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# Hepatic Status and Lipid Petroxidation in Rats Fed Bambara Groundnut (*Voanzela subterranea)* And Pigeon Pea (*Cajanus cajan)*

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**Abstract**

The Liver function status and Lipid Peroxidation level were investigated in rats fed with Bambara groundnut *(Voanzela subterranea)* and pigeon pea *(Cajanus cajan)*supplemented diets. The results showed a significant decrease (P>0.05) in serum aspartate amino transferase (AST), serum alkaline amino transferase (ALT) and alkaline phosphatase activities. There was a marginal reduction in lipid peroxidation levels. The animals gained weights throughout the period of study.

*Key Words:* **Bambara Groundnut, Pigeon Pea, Asparate Transferase, Alanine Transferase, Alkaline Phosphatase, lipid Peroxidation.**

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## Introduction

Bambara groundnut (*Voanzela subterranea)* and Pigeo pea (*Cajanus cajan)*are important tropical legumes which are grown primarily for their seeds. The seeds are highly nutritious and consumed largely for their sources of protein, carbohydrate, vitamins and minerals (1,2,3,4). These legumes also contain biologically active substances such as saponins, sterols, glycosides and flavonoids (5)

Some plant extract which contained tannins, saponins, flavonoids, and glycosides have been shown to have protective effects on some organs (6,7). The liver is a vital organ and plays a major role in the overall metabolic economy of living systems. The protective effect of plant extract on the liver, reduces the incidence of hepatic

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defects and diseases. Lipid peroxidation is associated with diseases and its consequences include structural damage to membranes, loss of essential fatty acid, formation of cytotoxic aldehydic products and loss of hydrolytic enzymes [8, 9]

The present study was aimed at assessing the liver protective effect and lipid perodixidation associated with the consumption of two legumes namely Bambara groundnut and pigeon pea, which are commonly eaten in Eastern Nigeria.

## MATERIALS AND METHODS

### Animals:

Adult wister albino rats aged between 11 and 14 weeks old were purchased from the animal house of the University of Nigeria teaching Hospital (UNTH). The animals were housed in metal cages under tropical room temperature condition and fed standard formulated diets and tap water throughout the experiment.

### Plant:

Dry seeds of *V. Substerranea* and C *Cajan* were purchased from a local market in Okigwe, Imo State, Nigeria.

### Chemical and Reagents:

All chemicals used were of analar grade and reagents were freshly prepared according to standard methods.

### Feed formulation:

Feed stuff-included maize, maize offals, wheat offals, crayfish dust, bone ash, vitamin premix, pigeon pea flour and Bambara groundnut flour. Three different diets I ( Control), II (test A) and III (test B) were formulated based on the proximate compositions of feed stuff as shown in table 1, 2 and 3.

**Table 1: Feed Formulation for Diet I (Control-diet)**

| Feed stuff | Amount (g/kg) | % Crude protein | Energy |
|---|---|---|---|
| Maize | 255 | 2.55 | 875.67 |
| Wheat Offals | 335 | 5.025 | 636.50 |
| Crayfish Dust | 395 | 7.505 | 987.50 |
| Bone Ash | 10 | - | - |
| Salt | 2.5 | - | - |
| Vitamin ptrmix | 2.5 | - | - |
| Total | 1000 | 15.08 | 2499.67 |

**Table 2: Feed Formulation for Diet II (Bambara groundnut Supplemented)**

| Feed stuff | Amount (g/kg) | %Crude protein | Energy |
|---|---|---|---|
| Maize | 100 | 1.0 | 343 |
| Maize offals | 485 | 5.335 | 1212.50 |
| Bambara groundnut | 300 | 6.80 | 789.0 |
| Crayfish Dust | 100 | 1.9 | 250.0 |
| Bone Ash | 10 | - | - |
| Salt | 2.5 | - | - |
| Vitamin premix | 2.5 | - | - |
| Total | 1000 | 15.035 | 2594.40 |

**Table 3: Feed Formulation for Diet III (Pigeon pea Supplemented)**

| Feed stuff | Amount (g/kg) | %Crude protein | Energy |
|---|---|---|---|
| Maize | 50 | 0.5 | 171.7 |
| Maize offals | 535 | 5.885 | 1337.5 |
| Pigeon Pea | 300 | 6.807 | 717.0 |
| Crayfish Dust | 100 | 1.90 | 250 |
| Bone Ash | 10 | - | - |
| Salt | 2.5 | - | - |
| Vitamin premix | 2.5 | - | - |
| Total | 1000 | 15.092 | 2476.2 |

**Animal grouping and feeding:**

Twelve animals of mean average weight 137.2+0.25g were divided into six groups of two animals each. Three groups comprised of males, while others were females. Each gender group was made up of a control and two test groups, A and B. The control groups were fed diet I while the test groups A and B were fed diet II and III respectively as shown in table 4. Feeding was *ad libitum* for a period of six weeks.

