GCMS/MS ANALYSIS AND CARDIOPROTECTIVE POTENTIAL OF CUCUMIS CALLOSUS ON DOXORUBICIN INDUCED CARDIOTOXICITY IN RATS

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INTRODUCTION

Myocardial infarction (MI) is characterized by necrosis of a portion of the heart muscle. It is one of the most frequent causes of death in the developing country. Coronary atherosclerosis has been frequently an underlying factor in the pathogenesis of MI. The acute event is often provoked by rupture of an atherosclerotic plaque, leading to the formation of an occlusive thrombus and vasospasm, which hinder the delivery of oxygen to the myocardial tissue supplied by that artery [1].

Doxorubicin (DOX) is an anthracycline antibiotic that is rooted as a chemotherapeutic agent. The administration of DOX is known to induce numerous cardiotoxic effects, including transient arrhythmias, nonspecific electrocardiographic abnormalities, pericarditis, and acute heart failure [2, 3]. Increased level of low density lipoproteins (LDL) [4] and serum total cholesterol [5] and decreased levels of high density lipoprotein (HDL) [6] are associated with increased risk of MI. DOX-induced cardiotoxicity in rat was associated with increased lipid peroxide levels in the myocardium [7]. Oxidative stress refined by free radicals or reactive oxygen species (ROS), as evidenced by a marked increase in production of lipid peroxidative products and transient inhibition of endogenous antioxidant defense, such as superoxide dismutase (SOD), catalase (CAT) and reduced glutathione (GSH) have been shown to incline the myocardial damage during MI [8].

A number of herbs are conventionally used in different countries during drug or toxin induced hepatic, renal, and cardiac disorders [9]. Cucumis callosus is commonly known as Bitter Cucumber belongs to the Cucurbitaceae family. It grows in desert regions. In India it mainly grows in dry districts. It is reported to be light, bitter, hot abortifacient, purgative, blood purifier and cathartic [10]. The fruit is useful in biliousness, jaundice, cerebral congestion, colic, constipation, dropy, fever, worms and sciatica [11, 12]. Root is given in cases of abdominal enlargement, cough, asthma, and inflammation of the breast, ulcers, urinary diseases and rheumatism [13]. Oil from seeds is used for poisonous bites, bowel complaints, epilepsy and also for blackening the hair [14]. In India, ripe fruit eaten raw and used in curries, green fruit used as a vegetable, dried fruit rind and seeds used in curries.

Previous phytochemical investigations on this plant resulted in the discovery of the presence of flavonoids, alkaloids, steroids terpenoids and derivatives [15], a previous study reported the presence of alkaloids, Wilfortrine and Wilforine have been reported to possess immunosuppressive effects and cardioprotective activity [16]. Wilfortrine can inhibit leukemia cell growth in mice [17,18] and show anti-HIV activity [19].

Previous studies reported that the presence of alkaloids in the Cucumis callosus extract which have cardioprotective activity, however, no scientific claims are available on the cardioprotective activities of Cucumis callosus. Therefore, this study was designed to investigate the cardioprotective activity of Cucumis callosus extract against DOX-induced cardiotoxicity in rats.

MATERIALS AND METHODS

Plant material

Leaves of Cucumis callosus were collected, identified and authenticated by a Botanist, Dr. K. Shanthi, government arts college, Tiruvannamalai. Voucher specimen (KPCP-10/2016) was retained in the, PG Department of Pharmaceutical chemistry, Kamalakshi Pandurangan College of Pharmacy, Tiruvannamalai, Tamil Nadu, India.

Chemicals and reagents

Doxorubicin was purchased from Microlabs, Tamilnadu, India. ALT, AST, ALP, CPK kit were procured from span Diagnostics, Surat, India.
All other chemicals and solvent were of analytical grade and commercially available.

**Acute toxicity studies**

Acute oral toxicity study was performed as per OECD-423 guidelines (acute toxic class method). Albino rats (n=6) of single sex were selected for the acute toxicity study. Which received a single oral dose of 2000 mg/kg body weight of ethanol extract of combretum albumin. The dose was administered to overnight fasted rats and food was withheld for further 3-hours after administration of the drug and observed for signs of toxicity for a period of 14 d.

**Extraction**

Leaves (1000 g) of *Cucumis callosus* were cleaned with water and dried, then they were powdered using a mechanical grinder to obtain a coarse powder. The coarse powder (500 g) was passed through 40 mesh sieve and extracted with ethanol (90/10 v/v) in a Soxhlet apparatus at 25 °C. The extract was freeze-dried and stored in a vacuum desicator and the yield was 7 g.

