vascular disease (5, 6, 7) Since these risk factors play an important role in determining atherogenesis and the subsequent development of hyperlipidemia and atherosclerosis. Oxidation is one of the destructive processes, wherein it breaks down and damages various molecules. Molecular oxygen is an essential component for all living organisms, but all aerobic species suffer from injury if exposed to concentration more than 21%. (13)

Free radicals are chemical species that have a single unpaired electron in an outer orbit. They attack and induce oxidative damage to various biomolecules including proteins, lipids, lipoproteins, and DNA. (13, 14) Lipids are one of the most susceptible targets of free radicals. (14)

Antioxidants- Antioxidants are compounds that act as inhibitors of the oxidation process and are found to inhibit oxidant chain reactions at small concentrations and thereby eliminate the threat of pathological processes. (12) They block the initiation of free radicals and terminate radical damage and inhibit lipid peroxidation which was the factors of atherosclerosis. The body possesses several defense systems comprising enzymes and radical scavengers. (10)

Nowadays, natural medicine is constantly expanding, which has various kinds of herbal medicine. Plants are potential sources of natural antioxidants. They absorb the sun’s radiation and generate high levels of oxygen as secondary metab-
Morinda citrifolia L. (Noni)- Morinda citrifolia L. commonly known as Noni from the family Rubiaceae, is a plant typically found in Hawaii, Tahiti, tropical Asia, and southern Taiwan. Dried fruits or leaves powder boiled with water produces a tea, which is used to relieve blood pressure, muscle pains and vomiting. It can be used as a raw material for nutritional and functional food products. Recently ‘Noni’ juice extract has been commercially processed and distributed internationally as a dietary supplement. Relatively unheard extract has been commercially processed and distributed internationally as a dietary supplement. Relatively unheard extract has been commercially processed and distributed internationally as a dietary supplement. Relatively unheard extract has been commercially processed and distributed internationally as a dietary supplement. Relatively unheard extract has been commercially processed and distributed internationally as a dietary supplement. Relatively unheard extract has been commercially processed and distributed internationally as a dietary supplement.

The total plasma cholesterol, triglyceride, HDL-cholesterol, LDL-cholesterol, and triglyceride level.

The temperature was maintained at 24°C: 1°C and relative humidity between 50 to 70%; 12 hours each of dark and light cycle was maintained. Groups of animal at each dose level were identified by cage number and were individually colour coded, stained with diluted picric acid.

DOSE PREPARATION- Stock solution of different concentration of Morinda citrifolia L. plant raw fruit extract was freshly prepared as mg/ml, on the day of dosing by dissolving in the vehicle sample according to doses to be administered, the volume to be administered, either of the extract or vehicle was estimated to attain 1 ml/100g body weight.

Antioxidant studies- To investigate the effects of daily intake of medicinal plants on antioxidant enzymes, 36 rats 18 male and 18 female were randomly divided into three groups 6 animals of each gender in each group. The test solutions were administered to rats at the dose levels of 500 mg/kg (Group I) and 1000 mg/kg (Group II) for 8 weeks. The animals in the Control group (Group III) received the vehicle alone in a similar way. The dilutions were made in such concentrations to allow the administration of each dose in a constant volume of 1 ml / 100g bodyweight. The animals were administered orally by orogastric catheter once daily for 56 days. On 56th day, the animals were fasted for overnight and blood samples were collected through cardiac puncture from all animals used in the study. The blood was centrifuged at 1500 rpm for 5 min; and serum was separated for enzymes assay.

Lipid peroxidation (Malondialdehyde (MDA) and Superoxide dismutase (SOD) was carried out by Malondialdehyde formation was estimated by the method of, Dr. M. M. Misro, Ms. Rekha, Ms. Ramya and Mr. Ibrahim.

OBJECTIVES OF THE STUDY

As far as our literature survey could ascertain, there are lot of in vitro and in vivo studies were carried out on Morinda citrifolia L. leaf which suggest strong antioxidant antihyperlipidemic potential of leaf extract whereas very little is known about fruit extract. There was no study report available on in vivo antioxidant and anticholesterol activity of Morinda citrifolia L. fruit extract in triton induced hyperlipidemic rats. Furthermore, another study was also carried out to evaluate anticholesterol activity of Morinda citrifolia L. fruit extract in triton induced hyperlipidemic rats.

