Ethno-medicinal studies of *Brachystegia eurycoma* Harms, *Detarium microcarpu* Guill. & Perr and *Mucuna pruriens* (L.) DC Seeds on Blood Glucose Levels, Liver Enzymes, and Lipid Profile of Female Wistar Rats

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**ABSTRACT**

**Aim:** This study was designed to investigate the ethno-medicinal effect of *Brachystegia eurycoma* Harms (B. eurycoma), *Detarium microcarpu* Guill. & Perr (D. microcarpu) and *Mucuna pruriens* (L.) DC (M. pruriens) seeds on blood glucose levels, liver enzymes, and lipid profile of female Wistar rats. **Materials and Methods:** *B. eurycoma*, *D. microcarpu* and *M. pruriens* aqueous seeds extract were administered at a single dose of 200 mg kg⁻¹ body weight to the experimental animals individually and in combination daily for three weeks. **Results:** The blood glucose level in group II, IV and V (94.5±3.09, 99.5±3.77 and 100.0±5.83 mg dL⁻¹) were significant different (p<0.05) when compared to group I (120.0±5.85 mg dl⁻¹). HDL, LDL and TG concentration in groups III, IV and V were significant different (p>0.05) compare to the control. AST and ALT level in group II and III were also significant different (p<0.05) when compared to group I and V. However, group IV was significant higher (p<0.05) when compared to group II, III and V. **Conclusions:** This present study showed that administration of *B. eurycoma*, *D. microcarpu* and *M. pruriens* seeds extract at 200 mg kg⁻¹ alone or in combination improved blood glucose level, liver function profile, liver enzymes, pancreas and did not posed any significant health risk. In conclusion, *B. eurycoma*, *D. microcarpu* and *M. pruriens* may be safe for use as a soup thickener.

**KEY WORDS:** *Brachystegia eurycoma* Harms; *Detarium microcarpu* Guill. & Perr; *Mucuna pruriens* (L.) DC blood glucose; lipid profile; liver enzymes

**INTRODUCTION**

Thickening agents are substances that increase its viscosity without significantly modifying other important properties such as taste and aroma when added to a mixture [1]. Most plants seeds have shown to have this property when pulverized. Dicotyledonous plants are a class of legume which commonly grow along river banks and agricultural lands in Nigeria and most other African countries [1]. They usually blossom between April and May and develop fruits between September and January every year. The fruits are very persistently woody and conspicuous in form [2]. Their seed flour has gelation properties when mixed with water and imparts a gummy texture when used in preparing soups.

This contribute to it desirable property necessary for the eating of garri, pounded yam and major local food delicacies in Africa especially in West Africa [3,4]. They are among the major food products consumed by millions of people in Nigeria every single day [5]. These hydrocholliods are good sources of soluble fibre and could replace fat in food processing. *Brachystegia eurycoma* Harms (B. eurycoma), *Detarium microcarpu* Guill. & Perr (D. microcarpu) and *Mucuna pruriens* (L.) DC (D. pruriens) (as named on The plant List 2014 database) are plants whose seeds are commonly used as a soup thickener in Nigeria, especially in South-Eastern and Southern region of the country [4,5].

*B. eurycoma* is used in West Africa both as food additive and medicine. Among the Igbo tribe in the South Eastern region of Nigeria, the seeds are usually used as thickening agents for soup preparation and as a flavoring agent [7]. The seeds serve as a good source of nutrients, carbohydrate and fiber. This plant has been shown to softens stool, protects against rectal and colon cancer as well as control the body temperature [8]. Its cholesterol lowering effect, hypoglycemic effect and the ability to lower the risk of heart diseases has been reported by Okwu [9]. The stem bark is reported to have anti-inflammatory activities and diuretic effect, which makes it very important for the treatment of some gynecological conditions such as uterine fibroids and premenstrual syndrome [10,11]. The combination of *B. eurycoma*, snail mucin and honey have been used in native treatment of wound, promote the regeneration of...
hair follicles and in the prevention of scar formation [12]. Adekunle [13] reported that water extracts of *B. eurycoma* has antifungal properties against various species of fungi [11,14].