**GC–MS/MS analyses of ethanol extract of *Cucumis callosus* for the determination of chemical composition**

**GC programme**

Column BR-5MS (5% Diphenyl/95% Dimethy poly siloxane), 30m x 0.25 mm ID x 0.25 mm df

Equipment Scion 436-GC Bruker, Carrier gas 1 ml per min, Split 1:10, Detector: TQ Quadrupole Mass Spectrometer, Software MS Work Station 8, Sample injected 2 ml.

**Oven temperature programme**

110 °C hold for 3.50 min, Up to 200 °C at the rate of 10 °C/min-No hold, Up to 280 °C at the rate of 5 °C/min-9 min hold, Injector temperature 280 °C, Total GC running time: 37.50 min.

**MS programme**

Library used NIST Version-11, Inlet line temperature 290 °C, Source temperature 250 °C, Electron energy 70 eV, Mass scan (m/z) 50-500 amu, Solvent Delay 0-3.5 min, Total MS running time: 37.50 min.

The identification of the constituents of the ethanolic extract of *Cucumis callosus* was performed using a mass spectrometer (Agilent 6890/Hewlett-Packard 5975) fitted with an electron impact (EI) ion source. The ethanolic extract (2.0 µl) of *Cucumis callosus* was injected manually in the split mode with a Hamilton syringe to the GC–MS for total ion chromatographic analysis. For quantitative analysis, the selected ion monitoring (SIM) mode was employed.

**Experimental animals**

Studies were carried out using Wistar male albino rats (150–200 g), obtained from the Institute of Veterinary Preventive Medicine (IVPM), Ranipet, and Tamilnadu, India. The animals were housed in polyacrylic cages (38 cm, 23 cm, and 10 cm) and maintained under standard laboratory conditions with dark/light cycle (12/12 h). The animals were acclimatized to lab conditions for a week before commencement of the experiment. The animals were fed with standard pellet diet (supplied by the poultry research station, Ranipet, and Tamilnadu, India). All the preparations were given ad libitum. All the animals were acclimatized to lab conditions for a week before commencement of the experiment. All animal studies were performed in accordance to guidelines of CPCSEA and Institutional Animal Ethical Committee (IAEC) of Kamalakshi Pandurangan college of Pharmacy, Tiruvannamalai (Tamilnadu). CPCSEA registration number was 745/03/ac/CPCSEA and all the procedures were followed as per rules and regulation.

**Induction of experimental myocardial infarction**

Doxorubicin was dissolved in sterile double distilled water and injected subcutaneously into rats (20 mg/kg) in group II, IV and V respectively, after the last dose of the extract to induce Cardiotoxicity.

**Experimental procedure**

Group 1: (Normal), Saline (0.75 ml/animal), orally for 14 d.

Group 2: (Drug control), Saline (0.75 ml/animal)+DOX 20 mg/kg, single intraperitoneal injection after 14th day.

Group 3: (Extract control), *Cucumis callosus* (500 mg/kg), orally for 14 d.

Group 4: *Cucumis callosus* (250 mg/kg), orally for 14 d+DOX (20 mg/kg) single intraperitoneal injection after 14th day

Group 5: *Cucumis callosus* (500 mg/kg), orally for 14 d+DOX (20 mg/kg) single intraperitoneal injection after 14th day

**Induction of experimental myocardial infarction**

Doxorubicin was dissolved in sterile double distilled water and injected subcutaneously into rats (20 mg/kg) in group II, IV and V respectively, after the last dose of the extract to induce Cardiotoxicity.

**Isolation of working heart preparation**

The animals were anesthetized with chloroform after 72 h of DOX administration, and then heart was punctured with a sterile syringe and blood was stored with EDTA, which is an anticoagulant agent and was excised out. Cardiac muscle from the lower third of the ventricle was collected and stored in liquid nitrogen for antioxidant studies.

