snehapaka*.

Sneha murcchana (detoxification or exhilarate and penetrate or to enhance) [fortification of oleaginous base]

The oleaginous material (*ghee* or oil) is subjected to the process of *Murcchana* prior to the main process.

Importance of sneha murcchana

The process of *Murcchana* has been described first time in the text *Bhaishajya Ratnavali* [81]. This procedure helps to enhance the potency of oleaginous material and makes it more suitable to extract and assimilate the vital constituents from the medicaments. It also

helps to remove *amadasha* (Unrefined-elimination of 'Ama' can be compared as the moisture content) and eliminate the odor there by imparting good smell to the finished product. It is apparent from the study that *Murcchana* alters the solubility pattern and absorbability which helps to improve the medicinal value of the finished product. *Murcchana* helps in maintaining the necessary ratio of unsaturated and saturated fats suitable for human physiology [82].

In case of oil, this process is referred as refinement of oil and is aimed at removal of free fatty acids, phosphatides, undesirable color, moisture and solids from crude oil. Hence it alters the physical as well as chemical characteristics of the oil base.

Ghrut/Tila taila murcchana [83, 84]

The process of detoxification of *ghee/oil* is described in table 4.

Table 4: Drugs used in murcchana process

Oleaginous material	Paste	Liquid medium
Cow's <i>ghee</i> -1 part-1 prasth-768 ml.	1/16 part of each- <i>Haritaki</i> (<i>Terminalia chebula</i>), <i>Bibhitaki</i> (<i>Terminalia belerica</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Musta</i> (<i>Cyperus rotundus</i>), <i>Haridra</i> (<i>Curcuma longa</i>) fresh juice of <i>Matulunga</i> (<i>Citrus medica</i>)	Water-4 parts
<i>Tila Taila</i> [76] 1 Part Sesame oil	1/16 th Part <i>Manjishta</i> (<i>Rubia cordifolia</i>) 1/64 part each of <i>Haridra</i> (<i>Curcuma longa</i>), <i>Lodhra</i> (<i>Symplocos racemosa</i>), <i>Musta</i> (<i>Cyperus rotundus</i>), <i>Nalika</i> (<i>Cinnamomum zeylanicum</i>), <i>Amalaki</i> (<i>Emblica officinalis</i>), <i>Haritaki</i> (<i>Terminalia chebula</i>), <i>Bibhitaki</i> (<i>Terminalia belerica</i>), <i>Ketaki pushpa</i> (screw pine flowers), <i>Vatankura</i> (<i>Ficus benghalensis</i>), <i>Hriversa</i> (<i>Coleus zeylanicus</i>).	Water-4 parts
<i>Eranda tail</i> Castor oil 1 prasth-768 ml.	1 shan-3 gram each <i>Manjishta</i> [<i>Rubia cordifolia</i>], <i>Musta</i> [<i>Cyperus rotundus</i>] <i>Shunthi</i> [<i>Zingiber officinalis</i>], <i>Dhanyaka</i> [<i>Coriandrum sativum</i>], <i>Amalaki</i> [<i>Emblica officinalis</i>], <i>Haritaki</i> [<i>Terminalia chebula</i>], <i>Bibhitaki</i> [<i>Terminalia bellerica</i>], <i>Kharjur</i> [<i>Phoenix sylvestris</i>], <i>Vatankura</i> [<i>Ficus bengalensis</i>], <i>Haridra</i> [<i>Curcuma longa</i>], <i>Daruharidra</i> [<i>Berberis arista</i>], <i>Nalika</i> [<i>Cinnamomum zeylanicum</i>], <i>Ketaki</i> [<i>Pandanus tectorius</i>]	<i>Dadhikanji</i> -fermented gruel 2 prastha-3.072 ml. water-4 parts
<i>Sarshapataila</i> [<i>Brassica campestris</i>] oil-1 prasth-768 ml.	1 karsha-12 gram each- <i>Amalaki</i> [<i>Emblica officinalis</i>], <i>Haridra</i> [<i>Curcuma longa</i>], <i>Musta</i> [<i>Cyperus rotundus</i>], <i>Bilva</i> [<i>Aegle marmelos</i>], <i>Dadima</i> [<i>Punica granatum</i>], [<i>Nagkeshara</i>] [<i>Mesua ferrea</i>], <i>Krishna jeeraka</i> [<i>Carum carvi</i>] <i>Ushira</i> [<i>Vetiveria zizanioides</i>], <i>Nalika</i> [<i>Cinnamomum zeylanicum</i>], <i>Bibhitaki</i> [<i>Terminalia chebula</i>]. 12 pala-96 gram- <i>Manjishta</i> [<i>Rubia cordifolia</i>]	Water-1 Adhak-3.75 L.

