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# Carcass Characteristics, Haematological Parameters and Reproductive Tract Morphometry of Rabbits Fed Cassava Leaf Meal.

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***Abstract:*** *A 12 week feeding trial was conducted to evaluate the feed effect on carcass characteristics, haematological parameters and reproductive tract morphometry of female rabbits fed cassava leaf meal diets. The study was conducted at the University of Agriculture Makurdi, Livestock Teaching and Research Farm. Sixteen weaned rabbits (4 weeks old) were fed four diets in a completely randomised design experiment. Diet 1 contained no cassava leaf meal (CLM), while Diets 2, 3 and 4 has maize replaced with cassava leaf meal at 10, 20 and 30% CLM respectively. Haematological parameters of the rabbits did not show any significant difference between treatments. There was also no significant difference on the reproductive tract morphometry except on the length of the left oviduct and the weight of the vagina. Sun dried CLM has no adverse effect on carcass yield, visceral organ weight, haematological characteristics and reproductive tract morphometry of female rabbits. This suggests that sun dried cassava leave meal in diet to replace maize up to 30% can support visceral organ development, haematological characteristics and female reproductive tract development in rabbits. Further studies are necessary to determine the reproductive and growth performance of rabbits fed CLM diets at higher levels of replacement.*

***Keywords:*** *Cassava Leave, Performance, Rabbits, Reproduction*

## I. Introduction

The consequence of rivalry between human and livestock for grains is escalations in cost of feed and inadequate feed resources, which have often forced a major limitation on the growth of animal production in Nigeria and elsewhere in the developing countries. More research is now focused towards uncovering the nutritional worth, and then exploitation of crop residues and agro-industrial waste, unsuitable for human consumption but which may be very suitable for utilization in livestock nutrition.

Rapid increase in meat consumption are not attainable with large animal in view of their long gestation period but may however be met by short breeding-circle animals like the rabbit [1]. Thus, effort to tackle this quandary of high cost of feed and unavailability of feed resources for livestock and food for human consumption and raw materials for industries brings rabbits in to focus. Rabbits are monogastric herbivours, fast growing, they have short gestation length, with the ability to rebreed shortly after parturition, highly prolific, and they have the ability to efficiently convert non-competitive feed sources to meat [1] and do not require a hatchery for continuous production.

Cassava leaf is an agricultural by-product that is cheap to obtain and readily available all year round as it can be dried and stored. As far back as four decades, leaf yields of 20,000kg/ha/year have been reported [2]. It is established [3] that the crude protein content of cassava leaves is as high as between 21-30%, while [4] reported a value of 24.2% with crude fibre content of 14.87% and gross energy of 19.66MJ/kg. Proximate analysis [5] reveals the leaves of cassava to contain 25.10% crude protein, 11.40% crude fibre, 12.70 ether extract and 9% ash. The amino acid profile has indicated deficiency only in the methionine content (1.75g/16gN) [6]. Cassava leaves contain cyanogenic glucosides (linamarin and lotautralin) which on hydrolysis gives hydrogen cyanide [7]. Levels of cyanide less than 5% are however harmless [8]. Thus, this study shall make possible a comparison of the merits of cassava leaf meal and maize as alternate feed ingredients for rabbits.

## II. Materials and Methods

**Cassava leaf meal**: The cassava leaves that were used in the diets were obtained from the bitter variety of cassava (*Manihot utilissina*) at farms in Makurdi, metropolis. Fresh cassava leaves were plucked from the stems after the roots have been harvested. The leaves were sun dried on tarpaulin to a moisture content of less than 10%. Cassava leaf meal (CLM) was prepared by pounding of the leaves in a mortar to obtain a smooth texture meal.

**Experimental diets**. Four diets were formulated. Diet 1 contained no CLM, while in Diets 2, 3 and 4 maize was replaced with cassava leaf meal at 10, 20 and 30% respectively (Table 1).

