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# Growth Performance, Genital Organ Dimensions, Visceral Organ Weights and Haematology of Male Rabbits Fed Graded Levels Of Gmelina Arborea Leaf Meal

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***Abstract:*** *The study was undertaken to determine the effect of feeding varying levels of Gmelina arborea leaf meal on growth performance, genital tract dimensions visceral organ weights and haematology of male rabbits. A total of 32 rabbits of mixed breeds, aged between 8 and 12 weeks, weighing between 1100 and 1250g were randomly allocated to four dietary treatments in a trial that lasted for sixteen (16) weeks. The four diets were designated $T_1$, $T_2$, $T_3$ and $T_4$ with Gmelina arborea leaf meal inclusion of 0%, 5%, 10% and 15% respectively. Eight rabbits were allocated per treatment while each rabbit served as a replicate in a completely randomized design. At the end of the feeding trial, three rabbits per treatment were slaughtered for haematology, visceral organ weights and reproductive tract dimensions evaluation. The result showed no significant effect of diet on Daily weight gain, Daily feed intake and Feed gain ratio. Dressing percent was significantly ($p<0.O5$) higher in treatment ($T_4$). The genital organ dimensions and viscera organ weights showed no significant ($p>0.05$) differences. No significant ($p>0.05$) influenced of diets was observed on the haematological parameters measured except White blood cell counts (WBC). This results showed that Gmelina arborea leaf meal could be utilize up to 15% level of incorporation in diets without any deleterious effect on the growth performance, genital tract dimensions, viscera organ weights and haematology of male rabbits. It is recommended that further study on the feeding potential of Gmelina arborea leaf meal at higher levels of inclusion be conducted.*

***Keywords:*** *Gmelina arborea, Growth performance, rabbits, organ weights, haematology*

## I. Introduction

Inadequate supply of protein from such conventional livestock as cattle, goat, sheep and pig to meet the demands of the Nigerian populace has led to a shift of emphasis towards rabbit production. Top most in the attributes promoting the production of rabbits includes high fecundity, rapid growth rate and the ability to utilized forages and turn out low cost and high quality proteins (Ani, 2006). In spite of all these advantages over other livestock, rabbit production has not achieved its potential as cheap animal protein source in Nigeria (Herbert and Adejumo 1995). Feed constitute the bulk of expense incurred in livestock production. About 70% of the total cost of production goes to feeds, a situation which has forced animal nutritionist to expand the raw materials base for livestock formulation to accommodate unconventional feed resources in order to reduce cost.

The *Gmelina arborea* locally known as malina, is a fast growing tree, which grows on different localities and prefers moist fertile valleys with 750 – 4500mm rain-fall. Majgaonkar *et al*. (1987) reported that *Gmelina arborea* leaf has a dry matter digestibility of 57%, crude protein content of 11.5% and the protein was 55% digestible. *Gmelina arborea* leaf is one of the tree leaves considered as an important source of nutrient for ruminant and non ruminant, especially in those areas with pronounced dry season.

The effect of *Gmelina arborea* leaf meal on growth performance of rabbits has been reported elsewhere (Majgaonkar *et al*., 1987; Gangadharan, 2012). However little information is available on the effect of *Gmelina arborea* leaf meal on genital tract dimensions, organ weights and haematology of rabbits in the southern guinea savanna ecological zone of Nigeria. This study was designed to investigate the growth performance, genital tract dimensions, visceral organ weights and haematology of rabbits fed graded levels of *Gmelina arborea* leaf meal.

## II. Materials And Methods

### 2.1. Study Location

The study was conducted at the Rabbitry unit of the Livestock Training and Research Farm, University of Agriculture, Makurdi, Nigeria. Makurdi is located at Latitude $7^o$ 14′ North and Longitude $8^o$ 21′ East and lies within the Southern guinea savannah region of Nigeria. The area is warm with temperature range of 24.20 to 36.33$^o$C and high temperature is experienced between late February and April. The rainfall is between 508 and 1016mm (TAC, 2009).

