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# Effects of Charcoal Inclusion on the Performance of Growing Rabbits Fed Acacia (*Acacia nilotica*) Pod Meal Based Diet

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**Target Audience:** Farmers, Animal Scientist, Extension experts

## Abstract

*An experiment was carried out to study the effects of charcoal inclusion in the diet of growing rabbits fed Acacia pod meal (APM) diet. Eighteen (18) growing rabbits of mixed breeds (give the crosses) and sexes with an average initial weight of 5202±0.25g were used for this study in a completely randomized design, involving three dietary treatments with control ($T_1$), acacia pod meal diet ($T_2$) and acacia pod meal diet with charcoal ($T_3$). The experiment lasted 8weeks and thereafter at the end a digestibility trial was conducted. Significant differences ($p<0.05$) were observed in average daily weight gains, feed intake and feed: gain ratios. Treatment 3 had the highest average daily weight gain, feed intake and feed: gain ratio which were significantly different ($p<0.05$) higher than $T_1$ and $T_2$, with $T_2$ being lowest. Water intake was significantly ($p<0.05$) higher in $T_2$, but lower and similar in $T_1$ and $T_3$. Nutrient digestibility and nitrogen balance were significantly different ($p <0.05$) across the dietary treatments. Lower nutrient digestibility and nitrogen balance was recorded in $T_2$, while $T_3$ had significantly ($p<0.05$) higher than the control $T_1$. Carcass characteristics were highest in rabbits fed $T_3$ diet and was significantly different ($p>0.05$) from $T_1$. While $T_2$ had the lowest carcass characteristics. From the results obtained in this study, it was concluded that inclusion of charcoal in diet with acacia pod meal can improve the performance of growing rabbits.*

**Key words**: *Acacia nilotica*, Charcoal, Growing rabbit, Performance

## Description of Problem

In Nigeria and other developing countries there is animal protein malnutrition. An average Nigeria takes about 5.5g of animal protein per day which is quiet very low when compared to the recommended 77g per day by food and agricultural organization [1], which the minimum is due to poor economic condition as well as high cost of animal products.

In order to bridge this gap and make animal protein available rabbit has been looked as an alternative animals to provide protein, due to its very low cost of production, higher feed conversion efficiency, high prolificacy due to very short gestation period and also be easily raise by women and children, and does not require more space.

Moreover Rabbit defend on about 90-80% forage as feed sources. However, intensive livestock farming (Rabbits) in Nigeria has been greatly affected by high cost of feed and feeding ingredient especially the conversional protein and energy ingredient like soya bean bake, groundnut cake and maize [2].
Trees and shrubs have provide valuable forage to man's habivouse animals probably since the time of domestication by Robinson [3]. Trees and shrubs have multipurpose uses, such as their fruit pod, leaves and young leaves as food for human consumption, trunk for wood and leaves, pods and seed for animals [4]. They serve as alternative sources of forage due to their high production of edible highly acceptable biomass and drought resistant [5]. Tree leaves have high protein content ranging from 13-26% crude protein on average [6].

Limitation to the utilization of the leaves and pods of browse trees and shrubs by animals is the presence of secondary plant factors. Osagie [7] reported that the utility of the leaves, pods and edible twigs of shrubs and trees as feed resource for animals is limited by the presence of anti-nutritional factors (ANFs).

Several methods have been used to overcome the negative effects of secondary plant factors, such as biodegradation of tannins [8] using white-rot fungi (*Sporotricum pulverulentum, Ceriporiopsis subvermispora and Cyathus steroreus*), post- harvest processing techniques [9, 10]. However the use of charcoal in detannification has been reported by Poage [11], together with other different chemical treatment methods with a lot of success. The objective of this study was to evaluate the chemical composition of acacia pod meal and also to evaluates the effect of acacia pod meal with or without charcoal on performance of growing rabbits

## Material and methods

### *Location*

The study was conduction at the rabbitry unit of the Department of Animal Science, Ahmadu Bello University, Samaru-Zaria. Located at (11°11´S and 38°E) in the northern guinea savannah zone of Nigeria.

### *Experimental animals and their management*

Eighteen (18) growing rabbits of mixed breed (give crosses) and sexes with average initial weight of 526.92 ±0.25g obtained from Samaru were used for this study. Prior to the commencement of the experiments, the rabbits were prophylactically treated against internal and external parasites by subcutaneous injection of Ivomec (0.2ml/rabbit), and a broad-spectrum antibiotic (Oxytetracycline L.A) was also given

**subantaneously** (check spelling) at the rate of 0.2ml/rabbit. After balancing for weight, the rabbits were randomly grouped into three (3) dietary treatments with six (6) rabbits per treatment in a completely randomized design.