**Experimental animals**: Sixteen, four- five week old, cross bred rabbits, with average weight of 260g were used in the feeding trial. Prior to the commencement of the study the rabbits were treated of internal and external parasites by subcutaneous injection of *ivomec* (0.2ml/rabbit).

**Experimental design and procedure**: Four female rabbits were, randomly, allocated to each treatment, in a completely randomised design, such that mean live weight was uniform (240-270g) for all treatments. The animals were housed individually in cages. Using standard rabbit husbandry methods [9], the animals were maintained on their respective diets throughout the experimental period. Feed and water were given *ad libitum*. All the rabbits were slaughtered at the end of the 12 weeks feeding period. Before slaughter, the rabbits were starved of feed for 18 hours while water was still served *ad libitum*. The rabbits were stunned and killed by severing the jugular veins and blood was collected at slaughter while the rabbits were eviscerated and the heart, liver, kidney, and the reproductive tract were carefully removed. Visceral organ and haematological parameters were then evaluated. The reproductive tract was removed completely, trimmed free of fats and adhering connective tissues and subjected to morphometric analysis as described [10]. Weights of the reproductive organs as well as their length were obtained using a digital scale and a well calibrated linear rule respectively.

The date obtained was subjected to the analysis of variance (ANOVA) procedures of SPSS in a completely randomized design. Duncan Multiple Range Test was used to compare treatment means (at $\alpha$=0.05) were differences exist.

## III. Results and Discussion

The crude protein, crude fibre and ash content of the diets increased while the content of ether extract nitrogen free extract and total digestible nutrients decreased linearly as the amount of cassava leaf meal increased in the diets (Table 1). This effect reflects the high levels in CP, CF, and Ash and low levels in EE and NFE of CLM compared to maize.

Results on Table 2 showed that, there were no significant differences ($p>0.05$) between treatments in all the haematological indices measured (packed cell volume, haemoglobin, white blood cell count, red blood cell count and leucocytes differential counts). This implies that, cassava leaf meal, in spite of any residual cyanide, had no adverse effects on the blood forming cells of rabbits. Similar observations were made [11] when weaned rabbits were fed dried cassava peal meal diets fortified with local spices. Results for haemoglobin and white blood cells were similar to the findings [12] on the preliminary investigation on the effect of pawpaw peal meal on growth, visceral organs and haematology of male rabbits. The population of neutrophils, eosinophils, lymphocytes and monocytes were not significantly ($p>0.05$) affected by dietary treatments. Thus, indicating probably, a normal blood physiology across treatments. Basophils were conspicuously absent in the blood of female rabbits fed both the control and the cassava leaf meal diets. This confirms the research findings [12]; [13] that, basophils are absent in peripheral blood except in cases of chronic anaemia thus, confirming that the treatments used in this study do not cause anaemia since the rabbits used in this study were not anaemic.

The morphometric characteristics of the left and right ovary, left and right oviduct, paired uterine horns and cervix were not significantly ($p>0.05$) affected by dietary treatment (Table 3), suggesting that, female rabbits fed a diet in which, as light as 10.05 percent cassava leaf meal replaces maize may support normal reproductive processes. Similar findings were reported [10] involving paw-paw peel meal and the reproductive potential of the female rabbits. The weight of the vagina showed a significant difference ($p<0.05$) among treatments with a decreasing trend as the cassava leaf meal increased in the diets. In terms of linear measurements, the length of the vagina, left and right uterine horns and the right oviduct did not show significant difference ($p>0.05$) between dietary treatments. The length of the left oviduct, however, showed significant difference ($p<0.05$) with a decreasing trend as the level of cassava leaf meal increased in the diet. The effect of cassava leaf meal on the weight of the vagina and the length of the left oviduct requires further research as this may affect vital processes such as fertilization in female rabbits.