MATERIALS AND METHODS

The Morinda citrifolia raw fruit extract was obtained from Brihans Pharmaceuticals Pvt. Ltd. Mulund, Mumbai, India.

ANIMAL PROCUREMENT AND MANAGEMENT- Albino male Wistar rats weighing between 200 to 250 g were procured from Haffkine Biopharmaceuticals limited, (Haffkine BPCL), CPCSEA Registered breeder & Supplier No: 200/2000/CPCSEA, Parel, Mumbai. All the animals were weighed and their health was verified. Animals were allowed acclimatization period of 7 days to the laboratory conditions prior to initiation of study. Animals were assigned to cages and groups, two or three per cage, sex-wise and the individual animal was fur marked. The females were nulliparous and non pregnant.

The rats were housed gender-wise; two or three per cage in polypropylene cages with stainless steel grill tops facilities for food and water bottle, and bedding of clean paddy husk which was changed everyday. A standard ‘Amrut’ brand Pelleted rat feed was provided to the test animals manufactured by M/s. Pranav Agro Industries Ltd., Sangli. Water was provided ad-libitum in glass amber coloured bottles.

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Antioxidant activity of Morinda citrifolia L. fruit extract

**RESULTS AND DISCUSSION**

Plants are generally believed to be rich in a wide variety of secondary metabolites such as alkaloids, flavonoids, terpenoids and saponins. Of these metabolites, plant antioxidants such as the numerous phenolic compounds have received increased attention as useful nutraceutical in management of diseases.

In the present antioxidant study fruit extract of Morinda citrifolia L. fruit extract was administered at the dose of 500 mg/kg and 1000 mg/kg by oral route in rats for 8 weeks. Result of this study showed that there was non significant increased in SOD in male rats whereas significant increased in SOD value in female rats treated with 1000 mg/kg of Morinda citrifolia L. fruit extract as compared to control. There was significant decreased in lipid peroxidation activity in both male and female groups treated with 500 mg/kg and 1000 mg/kg of Morinda citrifolia L. fruit extract as compared to control.

Treatment with test drug reduces the level of lipid peroxides indicating the effective anti-oxidant property of the test drug. Test drug extract produced higher but non significant levels of the superoxide dismutase for both doses in male and significant levels in females treated with 1000 mg/kg when compared with control. This may be due to decrease in the conversion of super oxide anions to hydrogen peroxide (H₂O₂) which is caused due to the catalysis produced by the SOD. Which is an enzyme prevents the further generation of free radical (40) hence it was assumed that extract has significant antioxidant property.

In pertinent study, tritonised animals have been used to test the antitriglyceridemic and anticholesterolemic efficacy of Morinda citrifolia L. fruit extract as, such a model has been used for the induction of acute hyperlipidemia (46) as well as for testing the potential of natural/chemical hypolipidemic drugs. (47, 48, 49, 50, 51, 52, 53) triton induced hyperlipidemic rats were treated with Morinda citrifolia L. fruit extract at the dose of 1000 mg/kg by oral route and the result were compared with positive control tritonised rats treated with standard drug Atorvastatin. Significant elevation is seen in the increased levels of plasma total cholesterol, triglyceride, and LDL in Triton WR 1339 induced hyperlipidemic rats within 24 hrs treatment. In hyperlipidemic Atorvastatin treated rats significant decrease was seen in the levels of plasma total cholesterol at 24 hour treatment, also the levels of triglyceride show significant decline in this group. Whereas hyperlipidemic rats treated with Morinda citrifolia L. fruit extract did not show any lipid lowering effect. Increased levels of cholesterol, triglycerides and LDL due to tritonisation did not show any declination in this group cholesterol, triglycerides and LDL levels are significantly more than positive control group. VLDL levels were also as compared to positive control group.