*D. microcarpum* seed is edible and rich in vitamin C, and the leaves, stem, bark and seeds are used to treat ailments like itches, diarrhea, meningitis and tuberculosis [15]. The fruit seed coats have been reported to contain antimicrobial properties due to the presence flavonoid (rutin), steroidal saponins (dioscin), in addition to limited amount of heavy metals higher than tolerable limits [16,17]. Wahedi and David [18] reported that *D. microcarpum* fruit pulp used in formulation of animals’ feeds had effect on the body weight and hematological parameters of rats.

Finally, *M. pruriens* seeds contain high concentrations of L-DOPA (non- protein) which act as a direct precursor to the neurotransmitter dopamine as reported by Erowid, [19]. *M. pruriens* is reported to have valuable medicinal properties which include its use in the treatment of various type of disorders such as ulcers, edema, fever, urinary tract, constipation, neurological, menstruation disorders and helminthiases like elephantiasis [20,21,22,23]. Its has also been reported that the pulverized seeds of *M. pruriens* increases the general mating behavior and thereby positively improving the sexual activity in rats [24]. The roots are considered useful to relieve dropy, ulcers, constipation, amenorhea, elephantiasis, neuropathy, nephropathy, dysmenorhea, helminthiasis, fever and delirium, toxin antagonist for various snakebites, antidepressant properties in cases of depressive neurosis when consumed and management and treatment of Parkinson’s disease [23,25,26,27]. Besides the medicinal uses of *M. pruriens*, this plant is also used as additive in other foods to impact the desirable textural, taste as well as functional properties to the finished food product particularly the “convenience foods” [28,29].

Due to desirable nature and pleasant odor, there has been a great demand of soup thickener because they are used to make soup edible, palatable and presentable. They are equally used as emulsifiers and flavoring agents in traditional soups due to their gum contents [2].

Because of the daily consumption rate of these thickeners and the assumed possible human health risks associated with their usages; this study aimed at investigating the ethno-medicinal effects of these thickeners including (*Brachystegia eurycoma* harms, *Detarium microcarpum* Guill. & Perr and *Mucuna pruriens*) seeds n blood glucose levels, liver enzymes, lipid profile and pancreas of female Wistar albino rats.

**MATERIALS AND METHODS**

**Experimental Animals**

A total number of twenty (25) female Wister rats (90–110 days) weighing between 98-130g were used for the study. The animals were purchased from the animal house of Department of medical physiology, Delta state university, Abaraka campus and kept in the animal house of the Department of Medical Physiology Madonna University, Elele campus for two weeks to acclimatize. The animals were later grouped into experimental and control groups as shown on Table 1 and housed in sanitized wooden cages containing saw dust as bedding. They were fed with standard rat chow pellet as diet and clean water ad-libitum was supplied and maintained under standard laboratory conditions (temperature of 25 ± 3°C and 12 h light/12 h dark cycle), in accordance with the guidelines for the care and use of laboratory animals by National Academy of Science [30]. Ethical approval for animal studies was obtained from the Animal Ethics Committee of Madonna University on November 12, 2015.

**Seeds Collection and Preparation**

The seeds (*B. eurycoma*, *M. pruriens* and *D. microcarpum*) were purchased from Port Harcourt market Mkpolu-Oroworukwo mile III Diobu, Port Harcourt. They were oven dried at 35°C, until a constant weight was obtained. They were pulverized using a laboratory grinding hand mill. Then weighed (about 5342g) and kept away from light before extraction.

**Extraction and Concentration of the Seeds**

Four kilograms (4kg) of the pulverized seeds of *D. microcarpum*, *B. eurycoma*, and *M. pruriens* each was extracted with water respectively (aqueous extraction method). One thousand (1000) ml of water was added

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatments</th>
<th>Durations</th>
<th>Number of Rats</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal feed + water</td>
<td>21days</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>Normal Feed + Water + 200 mgkg⁻¹ <em>B. eurycoma</em></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>III</td>
<td>Normal feed + water + 200 mgkg⁻¹ <em>D. microcarpum</em></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>Normal feed + water + 200 mgkg⁻¹ <em>M. pruriens</em></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Normal feed + water + 200 mgkg⁻¹ <em>B. eurycoma + D. microcarpum + M. pruriens</em></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>
to the different powdered seeds for four consecutive times. The jars were tightly closed and thoroughly shaken intermittently. After 24 hours, each mixture was decanted and the extracts were filtered using a funnel on which a Whitman’s no. 1 filter paper placed. The filtrates were collected into three different glass jars each and were heated in water bath at a temperature of 45°C for 7 days (this made it concentrated to a gelatinous substance). After then, the concentrated aqueous extract of *D. microcarpum*, *M. pruriene* and *B. eurycoma* seeds were diluted with distilled water, transferred into amber bottle and stored in a refrigerator at 4°C before use. A dose of 200 mg kg⁻¹ was used for the administration for the extracts. The dosage of these extracts was selected based on previous studies carried out by Bhadra et al. [31] and Olughuyiro *et al.* [32] on acute toxicity studies performed by Bhadra et al. [31] and Olughuyiro *et al.* [32].