**Carcass evaluation.**

Table 4 showed the carcass characteristics and organ weights of experimental rabbits. The dressing percentage (56.36 to 89.14) of the female rabbits was the same for all the treatments. When compared to the values recorded [14]; [1], the values obtain in this study were slightly higher than the results of 66.87-75.98% and 60-62% respectively. The observed difference may be due to differences in the weight of the rabbits at slaughter and the nature of the carcass, whether the heads were removed or not. The heads, skin and feet contributed about 10%, 11% and 3% respectively to the dressing percentage [15]. In Nigeria, the head, skin and legs are left on the carcass so, a dressing percentage of 74 is normally obtained and reported [1] but is slightly lower than the 83.28 percent reported in the present study. These observe difference could be due to differences in age of the animals used for the different studies.

**Visceral organ weight.**

The absolute weight of the liver, paired kidney and heart were not significantly ($p>0.05$) affected by the dietary treatments. The weight of these organs recorded a fluctuating trend as the level of cassava leaf meal increased in the diet. When expressed as a percentage of the carcass weight, the weight of the liver recorded a significant difference between dietary treatments implying that cassava leaf meal may have an adverse effect on the liver of female rabbits. However, [1], no significant difference is recorded in liver weight in rabbits fed cassava leaf meal. The observed difference could be due to sex effects, and the level of inclusion of the cassava leaf meal in the different diets. It could also be that, the results [1] were on absolute weight not relative weight. Reports of [16] and [17] showed no direct relationship between serum or urinary thiocyanate and growth performance and carcass characteristics in rabbits. However, none of the studies reported for rabbits used a variety of cassava that is high in hydrocyanic acid. The observed difference in this work could be as a result of the variety of cassava used.

Table 1: Ingredients and Nutrient Composition of Experimental Diets (%).

| | Treatments (% CLM substitution levels ) | | | |
|---|---|---|---|---|
| Ingredients | 1(0) | 2(10) | 3(20) | 4(30) |
| Maize | 33.5 | 30.15 | 26.80 | 23.45 |
| CLM[5] | - | 3.35 | 6.70 | 10.05 |
| FFSB[1] | 21.5 | 21.5 | 21.5 | 21.50 |
| BDG[2] | 25.00 | 25.00 | 25.00 | 25.00 |
| Rice offal[3] | 24.50 | 24.50 | 24.50 | 24.50 |
| Bone meal | 3.00 | 3.00 | 3.00 | 3.00 |
| Salt | 0.50 | 0.50 | 0.50 | 0.50 |
| Premix[4] | 1.00 | 1.00 | 1.00 | 1.00 |
| Crude protein (%) | 16.21 | 16.32 | 16.56 | 16.75 |
| Crude fibre (%) | 12.52 | 12.96 | 13.39 | 13.82 |
| Ash | 6.88 | 7.38 | 7.87 | 8.87 |
| Ether extract | 9.89 | 9.79 | 9.62 | 9.45 |
| Nitrogen free extract | 48.44 | 47.65 | 46.93 | 45.71 |

[1] Full fat soybean meal; [2] Brewers dried grain; [3] Vitamin / mineral premix; [5] Cassava leaf meal.

## IV. Conclusion

The present study has established that sun dried cassava leave meal with its associated residual cyanide (if any present) can be included in rabbit diets to replace maize up to 30% with no adverse consequence on reproductive tract morphometry and hematological characteristics, carcass yield, and visceral organ weights of female rabbits. Further research may be necessary on the reproductive tract morphometry of female rabbits to ascertain the affect of cassava leaf meal on the normal physiological processes of the vagina and the oviduct.

Table 2: Haematological Parameters of Female Rabbits Fed Cassava Leave Meal in Diets.

