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Changes in lipid profile, serum protein, haemoglobin and haematocrit levels of albino rats fed with 15g/kg body weight of *Pentaclethra macrphylla*

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Abstract

Pentaclethra macrophylla (African oil bean) seeds are widely consumed in West Africa and are valued for their nutritional and medicinal properties. However, the effects of high-dose intake on lipid metabolism, protein status, and haematological indices remain poorly understood.To evaluate the effects of 15 g/kg body weight of *P. macrophylla* on lipid profile, serum proteins, haemoglobin, and haematocrit in albino rats.Adult male albino rats were randomly assigned to a control group or a treatment group receiving 15 g/kg body weight of *P. macrophylla* homogenate daily for 28 days. Blood samples were analysed for total cholesterol, triglycerides, HDL-C, LDL-C, total protein, albumin, globulin, haemoglobin, and haematocrit. Data were expressed as mean ± SD and compared using Student's t-test, with significance set at $P < 0.05$.Treatment with *P. macrophylla* significantly decreased total cholesterol, triglycerides, and LDL-C, while HDL-C increased significantly ($P < 0.05$). Albumin and globulin levels were significantly reduced, whereas total protein showed a non-significant decrease ($P > 0.05$). Haemoglobin and haematocrit levels increased significantly ($P < 0.05$) compared with controls.High-dose administration of *P. macrophylla* (15 g/kg) improves lipid profile and enhances haematological indices in albino rats, indicating potential cardioprotective and haematopoietic benefits. However, reductions in albumin and globulin suggest caution regarding protein metabolism. Further studies are recommended to establish safe consumption limits and elucidate underlying mechanisms.

Keywords: *Pentaclethra macrophylla*; Lipid profile; Serum protein; Haemoglobin; Haematocrit; Albino rats

Introduction

*Pentaclethra macrophylla*Benth., commonly referred to as the African oil bean, is a leguminous tree widely distributed across West and Central Africa. Its seeds are popularly consumed after boiling, slicing, and fermenting to produce a delicacy commonly known as "ugba" or "ukpaka." Beyond its nutritional value, the plant is used extensively in ethnomedicine for the management of gastrointestinal disorders, inflammatory conditions, and metabolic dysfunctions. Phytochemical investigations have identified bioactive constituents including saponins, tannins, phytosterols, alkaloids, flavonoids, and high amounts of unsaturated fatty acids, which contribute both to its therapeutic potential and possible toxicological concerns [1-2].Although *P. macrophylla* is culturally important and nutritionally rich, its seeds are also characterised by a high lipid content, comprising mainly oleic, linoleic, and palmitic acids. Regular consumption may therefore influence lipid metabolism, modulate serum lipid fractions, and potentially alter cardiovascular risk markers. The nutritional profile additionally includes substantial protein content; however, the presence of antinutritional factors such as tannins, oxalates, and phytates may impair protein digestibility, reduce nutrient bioavailability, and interfere with hepatic protein synthesis. These biochemical interactions underscore the need to evaluate the effects of high-dose consumption on serum protein levels [3-4].

Haematological parameters such as haemoglobin and haematocrit are sensitive indicators of systemic toxicity, nutritional adequacy, and the integrity of erythropoietic function. Antinutritional constituents commonly found in legumes, including tannins and alkaloids, can bind dietary iron, inhibit erythrocyte formation, or cause oxidative stress-mediated red cell destruction. As *P. macrophylla* contains some of these secondary metabolites, assessing its effect on haemoglobin and haematocrit is essential for determining potential haematotoxic or blood-modifying properties [5].In many communities, *P. macrophylla* is consumed in relatively large quantities, particularly during festive periods or in areas where it serves as a major protein substitute. Despite its widespread consumption, there remains limited scientific evidence on the physiological impact of high-dose ingestion. Previous studies have focused primarily on proximate composition and antimicrobial or antioxidant properties, with fewer works examining its metabolic, biochemical, or haematological effects under controlled conditions [6].

