Advantages of high fiber content millet family chosen for the study of anti-hyperlipidemic activity using the extract of Italica seeds and husk on rats

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\textbf{ABSTRACT}
Setaria italica is usually identified as Foxtail millet (Korralu in Telugu). It belongs to the millet family consisting of high fiber content along with many minerals, vitamins, essential amino acids, proteins, gluten-free and very less quantity of carbohydrates. Due to enormous advantages and was less explored, this millet was chosen for the study of anti-hyperlipidemic activity. To examine the anti-hyperlipidemic activity of hydroalcoholic extract of seed and husk of Setaria italicain atherogenic diet-induced hyperlipidemic rats. The hydroalcoholic extract of Setaria italicaseeds and husk are assessed for anti-hyperlipidemic movement in atherogenic diet brought hyperlipidemic rats. The study was performed by comparing the results with that of standard drug atorvastatin (10mg/kg body wt). The education results are uttered as mean ± S.E and the data is analyzed by utilizing one-way investigation (ANOVA). Values with $P<0.05$ is measured as important. Oral management of 500mg/kg body wt of hydroalcoholic extract of Setaria italicaseeds showed a significant reduction in the serum levels of low-density lipoproteins (LDL), triglycerides (TG), total cholesterol and an increase in high-density lipoproteins (HDL) than the standard control. The hydroalcoholic extract of seed possesses significant activity than the hydroalcoholic extract of a husk of Setaria italicais. The hydroalcoholic seed extract of Setaria italicaproduced promising results the millets have to be consumed as a diet as it immensely controls the serum cholesterol levels, which plays a vital role in the control of cardiovascular diseases.

\textbf{INTRODUCTION}
In this modern era, highly sophisticated instruments made mankind too lazy to work. Lack of physical exercise, sedentary work style, high fat diet, fast foods, irregular time periods of consuming food, diseased states, are being faced by the present generation which is an alarming sign in increasing hyperlipidemia in the present scenario. Hyperlipidemia is a lipid metabolic disorder, which includes abnormal levels of lipids in the blood such as ele-
vated stages of total cholesterol (TC), Low-density lipoprotein (LDL), Triglycerides (TG) and low levels of High-density lipoprotein (HDL). (Gofman et al., 1950) Hyperlipidemia was a modifiable risk factor for the expansion of atherosclerosis. (Mozaffarian, 2015) This may lead further complications with high injury and humanity rate, mainly coronary thrombosis artery disease and stroke in India most prevalent dyslipidemia was due to borderline and higher levels of LDL-C, low levels of HDL-C (men – 54.9% and women – 64.4%). (Levy et al., 1979) Medicinal plants show a chief role in the hypolipidemic activity and extensively utilized by the popular of the population to cure numerous diseases like hypertension and atherosclerosis and illness hastall influence on the world’s budget. Millets are rich in variable nutrients like fibre, minerals, amino acids, vitamins, proteins and low content of carbohydrates. (Smolders et al., 2007; Gowda et al., 2007) Foxtail millet, technical name Setaria italica (synonym Panicum italicum L.), is an annual grass grown up for human food. Due to this tremendous benefits, foxtail millet has been chosen for evaluating the antihyperlipidemic activity.

MATERIALS AND METHODS

The whole grain seeds of Setaria italica were purchased from the local market of Mangalagiri, Guntur dist, Andhra Pradesh. They were genuine by Dr P. Satyanarayana Raju, Plant Taxonomist, Department of Botany and Microbiology, Acharya Nagarjuna University, Guntur, Andhra Pradesh, India.

Preparation of Hydroalcoholic extract

The seeds were shade dried for 3-4 days and grounded to a fine powder. The powder was passed through the sieves and husk was separated. The seed powder and husk were taken separately and were macerated in hydroalcoholic solution in the ratio of 3:1 for three days and filtered. The procedure was repeated twice and the filtrates were combined. The combined filtrates were subjected to distillation. The extracts obtained are refrigerated until further studies were carried out (Diao and Jia, 2017; Chandrasekara and Shahidi, 2010). Graph 1 is Standards are statistically important at **p < 0.001 as compared with the standard group.

