# THE HAEMATOLOGY, SERUM BIOCHEMISTRY AND CARCASS CHARACTERISTICS OF RABBITS FED SELECTED LEGUME FORAGES AND TIGER NUT RESIDUE BASED – DIET

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***ABSTRACT***

*A study was conducted to assess selected tropical legume forages and tiger nut residue based-diet on haematology, serum biochemistry and carcass characteristics of grower rabbits. Twenty-four rabbits of 2-3 months of age were used for the experiment. They were divided into four treatment groups with 6 rabbits in each treatment and replicated three times with 2 rabbits per replicate. Experimental diet was formulated to meet the nutrient requirement of grower rabbits using tiger nut residue. All the rabbits in the treatment groups were fed the experimental diet. Legumes forages were fed to the rabbits using complete randomized design such that $T_1$ (control) received concentrate without any forage, T2 received concentrate and Centrosema pubescens, $T_3$ received concentrate and Calogonium muconoides while T4 received concentrate and Leucaena leucocephala. All management practices necessary for the production of rabbits were observed. Data on hematological indices (Red Blood Cells, haemoglobin, packed cell volume, white blood cells,lymphocytes, mean corpuscular haemoglobin), serum biochemical indices (creatinine, total protein, Alanine amino transferase and aspartate amino transferase) and carcass characteristics (carcass weight, eviscerated weight, Dressing percentage and organ weights) were collected and subjected to ANOVA. Results of Haematological and serum biochemical indices showed significant differences ($P<0.05$) in all the treatments although they were within normal ranges for healthy rabbits. Results on carcass characteristics revealed that there were no significant ($P>0.05$) effects in most parameters measured except in foreleg, thoracic cage and loins. It was concluded that tiger nut residue, Centrosema pubescens, Calopogonium mucoides and leucaena leucocephala did not have any negative effect on haematological indices, serum biochemical indices and carcass characteristics of grower rabbits. It is recommended that tiger nut residue, centrosema pubescen, calopogonium muconoides and leucaena leucocephala be fed to grower rabbits.*

**Key Word:** Grower Rabbits, haematology, serum biochemistry, rabbit, carcass characteristics, legume forages, tiger nut residue.

## INTRODUCTION

The level of animal protein intake is a concern in Nigeria. Issac *et al*.,(2011) reported that in Nigeria, the available protein is given at 45g/caput/day with animal protein accounting 8g/caput/day. This short fall in animal protein can be bridged through intensive rabbit production and other livestock species (Evans a*t al.,* 2022, Christopher, *et al.,* 2024). However, the production of rabbit is limited because of lack of information on forages and forage preference by the rabbits, diseases infestation and poor nutrition (Evans, 2023). It has been noted that while intensive system of production restricts animal from being infected; it denies them free access to fresh green leaves whose contributions would enhance their growth and productivity. Succulent legumes plants like *Leucaena lecocephala, Centrosema Pubescens, Calopogonium mucoides* are available around

homestead and are believed to contain reasonable levels of certain valuable nutrients and these resources appear not to have been assessed with regards to haematology, serum biochemical indices and carcass characteristics to be applied in rabbit feeding. However, they have been reported to possess anti nutrients which can cause disease and affect the growth, productivity and meat quality of rabbits. Asides this, research has further shown that forages need to be supplemented with concentrate to improve on the well-being of rabbits (Christopher *et al.,* 2024). Tiger nut has levels of anti-nutrients, and may affect haematological, serum biochemical components as well as carcass quality of rabbits. Oyeniyi *et al.* (2016), and Olumide *et al*. 2020) reported that tiger nut is rich in energy and also identified to contain alkaloids, phytate and tannins. Tiger nut residue has recently been used by nutritionist in the formulation of feeds (Usoro, *et al*., 2025; Essien *et al., 2021*) and positive results have been recorded.

Etim (2010) reported that haematology and serum biochemistry are necessary tools in medical diagnosis of disease and is considered integral part of clinical laboratory diagnosis in animals. Carcass evaluation assess meat quality.

There is dearth of information on the use of legumes such as *Centrosema pubescens, Calopogonium mucunoides, Leucena leucocephela* and tiger nut residue as alternative feed ingredients for concentrate feed. Hence, the purpose of this study was to evaluate the effects of these legumes and tiger nuts residue-based diet on the haematological, serum biochemistry profile and carcass characteristics of rabbits.