Experimental animal models, especially albino rats, offer a reliable means of assessing the biological and potential toxicological consequences of dietary substances. Administering a high dose, such as 10 g/kg body weight, provides insight into the threshold at which nutritional components may exert adverse or modulatory effects. Understanding changes in lipid profile, serum protein concentration, haemoglobin, and haematocrit following exposure will therefore help to define the safety margins and metabolic implications of high consumption [7-8].Given the nutritional relevance of *P. macrophylla* and the paucity of comprehensive toxicological data, this study was undertaken to evaluate the effects of feeding albino rats with 10 g/kg body weight of processed *P. macrophylla* seeds for 28 days. Specifically, the study aimed to determine alterations in lipid profile (TC, TG, HDL-C, LDL-C), serum protein levels, haemoglobin concentration, and haematocrit values. The findings will contribute to a clearer understanding of the metabolic consequences of high-dose intake and provide scientific evidence relevant to public health, dietary practices, and food safety evaluations.

Materials and Methods

Pentaclethra Macrophylla (African oil bean seed)

The African oil bean seeds used was purchased from a public local market Owerri, Imo State and identification done at the department of plant science and bio-technology of Imo State University. African oil bean seeds were stored in

a cool dry place. The fermented seeds were open air dried and milled to make fermented African oil bean diet.

Animal

Twenty-four (24) albino rats of both sexes weighing between 130g to 180g used for the study were purchased from Emi Ventures, No 120 Royce road, Owerri, Imo state. They were kept in well ventilated iron cages at the school farm of the faculty of Agric and Veterinary Medicine, Imo state University three weeks. One week was used for their acclimatization before the experiment and ethical rules guiding the use of laboratory animals according to Zimmerman (1983) were strictly followed. The Animals was grouped into four of six (6) animals in each group. The albino rats were fed with growers' mash and also were given clean tap water.

Experimental Design

Group I: Received normal diet and water only

Group II: Received normal diet, water and 10g/kg body weight of *Pentaclethramacrophylla.*

Group III: Received normal diet, water and 15 g/kg body weight of *Pentaclethramacrophylla.*

Group IV: Receive normal diet, water and 20g/kg body weight of *Pentaclethra macrophylla.*

Route of Administration

The rats were fed with ground Ugba orally, by using a syringe without a needle and inserting it into the mouths of the rats by the side gently and slowly to make sure that the required volume was consumed successfully.

Blood collection

Twenty-four hours after the last *Pentaclethra macrophylla* meal, the animals were anaesthetized with chloroform vapor, quickly brought out of the jar. Whole blood was collected by cardiac puncture from each animal into clean plain tubes. Part of the blood sample was put in EDTA bottle for Hemoglobin and Packed Cell Volume estimation. The remaining blood was allowed to stand for about 15 minutes to clot, then spurn in a centrifuge at 5000g for 10 minutes. Serum was separated from the clot with Pasteur pipette into sample tubes for estimation of lipid profile and serum protein and the samples stored at -20^{0}C prior to use.

Laboratory Procedures

All reagents used were commercially purchased and manufacturers' standard operating procedures were strictly adhered to.

Determinations

A. Serum Total Cholesterol Assay

The RANDOX diagnostic cholesterol kit with catalogue n umber CH-200 was used. It uses the enzymatic end point method as modified by Randox laboratory.

Procedure

The tubes were arranged accordingly as test, standard and blank. 0.01ml of each serum, cholesterol standard and distilled water was introduced accordingly into test, standard and blank tubes respectively. Then 1ml of the cholesterol reagent was added into each of the tubes and mixed thoroughly. It was incubated at 37^{0}C for 5 minutes. After incubation, the absorbance test and standard were read against that of blank within 60 minutes at 546nm wavelength.

B. Serum HDL – Cholesterol Assay

The RANDOX diagnostics HDL – cholesterol KIT with catalogue number CH – 203 was used. It uses the enzymatic end point method as modified by Randox laboratory.

