Antihyperglycemic and Antilipidemic effect of Cyelohexane 1,2,3,4,5,6-hexol and 3,7,11-trimethyldodeca-2, 6, 10-trien-1-ol constituents isolated from Launaea pinnatifida Cass. leaves in diabetic rats

ABSTRACT

Plants possessing biological properties have been used as natural remedy for curing ailments based upon the tribal and indigenous knowledge. The crude Launaea pinnatifida Cass ethanolic extract (LPEE), cyclohexane 1,2,3,4,5, 6-hexol (C-1) and 3, 7, 11-trimethyldodeca-2, 6, 10-trien-1-ol (C-2) isolated from Launaea pinnatifida Cass leaves were screened for their antihyperglycemic and antilipidemic properties in alloxa induced diabetic rats. In antihyperglycemic studies, both C1 and C-2 exhibited significant regulated blood sugar levels than LPEE and standard drug when compared to diabetic rats (p<0.001). An ameliorative influence of compounds was observe by lowering significantly the cholesterol, LDL and triglycerides (p<0.001); SGOT, SGPT, ALP (p<0.01) and increasing the HDL and protein contents. Experimental evidences obtained in our study, it can be concluded that the bioactives of Launaea pinnatifida Cass leaves possess antihyperglycemic and antilipidemic properties. Thus these compounds can serve as better agents in combating diabetes.

Key work: Launaea pinnatifida, antihyperglycemic, antilipidemic, Cyclohexane 1,2,3,4,5, 6-hexol, 3, 7, 11-trimethyldodeca-2, 6, 10-trien-1-ol.

INTRODUCTION

There is an estimated 143 million people world wide suffering from diabetes. almost five more than the estimates ten years ago. This number may to be in the midst of an epidemic of diabetes. Reports from the World Health Organization (WHO) indicate that diabetes mellitus is one of the major killers of our time, with people in Southeast Asia and western Pacific being most at risk and it is a debilitating and often life-threatening disorder with increasing incidence throughout the world. Diabetes mellitus is a major cause of disability and often life-threatening disorder with increasing incidence throughout the world. Diabetes mellitus is a major cause of disability and hospitalization and it results in significant financial burden (Foster, 1994). Diabetes mellitus is a metabolic disorder leading to hyperglycemic condition and causes diabetic related complications. All forms of diabetes are characterized by chronic hyperglycemia and leads to the development of diabetes-specific micro vascular pathology in the retina, renal glomerulus and peripheral nerve as a consequence. It is a leading cause of blindness, end stage renal disease and a variety of debilitating neuropathies, also associated with accelerated atheroslerotic microvascular disease affecting arteries that supply the heart, brain and lower extremities. As a result, patients with diabetes have a much higher risk of myocardial infraction, stroke and limb amputation (Ginsberg, 2000). Large prospective clinical studies show a strong relationship between glycaemia and diabetic microvascular. Hyperglycemia and insulin resistance both seem to have important roles in the pathogenesis of microvascular complications. Currently, phytochemicals identified form traditional medicinal plants are presenting an exciting opportunity for the development of new types of therapeutics.
This has accelerated the global effort to harness and harvest those medicinal plants that bear substantial amount of potential phytochemicals showing multiple beneficial effects in combating diabetes and diabetes related complications (Tiwari and Rao, 2002). For various reasons in recent years, the popularity of complementary medicine has increased. Dietary measures and traditional plant therapies as prescribed by ayurvedic and other indigenous systems of medicine were used commonly in India (Warier, 1995). Launaea pinnatifida Cass is found along the coastal regions from Bengal to Ceylon and Madras to Malbar where it serves as sand binders with other plants. It is an edible plant commonly called as Paathri, Knekhowa, almiroa etc. It is reported to possess tonic, soporific diuretic and used as substitute for taraxacum. Leaves are eaten during famine and herbs are fed to buffaloes as a galactagogue. It is externally applied in rheumatic affections combined with the oil of Pongamia galbana (Nadkarni, 1996). The leaves are being eaten as an edible salad as a remedy for controlling the blood sugar level based on tribal knowledge without any proper scientific evidences. Therefore, the primary objective of this study was to assess the anti-hyperglycemic efficacy of Launaea pinnatifida Cass.