**Biochemical analysis**

Blood samples were collected into tubes pre-coated with EDTA by vein puncture at baseline and post intervention. Serum was separated by centrifuging for 10 min 3000g at 4 °C. The serum used for the assay of urea, and uric acid which were being estimated by the methods of Nateron et al. [20] and Garaway et al. [21] respectively. The activities of serum glutamate-pyruvate transaminase (SGPT) and serum glutamate oxaloacetate transaminase (SGOT) were determined spectrophotometrically by the method of Mohun and Cook [22]. The lactate dehydrogenase (LDH), creatine phosphokinase (CPK) and alkaline phosphatase (ALP) were determined by the methods of King [23]. The levels of total cholesterol and triglycerides (TGs) were estimated by the methods of Zaltkis et al. [24], Foster and Dunn [25]. Serum high density lipoprotein (HDL) was determined according to the method of Wilson and Spiger [26]. Serum low density lipoproteins (LDL) and very low density lipoproteins (VLDL) were calculated as VLDL=triglycerides/5 and LDL = total cholesterol – (HDL cholesterol+VLDL cholesterol) respectively.

**Antioxidant assay**

The heart was dissected, immediately washed in ice-cold saline and a homogenate was prepared in 0.1 Mol L⁻¹ Tris-HCl buffer (pH 7.4). The homogenate was centrifuged and the supernatant was used for the assay of antioxidant parameters. MDA content assayed by adding tissue homogenate to TBA aqueous solution and incubated, and then the MDA content was measured according to the method of Zhang et al. [27]. Superoxide dismutase (SOD) activity assayed by adding NADH and incubated, and then SOD activity was measured according to the method of Rai et al. [28]. CAT activity was determined from the rate of decomposition of H₂O₂ according to Bergmeyer, Woeheh, and Grassel [29]. Glutathione peroxidase (GSH-Px) activity was determined by measuring the decrease in GSH content after incubating the sample in the presence of H₂O₂ and Na₂S₉ according to Haefemann et al. [30]. GSH reductase activity was assayed according to Carberg and Mannervik [31] and Mohandas et al. [32]. Bergmeyer et al. [29]. Glutathione peroxidase (GSH-Px) activity was determined by measuring the decrease in GSH content after incubating the sample in the presence of H₂O₂ and Na₂S₉ according to Haefemann et al. [30]. GSH reductase activity was assayed according to Carberg and Mannervik [31].

**Statistical analysis**

The obtained results were analyzed for statistical significance using one-way ANOVA followed by Dunnet test using graphpad prism statistical software for comparison with control group and DOX-treated group. P<0.05 was considered as significant.
RESULTS

Acute toxicity

It was observed that the administration of single oral dose 2000 mg/kg/body weight of ethanol extract of *Cucumis callosus* to a rat, didn't induce drug-related toxicity and mortality in the animals, and it was safe up to the dose of 2000 mg/kg/body weight.

GC-MS/MS analysis

The ethanolic extract of *Cucumis callosus* is a complex mixture of many constituents, and 32 compounds were identified in this plant by GC–MS/MS (fig. 1, table 1). Glycerin, Hexadecanoic acid, methyl ester, Palmitoleic acid, n-Hexadecanoic acid, 9,12-Octadecadienoic acid (Z,Z)-, Oleic Acid, cis-13-Octadecenoic acid, Octadecanoic acid, 3,4-DihydroisoquinoLine, 1-[3-methoxybenzyl]-6-methoxy-4H-Dibenzo[de,g]quinol ine, 5,6,6a,7-tetraydroxy-10,11-dimethoxy-6-methyl- (R), 3,4-Dihydroisoquinol ine, 1-[3-methoxybenzyl]-6-methoxy-2,3,9,10-Tetrahydro-1,8-dioxo-7,12-diazacyclopenta (b) phenanthrene, Furo (3,4-e)-1,3-benzodioxol-8(6H)-one, 6-(1,2,3,4-tetraydro-6,7-dimethoxy-2-methyl-1-isoquinolinyl)-,(R- (R*,S*)), Campesterol, and Stigmasterol were identified in the ethanol extract of *Cucumis callosus* by relating to the corresponding peak area through coupled GC–MS. Most of the phytochemical compounds possess medicinal properties (eg. Antioxidant, antimicrobial, antitumor, hepatoprotective, hypocholesterolemic, and anti-inflammatory properties, as identified by Dr. Duke’s Phytochemical and Ethnobotanical Databases).