Findings of such research work did not contribute substantially to explicate the favorable outcome of Morinda citrifolia L. extract on positive control Since Ayurvedic/herbal medicines are needed to be used in higher doses and for relatively longer periods for permanent effects, hence further study is to be carried out on prolonged exposure of Morinda citrifolia L. fruit extract to evaluate its beneficial effect against hyperlipidemia and hypercholesterolemia. Further investigation on the isolation and identification of antioxidant component(s) in the plant may lead to chemical entities with potential for its clinical use.

**TABLES AND GRAPHS**

**Antioxidant activity of Morinda citrifolia L. fruit extract**

**Sex – male**

<table>
<thead>
<tr>
<th>Dose group</th>
<th>SOD activity units/ml (mean ± sd)</th>
<th>LPP activity (mean ± sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.90 ± 0.51</td>
<td>29.66 ± 4.11</td>
</tr>
<tr>
<td>500 mg/kg</td>
<td>2.89 ± 1.34</td>
<td>14.47 ± 5.52</td>
</tr>
<tr>
<td>1000 mg/kg</td>
<td>3.68 ± 3.11</td>
<td>13.67 ± 4.16</td>
</tr>
</tbody>
</table>

**Sex – female**

<table>
<thead>
<tr>
<th>Dose group</th>
<th>SOD activity units/ml (mean ± sd)</th>
<th>LPP activity (mean ± sd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.14 ± 0.36</td>
<td>23.06 ± 3.30</td>
</tr>
<tr>
<td>500 mg/kg</td>
<td>1.54 ± 0.47</td>
<td>11.05 ± 1.33</td>
</tr>
<tr>
<td>1000 mg/kg</td>
<td>2.23 ± 0.32</td>
<td>10.5 ± 0.86</td>
</tr>
</tbody>
</table>

**By Student t Test** P < 0.05 Significant

P > 0.05 NS: Not Significant
### Anticholesterol activity of *Morinda citrifolia* L. fruit extract

<table>
<thead>
<tr>
<th>GROUP</th>
<th>CHO (mg/dl) MEAN ± SD</th>
<th>HDL (mg/dl) MEAN ± SD</th>
<th>TG (mg/dl) MEAN ± SD</th>
<th>LDL CHO (mg/dl) MEAN ± SD</th>
<th>VLDL CHO (mg/dl) MEAN ± SD</th>
<th>CHOL/HDL RATIO MEAN ± SD</th>
<th>LDL/HDL RATIO MEAN ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Normal Control</td>
<td>55.17 ±9.02</td>
<td>29.35 ±4.82</td>
<td>101.00 ±12.10</td>
<td>5.62 ±7.04</td>
<td>20.20 ±2.42</td>
<td>1.88 ±0.17</td>
<td>0.19 ±0.22</td>
</tr>
<tr>
<td>II: Triton Control</td>
<td>398.67 ±102.56</td>
<td>74.07 ±65.88</td>
<td>1411.17 ±213.21</td>
<td>42.37 ±99.55</td>
<td>282.23 ±42.64</td>
<td>8.80 ±5.58</td>
<td>1.54 ±2.31</td>
</tr>
<tr>
<td>III : Triton + Drug S</td>
<td>399.17 ±143.54</td>
<td>54.72 ±44.07</td>
<td>1215.33 ±203.97</td>
<td>101.38 ±90.78</td>
<td>243.07 ±40.79</td>
<td>9.28 ±3.91</td>
<td>1.97 ±1.73</td>
</tr>
<tr>
<td>V : Triton + Std Drug</td>
<td>185.17 ±41.11</td>
<td>21.10 ±2.97</td>
<td>665.33 ±158.92</td>
<td>31.00 ±22.74</td>
<td>133.07 ±31.78</td>
<td>8.89 ±2.07</td>
<td>1.57 ±1.31</td>
</tr>
</tbody>
</table>

**Comparison**

- I Vs V * P<0.05
- II Vs V * P<0.05
- III Vs V * P<0.05
- Comparison I Vs V * P<0.05
- Comparison II Vs V * P<0.05
- Comparison III Vs V * P<0.05

**By Student t Test**

- *P < 0.05 Significant
- P > 0.05 NS: Not Significant

### Anticholesterol activity of *Morinda citrifolia* L. fruit extract

![Graph showing lipid profile](image)

**REFERENCE**