MATERIALS AND METHODS

Instruments and chemicals

Ascensia Entrust Glucometer (Bayer Health Care, India), Autoanalyzer (ERBA Chem/Splus Version-2, Germany), capillary tubes (Micro Hematocrit Capillaries, Mucaps), T8 electric centrifuge (Remi Udyog, New Delhi), Alloxan monohydrate (Lob Chemie Pvt, Ltd, Mumbai, India), Tween-80 (SD fine, Mumbai), lipid profile kits (ranabax Diagnostics, Ltd; New Delhi, India), serum marker kits (ERBA chemi, Germany), Glimpride (USV Ltd Mumbai) and all other chemicals used were of the analytical grade.

Experimental animals

Male albino Wistar rats (150-250 g) procured from Mahaveer Enterprises, Hyderabad (India) were used for the studies. All the experiments were conducted according to the protocols approved by the institutional Animal Ethics Committee (IAEC Reg.no:346/CPCSEA). The rats were housed in polypropylenes cages lined with husk, renewed every 24 h under 12/12 h light /dark cycles at 22+ 2 C and at 45% - 55% relative humidity. The animals were fed with a standard pellet diet supplied by Lipton India Ltd. and allowed to free access of water ad libitum after randomization into various groups, the animals were acclimatized for a period of 7 days. Animals described as fasting had been deprived of food for at least 16 hr but had been allowed free access to drinking water before the experiment was carried out.

Plant materials

The fresh leaves of Launaea pinnatifida Cass (Asteraceae) were collected from the farmland of saradagi village 24 km south of Gulbarga district, Karnataka (India) during the flowering month. The plant was identified and authenticated by Prof Y.N. Seetaram, Department of Botany, Gulbarga University, Gulbarga. A voucher specimen (HGUG/SN76) is deposited in this department.

Preparation of extracts and isolation of compounds C-1 C-2

The shade dried leaves of the plant Launaea pinnatifida Cass were powdered to 22 mesh size and subjected to successive soxhlet extraction from non–polar to polar solvent system, with increasing polarity (petroleum ether, chloroform, ethanol and distilled water). Based upon the preliminary phytochemical screening results, the Launaea pinnatifida ethanolic extract (LPEE) was subjected to column chromatography to isolate the various fractions of compounds. The elution was carried out into the column containing silica gel-C (60-120 mesh), using various percentages of polar and non polar solvents. Compounds 1 and 2 obtained from the fraction chloroform:methanol (60:40) and chloroform:methanol (10:90) was again purified by eluting through the freshly prepared column using the respective solvent ratios. The isolated compounds were subjected for recording IR spectra (Shimadzu IR-450) with KBr pellets (cm1). The 1H NMR (Bruker DRX- 500) was carried out in 300 MHz CdCl3 using TMS as reference standard and finally these compounds were assessed by injecting into GC –MS. The strong retention time of 3.5 and 4.8 min and the base peaks of 73 and 44 were detected in the compounds 1 and 2, which are abbreviated as C-1 and C-2 respectively.

Experimental design

Launaea pinnatifida ethanolic Extract (LPEE), cyclohexane 1,2,3,4,5,6-HEXOL (C-1), 3, 7, 11-trimethyldecane-2, 6, 10 – trien -1-ol (C-2) and glimipride were suspended in 1% Tween 80 immediately before their oral administration.

Acute toxicity studies

Healthy adult male albino rats were subjected for oral acute toxicity. The overnight fasted animals were divided into several groups (n=6) and were orally fed with LPEE, C-1,
and C-2 respectively they were observed continuously for 2 h for behavioral, neurological and autonomic profiles and after 24 and 72 hrs for any lethality (Turner and Ghosh 1985).

Sample collection

The blood sample was collected from tail vein of rats for antihyperglycemic studies at different time intervals to detect blood glucose level. Lipid profile and serum markers were evaluated by collecting the blood from the retro-orbital plexus from the inner canthus of the eye under light ether anesthesia using capillary tubes. The plasma was separated in a T 8 electric centrifuge at 2000 rpm for 2 min assessment.

