Hypolipidaemic efficacy of *Capparis decidua* fruit and shoot extracts in cholesterol fed rabbits

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High fat diet caused significant (8-fold) increase in serum total cholesterol in rabbits. Administration of *C. decidua* fruit extract (50% ethanolic) at the dose of 500 mg/kg body weight significantly reduced serum total cholesterol (61%), LDL cholesterol (71%), triglycerides (32%) and phospholipids (25%). Similarly *C. decidua* shoot extract lowered serum total cholesterol (48%), LDL cholesterol (57%), triglycerides (38%) and phospholipids (36%). The cholesterol content of aorta was decreased by 44 and 28% in fruit and shoot extract treatment respectively. The HDL to total cholesterol ratio and atherogenic index was significantly decreased in plant extract treated groups suggesting antiatherosclerotic nature of these plant extract. These results reveal the hypolipidaemic potential of *C. decidua* fruit and shoot.

**Keywords**: Antiatherosclerotic, Atherogenic index, *Capparis decidua*, Cholesterol, Hypolipidaemic

**[IPC Code]: Int Cl A61P**

There is a close association between ischaemic cardiovascular disease and hyperlipidaemia. The beneficial effect of lowering elevated serum cholesterol level in the prevention of coronary heart disease is well established. All drugs which are used in cardiovascular disease lower the lipid profile specially cholesterol.

*Capparis decidua* (Frosk.) Edgew (family: Capparidaceae) is a xerophytic shrub, commonly known as Karrel or Ker. It is an extremely useful plant for food (vegetable), fuel, wood and medicinal properties. The shoots and young leaves contain a rubefacient and vesicant principle. Bark is acrid, laxative, diaphoretic, alepetytic, antihelminthic, used for cough, asthma and inflammation. Root and root bark are pungent, bitter given in intermittent fevers and rheumatism. The flower buds, known as “pasi”, of this spiny tree are cooked as a potherb, and also used in pickle. The data indicate that *Capparis decidua* may have potential use as an anti diabetic agent, especially in chronic cases as it helps in lowering the oxidative stress in diabetes. In the present study the possible lipid lowering potential of *Capparis decidua* fruit and shoot extract (50% ethanolic) has been explored on serum and tissue biochemical parameters.

**Materials and Methods**

**Animal**—White adult male rabbits were procured from Rajasthan Government Sheep and Wool Farm, Avikanagar (Rajasthan). Weight and age of animals were 1.25-1.5 kg and 10-12 month respectively.

Animal were housed in well lighted air conditioned room (26°±1°C) in metallic wire gauge cages. Animals were fed on standard rabbit chow supplied by Hindustan Lever Ltd. The food was supplemented with green leafy and seasonal vegetables and water ad libitum.

**Preparation of extract**—The chosen plant, *Capparis decidua* was identified and selected by the experts of Botany Department, JNV University, Jodhpur. For the present study, fruits and shoots of *C. decidua* were collected. These materials were allowed to shade dry. Dried fruits and shoots were powdered and extracted with 50% ethanol for about 18 hr. The ethanol was separated under reduced pressure to obtain viscous brown mass. The crude drug was weighed and dissolved in quantified distilled water every morning to administer the animals. The dose was determined by LD<sub>50</sub> test. The LD<sub>50</sub> value of *C. decidua* fruit and shoot extract was 2 mg/kg body weight.

**Experimental design**—Adult rabbits (24) were divided into following 4 groups of 6 each:

- **Group A**: Vehicle treated control (60 days)
- **Group B**: High fat diet + cholesterol feeding (400 mg/kg body weight) for 60 days
Group C: High fat diet + cholesterol feeding (400mg/kg body weight) + *C. decidua* fruit extract (500mg/kg body weight) for 60 days.

Group D: High fat diet + cholesterol feeding (400mg/kg body weight) + *C. decidua* shoot extract (500mg/kg body weight) for 60 days.

The high fat diet (HFD) comprised of wheat flour base with addition of milk powder, dried egg yolk, hydrogenated fat, butter, dried yeast, salt, sugar and vitamin mixture to produce the following nutrients in the given proportion (Table 1). The average consumption of control diet was 100 g/rabbit/day, while average consumption of high fat diet was 75 g/rabbit/day.

Group A served as normal control. Group B-D received high fat diet plus cholesterol (400mg/kg body weight) for induction of hyperlipidaemia. In addition to this, groups C and D were given ethanolic extract of *C. decidua* fruit and shoot at the dose of 500mg/kg body weight, respectively.

Cholesterol (400mg/kg body weight) in 5ml oil mixture was administered orally every day for 60 days. The plant extracts (500mg/kg body weight) suspended in 5 ml distilled water were administered orally every day for 60 days. The experimental protocol on animals has been approved by the Institutional Animal Ethics Committee.

At the end of experimental period all the animals were fasted over night and blood was collected by cardiac puncture. The total cholesterol (TC) 15, triglycerides (TG) 13, phospholipids 14 and HDL-cholesterol 12 were estimated in serum.

The LDL, VLDL and Atherogenic index were calculated using the following formulae

\[
LDL = TC - HDL - VLDL \\
Atherogenic index = \frac{LDL + VLDL}{HDL}
\]

The HDL/total cholesterol ratio was also calculated.

Biochemical analysis of fresh frozen tissues of liver, heart and aorta were made for cholesterol 15, triglycerides 13 and phospholipids 14. All the values were recorded as Mean ± SE and data analyzed by Student’s *t* test.