Materials

Setaria italica whole grains (Local market of Mangalagiri), Albino rats (Mahaveer Enterprises) Formaldehyde (from Sigma Aldrich Chemicals Pvt Ltd, Bangalore, India), Ethanol and chloroform (from Sigma Aldrich Chemicals Pvt Ltd, Bangalore, India, Distilled water).

Graph 1: Values were given as mean ± S.D. for six rats in each group.
Table 1: Phytochemical constituents of Setaria italica Seed and Husk.

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Hydroalcoholic seed</th>
<th>Hydroalcoholic husk Extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Glycosides</td>
<td>+</td>
<td>_</td>
</tr>
<tr>
<td>Steroids</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>+</td>
<td>_</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tannins</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Terpenes</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Phenols</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table 2: Effect of Setaria italica Seed and Husk extract on Serum lipids mg/dl

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Treatment</th>
<th>LDL mg/dl</th>
<th>HDL mg/dl</th>
<th>TG mg/dl</th>
<th>Total cholesterol mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal</td>
<td>55.5 ± 1.23</td>
<td>38.13 ± 1.83</td>
<td>65.33 ± 2.14</td>
<td>60.83 ± 1.82</td>
</tr>
<tr>
<td>2</td>
<td>Control (HFD)</td>
<td>105.66 ± 2.31</td>
<td>18.16 ± 1.68</td>
<td>101 ± 3.00</td>
<td>106.5 ± 4.08</td>
</tr>
<tr>
<td>3</td>
<td>Standard Atorvastatin 10mg/kg</td>
<td>49.64 ± 2.27</td>
<td>32.14 ± 3.50</td>
<td>76.13 ± 1.83</td>
<td>174.91 ± 1.84</td>
</tr>
<tr>
<td>4</td>
<td>SIHaSE 250mg</td>
<td>67.45 ± 2.70</td>
<td>32.44 ± 2.56</td>
<td>82.45 ± 2.65</td>
<td>182.45 ± 1.82</td>
</tr>
<tr>
<td>5</td>
<td>SIHaSE 500mg</td>
<td>54.15 ± 1.87**</td>
<td>38.45 ± 1.76**</td>
<td>78.48 ± 1.83**</td>
<td>171.08 ± 1.69**</td>
</tr>
<tr>
<td>6</td>
<td>SIHaHE 25mg</td>
<td>84.26 ± 1.78</td>
<td>24.56 ± 1.54</td>
<td>105.30 ± 1.27</td>
<td>214.12 ± 1.32</td>
</tr>
</tbody>
</table>

Atherogenic diet

Investigational hyperlipidemic diet: Investigational diet contains of well crushed combination of cholesterol (2%), cholic acid (1%), peanut oil (10%), sucrose (40%) and normal laboratory diet (47%).

Experimental animals

Adult male Albino rats (150-200gm) of swiss strain were obtained from (Mahaveer Enterprises, Hyderabad), for the study of antihyperlipidemic activity. Those animals were acclimatized on standard lab states (temp 25 ± five °C), stickiness (55 ± 5%) What's more looked after ahead 12-h light: 12-h dim cycle. They were Gave for typical rodent chow What's more drinking water not indispensable Appropriately Concerning illustration for every those guideline provided for Eventually Tom’s perusing regulate creature moral council. (CPCSEA) 11. (Approval No: 1629/PO/a/12/CPCSEA) (National Institutes of Health, 1996).

Selection of dose

As per LD₅₀ of both extracts, one-tenth of the dose was taken as the raputic dose to evaluate antihyperlipidemic activity.

Preparation of standard drug

Atorvastatin (10mg/kg) might have been utilized as position typical drug for assessing the antihyperlipidemic action which might have been suspended to refined water Toward utilizing 1% tween-80 as hanging agenize.

Acute toxicity studies

As per the literature review, acute toxicity studies for Setaria italica seed and husk was found to be safe up to 5000 mg/kg as per OECDguidelines-423 (Dunnell, 1964; OECD, 2000).
**Induction of experimental Hyperlipidemia**

High-fat hyperlipidemia was induced in experimental animals by giving the high-fat atherogenic diet up to 15 days.