| | Treatments (% CLM* substitution levels) | | | | |
|---|---|---|---|---|---|
| | 1(0) | 2(10) | 3(20) | 4(30) | [1]NRV |
| Haemoglobin | 11.15 | 11.35 | 12.50 | 12.00 | 11.6-14.5 |
| PCV | 33.50 | 34.00 | 37.50 | 36.00 | 26.7-47.2 |
| WBC ($X10^9$/l) | 3.60 | 4.10 | 2.85 | 2.85 | 5.2-16.5 |
| RBC ($X10^6/mm^3$) | 52.00 | 72.00 | 54.40 | 95.60 | 37.0-75.0 |
| | Leucocyte differential counts (%) | | | | |
| Neutrophils | 27.50 | 23.00 | 37.00 | 38.00 | |
| Eosinophil | 0.50 | 1.50 | 2.00 | 1.00 | |
| Basophils | 0.00 | 0.00 | 0.00 | 0.00 | |
| Lymphocytes | 67.50 | 73.00 | 55.00 | 57.50 | |
| Monocytes | 4.50 | 2.50 | 6.00 | 3.50 | |

*Cassava leaf meal; PCV Packed cell volume; WBC White blood cell; RBC Red blood cell;

Mean values on the same row with similar superscript do not differ ($P>0.05$) significantly.

Table 3: Reproductive Tract Weight and Morphometry of Female Rabbits.

| | Treatments (%CLM* substitution levels) | | | |
|---|---|---|---|---|
| | 1(0) | 2(10) | 3(20) | 4(30) |
| **Weight (g)** | | | | |
| Left Ovary | 0.08 | 0.06 | 0.05 | 0.11 |
| Right Ovary | 0.08 | 0.04 | 0.05 | 0.12 |
| Left Oviduct | 0.22 | 0.11 | 0.08 | 0.09 |
| R. Oviduct | 0.23 | 0.10 | 0.12 | 0.10 |
| Paired uterine horn | 0.72 | 0.86 | 0.68 | 0.39 |
| Cervix | 0.48 | 0.18 | 0.17 | 0.10 |
| Vagina | $3.53^{a}$ | $2.13^{b}$ | $1.65^{b}$ | $1.33^{b}$ |
| **Length (cm)** | | | | |
| Left Oviduct | $10.40^{a}$ | $8.65^{ab}$ | $6.20^{bc}$ | $5.55^{c}$ |
| Right Oviduct | 9.55 | 8.15 | 8.70 | 6.55 |
| Left uterine horn | 8.75 | 8.90 | 6.85 | 5.35 |
| Right uterine horn | 8.50 | 8.25 | 8.05 | 4.90 |
| Vagina | 13.00 | 11.35 | 9.65 | 6.40 |

*Cassava leaf meal.

Mean values on the same row with different superscript differs (P>0.05) significantly.

Mean values on the same row with similar superscript do not differ (P>0.05) significantly

Table 4. Carcass Characteristics and Organ Weights of Rabbits Fed Cassava Leave Meal

| Parameter | Treatments (% CLM* substitution levels) | | | |
|---|---|---|---|---|
| | 1(0) | 2(10) | 3(20) | 4(30) |
| Slaughter weight | 2150±251 | 1700±100 | 1825±75 | 1800±50 |
| Dressed weight | 1775±75 | 1000±50 | 1625±25 | 1400±301 |
| Dressing percent | 83.28±6.2 | 56.36±3.0 | 89.14±2.3 | 77.38±14.6 |
| Liver weight | 36.69±3.7 | 32.81±2.1 | 29.53±0.5 | 37.48±1.4 |
| Heart weight | 3.86±0.40 | 3.31±0.14 | 3.75±0.35 | 4.02±0.37 |
| Paired kidney weight | 9.77±1.02 | 8.97±0.43 | 9.17±0.70 | 8.90±0.78 |
| | Relative weights | | | |
| Liver weight | $2.06±0.12^{b}$ | $3.28±0.05^{a}$ | $1.82±0.01^{b}$ | $2.79±0.05^{ab}$ |
| Heart weight | 0.22±0.02 | 0.33±0.00 | 0.23±0.02 | 0.30±0.04 |
| Paired kidney weight | 0.05±0.04 | 0.09±0.00 | 0.57±0.06 | 0.66±0.09 |

*Cassava leaf meal.
Mean values on the same row with different superscript differs (P>0.05) significantly.
Mean values on the same row with similar superscript do not differ (P>0.05) significantly.

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