![Fig. 1: The chromatogram showing n-Hexadecanoic acid (9.36), 4H-ibenzo[de,g]quinoline, 5,6,6a,7-tetraydroxy-6-methyl- (R)-(30.82), and Dodecane, 1-cyclopentyl-4-(3-cyclopentylpropyl)-(7.37) peaks detected by GC MS/MS](image-url)

### Table 1: Phytocomponents identified in *Cucumis Callosus* (GC–MS/MS study)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>RT</th>
<th>Name of the compound</th>
<th>Molecular formulae</th>
<th>MW</th>
<th>Peak area %</th>
<th>Compound nature</th>
<th><strong>Activity</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3.68</td>
<td>p-Cresol</td>
<td>C7H8O</td>
<td>108</td>
<td>0.82</td>
<td>Phenolic compound</td>
<td>Anti-microbial, Anti-inflamatory</td>
</tr>
<tr>
<td>2.</td>
<td>4.19</td>
<td>Phenylethyl Alcohol</td>
<td>C8H10O</td>
<td>122</td>
<td>0.25</td>
<td>Aromatic compound</td>
<td>Antioxidant, Analgesic</td>
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<tr>
<td>3.</td>
<td>4.66</td>
<td>4H-Pyran-4-one, 2,3-dihydroxy-6-methyl-5-Hydroxymethylfurural</td>
<td>C6H8O4</td>
<td>144</td>
<td>0.27</td>
<td>Flavonoid fraction</td>
<td>Anti-microbial, Anti-inflammatory</td>
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<tr>
<td>4.</td>
<td>5.89</td>
<td>3-Hydroxy-3,5-dihydroxy-6-methyl-2-hexadecen-1-ol</td>
<td>C6H6O3</td>
<td>126</td>
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<td>Aldehyde compound</td>
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<td>5.</td>
<td>9.01</td>
<td>Benzeneethanol, 4-hydroxy-2-methyl-6-hexene-1-ol</td>
<td>C8H10O2</td>
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<td>Anti-microbial, Anti-inflamatory</td>
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<td>6.</td>
<td>9.70</td>
<td>Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl-2-fluorobenzene</td>
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<td>7.</td>
<td>10.15</td>
<td>Lactose</td>
<td>C12H22O11</td>
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<td>Sugar moiety</td>
<td>Preservative</td>
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<td>8.</td>
<td>10.69</td>
<td>Dodecanoic acid</td>
<td>C12H24O2</td>
<td>200</td>
<td>0.22</td>
<td>Lauric acid</td>
<td>Arachidonic acid inhibitor, Urine acidifier</td>
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<tr>
<td>9.</td>
<td>13.07</td>
<td>Tetradecanoic acid</td>
<td>C14H28O2</td>
<td>228</td>
<td>0.33</td>
<td>Myristic acid</td>
<td>Antioxidant, Cancer prevent, Cosmetic, Hypercholesterolemic, Lubricant, Nematicide</td>
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<tr>
<td>10.</td>
<td>13.99</td>
<td>3,7,11,15-Tetramethyl-2-hexadecen-1-ol</td>
<td>C20H40O2</td>
<td>296</td>
<td>0.44</td>
<td>Terpene alcohol</td>
<td>Anti-microbial, Anti-inflammatory</td>
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<tr>
<td>11.</td>
<td>15.10</td>
<td>Hexadecanoic acid, methyl ester</td>
<td>C17H34O2</td>
<td>270</td>
<td>0.15</td>
<td>Palmitic acid ester</td>
<td>Anti-microbial, Hypocholesterolemic, Nematicide, Pesticide, Lubricant</td>
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**Note:** MW = Molecular Weight, **Activity** refers to the biological properties of the compounds identified.
<table>
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<tr>
<th>No.</th>
<th>Similarity</th>
<th>Compound Name</th>
<th>CAS Number</th>
<th>MW</th>
<th>Molecular Formula</th>
<th>Activity</th>
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<td>12</td>
<td>15.49</td>
<td>Palmitoleic acid</td>
<td>C16H30O2</td>
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<td>15.68</td>
<td>n-Hexadecanoic acid</td>
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<td>Palmitic acid</td>