Process

Cow's *ghee* or Sesame/Castor/Mustard oil is heated on low temperature and cooled down on its own. Paste of the above-mentioned drugs followed by water is added to the *ghee/oil*. The *ghee/oil* is then heated on mild flame till appearance of *siddhi lakshana* of *madhyamapaka* (signs of completion or desired attributes). This refined *ghee/oil* is then filtered and stored in an air tight container. Also contribution of drugs used for detoxification is summarised in table 5.

Main process

General method [87]

After completion of *murchhana*, *snehapaka* process is performed with desired drug. For preparation of any medicated *ghee* or oil, 1

part of fresh wet grind, 4 parts of *ghee/oil* [*murcchit*] and 16 parts of liquid media are mixed together and subjected to moderate heating till the liquid portion gets evaporated. Before processing of *sneha* (lipid material) care should be taken to ensure that, the oil/*ghee* used are pure, clear and without slurry. Fortified old *ghee* and refined new oil should be used for formulation. The process is followed by filtration and the formulation is stored in an airtight container for further medicinal uses.

Duration of Snehpak in different media

The process is not usually completed within a day. Intermittent heating is provided for specific duration depending upon the nature of the liquids added to the material. Longer duration of preparation results in to enhanced properties and extraction of active constituents. Significance of specific duration for heating process is briefed in table 6

Table 5: Contribution of the drugs used for detoxification with chemical composition [85, 86]

Name and latin name of the drug	Chemical constituents	Contribution with Murcchana
<i>Amalaki (Embllica officinalis)</i>	Vit-E, essential oil Phosphatides	Increase acid value, solubility of drugs
<i>Bibhitaki (Terminalia bellerica)</i>	Tannin, gallic acid, alleagic acid	Increase solubility of active principles
<i>Bilva [Aegle marmelos],</i>	Furocoumarins, xanthotoxol, methyl ester of alloimperatorin, flavonoids, rutin, marmesin; essential oils	Imparts aroma
<i>Dadima [Punica granatum]</i>	Alkaloids, Pelletierine, isopelletierine	Colorant, antiviral, antifungal
<i>Daruharidra [Berberis arista],</i>	Berberine, carbohydrates, organic acids, polyphenolic compounds, pectin, tannin, mineral elements	Colorant and antifungal
<i>Dhanyaka [Coriandrum sativum]</i>	Volatile oil, consisting mainly of delta-linalool, alpha-pinene terpinin, Flavonoids, coumarins, phthalides phenolic	Increase acid value decreasing of the rancidity factors
<i>Haridra (Curcuma longa)</i>	Alkaloid Curcumin, essential oil.	Colorant and antifungal
<i>Haritaki (Terminalia chebula)</i>	Tannin, Chebulic acid	Increase solubility of active principles, anti-lipid peroxidation, anti-superoxide radical formation and free radical scavenging activities
<i>Hriversa (Valeriana hardwickii)</i>	Vitamin E, glycosides, Essential oils	Imparts aroma
<i>Ketaki (Pandanus odoratisimu)</i>	Essential oil-methyl Ether, Benzyl benzoate and Aldehydes	Imparts aroma
<i>Kharjur [Pheonix sylvestris]</i>	Phenolics, sterols, carotenoids, anthocyanins, procyanidins, flavonoids	Antioxidant and radical scavenging activities
<i>Krishna jeeraka [Carumcarvi]</i>	Essential oils, Carvone, limonene	Increase acid value, antimicrobial, bio enhancer
<i>Lodhra (Symplocos racemosa)</i>	Alkaloid loturineandcolloturine	Imparts aroma, suppressive effect on lipid peroxidation
<i>Manjistha (Rubia cordifolia)</i>	Coloring matter purpurence, xanthine Alizarine (orange red)	Colorant, inhibit lipid per oxidation antioxidant property
<i>Matulunga (Citrus medica)</i>	Volatile oil, Limone, dipentene, citral oil from peel, glycosides	Increase acid value and Solubility of drug
<i>Musta (Cyperus rotundus)</i>	Unstable alkaloids and Essential oils	Increase the acid value And imparts aroma
<i>Nagkeshara [Mesua ferrea]</i>	Essential oil, fatty acids Oleo-resin Mesuol, Mesuaxanthofle A and B, Mammeisin	Imparts aroma, digestant, anti poisonous
<i>Nalika (Cinnamomum zeylanicum)</i>	Essential oils, cinnamic Aldehyde	Increase acid value and Imparts aroma
<i>Shunthi [zingiber officinalis,]</i>	Carbohydrates, lipids, terpenes, phenolic compounds	Increase acid value
<i>Ushira [Vetiveri azizanioides]</i>	Essential oil mainly consisting of sesquiterpenes, sesquiterpenols	Imparts aroma, antibacterial
<i>Vata (Ficus bengalensis)</i>	Carbohydrates, flavonoids, amino acids/proteins, steroids, saponins and Tannins	Imparts aroma