**Table 4: Animal grouping and Feeding**

| Feed stuff | Amount (g/kg) | %Crude protein | Energy |
|---|---|---|---|
| Control 1 | Male | 2 | Diet I |
| Control 2 | Female | 2 | Diet I |
| Test A1 | Male | 2 | Diet II |
| Test A2 | Female | 2 | Diet II |
| Test B1 | Male | 2 | Diet III |
| Test B2 | Female | 2 | Diet III |

**Weekly Weight:**

The animals were weighed at the start of experiment and weekly throughout the duration of the study.

**Collection of blood and serum:**

The animals were starved overnight, aneasthesized under light chloroform and sacrificed. Blood was collected by cardiac puncture and left to clot. The clotted blood was centrifuged at 2000g for 5 minutes to obtain the serum.

**Estimation of serum alanine Amino Transferase (ALT) and Asparatate Amino Transferase (AST) Activities**

The serum alamine aminotransferase (ALT) and aspartate aminotransferase (AST) activities were estimated using the method of Rietman and Frankel (1957) to estimate the amount of pyruvate formed.

**Estimation of Alkaline Phosphatase**

The method of Bassey et al (1946) was used to estimate serum alkaline phosphatase activity.

**Determination of Lipid Peroxidation**

The method of Gutteridge and wilkins (1982) was used to determine the level of lipid Peroxidation in the serum.

**Statistical analysis**

Data were expressed as mean LSD and assessed by ANOVA. The difference between values of control and test groups was evaluated by the student's t-test. Significance was considered at $P>0.05$.

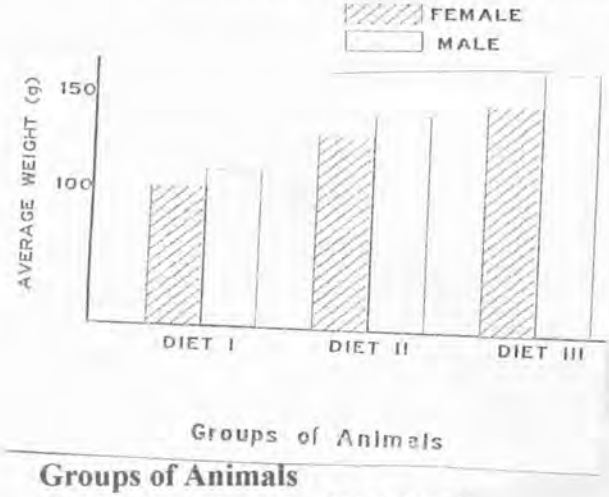
**RESULTS**

**Weekly Weight of Animals:**

All the animals in the experimental groups steadily increased in weight throughout the period of experiment as shown in table 5 and figure 1. The groups fed Bambara groundnut and pigwon pea – supplemented diets gained more weight than the control group

**Table 5: Weekly Weight of Animals (g)**

| Group | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 |
|---|---|---|---|---|---|---|
| Control 1 | 68.5[a] | 101.3 | 133.1 | 135.2 | 136.3 | 138.4 |
| | 91.0[b] | 120.1 | 154.4 | 156.4 | 158.5 | 159.3 |
| Control 2 | 60.3[g] | 74.7 | 83.5 | 85.3 | 87.5 | 90.2 |
| | 109.0 | 94.2 | 122.7 | 124.2 | 126.3 | 127.4 |
| Test A1 | 141.5 | 155.2 | 163.6 | 165.8 | 166.2 | 168.5 |
| | 143.6 | 157.3 | 173.3 | 175.5 | 177.4 | 180.5 |
| Test A2 | 110.0 | 126.7 | 133.9 | 135.5 | 138.3 | 139.4 |
| | 112.0 | 136.0 | 135.6 | 137.8 | 139.2 | 141.3 |
| Test B1 | 123.0 | 139.0 | 155.3 | 158.4 | 160.2 | 162.4 |
| | 151.0 | 173.2 | 186.2 | 1892 | 189.9 | 193.2 |
| Test B2 | 123.3 | 124.9 | 155.9 | 158.3 | 159.3 | 161.5 |
| | 124.0 | 127.9 | 184.6 | 186.2 | 189.2 | 192.5 |




**Groups of Animals**

**Fig 1: Total Average Weight of Animals at the end of Experiment**

**Levels of serum alkaline transferease (ALT):**

The levels of serum alkaline transferase are shown in Table 6. Animals fed with the control diet had a mean value of 9.75 +0.007 UM. Animals given Bambara-supplemented diet (diet II) had a mean value of 7.5 +0.01 UM representing a significant decrease ($P<0.05$) of about 23% over the control group. Those fed gipeon – pea supplemented diet (diet III) had a mean value of 7.25 +0.7 UM.