**Samples Collection and Analysis**

After 14 days of treatment, the experimental animals were fasted for 24 hours prior to sacrifice. The animals were anaesthetized using chloroform and then sacrificed [33]. Thus, blood collected via cardiac punctured and put in a labeled Ethylenediaminetetraaetic acid (EDTA) bottle for lipid profile and liver enzymes and later centrifuged at 7000 rpm for ten minutes [33]. The serum was then collected and stored at -15°C. The animals were then dissected; the pancreases were removed. The blood glucose level was assayed weekly for two weeks with a glucose strip and a glucometer before and after administration of the extracts. The dosage of these extracts was based on previous studies performed by Bhadra et al. [31] and Olughuyiro *et al.* [32].

**RESULTS**

The effect of co-administration of *B. eurycoma*, *D. microcarpum* and *M. pruriens* seed extracts on blood glucose level of Wistar rats are presented on Table 2. Blood glucose level before administration of the aqueous extracts in group II, IV and V (94.5 ± 3.09, 99.5 ± 3.77 and 100.0 ± 5.83 mg dL⁻¹) were significantly different (p<0.05) when compared to group I (82.0 ± 5.85 mg dL⁻¹). However, there was no significant difference (p<0.05) when compared to group III. Although, after extract administration for 7 and 14 days, the experimental groups were significant different (p<0.05) when compared with group I for 7 and 14 days respectively. Also there was significant (p<0.05) increase in blood glucose levels after 7 and 14 days in group III and V respectively.

<table>
<thead>
<tr>
<th>Groups</th>
<th>BGL baseline (Before aqueous extracts administration) mg dL⁻¹</th>
<th>7 days of extracts administration mg dL⁻¹</th>
<th>14 days of extracts administration mg dL⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>82.0 ± 5.85</td>
<td>69.5 ± 4.21</td>
<td>79.3 ± 2.28</td>
</tr>
<tr>
<td>II</td>
<td>94.5 ± 3.09*</td>
<td>107.5 ± 10.6*</td>
<td>86.0 ± 2.45*</td>
</tr>
<tr>
<td>III</td>
<td>83.0 ± 7.04</td>
<td>87.8 ± 8.13*</td>
<td>107.3 ± 4.88*</td>
</tr>
<tr>
<td>IV</td>
<td>99.5 ± 3.77*</td>
<td>109.0 ± 3.00*</td>
<td>97.8 ± 4.69*</td>
</tr>
<tr>
<td>V</td>
<td>100.0 ± 5.83*</td>
<td>80.5 ± 5.78*</td>
<td>109.8 ± 2.53*</td>
</tr>
</tbody>
</table>

Data represented as Mean ± SEM; (*) p<0.05 significantly different in comparison with control group; (#) p<0.05 significantly different in comparison with extracts administered groups; n=4. BGL = Blood glucose levels.
The effect of co-administration of *B. eurycoma, D. microcarpum* and *M. pruriens* seed extracts on lipid profile are shown on Table 3. TC concentration in groups III and IV were significantly different (p<0.05) when compared to group I. While, groups II and V were not significantly different (p>0.05) when compared with group I. However, group II was significantly different (p<0.05) when compared to groups III, IV and V. Also, HDL, LDL and TG concentration in experimental groups III, IV and V were significantly different (p>0.05) when compared to group I. While, group II were also significantly different (p>0.05) when compared to group III, IV and V.