**2.2. Source of Gmelina arborea leaves and preparation of the experimental diets**

*Gmelina arborea* leaves were obtained from different locations in Makurdi. The leaves were shade-dried single layered on a concrete platform for about 8 hours daily until they became crispy to touch. The shade dried leaves were ground to produce *Gmelina arborea* leaf meal before incorporating into experimental diets. The *Gmelina arborea* leaf meal was thereafter included in the diets at the levels of 0, 5, 10 and 15% to produce diets $T_1$, $T_2$, $T_3$ and $T_4$ respectively. Other ingredients used were maize, full fat soya beans, brewers dried grain, rice offal, bone meal and vitamin premix (Table 1).

**Table1: Composition of the experimental diets**

| | Experimental Diets | | | |
|---|---|---|---|---|
| **Ingredients** | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** |
| Fall fat soybean | 25.00 | 24.95 | 22.95 | 22.95 |
| Maize | 46.95 | 42.00 | 40.00 | 38.00 |
| *G. arborea* | 0.00 | 5.00 | 10.00 | 15.00 |
| Maize brand | 10.00 | 10.00 | 9.00 | 6.00 |
| Rice offal | 15.00 | 15.00 | 15.00 | 15.00 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Bone meal | 2.50 | 2.50 | 2.50 | 2.50 |
| Salt | 0.30 | 0.30 | 0.30 | 0.30 |
| Total | 100 | 100 | 100 | 100 |
| Calculated values: | | | | |
| Crude Protein (% | 16.06 | 16.09 | 16.06 | 16.09 |
| Crude fibre (%) | 9.18 | 9.67 | 10.46 | 11.39 |
| DE (Kcal/kg) | 2992.05 | 2941.53 | 2876.87 | 2764.82 |

$T_1$=0% *Gmelina arborea* leaf meal, $T_2$=5% *Gmelina arborea* leaf meal,$T_3$=10% *Gmelina arborea* leaf meal,$T_4$=15% *Gmelina arborea* leaf meal

**2.3. Experimental animals and management**

A total of 32 grower male rabbits of mixed breeds (New Zealand x Chinchilla), aged between 8 and 12 weeks and weighing between 1100 and 1250g were used for the experiment. The rabbits were allowed a preliminary period of two-weeks before the feeding trial commenced. During this period, they were fed a common diet, and were treated with *ivermectin* subcutaneously at a dosage of 0.1ml per rabbit against ecto and endo-parasites. After the adjustment period, the animals were weighed and randomly assigned into four groups of eight rabbits with each rabbit serving as a replicate. The groups were assigned to diets $T_1$, $T_2$, $T_3$ and $T_4$. The rabbits were provided with feed and water *ad-libitum*. Feed offered and the left over were weighed to determine feed intake of the rabbits. After the initial weight, weekly weights were taken to determine weight gain. These records were used to monitor and determine the performance parameters in terms of feed intake, weight gain and feed to gain ratio. The feeding trial lasted for the period of sixteen (16) weeks, while standard management practices were adopted.

**2.4. Blood collection and visceral organ weights**

At the end of the feeding trial, 3 bucks were randomly selected from each experimental diet and were starved for 12 hours and thereafter sacrificed by stunning and decapitation. Five (5) ml blood samples were collected from 3 rabbits per treatment from the jugular vein. The samples were collected in ethylene diamine tetra acetic acid (EDTA) treated bottles and were analyzed for haemoglobin (Hb) Red blood cells, pack cell volume(PCV), platelets and white blood cells as reported by Ahemen, *et al.* (2015) after blood collection, the slaughtered rabbits were eviscerated according to the procedures of Aduku and Olukosi (1990). The viscera organs (lung, liver, kidneys, heart, spleen, pancreas and adrenal glands) were carefully removed weighed and expressed as percentage of slaughter weight.