Anti-hyperglycemic studies

In the pilot study lasting for 3 week, overnight fasted male albino Wistar rats were made diabetic by a single intraperitoneal (i.p.) injection of alloxan monohydrate except Group I. Alloxan monohydrate (125 mg /kg body weight) was solubilized in 0.2 ml saline (saline ( 154 mM NaCl) just prior to injecting (El-Demerdash et al., 2005; Grover et al., 2000). After 2 days of alloxan injection, rats with plasma glucose levels >160mg/dl were included in the study by one –touch glucometer (Jaouhari et al., 2000). The rats were divided into six groups (n=6) comprising of Group I: Normal control, Tween-80 (0.5 ml/250g) as vehicle; Group II: Alloxan induced (125 mg/kg; Group III: Glimipride (10 mg/kg); Group IV: LPEE (250mg/kg); Group V: C-1 (10 mg/kg); Group III : Glimipride (10 mg/kg);Group IV: LPEE (250 mg/kg); Group V: C-1(10 mg/kg ) and Group VI: C-2(10 mg/kg) for a period of 21 day orally.

Determination of biochemical parameters in alloxan induced diabetic rats

The lipid profile and the level of serum markers of the blood samples collected by the retro-orbital plexus in alloxan induced diabetic rats on 21st day of the studies were determined. The blood glucose levels were estimated using Ascensia Entust Glucometer, serum lipid profiles such as total cholesterol (TC), high-density lipoprotein (HDL), low density lipoprotein (LDL) and triglycerides (TG) and serum markers such as alkaline phosphates (ALP), serum glutamate oxaloacetate transaminases (SGOT), serum glutamate pyruvate transaminases (SGPT) and total protein (TP) were determined using the standard procedures prescribed in the enzymatic kits.

Effect of Launaea pinnatifida Cass on the body weight and food intake in alloxan induced diabetic rats

The effect of Launaea pinnaatifida Cass on body weight and food consumption of rats were assayed by measuring daily the body weight of individual experimental animal and by measuring the quantity of the balanced diet at every 24 h of the time interval before and after the food administered for 21 day.

Statistical analysis

Data were expressed as mean ± standard error of mean (SEM). One-way ANOVA following dunnet’s test instant graph pad (USA) was used for statistical analysis between all groups.

RESULTS AND DISCUSSION

Isolation and characterization of the fractions obtained from the crude ethanolic extract of Launaea pinnatifida Cass leaves led to successful isolation of two compounds Cyclohexane 1,2,3,4,5,6-hexol (C-1) and 3,7,11—trimethylododeca-2, 6, 10-trien-ol (C-2) as depicted in Figures 1 and 2. The test samples LPEE, C-1 and C-2 obtained were subjected for pharmacological screening to check their safety and efficacy. Based upon the continuous monitoring and observations for 72 h, oral acute toxicity studies revealed the non-toxic nature of the LPEE, C-1 and C-2 with and effective dose of 250 mg/kg in case of LPEE and 10 mg/kg body weight in case of isolated compounds, C-1 and C-2. The antihyperglycemic study was aimed for selecting the most potential constituent of Launaea pinnatifida Cass. In overnight fasted animals subjected to alloxan induced antihyperglycemic studies, all groups showed no significant difference in the basal levels of plasma glucose. However after induction of alloxan monohydrate, blood glucose levels were significantly higher in the animals selected for the study. In contrast non-diabetic controls remained persistently euglycemic throughout the course of study. Table 1 summarizes the antihyperglycemic effect of Launaea pinnatifida Cass leaves in alloxan induced rats. Compounds C-1 and C-2 showed significant reduction in blood sugar level from 7th day which persisted up to 21st day (p<0.001 respectively). The lowering effect of LPEE was witnessed only on 21st day (p<0.05).

Table 2 shows anti-diabetic effect of Launaea pinnatifida Cass on the lipid profile in alloxan induced diabetic rats. All the test samples were compared with the untreated diabetic. All the test samples (Group III-VI) showed a significant (p<0.001) decrease in TC, HDL and TG content. However no significant difference was noted in HDL content in all groups except Group VI. Table 3 shows the effect of the Launaea pinnatifida Cass leaves on the serum markers in alloxan induced diabetic rats. The test samples showed significant varying differences on the effect on serum markers in rats. All the test samples showed a significant (p<0.0001) decrease in ALP, SGOT and SGPT markers while significant (p<0.0001) increase was observed in serum proteins when compared to untreated diabetic rats Group II. Changes in body weight and food consumption were observed in both the untreated and treated diabetic rats up to 21st day as shown in Table 1. It was noteworthy to observe the decrease in body weight on 3rd day which increased subsequently from 7th week and lasted till the end of the experiment in all test groups compared to untreated diabetic rats. Balanced food consumption was maintained in all the test samples (Group III-VI) compared to diabetic rats.
Figure 1: Cyclo-1, 2, 3, 4, 5, 6-hexol