The effect of co-administration of *B. eurycoma, D. microcarpum* and *M. pruriens* aqueous seeds extract on plasma levels of AST, ALT and ALP of Wistar rats are shown on Table 4. AST and ALT level in group II and III were significantly different (p<0.05) when compared to group I and V. However, groups IV was significantly higher (p<0.05) when compared to group II, III and V. More so, group V statistically showed no significant difference (p>0.05) when compared to group I. On the other hand, group IV was significantly higher (p<0.05) when compared to group II,III and V. The scattered plot of the comparative effect of the aqueous extracts of *B. eurycoma, D. microcarpum* and *M. pruriens* on liver enzymes of female Wistar rats showed temporal spatial variation of the liver enzymes after administration as shown on Figure 1.

The results of the comparative effect of the aqueous extracts of *B. eurycoma, D. microcarpum* and *M. pruriens* on the pancreas of female Wistar rats are shown on Figure 2-6. Histological sections of pancreas tissues of group I and II showed normal cells and well-defined structure; it also showed pancreatic islets of Langerhans in a normal pancreas. No necrosis was observed as shown in Figure 2&3. While that of group III showed well defined pancreatic islets of beta cells and mild degree of necrosis as shown in Figure 4. The histological section of group IV showed mild degeneration in the islet cells of Langerhans while that of group V showed normal pancreas and no necrosis was also observed as shown in Figure 5&6.

### Table 3. Comparative effect of aqueous extract of *B. eurycoma, D. microcarpum* and *M. pruriens* on liver profile of female Wistar rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>TC (mmol/L)</th>
<th>HDL (mmol/L)</th>
<th>LDL (mmol/L)</th>
<th>TG (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>4.45 ± 0.22</td>
<td>1.86 ± 0.33</td>
<td>1.93 ± 0.25</td>
<td>2.14 ± 0.20</td>
</tr>
<tr>
<td>II</td>
<td>6.31 ± 0.51**</td>
<td>2.79 ± 0.31**</td>
<td>3.31 ± 0.47**</td>
<td>3.66 ± 0.57**</td>
</tr>
<tr>
<td>III</td>
<td>2.74 ± 0.48*</td>
<td>0.71 ± 0.22*</td>
<td>1.33 ± 0.07*</td>
<td>0.72 ± 0.31*</td>
</tr>
<tr>
<td>IV</td>
<td>3.50 ± 0.28*</td>
<td>1.37 ± 0.13*</td>
<td>0.81 ± 0.29*</td>
<td>1.38 ± 0.22*</td>
</tr>
<tr>
<td>V</td>
<td>4.83 ± 0.28</td>
<td>2.29 ± 0.36*</td>
<td>2.16 ± 0.38*</td>
<td>3.23 ± 0.58*</td>
</tr>
</tbody>
</table>

Data represented as Mean ± SEM; (*) p<0.05 significantly different in comparison with control group; (**) p<0.05 significantly increased in comparison with experimental groups; n=4. TC=Total cholesterol, HDL=High density lipoprotein, LDL=Low density lipoprotein, TG=Triglyceride.

### Table 4. Comparative effect of aqueous extract of *B. eurycoma, D. microcarpum* and *M. pruriens* on liver enzymes of female Wistar rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>AST(U/L)</th>
<th>ALT(U/L)</th>
<th>ALP(U/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>39.1 ± 0.47</td>
<td>42.6 ± 1.18</td>
<td>116.5 ± 5.85</td>
</tr>
<tr>
<td>II</td>
<td>59.3 ± 2.88*</td>
<td>50.7 ± 0.27*</td>
<td>136.5 ± 5.01*</td>
</tr>
<tr>
<td>III</td>
<td>30.2 ± 0.75*</td>
<td>33.1 ± 1.08*</td>
<td>90.7 ± 4.13*</td>
</tr>
<tr>
<td>IV</td>
<td>67.3 ± 2.94**</td>
<td>63.2 ± 2.33**</td>
<td>155.5 ± 4.26**</td>
</tr>
<tr>
<td>V</td>
<td>42.6 ± 1.05</td>
<td>42.3 ± 1.28</td>
<td>126.6 ± 4.21*</td>
</tr>
</tbody>
</table>

Data represented as Mean ± SEM; (*) p<0.05 significantly different in comparison with control group; (**) p<0.05 significantly increased in comparison with experimental groups; n=4. AST=Aspartate aminotransferase, ALT=Alanine aminotransferase, ALP=Alkaline phosphatase.
DISCUSSION

The desirable nature and usefulness of *B. eurycoma*, *D. microcarpum* and *M. pruriens* in food preparation in Africa and especially in Nigeria has contributed significantly to their great demand as soup thickener, since they are often used to make soup edible, palatable and presentable. In our study we found that co-administration of *B. eurycoma*, *D. microcarpum* and *M. pruriens* seeds extract individually did not posed any significant health risk on blood glucose levels of the experimental animals. The possible mechanism by which co-administration of *B. eurycoma*, *D. microcarpum* and *M. pruriens* seeds extract brings about modulation of glycaemic action may be by potentiating the insulin effect by either increasing or decreasing the pancreatic secretion of insulin from the b-cells of islets of Langerhans or its release from bound insulin.