The rabbits were housed in a three tier cage unit, with each cage measuring 45 $cm^2$. Each cage was equipped with plastic drinkers and aluminum feeders. The cages were housed in a room with concrete floor and windows for proper ventilation. Feed and water was supplied *ad libitum*. Proper sanitary condition was maintained throughout the experimental period. The experiment lasted for 8weeks.

***Experimental diet***

The percent composition of the experimental diet is presented in table 1.

Table 1. Percentage composition of experimental diets.

| Ingredient | Treatments | | |
|---|---|---|---|
| | $T_1$ | $T_2$ | $T_3$ |
| Maize offals | 63.4 | 36 | 32 |
| GNC | 23.9 | 24.5 | 27 |
| Rice offals | 10.0 | 15.0 | 16.0 |
| APM | – | 20 | 20 |
| Charcoal | – | – | 2.5 |
| Bone meal | 3.0 | 3.0 | 3.0 |
| Salt | 0.3 | 0.3 | 0.3 |
| Vit .premix | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 |

***Data collection***

The rabbits were fed twice a day at 7:00am and 4:00pm. Spilled and contaminated feed was recovered, air dried, weighed and subtracted from the amount of feed offered. Feed intake was then determined by the difference between feed offered and weigh back. Weight gain was measured weekly. At the end of the experiment average daily feed intake, average daily weight gain, feed to gain ratio and feed cost per Kg weight gain was computed.

***Carcass evaluation***

At the end of the feeding trial, three rabbits were randomly selected from each treatment group for carcass analysis. The animals were starved for twenty four hours and their live weight was taken prior to bleeding. Bleeding of the rabbits involved severing their jugular veins with a sharp knife followed by flaying which was done by hanging the animals by the neck on a hook and pulling the skin downwards.

The visceral content comprising the heart, lungs, kidney, and liver were

carefully removed and weighed. The weight of the dressed carcass, head, legs and skin were recorded. The dressed carcass was cut into shoulder, thigh and loin.

***Chemical analysis***

The dry matter content of feed, APM, and faeces were determined by drying the samples at 60ºC for 48 hours, crude fiber (CF) content – by means of Foss Tecator Analyzer, ether extract content – by Soxtec System 1040 and ash content – by combustion at 550ºC in Muffle furnace. Kjeldahl nitrogen analyses were performed in duplicate on dried APM, experimental diets, fecal and urine samples and CP calculated as (N x 6.25) according to [12] procedure. Tannin was analyzed by methods of Wheeler *et al.* [13].

***Statistical analysis***

The data obtained from the various studies were subjected to analysis of variance (ANOVA) procedure of SAS [14] in a completely randomized design. Means that were significantly different Duncan multiple range test (DMRT) [15] was used to compare the treatment means.

**Result and discussion**

***Experimental diets***

The result of the chemical composition of the *Acacia* pod meal (APM) and the experimental diets are presented in Table 2. The result showed that the crude protein content of the APM (12.56) is within what was reported by Le Houerou [16] for *acacia* pods and leaves (12.4% crude protein), and other browse plants [17]. The CP and CF of the experimental diets are within the range to meet the nutrient requirement of growing rabbits [18, 19].

***Intake of experimental diets***

The result of the feed intake (Table 3) showed significant ($P<0.05$) among treatments with $T_3$ having the highest value (56.6 g/day) and the least (42.10 g/day) being $T_2$.The result is in agreement with the result obtained in sheep [20], that there was reduction of dry matter intake and crude protein intake, also Waghorn *et al.* [21] reported that smaller depression of voluntary feed intake was observed by sheep fed *Lotus pedunculatus*. The increase in feed intake observed in $T_3$ as a result of charcoal inclusion agrees with the findings of Poage *et al.* [11]. Who in their study reported lambs fed bitter weed (*Hymenoxys odorata* DC) alone consumed considerably less than lambs that received bitter weed with activated charcoal.

Average water intake showed a significant difference ($p<0.05$). The highest water intake was recorded in $T_2$ group fed *acacia* pod meal diet (177.7ml/day), while the least water intake (102.5ml/day) was obtained in $T_3$ diet. The result of this study is in accordance with the report of Hove *et al.* [22], that animals fed with containing tannin tends to drink more water than those animals fed with low tannin diet. The increase in water intake may be to detoxify the effect off the tannin.