Table 1: Antihyperglycemic effect of \textit{launaea pinnatifida} leaves in alloxan induced rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment Dose (mg/kg)</th>
<th>1st Day</th>
<th>3rd day</th>
<th>7th Day</th>
<th>15th Day</th>
<th>21st Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Tween-80 (0.5ml)</td>
<td>90.16±4.81</td>
<td>95.16±5.88</td>
<td>99.16±4.59</td>
<td>99.15±5.59*</td>
<td>99.50±3.19**</td>
</tr>
<tr>
<td>II</td>
<td>Alloxan (0.5 ml)</td>
<td>96.16±6.49</td>
<td>269.50±9.73</td>
<td>251.83±28.73</td>
<td>305.50±2.27</td>
<td>326.01±25.29</td>
</tr>
<tr>
<td>III</td>
<td>Glimipride (10)</td>
<td>96.50±6.58</td>
<td>296.50±32.01</td>
<td>230.33±14.45</td>
<td>187.67±13.76**</td>
<td>189.33±17.50**</td>
</tr>
<tr>
<td>IV</td>
<td>LPEE</td>
<td>76.66±4.16</td>
<td>263.67±7.54</td>
<td>139.17±09.52</td>
<td>247.67±11.82</td>
<td>280.83±47.96**</td>
</tr>
<tr>
<td>V</td>
<td>C-1 (10)</td>
<td>80.16±5.52</td>
<td>239.33±26.71</td>
<td>211.33±4.30**</td>
<td>212.83±23.01**</td>
<td>141.67±11.03</td>
</tr>
<tr>
<td>VI</td>
<td>C-2 (10)</td>
<td>80.00±5.38</td>
<td>223.83±21.94</td>
<td>268.17±0.32*</td>
<td>98.97±19.56***</td>
<td>110.67±8.27**</td>
</tr>
</tbody>
</table>

Values are expressed as Mean ± SEM.***P < 0.001;*P < 0.05, when compared to group-II. Group I=Tween80, Group II=Alloxan (125mg/kg) in normal saline on 1st day, LPEE= \textit{launaea pinnatifida} Cass Ethanoic extract, C-1=Cyclo-1,2,3,4,5,6-hexol and C-2=(2Z,6E)-3,7,11-trimethyldodeca-2,6,10-trien-1-ol.

Table 2: Antihyperglycemic effect of \textit{Launaea pinnatifida} Cass leaves on lipid profile in alloxan induced rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment Dose (mg/kg)</th>
<th>TC</th>
<th>HDL</th>
<th>LDL</th>
<th>TG</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Tween-80 (0.5ml)</td>
<td>74.57±0.81</td>
<td>37.36±1.02</td>
<td>17.56±0.21</td>
<td>71.51±0.72</td>
</tr>
<tr>
<td>II</td>
<td>Alloxan</td>
<td>23.16±27.29</td>
<td>20.57±021</td>
<td>50.86±1.31</td>
<td>368.00±0.859</td>
</tr>
<tr>
<td>III</td>
<td>Glimipride</td>
<td>77.50±2.56**</td>
<td>23.66±0.70*</td>
<td>36.22±79***</td>
<td>90.37±0.95***</td>
</tr>
<tr>
<td>IV</td>
<td>LPEE</td>
<td>87.09±0.42***</td>
<td>18.86±4.86</td>
<td>37.54±0.32***</td>
<td>154.41±0.34***</td>
</tr>
<tr>
<td>V</td>
<td>C-1 (10)</td>
<td>81.99±0.61***</td>
<td>19.32±0.86</td>
<td>34.14±0.16***</td>
<td>120.39±0.69***</td>
</tr>
<tr>
<td>VI</td>
<td>C-2 (10)</td>
<td>70.10±0.16***</td>
<td>19.60±0.17</td>
<td>24.43±0.42***</td>
<td>100.15±0.61***</td>
</tr>
</tbody>
</table>