## Methodology

### Site of the Experiment

The study was conducted in the Teaching and Research Farms of the Rabbitry Unit of the Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus.

### Sources of Experimental Materials

Experimental rabbits and tiger nut Residue were purchased and the legume forages harvested all within the University community. Tiger nut residue was dried for 3 days to free the residue from mold. Harvesting of the forages was done on every eve of the day proceeding feeding.

### Experimental Diet

40% tiger nut residue was used to formulate the experimental diet. Other ingredients were adjusted such that the diet met the requirements of growing rabbits. Ingredients and calculated nutrient composition of the experimental diets are presented in Table 1.

### Management of Experimental Animals and Design

Twenty four (24) rabbits of mixed sex between 2-3 months of ages were used for the experiment. They were housed in a well washed and disinfected hutches measuring 60 x 45 x 45. The rabbits were divided into four treatment groups with 6 rabbits to each treatment and replicated 3 times with two rabbits in each replicate. Rabbits were fed in a completely randomized design such that rabbits in $T_1$ (control) had only concentrate, $T_2$ had concentrate and *Centrosema pubescence,* $T_3$ had concentrate and *Calopogonium mucoides*; $T_4$ had concentrate and *Leucaena leucocephala.* Feed and water were given *ad-libium*. All routines management practices were observed and the experiment lasted for 56 days.

### Data Collection

### Blood collection

At the end of the feeding trial three rabbits were selected from each treatment group (one per replicate) and used for the determination of the haematological and serum biochemical indices. 5mls of blood was collected by severing the jugular vein with sharp knife, this allowed free flow of blood into labelled sterile universal bottle containing ethylene diamine tetracetic acid (EDTA) as anticoagulant to determine the following haematological parameters such as haemoglobin, packed cell volume, red blood

cell, white blood cell, lymphocytes, mean corpuscular haemoglobin concentration. Another 5mls of blood was also collected into a labeled sterile sample bottle without anticoagulant to determine the serum biochemistry parameters such as total protein, creatinine, Aspartate amino transferase, Alanine amino transferase and cholesterol

## Carcass Characteristics

At the end of the feeding trial, three rabbits were selected from each treatment group (one per replicate) for carcass evaluation. Each of the animals were stunned and bled after severing the jugular vein with sharp knife. The heads were thereafter removed as the carcass were skinned. The visceral organs were carefully removed, and then the eviscerated weight of each animal was recorded. Dressing percentage was calculated as: Dressing percentage (%) = Dressed weight ÷ live weight x 100. Carcass was separated into cuts namely: Foreleg, Hind leg, thoracic cage, Loin, Rump, Liver, Kidney, Lungs, Heart and Neck and each cut part was weighed.

## Statistical Analysis

All the data obtained were subjected to one way analysis of variance (ANOVA). Significant means were separated using Duncan New Multiple Range Test (SPSS, 2011).

Table 1 Percent Ingredient and calculated analysis composition of the experimental diet

| Ingredients | Composition |
|---|---|
| Tiger nut residue | 40.00 |
| Soybean | 20.00 |
| PKC | 5.00 |
| Wheat offal | 30.00 |
| Bone meal | 4.00 |
| Lysine | 0.25 |
| Methionine | 0.25 |
| Vitamin premix | 0.25 |
| Salt | 0.25 |
| Total | 100.00 |
| Calculated | |
| ME (kcal/kg) | 2716.32 |
| Crude protein (%) | 17.78 |
| Crude fiber (%) | 10.03 |
| Ash (%) | 2.75 |
| Nitrogen free extract | 69.44 |

## Results and Discussion

The haematological and serum biochemical indices of rabbits as well as carcass characteristics of js fed tiger nut residue-based diet and selected legumes are presented in Tables 2, 3 and 4