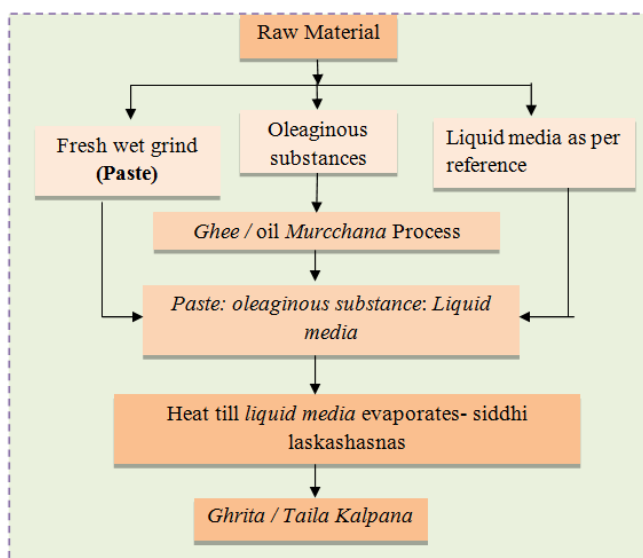


Fig. 1: Flow chart for process of the preparation of ayurvedic lipid base dosage form

Table 6: Liquid medium and duration of heat [88, 89]

Liquid media	Duration	Reason
<i>Mamsa Rasa [meat broth], Vrihi Dhanya [Rice with husk]</i>	1 night	Easily get fetid and impart bad odor within a day due to biodegradation
<i>Ksheer [milk]</i>	2 nights	Spoiled within a day or two.
<i>Swarasa [juices]</i>	3 nights	It may take longer time period to absorb active principles in to the oleaginous media
<i>Kwatha [decoction], Arnal [gruel], Takra [buttermilk]</i>	5 nights	Chemical constituents may take a longer time to absorb
<i>Kwatha of Valli [Creepers], Mula [Roots]</i>	12 nights	Dried and hard substances, may take as much as longer period to absorb their therapeutically potent principles to the oleaginous media

Sneha siddhi lakshana: (Signs of optimization) [90, 91]

- The paste obtained should be able to form a small elongation-*varti* and should burn without crackling sound confirming devoid of any liquid material.
- Stoppage of bubbling sounds (Sneha)
- The *ghee*/oil should exhibit the smell, color and taste of the herbs used.
- Appearance of froth (*phena*) in the oil and disappearance of froth from the *ghee*.

Types of snehapaka and therapeutic uses of different sneha paka

Different types of snehapaks mentioned are mainly divided into three stages (paka), (refer table 7) the most important ones are [92]

- Low temperature: *Mrudu Paka/manda*(light) *paka*
- Mild/Moderate temperature: *Madhyama Paka/cchikkana*(sticky) *paka*
- High temperature: *Khara Paka/kharacchikkana*(dry sticky) *paka*

The amapaka (under heated) and *dagdhapaka* (over heated) *ghrita* or *taila* does not have any therapeutic value [93]. Therapeutic uses of snehapaka at different stages of paka are well illustrated in table 7.

Patra paka or gandha paka (Flavoring) [97]

Flavouring process for oils is termed as *Patra Paka* or *Gandha Paka* where in the paste prepared with aromatic material e. g., *Kasturi (musk)* is placed in a vessel of warm oil that imparts the aroma to the oil.