Values are expressed as Mean±SEM.*P<0.0001,**P<0.001;*P<0.05 when compared to group-II. TC – Total cholesterol, HDL – High-density lipoprotein, LDL – Low density lipoprotein and TG – Triglycerides Group II= Alloxan (125 mg/kg) in normal saline on 1st day, LPEE=\textit{Launaea pinnatifida} Cass ethanoic Ethanolic Extract, C-1=Cyclo-1,2,3,4,5,6-hexol and C-2=(2Z,6E)-3,7,11-trimethyldodeca-2,6,10-trien-1-ol.
Table 3: Antihyperglycemic effect of *Launaea pinnatifida* Cass leaves on serum markers in alloxan induced rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment dose (mg/kg)</th>
<th>ALP</th>
<th>SGOT</th>
<th>SGPT</th>
<th>TP</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Tween -80 (0.5 ml&lt;sup&gt;a&lt;/sup&gt;)</td>
<td>271.85±4.59</td>
<td>89.00±3.09</td>
<td>86.29±1.84***</td>
<td>11.01±0.33</td>
</tr>
<tr>
<td>II</td>
<td>Alloxan (0.5 ml&lt;sup&gt;a&lt;/sup&gt;)</td>
<td>545±.2.74</td>
<td>427.84±1.87</td>
<td>281.66±5.67</td>
<td>5.55±0.17</td>
</tr>
<tr>
<td>III</td>
<td>Glimipride (10)</td>
<td>394.14±2.25***</td>
<td>225.38±4.21***</td>
<td>106.68±3.27***</td>
<td>7.39±0.34***</td>
</tr>
<tr>
<td>IV</td>
<td>LPEE (250)</td>
<td>593.20±2.35***</td>
<td>251.38±302***</td>
<td>176.18±5.67***</td>
<td>6.33±0.22***</td>
</tr>
<tr>
<td>V</td>
<td>C-1 (10)</td>
<td>199.03±1.49***</td>
<td>254.66±2.2***</td>
<td>95.22±1.69***</td>
<td>7.75±0.09***</td>
</tr>
<tr>
<td>VI</td>
<td>C-2</td>
<td>154.3±0.204***</td>
<td>286.6±5.4***</td>
<td>68.47±1.10***</td>
<td>8.22±0.15***</td>
</tr>
</tbody>
</table>

Values are expressed as Mean±SEM***P<0.001;*P<0.05, when compared to group-II. ALP=Alkaline phosphatase, SGOT=Serum glutamate oxaloacetate transaminases, SGPT=Serum glutamate pyruvate transaminases and TP=Serum protein. Group I=Alloxan (125mg/kg) in normal saline on 1<sup>st</sup> day LPEE =*Launaea pinnatifida* Cass Ethanolic Extract . C-1=Cyclo-1,2,3,4,5,6-hexol and C-2=Cyclo-1,2,3,4,5,6hexol and C-2=(2Z,6E)-3,7,11-trimethyldodeca-2,6,10-trien-1-ol.

Hyperglycemia and hyperlipidaemia are the two most important characteristics of diabetes mellitus. Though different types of oral hypoglycemic agents are available along with insulin for the treatment of diabetes mellitus, there is an increasing demand amongst patients to indication of efficacy of plants in mild to server degree of diabetes and this fact has been hinted earlier (Pabrai and Sehra, 1962). The isolated compounds C-1 and C-2 have been more potential, specific and efficient in regulating the blood sugar levels compared to LPEE which contains several other secondary metabolites. Cyclohexane 1,2,3,4,5,6-hexol(C-1), also called as inositol, a simple polyol with eight natural
occurring stereo-isomers has been examined as potential therapeutic agent for various diseases with favorable results (Fenili et al., 2007). A decrease in inositol levels has been speculated to play an important role in insulin resistance in Type II diabetes (Kennington et al., 1990; Ostlund et al., 1993). Administration of C-1 in our study significantly reduced the blood sugar level signifying the efficacy of the compound in Launaea pinnatifida Cass leaves. The use of inositol stereo-isomers as therapeutic agents is easily tolerated without any apparent side effects (Fenili et al., 2007). Some of the inositol derivatives such as 1,2,3,4,5,6, cyclohexanehexol have been reported to help the action of insulin stimulating glucose uptake by the inositol in skeletal muscle cells of rat L6 myotubes in in-vitro model system to study GLUT 4-glucose dependent glucose uptake (Yap et al., 2007). Polyphenols seemingly present in relatively high concentration in plants exhibit the allelopathic properties (Hruska et al., 1982) and cause an effect on secretion of pancreatic exocrine and enzymes (Bartos and Brzek, 1979). The triterpenes, a purified polyphenol chemical affects the blood sugar level and reduces all the symptoms of type II diabetes (Queensberry and Gyerstad, 1967). An intraperitoneal injection of 2 mg of purified triterpenes fraction was equivalent in hypoglycemic activity to an injection of 0.8 units insulin for the restoration of normal blood glucose levels in animals with non insulin dependent diabetes mellitus (Villar et al., 1986).