**2.5. Genital Organ dimensions**

The reproductive tract of the 3 randomly selected male rabbits were carefully removed and trimmed free of adhering tissues. The various components of the reproductive tract namely, testis, epididymis and ductus deferens were separated, trimmed free of fats and linear measurements taken with the aid of calibrated ruler. The right and left testes volumes were determined by water displacement method as reported by Bitto (1989).

**2.6. Data Analysis**

Data obtained from this study were subjected to one way analysis of variance (ANOVA) using GenStat (Release 4.24) statistical package, GenStat, 2005. Significant differences between treatment means were separated using Duncan's Multiple Range Test of the same software.

## III. Results And Discussion

The result of performance of rabbits fed graded levels of *Gmelina arborea* Leaf Meal are presented in Table 2. The total weight gain ranged from 395 – 437g which was comparable to the range of 250.00 – 562.50g reported by Abukakar *et al.* (2011). The total weight gain was not significantly ($p > 0.05$) affected by the experimental diets. Values of treatment 1 ($T_1$) and 3 ($T_3$) were however numerically less than treatment 2 ($T_2$) and 4 ($T_4$) which shows that *Gmelina arborea* leaf meal support weight gain. The observed values of daily weight gain ranges from 7.90 – 8.16g which were within the range of 7.37 – 12.66g reported by Attah and Ekpeyoug (1998).

Daily feed intake was not affected ($p>0.05$) by dietary treatments. Values obtained range from 71.63 – 80.86g. The dressing percentage was influenced by the dietary treatments. The mean dressing percent of rabbits fed treatment $T_4$ was significantly ($p<0.05$) reduced. Values obtained ranged from 67.52 – 77.86% which were higher than the range of 43.28 – 43.28-44.78g reported by Abukakar *et al.* (2011). This may be because the heads and legs were included as carcass weight in this study.

There were no significant differences ($P>0.05$) in relative organ weights of rabbits placed on the different test diets (Table 3). This implies that any of the diets is acceptable. The Corresponding values of the relative organ weights obtained in the study were comparable to the values reported by Abukakar *et al.* (2011).in rabbits fed graded levels of *Moringa oleifera* leaf meal in diets.

The result of the reproductive organ dimensions of rabbits fed graded levels of *Gmelina arborea* leaf meal is shown in Table 4. The right and the left testis volume ranged from 2.00±0.00ml to 2.33±0.33ml and 2.23±0.03ml to 2.70±0.10ml respectively. The values were not significantly ($P>0.05$) different from one another. The right testis and the left testis length values ranged from 2.23±0.03cm to 2.70±0.10cm and 2.50±0.00cm to 3.06±0.26cm respectively. The values were not significantly ($P>0.05$) different from one another. Testicular length is the measure of testicular size which had been found to be significantly correlated with sperm production (Akpa *et al.*, 2012). The right and left epididymis length values ranged from 6.00±0.00cm to 6.96±0.68cm and 6.20±0.10cm to 7.13±0.76cm respectively. The values were not significantly ($P>0.05$) different from one another.

The right ductus and left ductus length values ranged from 5.23±2.16cm to 9.26±0.73cm and 3.63±2.63cm to 8.50±0.40cm respectively. The values were not significantly ($P>0.05$) different from one another. This result shows that the inclusion of *Gmelina arborea* leaf meal in rabbit diet has no negative effect on reproductive organs dimensions.

Haematological components of rabbits fed graded levels of Gmelina arborea leaf meal are presented in Table 5. The pack cell volume (PCV) values ranged of 42.33 – 47.00% obtained from the study were within the normal range values of 33 – 50% reported by Mitruka and Rawnsley (1977). This indicates that the animals were healthy. The normal packed cell volume (PVC) value was also suggestive of an adequate nutritional status of the rabbits.