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<td>14</td>
<td>18.03</td>
<td>(Z,Z)-9,12-Octadecadienoic acid</td>
<td>C18H32O2</td>
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<td>1.89</td>
<td>Linoleic acid</td>
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<td>15</td>
<td>18.12</td>
<td>Oleic Acid</td>
<td>C18H34O2</td>
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<td>3.44</td>
<td>Oleic Acid</td>
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<td>16</td>
<td>18.32</td>
<td>cis-13-Octadeconoic acid</td>
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<td>Octadecanoic acid</td>
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<td>22.64</td>
<td>3,4-Dihydroisoquinolone, 1-[3-methoxybenzyl]-6-methoxy-4H-Dibenzo[a,e]isoquinoline, 5,6,7-tetrahydro-10,11-dimethoxy-6-methyl-1-(R)-1,2,3,4-Dihydroisoquinolone, 1-[3-methoxybenzyl]-6-methoxy-4H-Dibenzo[a,e]isoquinoline, 5,6,7-tetrahydro-10,11-dimethoxy-6-methyl-1-(R)-</td>
<td>C19H21NO2</td>
<td>281</td>
<td>3.17</td>
<td>Alkaloid</td>
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<td>19</td>
<td>23.12</td>
<td>3,4-Dihydroisoquinolone, 1-[3-methoxybenzyl]-6-methoxy-4H-Dibenzo[a,e]isoquinoline, 5,6,7-tetrahydro-10,11-dimethoxy-6-methyl-1-(R)-</td>
<td>C19H21NO2</td>
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<td>30.82</td>
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<td>20</td>
<td>23.53</td>
<td>7-Methoxy-1,2,3,4-tetrahydro-5',6'-dihydroisoquinoline, 1-[3-methoxybenzyl]-6-methoxy-4H-Dibenzo[a,e]isoquinoline, 5,6,7-tetrahydro-10,11-dimethoxy-6-methyl-1-(R)-</td>
<td>C18H19NO2</td>
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<td>21</td>
<td>24.49</td>
<td>(-)-Roemerine</td>
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<td>1.54</td>
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<td>22</td>
<td>24.89</td>
<td>2,3,9,10-Tetrahydro-1,8-dioxo-7,12-diazaacycloundecan-1(1H)-one</td>
<td>C16H12N2O2</td>
<td>264</td>
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<td>23</td>
<td>25.24</td>
<td>Spiro[2,5-cyclohexadiene-1,7(1'H)-cyclopent[1][4]-isquinolin]-4-one, 2,3,5,8,8a-tetrahydro-5',6'-dimethoxy-1'-methyl-1,2,3,4-tetrahydroisoquinolinyl]-4-one, 2,3,5,8,8a-tetrahydro-5',6'-dimethoxy-1'-methyl-[4H]-1,2,3,4-tetrahydroisoquinolinyl]-4-one, 2,3,5,8,8a-tetrahydro-5',6'-dimethoxy-1'-methyl-[4H]-1,2,3,4-tetrahydroisoquinolinyl]-4-one, 2,3,5,8,8a-tetrahydro-5',6'-</td>
<td>C19H21NO3</td>
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<td>25.42</td>
<td>Furo[3,4-e]-1,3-benzodioxol-8(6H)-one, 6-[1,2,3,4-tetrahydro-6,7-dimethoxy-1-isoquinolinyl]-1-(R,R,R)-1,2,3,4-tetrahydroisoquinolinyl]-4-one, 2-(p-Methoxyphenyl)-8-methyl-1H-thieno(2,3-b)indole</td>
<td>C21H21NO6</td>
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<td>C13H17NO4</td>
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<td>26</td>
<td>26.13</td>
<td>2-(p-Methoxyphenyl)-8-methyl-1H-thieno(2,3-b)indole</td>
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<td>28.99</td>
<td>2-(p-Methoxyphenyl)</td>
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<td>30.69</td>
<td>3,5-Cyclohexanetrione, tris(dimethylaminomethylidene)</td>
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<td>291</td>
<td>2.45</td>
<td>Nitrogen compound</td>
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<td>29</td>
<td>31.65</td>
<td>Stigmasteran-3-ol, 5-chloro, acetate, (3[S])</td>
<td>C31H53ClO2</td>
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<td>32.56</td>
<td>Dodecane, 1-cyclopentyl-4-(3-cyclopentyl)propiyl-</td>
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<td>C29H48O</td>
<td>412</td>
<td>1.28</td>
<td>Steroid</td>
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</table>