Table 7: Therapeutic uses of different snehapaka [94-96]

Stages of paka	Kalka	Sneha	Therapeutic uses
<i>Amapaka</i>	Water content (+), cracking sound	Water content (+), cracking sound	No therapeutic use
<i>Mridupaka</i>	Sticky, traces of water (+), cracking sound	Traces of water (+), cracking sound	<i>Pana</i> (internal) <i>Nasya</i> [nasal application]
<i>Madhyampaka</i>	Non-sticky, free from water content, no cracking sound, <i>varti</i> can be made.	Water content (-), cracking sound (-), froth appearance (<i>taila</i>), subsidization of froth (<i>ghrita</i>), desired colour, odour, and taste	All purposes <i>Nasya</i> (nasal), <i>Abhyanga</i> , (massage), <i>Pana</i> , <i>Basti</i> (enema), <i>Pana</i> [internal use]
<i>Kharapaka</i>	Kalka become hard, rough, darkened, water-free and dry	Colour, odour, and taste may change.	External application
<i>Dagdhapaka</i>	Rough, dry, and black often charred burnt	Essential contents of Sneha particularly loss of color, odor, and taste	No therapeutic use

Aditya paka [98]

The heating process that utilizes photo energy to extract the active principles from the heat sensitive drugs under controlled low temperature. The drugs are mixed with oleaginous material and exposed to mild sunlight for specific time. e. g., *Aditya Paka Guduchi Taila*, *Kasisadhya Ghrita*.

Sneha avartana (Potentiation)

The term *Avartana* (repetition of process) was used for the first time in a southern text called *Sahasrayogam*. The potentiation of lipid-based dosage forms helps to minimize the dose and facilitates faster drug delivery. Medicated oil or *ghee* cannot be administered in large doses for longer duration. In this process the prescribed quantity of ingredients (paste and liquid medium) is added and the heating process is carried out repeatedly till the signs of optimization and desired potency is acquired. *Dashpak* (10 times), *Shatapaki* (100 times), *Sahasrapaki* (1000 times) denotes the number of times the process is carried out. Though there is a loss in oleaginous material but at the same time there is an increase in concentration of medicament.

Procedure of avartana (Potentiation) [99]

The initial ingredients with the same quantity are added to the medicated oil or *Ghrita* which is heated, cooked and filtered. The filtrate obtained is the first *Avartana*. For successive potentiation the first *avartitsneha* and other ingredients are added in prescribed ratio and heated, cooked and filtered. This filtrate is the second *Avartit Sneha*. The same process is repeated to carry out further potentiation of oil or *ghee*. *Madhyama paka* is employed to avoid the loss of medicinal properties. These *avartitasnehas* are used for oral or nasal administration.

Benefits and shortcoming of Avartana

The process helps to minimize the dose due to high potency, enhances the absorption of the drug, helps in easy administration and packaging of the formulation, but at the same time it increases cost and the time required for the preparation because the formulation needs to be prepared cautiously to avoid the loss of oleaginous material.

Precautions during the process [100]

Following precautions should be taken during the process-

- Mild to moderate heat should be maintained throughout the process.
- The mixture should be stirred at initial stage for facilitation of homogenous mixing and at later stage to avoid sticking of fresh wet grind to the vessel which may lead to carbonization.
- Care should be taken to determine proper stages of *snehapaka*.
- If *ksharadrava* (alkaline substances) or *gomutra* (cow's urine) are used for preparation of *Sneha Paka* then utmost care has to be taken as it may generate excessive froth and can cause spillage.
- If *saindhava lavana* (rock salt) and other alkaline substances are used they have to be added to *siddha sneha* (end product) and then filtered [101].
- Similarly, if *Sarkara* [102] is mentioned it should be added to the final product after cooling.

Finished products

Siddhi lakshan [signs of optimization] of *snehapaka* denotes completion of *sneha* formulations, having total attributes.

Storage [103]

The *snehapaka* should be stored in a dry glass, polythene or aluminum container. Container should be free from moisture. Perfuming drugs should be added gently in the container with stirring when the oil is lukewarm.

Matra (Dose)

The standard dose is 1 *pala* (48 gm) [104]. The prescribed dose varies as per the *dosha*, age, disease state, time and weather. *Acharya Chakrapani* mentions *uttamatra* [optimum dose] (1 *pala*-48 gm), *madhyamamatra* [medium dose] (3 *karsh*-3 gm) and *hinamatra* [lower dose] (1/2 *pala*-24 gm).

Anupana (Vehicle) [105]

Though the warm water is universal vehicle there are specific vehicles suggested to enhance the therapeutic activity of different

types of fat e. g., ghee with warm water, oil with *yush* (medicated soup of pulses) and *vasa majj* with *manda* (filtered liquid portion obtained after boiling 1 part of rice with 14 parts of water).