The haemoglobin (Hb) values ranged from 16.00 – 21.00g/dl which were higher than the range of 9.4-17.4g/dl reported by Fudge (1999) and this implies that the feeds were capable of supporting adequate oxygen supply. The red blood cells (RBC) for the experimental animals ranged from 7.00 X $10^{12}/L$ to 9.33 X $10^{12}/L$ which is higher than 4.8 – 6.3 X $10^{6}/\mu$ reported by Harkness *et al.* (1989). According to Brown *et al.* (2006) normal red blood cells (RBC) values are associated with high quality dietary protein and with disease free animals. The white blood cell count was significantly ($p<0.05$) higher in treatment 4 ($T_4$). This may be an indication that the rabbits in diet 4 were immunologically challenged. The values however, fall within the recommended range of 5.2 – 16.6 x $10^{9}$ /$mm^3$ ( Kronfield and Mediway, 1979).

## IV. Conclusion

The growth performance indices showed that daily body weight gain, feed intake, feed gain ratio were not affected by *Gmelina arborea* leaf meal inclusion in the diet of male rabbits. The result also indicated that the inclusion of Gmelina arborea leaf meal in the diet of male rabbits would not alter their relative organ weights and genital organ dimensions. Haematological parameters were also not affected by *Gmelina arborea* leaf meal inclusion in the diet of male rabbits except white blood cell count. It was therefore concluded that growing rabbits could be fed diet containing up to 15% *Gmelina arborea* leaf meal without any adverse effects on growth performance, genital tract dimensions, visceral organ weights and haematological parameters of male rabbits

**Table 2: Growth performance of rabbits fed graded levels of *Gmelina arborea* leaf meal.**

| | Experimental Diets | | | |
|---|---|---|---|---|
| **Parameters** | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** |
| Initial weight (g) | 1412.50±41.43 | 1412.50±55.41 | 1412.35 ±59.10 | 1412.55±65.70 |
| Final weight (g) | 1812.50±68.80 | 1850.0±87.00 | 1800.0±20.40 | 1800.0±124.20 |
| Total weight (g) | 387.50±65.70 | 437.50±42.7 | 387.50±77.40 | 395.0±111.20 |
| Daily weight gain (g) | 8.16±1.50 | 8.93±0.87 | 7.91±1.58 | 7.91±2.37 |
| Daily feed intake (g) | 77.75±2.02 | 80.86±4.42 | 80.86±3.23 | 71.63±3.23 |
| Feed gain Ratio | 10.61±1.96 | 9.20±0.603 | 11.30±1.85 | 11.71±3.28 |
| Dressing percent (%) | 77.86±3.24[a] | 74.20±2.13[a] | 71.05±1.61[a] | 67.52±0.86[b] |

$T_1$=0% *Gmelina arborea* leaf meal,$T_2$=5% *Gmelina arborea* leaf meal,$T_3$=10% *Gmelina arborea* leaf meal, $T_4$=15% *Gmelina arborea* leaf meal. [a,b]Means in the same row with different superscripts are significantly different ($p< 0.05$).

**Table 3: Relative organ weights of rabbits fed Graded levels of *Gmelina arborea* leaf meal**

| | Experimental Diets | | | | |
|---|---|---|---|---|---|
| **Organs** | **$T_1$** | **$T_2$** | **$T_3$** | **$T_4$** | Los |
| Liver | 2.48±0.26 | 2.26±0.16 | 2.85±0.13 | 2.16±0.160 | ns |
| Heart | 0.23±0.02 | 0.21±0.01 | 0.20±0.00 | 0.18±0.00 | ns |
| Spleen | 0.03±0.01 | 0.03±0.01 | 0.03±0.00 | 0.02±0.00 | ns |
| Kidney L | 0.26± 0.017 | 0.25±0.02 | 0.24±0.00 | 0.25±0.01 | ns |
| Kidney R | 0.26±0.02 | 0.24±0.02 | 0.25±0.01 | 0.25±0.01 | ns |
| Paired kidney | 0.52±0.03 | 0.49±0.03 | 0.49±0.01 | 0.50±0.02 | ns |
| Adrenal L | 0.00±0.00 | 0.00±0.00 | 0.01±0.00 | 0.01±0.00 | ns |
| Adrenal R | 0.00±0.00 | 0.00±0.00 | 0.01±0.00 | 0.00±0.00 | ns |
| Paired | 0.01±0.00 | 0.00±0.00 | 0.02±0.00 | 0.01±0.00 | ns |
| Lungs | 0.51±0.02 | 0.70±0.06 | 0.57±0.04 | 0.67±0.06 | ns |