**Investigational design**

Animals are separated into six clusters, each containing six animals. Group I helped as a usual controller. Group II was fed with a high-fat diet till 15th day. Group III received standard drug atorvastatin 10 mg/kg. Group IV & V treated with a hydroalcoholic excerpt of the Setaria Italica seed extract at a dose of 100mg/kg and 150 mg/kg body weight. Groups VI established hydro alcoholic excerpt of the husk of Setaria Italica at a dose of 25 mg/kg body weight (Dallas and American Heart Association, 1997; WHO, 2002).

**Biochemical analysis**

**Serum collection and analysis**

On the 15th-day blood samples are composed by direct cardiac puncture by using chloroform as anesthesia and were sent to a laboratory for analysis to estimate the amount of cholesterol, triglycerides, high-density lipoproteins, low-density lipoproteins present in the composed samples.

**Arithmetical Examination**

The consequences of the examination are communicated as mean ± S.E. Information was broke down by utilizing one path investigation of change test (ANOVA) trailed by Dunnett’s t-test for different correlations. Qualities with P < 0.05 are measured as critical (Acharya, 2004a,b).

**RESULTS**

These are found to be rich sources from claiming phytochemicals for example, such that phenolic acids, flavonoids (Acharya, 2004c; Tripathi, 2008), catechins, phytic acid, and phytosterols & specialists bring accounted for that those vicinity of dietary fiber Furthermore phenolic mixes help in the counteractive action of huge numbers ailments, for example, diabetes, cardiovascular diseases, What’s more, cataractogenesis Tables 1 and 2.

**Histopathological study**

To confirm the incidence of hyperlipidemias, the animals were sacrificed and their liver was isolated subjected to histopathological studies (Acharya, 2004d). The isolated liver is prepared off inessential tissue, weighed and washed by ice-cold usual saline and sent for histopathological studies Figures 1, 2, 3 and 4. From the histopathological studies, it is evident that:-

Group- III Atrovastatin 10mg shows the multi focal damage in the liver tissue and with extensive damage than treatment groups.

Group-IV Setariaitalica seed extract treated with 250mg shows that there is focal damage in the liver. The damage is limited when compared to the standard treated group.

Group-V Setariaitalica seed extract treated with 500mg shows very limited and negligible damage in multifocal areas which can be due to hepatoprotective activity of test drug administration.

Group-VI Setariaitalica husk extract treated with 25mg shows vascular damage which may lead to liver cirrhosis (Tripathi, 1946).

**DISCUSSION**

The antihyperlipidemic activity is evaluated by a decrease of LDL levels and increase of HDL levels. The present study reveals that there is a significant increase in HDL levels, which is considered as good cholesterol for the body as HDL removes extrahepatic cholesterol and transports it to the liver for endocytic mediated LDL receptor activity. The hydroalcoholic seed extract of Setaria italic 500 mg has shown a significant effect when compared to that of the standard atorvastatin 10mg. The hydroalcoholic seed extract of 500mg had shown very little and limited damage in multifocal areas which signifies the hepatoprotective activity (Sastri, 2007a) of the seed extract. The triglyceride levels and total cholesterol levels of seed extract 500mg are nearly equal to that of the standard atorvastatin, indicating that the plant extract shows hepatoprotective activity towards hyperlipidemias. The hydroalcoholic husk extract of setaria italic 25mg was found deviating from treating hyperlipidemias. The husk extract has produced a tremendous increase in LDL levels and very low HDL levels indicating that husk doesn’t possess flavonoids and phenolic compounds. Scientists have revealed that the attendance of dietetic fiber and phenolic mixes assistance in the counteraction of numerous maladies, for example, diabetes, cardiovascular sicknesses, and cataractogenesis (Sastri, 2007b). The triglycerides and total cholesterol levels are very high when compared to that of the standard indicating that husk lack proteins, minerals, fibres, Vit E, etc. than that of seed.

**CONCLUSIONS**

This study proves that Setariaitalica seed extract is very useful in treating hyperlipidemias than that of husk. This evidence paves the way to carry out further study in isolating the chemical constituents and...
to build up new entities in treating hyperlipidemia.

**Conflict of interest**

The authors declare that they have no conflict of interest for this study.

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