Prayogkala (Time of administration) [106]

The right time of administration for the medicated oil is *Pravrit Ritu* (before monsoon), for *ghee* is *Sharada Ritu* (autumn) and for rendered animal fat and bone marrow is *Vasanta Ritu* (spring). Though if required these could be administered in any season. For *shamana* (palliative therapy), oil/*ghee* is given on empty stomach (*abhaktak*) to maximize therapeutic efficacy.

Route of administration

Pana (oral), *anuvāsana* (anal), *abhyanga* (external), *shirobasti* (anoint), *uttarbasti* (urethral/vaginal), *nasya* (nasal), *karnapurana* (aural) are various modes of administration for different lipid-based formulations [107].

Shelf life

The shelf life of medicated oil or *ghee* is 4 mo but *Vangasen* mentions the shelf life of *pakvaghrita* as one year and for *pakva* and *apakvatailait* is more than a year. According to AFI, shelf life of these formulations can extend up to 16 mo [103, 108].

Modifications in sneha kalpana [109, 110]

The newer methods of preparations and modifications have been developed for *Sneha kalpana* as described in table 8.

Expected failures in the preparation of snehakalpana

Disagreeable product may be seen in some of the oil or *ghee* preparation, which may be due to change in the temperature, types of drugs used or by reaction with the containers.

Causes and Solutions to overcome these failures are recorded in table 9.

Table 8: Modifications in Sneha Kalpana

Modifications	Merit/demerit
Soft gelatin capsules-Oral dosage form	Merits-preserve for long time (Ghrit-extended 4 mo to 1 y), Easy to palatable,
Basti sachet-Rectal use	Easy for dispensing, Good appearance
Sukshmikarana of snehakalpana [Fineness]	Demerit-Cost value increases due to modification

Table 9: Expected failures in the preparation-Causes and solutions

Reasons	Solutions
Size of vessel	Wide mouth, suitable size vessel depending on the quantity and nature of batch
Lipids and other ingredients	The lipids i.e., <i>Ghee</i> /oil must be <ul style="list-style-type: none"> - Pure, clear and without slurry. - To be taken after doing <i>Murcchana Samskara</i>. - The necessary ingredients should be of good quality.
Water or other liquid-if quantity of water or prescribed liquids is not taken as per the guidelines, they may hamper the manufacturing process.	Water should be soft and taken as per ratio mentioned. If water is hard in nature the desired residue may not be obtained. Other liquids like decoction, juices, meat juice, infusions should be prepared as per given guidelines.
Temperature-if temperature is not maintained properly there are chances that can decompose some of the thermolabile active constituents. With extra heat given <i>sneha</i> becomes <i>kharpaka</i> or <i>dagdhapaka</i>	Mild to moderate heat [85-90 °C of temperature] throughout the process should be maintained.
Storage container	Should be moisture free

Therapeutic significance of snehakalpana

Ayurvedic texts mention various ailments in which medicated *ghee* and oils are administered for applications on the body, with or without massage for providing health benefits and to treat specific indications. Although most of the medicated oils are for external usage, certain types of medicated oils are administered orally also. However, medicated *ghrita* of *Ayurveda* are used systemically orally. The therapeutic significance of *ghrita* and *taila* are different. Oil is considered as the best pacifying drug for *vata*-predominant conditions, such as *Vatavyadhi* [Vata disorders], *Vatashonita* [Gout], *Moodhagarbha* [foetus astray/Obstruction in Labour], *Karnagataroga* [Ear diseases], *Vandhyatwa* [Infertility], *Yonivyapat* [disorders of the female genital tract] *Gandamala* [Lymphadenopathy], *Granthi* (Cystic Swellings), *Apachi* (Suppurating Lymphadenitis), *Arbuda* (Tumours), *Vidradhi* [Abscess]. These are the conditions where the prime vitiated entity is *vata dosha*. *Ghrita* is prominently used for rejuvenation purposes and *medhayushkamyarasayana* [enhance intellect and longevity] in Classical texts.

DISCUSSION

Medicated ghee

Ghee is one of the most popular traditional dairy products in India. The importance of ghee in Indian diets has been recognized from the prehistoric days because of its high nutritive value, pleasant aroma, and textural properties. Approximately one-third of the total milk produced in India is used for making ghee and ghee prepared by rural milk producers constitutes about 80% of the total sales in the

market. The organized dairies contribute about 20% of the consumer's needs of ghee. There are five methods of ghee making such as Desi or Indigenous Method, Direct Cream Method, Creamery Butter Method, Prestratification Method and Continuous Method. The principle involved in ghee preparation includes; the concentration of milk fat in the form of cream or butter, heat clarification of fat rich milk portion and thus reducing the amount of water to less than 0.5%, removal of the curd content in the form of ghee residue [111].