**Source: Dr. Duke's Phytochemical and Ethnobotanical Databases**
Biochemical parameters

The concentration of serum urea, uric acid, and alkaline phosphate was significantly increased in DOX-treated animals (group II) compared to normal animals (group I). Treatment with \textit{Cucumis callosus} extract the levels of serum urea, uric acid, and alkaline phosphatase concentrations was decreased significantly (group IV and group V) compared with group II (fig. 2).

The marker enzyme SGOT, SGPT, CPK, LDH were increased significantly in Group II compared with Group I (fig. 3 and 4). \textit{Cucumis callosus} extract 250 and 500 mg/kg body weight (Group IV and V) treated animals marker enzymes levels were significantly reduced when compared with DOX-only treated group (group II).

The significant increase in levels of serum cholesterol, TGs, LDL and VLDL and decreased level in HDL were observed in DOX-treated rats when compared to the normal rats (group II). Pretreatment with \textit{Cucumis callosus} (250 and 500 mg kg\textsuperscript{-1} d\textsuperscript{-1} for 14 d) to DOX-treated rats significantly altered the level of serum cholesterol, TGs, LDL, and VLDL (fig. 5 and 6) and increased the serum HDL concentration when compared to normal rats.

SOD, CAT, GSH-PX and GSH levels in DOX-induced rats (group II) were significantly decreased (fig. 7) when compared to normal rats (group I). But the \textit{Cucumis callosus} extract (250 and 500 mg/kg/day) counteracted dose-dependent manner and the detrimental effect of DOX by increasing the content of antioxidants. Administration of \textit{Cucumis callosus} alone (group III) did not show significant changes in antioxidants when compared to normal rats (group I).

\textbf{Fig. 2:} Effect of ethanolic extract of \textit{cucumis callosus} on urea (mg/l), uric acid (mg/l) and alkaline phosphatase (mg/l) in DOX intoxicated rats. Values are mean±SD (n=6) *P<0.01, **P<0.05 respectively

\textbf{Fig. 3:} Effect of ethanolic extract of \textit{cucumis callosus} on SGOT (IU L\textsuperscript{-1}) and SGPT (IU L\textsuperscript{-1}) in DOX intoxicated rats. Values are mean±SD (n=6) *P<0.01, **P<0.05 respectively

\textbf{Fig. 4:} Effect of ethanolic extract of \textit{cucumis callosus} on SOD (U mg protein\textsuperscript{-1}), LDH (IU L\textsuperscript{-1}) and CPK (IU L\textsuperscript{-1}) in DOX intoxicated rats. Values are mean±SD (n=6) *P<0.01, **P<0.05 respectively

\textbf{Fig. 5:} Effect of ethanolic extract \textit{Cucumis} on serum HDL (mg/l), LDL (mg/l), and VLDL (mg/l) in DOX intoxicated rats. Values are mean±SD (n=6) *P<0.01, **P<0.05 respectively

\textbf{Fig. 6:} Effect of ethanolic extract \textit{Cucumis} on serum TGs (mg/l) and total cholesterol (mg/l) in DOX intoxicated rats. Values are mean±SD (n=6) *P<0.01, **P<0.05 respectively
The increase in the activity of catalase/GSH, might be detrimental [36] because the increase of the LDH level in serum and extracellular fluid suggests an increased leakage of this enzyme from mitochondria as a result of toxicity induced by treatment with doxorubicin. This index has been recently used in other studies to test for cardiotoxicity [41].

Cucumis callosus was found to inhibit the doxorubicin-induced CPK and LDH release in the serum of rats. It is widely reported that doxorubicin-induced free-radical generation triggers membrane peroxidation and disruption of cardiac myocytes, which can lead to increased release of CPK in the serum. Cucumis callosus pretreatment led to inhibition of CPK and LDH release which resulted in either complete reversal or considerable recovery of the serum enzyme activities.

The cardioprotective activity of Cucumis callosus was further supported by increased myocardial antioxidant enzyme activity and decreased the extent of lipid peroxidation. Lipid peroxidation is known to cause cellular damage and is primarily responsible for reactive oxygen species-induced organ damage. Increased level of MDA and decreased levels of GSH, SOD and CAT were observed in heart tissue in doxorubicin-treated animals. Pretreatment with Cucumis callosus efficiently counteracted the doxorubicin-induced cardiac tissue damage by a significant decrease in MDA and the increase in GSH, SOD and CAT levels. The observed increase in CAT activity in doxorubicin-treated animals supports the above hypothesis that this increase is possibly required to overcome excessive oxidative stress [42].

CONCLUSION

In conclusion, the present results suggest that Cucumis callosus prevented the doxorubicin-induced myocardial toxicity by boosting the endogenous antioxidant activity. The cardioprotective property of Cucumis callosus could be due to lipid-lowering and antioxidant properties. Further studies are needed in isolation and characterization of chemical compounds present in the Cucumis callosus extract for the treatment of myocardial infarction.

CONFLICT OF INTERESTS

Declared none

REFERENCES