**Table 6: Levels of Serum Alanine Transferase Activity (UM Pyruvate released/min/mg protein).**

| Groups | Diet I | Diet II | Diet III |
|---|---|---|---|
| Test A1 | 11.00 | 7.00 | 8.00 |
| Test A2 | 10.00 | 9.00 | 8.00 |
| Test B1 | 9.00 | 6.00 | 6.00 |
| Test B2 | 9.00 | 8.00 | 7.00 |

**Levels of Serum asparatate transferase (AST)**

The levels of serum asparate transferase (AST) are shown in Table 7. The control group had a mean value of 11.25+0.007UM. Group fed diet II and diet III had values of 7.75+0.01UM and 9.25Um respectively. These values represented a significant decrease ($P<0.05$) of 31% and 18% respectively over the control group.

**Table 7: Levels of Serum Aspartate Transferase Activity (UM Oxaloacetate released/min/mg protein).**

| Groups | Diet I | Diet II | Diet III |
|---|---|---|---|
| Test A1 | 10.00 | 7.00 | 10.00 |
| Test A2 | 12.00 | 10.00 | 11.00 |
| Test B1 | 11.00 | 6.00 | 7.00 |
| Test B2 | 12.00 | 8.00 | 9.00 |

**Table 8: Levels of Serum Alkaline Phosphatase Activity (UM Pi relaeased/min/mg protein).**

| Groups | Diet I | Diet II | Diet III |
|---|---|---|---|
| Test A1 | 10.00 | 7.00 | 10.00 |
| Test A2 | 12.00 | 10.00 | 11.00 |
| Test B1 | 11.00 | 6.00 | 7.00 |
| Test B2 | 12.00 | 8.00 | 9.00 |

**Levels of serum alkaline phosphatase:**

The levels of alkaline phosphase are presented in Table 8. The mean value for the control group was 13.UM. The group fed diet II had a mean value of 9.25 UM representing a decrease of 27.8% over the control ($P<0.05$). The mean value for the group fed diet III was 9.0UM representing a decrease of 30.7% over the control.

**Levels of Lipid Peroxidation:**

The results for lipid peroxidation levels is presented in Table 9. The mean value of $1.80x10^6$ was observed for the group on diet I. The group fed diet II and diet III had values of $1.64x10^6$ and 1.69x10 respectively representing decrease of 9% and 6% respectively over the control group.

**Table 9: Levels of Serum Lipid Peroxidation (Malnodiadehyde Released (Units/ml).**

| Groups | Diet I | Diet II | Diet III |
|---|---|---|---|
| Test A1 | $1.87x10^6$ | $1.64x10^6$ | $1.81x10^6$ |
| Test A2 | $196x10^6$ | $1.69x10^6$ | $1.83x10^6$ |
| Test B1 | $1.51x10^6$ | $1.46x10^6$ | $1.49x10^6$ |
| Test B2 | $1.88x10^6$ | $1.77x10^6$ | $1.64x10^6$ |

**DISCUSSION**

The serum activities of alkaline transferase (ALT), aspartate transferase (AST) and alkaline phosphatase are usually used as indices in assessing the physiological status of the liver (11). The level of these serum enzymes increase during liver damage and disease conditions. Results indicate that the consumption of Bambara groundnut and pigeon pea sustained a stable physiological hepatic function and reduce lipid peroxidation. Several plant products have been reported to have protective effects on the liver (12,13,14,15).

Flavonoids as a group of pharmacologically active compounds have been found to have hepatic protective effects and also to inhibit lipid peroxidation (16,17). Also vitamins such as E and C act as oxygen scavengers and antioxidants in free radical reactions (18) Bambara groundnut and pigeon pea have neen found to contain flavonoids and a lot of vitamins (5). These constituents mediate the effect of the consumption of

these legumes on liver and lipid peroxidation. In conclusion the consumption of these legumes would in addition to provision of dietary requirements, serve as cheap local and natural source of hepato-protective and antioxidant subtances.

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