Los=Level of significance , ns = not significant 5% ($P> 0.05$),$T_1$=0% *Gmelina arborea* leaf meal, $T_2$=5% *Gmelina arborea* leaf meal,$T_3$=10% Gmelina arborea leaf meal,$T_4$=15% *Gmelina arborea* leaf meal

**Table 4: Reproductive tract organs dimensions of rabbits fed graded levels of G*melina arborea* leaf meal.**

| | Experimental Diet | | | | |
|---|---|---|---|---|---|
| Parameter | $T_1$ | $T_2$ | $T_3$ | $T_4$ | LOS |
| Right testis volume | 2.16±0.60 | 2.33±0.33 | 2.00±0.00 | 2.00±0.00 | ns |
| Left testis volume | 2.66±0.33 | 2.00±0.00 | 2.00±0.00 | 2.33±0.00 | ns |
| Right testis length | 2.60±0.30 | 2.70±0.10 | 2.23±0.03 | 2.46±0.06 | ns |
| Left testis length | 3.06±0.26 | 2.63±0.08 | 2.36±0.13 | 2.50±0.00 | ns |
| Right epididymis length | 6.10±0.72 | 6.96±0.68 | 6.00±0.00 | 6.66±0.33 | ns |
| Left epididymis length | 6.33±0.38 | 7.13±0.76 | 6.20±0.10 | 7.06±0.43 | ns |
| Right ductus length | 5.23±2.16 | 6.63±0.84 | 8.03±0.36 | 9.26±0.73 | ns |
| Left ductus length | 3.63±2.63 | 6.16±0.53 | 8.50±0.40 | 8.43±0.66 | ns |

ns= not significantly different. $T_{1=}$ 0% *Gmelina arborea leaf meal (control).* Los= levels of significant. $T_2$= 5% *Gmelina arborea leaf meal. $T_3$=10% Gmelina leaf meal*$T_4$= 15%*Gmelina arborea leaf meal.*

**Table 5: Haematological Components of Rabbits Fed Graded Levels of *Gmelina arborea* Leaf Meal.**

| | Experimental Diets | | | |
|---|---|---|---|---|
| Parameters | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
| Packed cell volume (%) | 42.33±1.45 | 45.33±1.20 | 44.33±2.33 | 47.00±3.00 |
| Haemoglobin (g/dl) | 16.00±3.22 | 20.33±3.18 | 17.66±3.66 | 21.00±1.00 |
| Mean corpuscular haemoglobin (pg) | 31.00±5.69 | 20.00±5.51 | 36.33±5.67 | 33.67±9.33 |
| Mean corpuscular haemoglobin concentration(g/dl) | 0.53±0.06 | 0.67±0.14 | 0.54±0.07 | 0.77±0.07 |
| Mean corpuscular volume (fl) | 74.33±7.88 | 77.33±9.33 | 63.00±4.00 | 52.33±12.33 |
| Platelets (x $10^9$) | 83.67±11.10 | 134.00±34.04 | 104.00±11.00 | 148.67±30.67 |
| Redbloodcells (x$10^{12}$/l) | 7.00±1.16 | 8.33±1.76 | 7.33±1.33 | 9.33±2.67 |
| White bloodcells (x $10^9$/l) | 4.33±1.86$^b$ | 3.00±1.16$^b$ | 5.33±1.67$^b$ | 14.33±1.67$^a$ |

$^{a\ b}$, Means in the same row with different superscripts are significantly different (P<0.05) $T_1$=0% *Gmelina arborea* leaf meal, $T_2$=5% *Gmelina arborea* leaf meal,$T_3$=10% Gmelina arborea leaf meal,$T_4$=15% *Gmelina arborea*leaf meal

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