**Results**

A non-significant reduction in body weights was noticed in rabbits fed with cholesterol (Gr. B) and treated with plant extracts (Gr. C and D). Liver weights were slightly increased in cholesterol fed rabbits (Table 2). An eight-fold increase in serum total cholesterol (TC) was noticed in rabbits fed HFD plus cholesterol (Gr.B) in compared to rabbits fed normal control diet. Administration of *C. decidua* fruit and shoot extract lowered the serum total cholesterol by 61 and 48% respectively (Table 3).

A significant reduction in LDL cholesterol level was observed in both plant extract treated groups (*P* ≤ 0.001) and lowering percentage were 71 and 57% in fruit and shoot extracts treated groups. The HDL/total cholesterol ratio was significantly reduced in rabbits fed with cholesterol (Gr. B) which became normal in both plant extracts treated groups (Gr.C and D). The atherogenic index revealed the same effect (Table 3). The serum triglycerides (TG) were decreased significantly (*P* ≤ 0.001) after treating with *C. decidua* fruit and shoot extract and lowering percentage were 32 and 25 % respectively. The serum phospholipids levels were also reduced significantly (*P* ≤ 0.05) in both plant extract treated groups (Table 3).

**Table 1**—Proportion of nutrients in high fat diet

<table>
<thead>
<tr>
<th></th>
<th>HFD (%)</th>
<th>Control (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Sugar</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Fats</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>Salt</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vitamin</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Fiber</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Table 2**—Body and organ weight of high fat diet/C. decidua extracts treated rabbits

<table>
<thead>
<tr>
<th>Treatment groups</th>
<th>Body weight (kg)</th>
<th>Liver (g/kg)</th>
<th>Heart (g/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial</td>
<td>Final</td>
<td></td>
</tr>
<tr>
<td>Gr. A</td>
<td>1.31 ± 0.67</td>
<td>1.54 ± 0.62</td>
<td>40.62 ± 1.78</td>
</tr>
<tr>
<td>Gr. B</td>
<td>1.61 ± 0.6</td>
<td>1.56 ± 0.6</td>
<td>44.49 ± 1.74</td>
</tr>
<tr>
<td>Gr. C</td>
<td>1.22 ± 0.76</td>
<td>1.16 ± 0.14</td>
<td>29.74 ± 2.72</td>
</tr>
<tr>
<td>Gr. D</td>
<td>1.18 ± 0.41</td>
<td>1.08 ± 0.16</td>
<td>31.34 ± 1.62</td>
</tr>
</tbody>
</table>

*P* values: *b* ≤ 0.01; *ns* non significant
Gr. B compared with Gr. A; Gr. C and D compared with Gr. B
Cholesterol, triglycerides and phospholipids content in liver, heart and aorta showed significant increase in cholesterol fed rabbits (Gr. B). *C. decidua* fruit and shoot treatment caused reduction in lipid content in liver, heart and aorta (Table 4).

**Discussion**

High fat diet plus cholesterol feeding increased serum total cholesterol and LDL cholesterol level significantly. Elevated cholesterol and LDL levels promote atherosclerosis and other cardiovascular disease. LDL carries cholesterol from the liver to the peripheral cells and smooth muscle cells of the arteries. A rise in LDL may cause deposition of cholesterol in the arteries and aorta and hence it is a direct risk factor for coronary heart disease. The search for hypolipidaemic drugs follows rationale that high levels of serum cholesterol are associated with an increased incidence of coronary heart diseases. Reduction in LDL cholesterol and increase in HDL cholesterol concentration are significantly related to lipid lowering therapy.

In the present study, the *C. decidua* fruit and shoot extract feeding resulted in significant reduction in total cholesterol and LDL cholesterol level. Regarding the mechanism of action these plant extracts may enhance activity of enzymes involved in bile acid synthesis and its excretion and this may have caused decrease in serum cholesterol and triglycerides. Therefore, in liver and aorta there was a significant decrease of lipids content.

A significant fall in the HDL cholesterol to total cholesterol ratio was observed in HFD plus cholesterol fed rabbits (Group B). Low level of HDL is associated with high risk of coronary artery disease. *C. decidua* fruit and shoot extracts feeding brought back this ratio to normal by increasing HDL concentration. HDL participates in reverse cholesterol transport transferring cholesterol from tissues back to the liver. This action aids the efflux of cholesterol from the arterial wall. HDL may also influence atherosclerosis by carrying enzymes that are antioxidants, which may block early steps in atherogenesis and slow progression of lesions.

The decrease in serum TG level is an important finding of this experiment. Recent studies show that triglycerides are independently related with coronary heart disease. Most of the hypolipidaemic drugs do not decrease serum triglycerides level, but *C. decidua* fruit and shoot extract lowered it significantly.
This effect may be related to increase in the endothelium bound lipoprotein lipase activity that hydrolyses the triglycerides into fatty acids. The atherogenic index was significantly reduced in plant extracts treated groups. These results demonstrate strong hypolipidaemic impacts of *C. decidua* fruit and shoot extract. It also provides additional benefits in the prevention and treatment of atherosclerosis.

Acknowledgements

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References

16. Pedersen T R, Pro and con: low-density lipoprotein cholesterol lowering is and will be the key to the future of lipid management, *Am J Cardiol*, 87 (2001) 8B.