**Table 2: Hematological indices of Rabbits Fed Tiger Nut Based Diets and Selected Legume Forages**

| Parameter | $T_1$(Control) | $T_2$(CT) | $T_3$(CP) | $T_4$(LL) | SEM | Normal Ranges |
|---|---|---|---|---|---|---|
| PCV(%) | $32.00^{c}$ | $35.00^{b}$ | $38.00^{a}$ | $37.00^{ab}$ | 7.33 | 30-50 |
| Hb (g/dl) | 9.90 | 10.90 | 11.60 | 10.90 | 0.31 | 9-15 |
| RBC(x$10^3$/ul) | 4.40 | 4.70 | 5.40 | 5.30 | 0.28 | 4-10 |
| WBC(x$10^3$/ul) | 5.90 | 6.30 | 7.50 | 7.10 | 0.31 | 5-12.5 |
| Lymphocytes(%) | $77.00^{a}$ | $69.33^{b}$ | $60.00^{c}$ | $54.00^{d}$ | 2.66 | 40-80 |
| MCH(pg) | $32.00^{a}$ | $22.33^{b}$ | $22.00^{b}$ | $21.00^{b}$ | 1.37 | 20-35 |
| MCV(fl) | $72.00^{ab}$ | $74.00^{a}$ | $69.00^{c}$ | $70.00^{bc}$ | 0.63 | 65-95 |
| MCHC(g/dL) | $22.00^{b}$ | $31.33^{a}$ | $31.33^{a}$ | $29.33^{a}$ | 1.20 | 20-37 |

Abcd: Means across treatment bearing different superscripts are significant ($p<0.05$). MCV = Mean corpuscular volume. MCH = Mean corpuscular haemoglobin. MCHC = Mean corpuscular haemoglobin concentration. SEM = Standard Error of Mean, WBC = White Blood Cell. PCV=Packed Cell Volume Hb = Haemoglobin, RBC + Red Blood Cell. CT= Centro, CP=Calpogonium, LL=Leucena.

**Table 3: Serum Biochemistry Indices of Rabbits Fed Tiger Nut Based Diets and Selected Legume Forages**

| Parameter | $T_1$(Control) | $T_2$(CT) | $T_3$(CP) | $T_4$(LL) | SEM | Normal Ranges |
|---|---|---|---|---|---|---|
| Creatinine (g/dl) | $75.00^{d}$ | $153.00^{a}$ | $134.00^{c}$ | $146.00^{b}$ | 9.28 | 50-200 |
| Total protein (g/dl) | $55.00^{c}$ | $61.00^{b}$ | $62.33^{b}$ | $65.00^{a}$ | 1.13 | 50-75 |
| AST(U/l) | $27.00^{d}$ | $41.00^{b}$ | $52.00^{a}$ | $36.00^{c}$ | 2.73 | 25-60 |
| ALT(U/l) | 17.00 | 29.66 | 43.00 | 30.66 | 2.79 | 10-60 |
| Cholesterol (g/dl) | $5.50^{a}$ | $2.10^{c}$ | $4.10^{b}$ | $2.20^{c}$ | 0.49 | 1.0-8.0 |

Abcd: Means across treatment bearing different superscripts are significant ($p<0.05$). AST = Asparate Am ino Transferase, ALT = Alanine Amino Transferase CT = Centro, CP = Calopogonium, LL -= Leucena..

**Table 4: Carcass Characteristics of Grower Rabbits Fed Tiger Nut Residue Based Diet and Selected Legumes Forages**

| Parameters | $T_1$ Control | $T_2$ Centrosema | $T_3$ Calopogonium | $T_4$ Leucena | SEM |
|---|---|---|---|---|---|
| Live weight (g) | 1196.50 | 1434.50 | 1120.50 | 1473.00 | 66.08 |
| Carcass weight (g) | 861.50 | 868.00 | 821.50 | 1096.50 | 61.23 |
| Eviscerated weight (g) | 578.50 | 728.00 | 559.50 | 800.00 | 44.46 |
| Dressing (%) | 72.00 | 59.00 | 72.50 | 74.00 | 3.11 |
| Foreleg (g) | $77.50^{bc}$ | $98.00^{ab}$ | $73.50^{c}$ | $104.00^{a}$ | 5.35 |
| Hindleg (g) | 154.00 | 195.00 | 140.00 | 176.50 | 10.69 |
| Thoracic cage (g) | $79.00^{b}$ | $117.50^{ab}$ | $96.00^{ab}$ | $133.50^{a}$ | 9.11 |
| Loin (g) | $61.50^{b}$ | $89.50^{ab}$ | $70.50^{b}$ | $101.50^{a}$ | 6.49 |
| Rump (g) | 136.50 | 130.50 | 97.50 | 157.00 | 10.68 |
| Liver (g) | 35.50 | 39.00 | 34.00 | 42,50 | 1.96 |
| Kidney (g) | 10.0 | 9.00 | 8.00 | 12.00 | 0.73 |
| Lungs (g) | 8.00 | 10.00 | 8.50 | 7.50 | 0.73 |
| Heart (g) | 4.50 | 4.50 | 3.00 | 4.50 | 0.30 |
| Neck (g) | 34.00 | 37.50 | 33.00 | 36.00 | 1.27 |

The haematological indices in this study showed significant effect ($P<0.05$) amongst the treatment groups.