The elevation of the lipid profile in group II could be attributed to the presence of antioxidants in the samples, especially the flavonoid. Igwenyi and Azoro [41] reported that *B. eurycoma*, *D. microcarpum* and *M. pruriens* contains 6.17, 9.75 and 41.9 mg/100g of flavonoids respectively. Flavonoids are most commonly known for their antioxidant activity. However, the health benefits they provide against cancer and heart disease are now clearly understood [42]. Report have shown that hydrocholloids which is a prominent characteristic physiologically of these plants extracts function as soluble fiber when ingested and as such they are very important in reducing blood cholesterol levels and moderating glucose response in diabetic’s patients [43]. Igwenyi *et al.* [44] also reported high level of essential palmicadis, amino acids and fatty acids, these could help in stabilizing lipid profile biomarkers and glucose level.

*B. eurycoma*, *D. microcarpum* and *M. pruriens* also contains other antioxidants such as alkaloids and lycopene as reported by Egwenyi and Azoro [41]. There was an increase in the level of TC, LDL and TG in group II, this increase could be due to the fact that TGs and LDLs share the same carrier LDL-particles and if the levels of LDL increases most of these carriers would be occupied and therefore
less available to TGs leading to the increase in serum TGs [45,46]. Also, the levels of TGs may increase due to the presence of fructose present in B. eurycoma as reported by Egwenyi and Azoro [41,47].

In this study, co-administration of B. eurycoma, D. microcarpum and M. pruriens seeds resulted in a significant increase in mean plasma activity of ALT, ALP and AST over control except in group III. It was observed that ALT was less affected by B. eurycoma, D. microcarpum and M. pruriens seeds extract than AST levels. This study observed that subjects consuming this extract especially the extract from M. pruriens had a significant rise in mean concentrations of serum liver aminotransferases. On the other hand, the experimental animal that was given the seed extract of D. microcarpum leads to a mark decrease in serum AST, ALT and ALP when compared with the control group. ALT is found majorly in the cytoplasm of hepatocytes, whereas AST is found in the mitochondria. However, when hepatocytes sustain more severe injury, the serum levels of AST will exceed that of ALT [48] as reported in Table 4. These elevations of liver aminotransferase activities present in the serum may be indicative of disturbed integrity of liver cells caused by administration of these extracts though the disturbance of the liver tissue integrity was mild. The study showed that administration of the extract at 200 mg kg\(^{-1}\) had significant modulating effect on the amino-transaminases (ALT, AST & ALP). Histological study of the pancreas tissues showed normalization of cells and well-defined structure; it also showed pancreatic islets of Langerhans in a normal pancreas. Though they were mild necrosis observed but not of serious consequences.

**CONCLUSION**

This study showed that co-administration of B. eurycoma, D. microcarpum and M. pruriens seeds extract did not posed any significant health risk on the blood glucose levels and lipid biomarkers of the experimental animals. The modulating effect of the extracts on the lipid profile in could be attributed to the presence of antioxidants present in them. The study showed that administration of the extracts at 200 mg kg\(^{-1}\) had significant modulating effect on the amino-transaminases (ALT, AST & ALP). Histological study of the pancreas tissues showed normalization of cells and well-defined structure; it also showed pancreatic islets of Langerhans in a normal pancreas. Though they were mild necrosis observed but not of major concern. This present study also showed that administration of B. eurycoma, D. microcarpum and M. pruriens seeds extract at 200 mgkg\(^{-1}\) alone or in combination improved the level of blood glucose level, liver function profile, liver enzymes, pancreas and did not posed any significant health risk. Therefore, B. eurycoma, D. microcarpum and M. pruriens may be safe to be use as a soup thickener.

**COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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