Table 2. Chemical composition of experimental diets

| | Treatment diets | | | |
|---|---|---|---|---|
| Parameters | $T_1$ | $T_2$ | $T_3$ | APM |
| Dry matter | 90.00 | 90.04 | 89.7 | 95.31 |
| Crude Protein | 17.89 | 18.15 | 18.38 | 12.56 |
| Crude Fiber | 11.19 | 10.36 | 10.36 | 1.85 |
| Ether Extract | 3.28 | 4.82 | 3.99 | 5.66 |
| Ash | 1.82 | 2.66 | 2.74 | 2.75 |
| Nitrogen Free Extract | 64.00 | 59.65 | 59.25 | 77.18 |
| Tannin(mg/100g) | 0.04 | 3.20 | 0.68 | 18.5 |

***Live weight changes of experimental animals***

Average daily weight gain result presented in the Table 3 showed significance ($p<0.05$) difference across dietary treatments. The average daily weight gain was highest (16.52g/day) in animals fed $T_3$ diet, while the lowest average daily weight gain of (5.80g/day) was observed in animals fed $T_2$ diet with APM. The reduction in the weight gain in rabbits fed $T_2$ diet may be attributed to the reduction in feed intake aversion due to the astringency of the tannin, causing dryness in the mouth as reported by [23] and the binding effect of the tannin to proteins in the feed [24] and its effects on digestive enzymes [25], hence making the nutrients unavailable for productive purpose. Also Bennick [26] reported that tannins have a number of effects on animals, among which include growth - rate depression.

Table 3. Performance of growing rabbits fed APM with charcoal

| | **Treatment diets** | | | |
|---|---|---|---|---|
| Parameters | $T_1$ | $T_2$ | $T_3$ | SEM |
| Initial Wt(g) | 520 | 525 | 525 | 0.24 |
| Final Wt(g) | $1170.0^b$ | $850^c$ | $1450^a$ | 118.8 |
| Average weight Gain(g) | $650.0^b$ | $325.0^c$ | $925.0^a$ | 38.41 |
| Average DWG(g) | $11.61^b$ | $5.80^c$ | $16.52^a$ | 0.69 |
| Average feed Intake (g) | $52.35^b$ | $42.10^c$ | $56.50^a$ | 1.63 |
| Average water Intake(ml/d) | $137.5^c$ | $177.5^a$ | $102.5^b$ | 5.42 |

[a,b,c] Mean values with different superscripts within a row differ significantly ($p<0.05$), SEM standard error of means
DWG daily weight gain

The result of this study agrees with Abdu *et al.* [19] in rabbits fed *Zizyphus mauritiana* leaf meal diet and also [27], who reported that bullocks fed 45% oil-extracted seeds of *A. nilotica* in their diet showed reduced weight gain (68 g/day to 16 g/day) and a 5% decrease in intake [27].

***Carcass characteristics***

The result of the carcass analysis is presented in Table 4. The result showed a significant ($P<0.05$) differences in the carcass characteristics. $T_3$ had the highest dress weight and dressing percentage, While $T_2$ had the lowest carcass characteristics.

Table 4. Carcass characteristics of rabbit fed APM diet with or without charcoal

| | Treatments | | | |
|---|---|---|---|---|
| Parameters | $T_1$ | $T_2$ | $T_3$ | SEM |
| Live Wt(g) | $1170^{b}$ | $850^{c}$ | $1450^{a}$ | 118.8 |
| Slaughter Wt(g) | $1149^{b}$ | $801^{c}$ | $1404^{a}$ | 114.3 |
| Dressed wt(g) | $617^{b}$ | $508.5^{c}$ | $643.5^{a}$ | 43.37 |
| Dressing % | $47.4^{b}$ | $40.18^{c}$ | $55.38^{a}$ | 3.04 |
| Loin(g) | $143^{ab}$ | $66.5^{c}$ | $155.5^{a}$ | 7.90 |
| Shoulder (g) | 204.5 | $118.0^{c}$ | $212.5^{bc}$ | 8.41 |
| Thigh(g) | $269.5^{a}$ | $118.5^{c}$ | $275.5^{a}$ | 8.27 |

$^{a,b,c}$ Mean values with different superscripts within a row differ significantly ($p<0.05$), SEM standard error of means

The result of this finding is in according to Makkar [28], who reported that the presence of condense tannin in diet reduces the carcass characteristics and fat content in lamb.

**Conclusions and application**

It can be concluded from the results obtained in this experiment.

1. APM in the diet of rabbits negatively affect growth and feed intake.
2. Carcass characteristics were affected by APM in the diet.
3. Inclusion of charcoal at 2.5% in the APM based diet was found to positively improve and growth performance.

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