Haemoglobin, packed cell volume, red blood cells, mean corpuscular haemoglobin concentration are indices use to detect the oxygen carrying capacity, anaemia and blood cells count. The lymphocytes and the white blood cells are responsible for detection of infection and the strength of the body immune system. Although there were significant differences ($P<0.05$) in the indices in all the treatment groups, they were within the normal ranges recommended for healthy rabbits. The differences may be attributed to the source of legume and the disparity in nutritional composition of the different legumes. The findings of this study imply that neither tiger nut residue nor any of the legumes had a negative influence on the haematological indices of grower rabbits. The results obtained in this study is in tandem with Usoro e*t al*., (2025) who reported normal ranges of hematological and serum biochemical indices of rabbit fed different sources of legume and tiger nut residue based diet. This ranges obtained from this study also agrees with Etim *et al.*,2014.

Serum biochemical indices in this study also showed significant difference ($P<0.05$) in all the treatments. Total protein measures the globubin and albumin levels and abnormal levels depicts infection and nutritional deficiency and malnutrition. Serum test with abnormal levels of aspartate amino transferase and alanine amino transferase signals liver problem. The presence of high level creatinine in the blood indicates poor kidney function, an inability of the kidney to filter creatinine, a waste product in the blood. Experimental diet and the legume forages maintained the healthy levels of biochemical parameters, a clear indication that levels of antinutrients in these studied forages and tiger nut residue posed no negative effect to health of rabbits. This study agrees with Etim *et al,* 2013 who reported normal ranges of serum biochemical indices of

rabbits fed Aspilia Africana. The meat quality of rabbits were assessed through whole sale cuts and the internal organs weights. The mean value of carcass traits of experimental rabbits fed tiger nut residue- based diet and selected legume forages showed no significant (P>0.05) difference in most parameters measured except for forelegs, loins and thoracic cage. The foreleg, loins and thoracic cage of rabbits were highest in treatment 4 fed with L*eucaena leucocephala* and the experimental diet compared to rabbits in treatments 2 and 3. They were lowest in in treatment 1.

It is possible that feeding of legume forages alongside the concentrate diet caused relatively more developed foreleg, loins and thoracic cage of rabbits than those of rabbits in the control. The results of this study could also be attributed to the high nutritive composition of leucaena leucophala compared to centrosema pubescens and calopogonium mucunoids as reported by Okonkwo *et al.,*2002 and Christopher *et al.*, 2024) These findings agree with the work of Adeyemo *et al.* 2013) who reported lower weight of rabbits fed only concentrate without forage. It also agrees with Naandan *et al.,* (2012) who reported a significant (P<0.05) effect of carcass characteristics of rabbits fed forages although the effect was dependent on the type of forage fed. The internal organ weights were not significantly (P>0.05) different among the treatment groups. The internal organs are commonly used in feeding trials as indicators of toxicity of the test materials. The non-significant difference (P>0.05) expressed by internal organs of rabbits in all the treatments in this study agrees with Alu (2015a) who had a similar report of non-significant in visceral organs of growing rabbits fed tiger nut residue-based diet. The results also agree with the findings of Oloruntola *et al (*2015*)* who reported that different selected forages showed no significant (P>0.05) effect on internal organs weight of rabbits.

## Conclusion

Haematology and serum biochemistry are tools for detecting nutritional abnormalities. Tiger nut based-diet and legume forages (Centrosema pubescence, Calopogonium mucoides and Leucaena leucocephala) did not show negative effect on both haematology and serum parameters. Carcass evaluation is one of the ways to assess animals' performance in terms of meat yield. The meat quality of grower rabbits improved with test ingredients.

## Recommendation

From the findings of this research, it is recommended that tiger nut residue-based diet and any of the legume forages should be used in feeding grower rabbits for maintenance of healthy ranges of indices of haematology and serum biochemistry and improved carcass quality of grower rabbits.

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