Cow ghee is the most preferred base for preparing any medicine because it can reach the deepest of tissues in the human body and nourish it, improves the absorption ability of the small intestines and decreases the acidic pH of the gastrointestinal tract. Ghee is a rich source of Omega-3 fatty acids, a natural antioxidant and prevents degenerative changes in the musculoskeletal system, prevents premature ageing.

Medicated oil

Normally crude sesame oil is used as *snehadravaya*, though occasionally castor oil and coconut oil is also used either in parts or in full. Sesame oil contains polyunsaturated fat-omega-3 and omega-6 fatty acids help prevent several diseases, including heart disease, cancer and help improve immune function. Sesame oil has known anti-inflammatory and antioxidant properties, enhance life, complexion, strength and anabolism of body. It has a high smoke point, which makes it good for high-heat cooking like stir-frying.

Therapeutic benefits

Medicated ghee/oil is used for various external and internal applications. Internal applications of medicated ghee/oil include oral

ingestion and an Ayurvedic treatment called panchakarma. Proper digestion, absorption, and delivery to a target organ system are vitally important for obtaining the maximum benefit from any therapeutic formulation. The lipophilic action of ghee/oil facilitates transportation to the target organ and final delivery inside the cell via the cell membrane, which also contains lipid. A research study compared different forms of herbs and herbal extracts and found that ghee/oil improved the efficacy of the formulation compared to usage in powder or tablet form [112]. Lipid-based formulations play a significant role in oral delivery of lipophilic drugs. Scientific findings suggest the presence of conjugated linoleic acid (CLA), butyric acid, sphingomyelin, myristic acid, and vitamin A in ghee, which has functional properties and has potential to inhibit different degenerative disease. When ghee was used as the sole source of fat at a 10% level, there was a large increase in oleic acid levels and a large decrease in arachidonic acid levels in serum lipids [113]. Previous studies have shown that natural sesame oil promotes the intestinal lymphatic transport and oral bioavailability of the highly lipophilic drug cannabidiol (CBD) [114].

Sneha kalpana may be defined as a process where compounds like ghee/oil, fresh wet grind, liquid media, and aromatic liquids are employed for the preparation of oleaginous medicaments. Lipid or water-soluble active principles of drugs are extracted into ghee or oil in this method. The formulations should be prepared under medium temperature. Confirmation of the stages during the process is important with respect to its therapeutic use. Medicated *ghee* or oils are potent and have better shelf life compared to non-medicated. The heat assimilates more amount of constituents and increases the concentration leading to increasing bioavailability. The extraction of wide range of simple to complex chemical constituents is possible via this process. For example, with respect to absorption, passive transport depends on the concentration gradient. The drug given as a concentrated solution is absorbed faster than the diluted solution. Secondly, only lipid-soluble drugs can penetrate the blood-CSF barrier; the non-lipid-soluble drugs entry is prohibited because of tight junctions in the capillary endothelium.

Liposomes

In the field of novel drug delivery systems, liposome is one of the advanced dosage forms in which nanoparticles comprising lipid bilayer membranes surrounding an aqueous interior are formed. The amphiphilic molecules used for the preparation of these compounds have similarities with biological membranes and have been used for improving the efficacy and safety of different drugs. In this dosage form, the active compound can be loaded either in the aqueous spaces, if it is water-soluble, or in lipid membrane, if it is lipid soluble [115, 116].

The fundamentals of *sneha kalpana/paka* of Ayurved and liposomes as advanced drug delivery vehicle have similarity with respect to their origin and character as both are lipoidal in nature. In the preparation of *snehapaka*, the principle is to transfer active constituents of herbs in lipid and water according to its solubility by application of heat [117].

CONCLUSION

Sneha Kalpana–lipid-based dosage forms have a unique place in Ayurvedic pharmacopeia owing to its oleaginous nature. The review comprehensively details classical and pharmaceutical information including processing techniques that are used and their significance. It also gives an insight into the significance of these traditional forms that could be related to advances in liposomal activities. These forms have promising possibilities for promotive-nutritional and curative-medicinal purposes to treat variety of illnesses.

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CONFLICT OF INTERESTS

Declared none

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