Similarly the significant anti-hyperglycemic activity rendered by the isolated compound 3,7, 11-trimethylodeca-2, 6, 10-trien-ol (C-2) depicted in Figure 2, belonging to the class of terpene series may also have exhibited similar mode of action like other triterpenes or polyphenols which apparently interfere with the synthesis or release of insulin by b –cells of pancreas. Diabetes mellitus is also associated with hyperlipidaemia with profound alteration in the concentration and composition of lipid. Changes in the concentrations of the lipid with diabetes mellitus contribute to the development of vascular disease. Fatty acids, important components of cell membranes, are eicosanoid precursors and are therefore required for both the structure and function of every cell in the body (Odetola et al., 2006). The abnormally high concentration of serum lipids in diabetes mellitus is mainly due to an increase in the mobilization of free fatty acids from the peripheral fat depots, since insulin inhibits the hormone sensitive lipase. The marked hyperlipidaemia that characterizes the diabetic state may therefore be regarded as a consequence of the uninhibited actions of lipolytic hormones on the fat depots (Al-Shamaony et al., 1994). Excess of fatty acids in plasma produced by alloxan promotes the liver conversion of some fatty acids to phospholipids and cholesterol. These two substances, along with excess of TG formed in the liver, may be discharged into lipoproteins in the blood as a result serum phospholipids will be further elevated (Bopanna et al., 1997). Administration of test samples in our studies significantly decreased the level of TC, LDL and TG while HDL level was increased the increase in HDL level could be due to the decrease in the mobilization of free fatty acids from the peripheral fat depots as usually confronted in diabetic complications. The anti-hyperlipidaemia in diabetic state may therefore be regarded as consequence of the inhibited actions of lipolytic hormones on the fat depots. However the significant decrease in TC and increase in HDL is a very desirable biochemical state for the prevention of atherosclerosis and ischemic conditions (Luc and Frchart, 1991).

During insulin deficiency diabetes, a significant decrease in total protein level occurs due to excessive catabolism of protein and amino acids released for gluconeogenesis and ketogenesis, while increase in transaminases activity due to the increased availability of test samples during diabetic state has reduced significantly in degradation of tissue protein and amino acid and also decreased the transaminases activity by activating the b –cell to produce insulin. This clearly indicates that the fraction isolated from Launaea pinnatifida Cass leaves possess ameliorative influence on the lipid and serum marker profiles in alloxan diabetic rats. Increased food consumption and decreased body weight were observed in diabetic rats. This polyphagia condition and loss of weight may be due to excessive tissue proteins (Kamalakkannan and Prince, 2006). The decrease in body weight in diabetic rats could also be due to dehydration and catabolism of fats and proteins (Hakim et al. 1997). Increased catabolic reactions leading to muscle wasting might also be the cause for the reduced weight gain by diabetic rats. Oral administration of Launaea pinnatifida test samples for 30 consecutive days to diabetic rats decreased their food consumption and improved body weight. This could be due to a better control of the hyperglycemic state in the diabetic rats. The fact that decreased fasting blood glucose improves body weight in alloxan-induced diabetic rats (Pari and Saravanan, 2005) is well justified through the present studies.

CONCLUSION

On the basis of this investigation on Lannaea pinnatifida Cass, it may be concluded that Cyclohexane 1,2,3,4,5,6-hexol(C-1) and (2Z,6E)3,7,11-trimethylodeca-2, 6, 10-trien-1-ol (C-2) possesses antihyperglycemic and antilipidemic properties which are quite efficient to standard drugs. The experimental observations confirm at least partly the ancient use of Launaea pinnatifida Cass as a medicine that cures diabetes as an herbal remedy. The mechanisms involved in their action are not completely understood and further studies seem to be carried necessarily.

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REFERENCES


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