Procedure:

Into a centrifuge tube, 0.2ml of the serum sample and 0.5ml of dilute precipitant was introduced. The contents were mixed properly and allowed to

stay for 10 minutes at room temperature. After the period, it was centrifuged for 10 minutes at 4,000 rpm. The supernatant was separated by the use of a Pasteur pipette. Then three tubes were arranged as test, standard and blank. Exactly 0.1ml of each of the supernatant, cholesterol standard and distilled water was added into the test, standard and blank tubes respectively. Then 1ml of cholesterol reagent was added into each of the tubes and mixed thoroughly. It then incubated at 37^0C for 5minutes. After incubation, the absorbance of test and standard were read against that of blank with 60minutes at 546nm wavelength.

C. Serum Triglyceride Assay

The RANDOX diagnostic triglyceride kits with catalogue number TR-210 was used. It uses the enzymatic end point method as modified by Randox laboratory.

Procedure

After preparation of the working reagents using the enzyme reagent and buffer, three test tubes were arranged and labelled test, standard and blank and 0.01ml of serum was introduced into the test, 0.01ml of distilled water into the blank tube. The 1ml of the working reagent was added into each of the tubes and mixed properly. The tubes were incubated at 37^0C for 5minutes. And the absorbance of the test and standard will be read against that of the blank within 60minutes at 546nm wavelength.

Serum LDL cholesterol determination

Serum LDL cholesterol was calculated by the Sand Kamp et al., (1990) modification of the Friedwald formula, which states;

$$\text{LDL-C} = \text{Total cholesterol} - \frac{\text{triglycerol}}{5} - \text{HDL} - \text{C}$$

Formula hinges on the assumption that VLDL –C is present in a concentration equal to one fifth of the triglyceride concentration.

(D) Serum VLDL – cholesterol determination

This was calculated using the formula

$$\text{VLDL-C} = \frac{\text{Triglyceride}}{5}$$

(E) Estimation of Serum Total protein

The Randox reagent with catalogue number TP. 245 was used. The method used was Biuret method as modified by Randox laboratory.

a. Procedure

Test tubes were arranged into reagent blank, sample blank and standard. 0.02ml of the distilled H_20 was added to the reagent blank test tube. Then 0.02ml of serum will be added to both sample tube and sample blank tube. Followed by the addition of 1.0ml of reagent 1 (RI) to all the tubes except sample blank tube which is 1.0ml of R2 was added. It was mixed and incubated for 30minutes at +20 to $+25^0$C. Then it was read at 546nm wavelength.

Estimation of Serum Albumin

Bromocresol Green of Randox with catalogue number AB362 was used.

a. Procedure

Three (3) test tubes for reagent Blank, standard and sample were properly arranged. 0.01ml of distilled water was added to the tube for reagent blank, 0.01ml of the standard was also added to the test tube for standard while 0.01ml of serum was added to the test tube for sample. Then 3.0ml of the bromocresyl green reagent was added to all the 3 test tubes each. It was mixed and incubated for 5 minutes at +20 to $+25^0$C. The absorbance of the sample and the standard was measured against the reagent blank.

Heamoglobin estimation

This was performed with Sysmex XE -5000 series automated heamatology analyzer manufactured by Sysmex Corporation, Japan.

Haematocrit estimation

Statisical Analysis

All values are expressed as mean± standard deviation (SD). The statistical analysis was carried out using student T-test. Results are displayed in tables.

Results

Table 1: Mean ± SD values in total cholesterol, triglyceride, HDL, total protein, albumin and globulin of albino rats fed with (15g/kg) *Pentaclethra macrophylla*

Parameters	Control	Group3	P values
Total cholesterol	119.3±5.9	103±4.7	P<0.05
Triglyceride	90.5±4.6	52±3.9	P<0.05
HDL	34.7±4.9	40.7±2.2	P<0.05
LDL	66.6±4.2	51.9±3.4	P<0.05
Total protein	4.8±1.0	3.5±0.9	P>0.05
Albumin	2.7±0.5	1.9±0.6	P<0.05
Globulin	2.2±0.61	1.6±0.52	P<0.05
Haemoglobin	11.5± 2.5	12.2±1.5	P<0.05
Haematocrit	34.8±4.9	37.2± 2.0	P<0.05

The table compared the mean changes of control and group 3 (15g/kg*) Pentaclethra Macrophylla*. It was observed that there was a decrease in both total cholesterol and triglyceride (103±3.7) and (52±3.9) when compared to their control (119.3±3.9) and (90.5±4.6) respectively and this was significant (P<0.05). HDL showed an increase (40.7±2.2) when compared with the control group (34.7±4.9) which was mildly significant (P<0.05). Total protein decreased from control (4.8±1) to (3.5 ±0.9) which was not significant (P>0.05). Albumin on the other hand decreased from control (2.7±0.05) to (1.7±0.4) significantly (P<0.05). Similarly, there was a significant decrease (P<0.05) in globulin decreasing from control (2.2±0.61) to (1.6±0.52). Also, haemoglobin and haematocrit increased from their control (12.2±1.5 and 37.2±2.0) to (11.5±2.5 and 34.8±4.9) significantly (P<0.05) (Table 1).

Discussion

The present study evaluated the effects of high-dose *Pentaclethra macrophylla* (15 g/kg body weight) on lipid profile, serum proteins, haemoglobin, and haematocrit levels in albino rats. The results demonstrate that administration of *P. macrophylla* significantly modulated several biochemical and haematological parameters, indicating both lipid-lowering and haematopoietic effects.The significant reduction in total cholesterol and triglycerides ($P < 0.05$) suggests that *P. macrophylla* may have hypolipidemic properties at high doses. This lipid-lowering effect is likely attributable to the high content of unsaturated fatty acids, phytosterols, and antioxidant phytochemicals present in the seeds, which may enhance lipid metabolism, reduce cholesterol absorption, and promote the clearance of circulating triglycerides. The observed decrease in LDL-C, accompanied by a significant increase in HDL-C, further indicates a potential cardioprotective effect, as the improvement in the

LDL/HDL ratio is consistent with reduced atherogenic risk. These findings are in line with previous reports that leguminous seeds and plant-based oils rich in unsaturated fatty acids can favorably modulate plasma lipid profiles [9].

In contrast, serum total protein decreased slightly but not significantly ($P > 0.05$), suggesting that overall protein metabolism and hepatic synthetic capacity were largely maintained despite high-dose intake. However, significant decreases in albumin and globulin ($P < 0.05$) indicate that high doses of *P. macrophylla* may impact individual protein fractions, possibly due to interference by antinutritional factors such as tannins or phytates, which are known to bind dietary proteins and reduce bioavailability. The reduction in globulin may also reflect alterations in immune-related protein synthesis, warranting further investigation [10].Haemoglobin and haematocrit levels increased significantly ($P < 0.05$) in treated rats compared with controls, suggesting a stimulatory effect on erythropoiesis or enhanced red blood cell production. The iron and amino acid content of *P. macrophylla*, along with its antioxidant constituents, may support erythropoietic activity and improve oxygen-carrying capacity. This increase in haematological indices could contribute to better tissue oxygenation and overall physiological resilience [11].

Conclusion

Administration of *Pentaclethra macrophylla* at a high dose of 15 g/kg body weight in albino rats significantly improved lipid profile by reducing total cholesterol, triglycerides, and LDL-C while increasing HDL-C, indicating potential cardioprotective effects. Haemoglobin and haematocrit levels were also significantly elevated, suggesting a stimulatory effect on erythropoiesis. Conversely, albumin and globulin levels decreased significantly, whereas total protein showed a non-significant reduction, highlighting potential impacts on protein fractions with high-dose intake. Overall, the study demonstrates that *P. macrophylla* possesses beneficial lipid-modulating and haematopoietic properties at this dose, but caution may be warranted regarding protein metabolism. Further long-term and mechanistic studies are recommended to evaluate safe consumption thresholds and the underlying biochemical mechanisms.

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