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Effects of *Balanites aegyptiaca* (Del) seed cake on growth and carcass performance of growing rabbit

Abstract

A study on growth and carcass performance was conducted to evaluate the effect of *Balanites aegyptiaca* seed cake meal (BASCM) as a substitute for groundnut cake in the diet of growing rabbit. Five experimental diets were formulated representing the following treatments: T_1, T_2, T_3, T_4 and T_5 respectively. T_1 (0% BASCM) was served as the control diet, while T_2, T_3, T_4 and T_5 contained 25%, 50%, 75% and 100% BASCM respectively. A total of 100 weaner rabbits of mixed breeds were purchased from the National Animal Production Research Institute (NAPRI), Zaria, Nigeria. The rabbits were fed the control diet during the one week of adjustment period. They were given vitalyte as anti-stress and were dewormed using ivermectin, at the end of one week of adjustment; the rabbits were housed in different hutches and fed their respective experimental diet for one month. Each treatment contained 20 rabbits and these treatments' (T_1–T_5) each was replicated in four portions and each portion had five rabbits each. Results showed that all the parameters were significantly different ($P<0.05$) among the treatment groups. *Balanites aegyptiaca* seed cake meal can replace groundnut cake at 25% level inclusion without adverse effect on the rabbit physiology.

Keywords: rabbit, growth, carcass, *Balanites aegyptiaca* seed cake, groundnut cake, evaluation

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Introduction

Rabbit production in developing countries as a means of alleviating world's animal protein shortage is on the rise. This is attributed to several advantages of rabbit over other livestock in the tropics.[1] It has been reported by Ayinde et al.,[2] that feed accounted for 65.75% of the total cost of rabbit production and therefore recommended research into alternative and cheaper feeds for rabbits in Nigeria. *Balanites aegyptiaca* is widely grown in Nigeria. Early studies,[3] showed that *Balanites* offers the most rapid and lowest means of providing adequate supplies of nutrients to the tropical people and their animals. Works on the chemical and nutritional composition of *Balanites* however, showed that *Balanites* tree contains chemical compounds namely saponins, tannins, nitrites, coumarines which could elicit deleterious effects in animals when consumed in large quantities. *Balanites aegyptiaca* have been reported to have anti-inflammatory and analgesic, anthelmintic, antioxidant, ant diabetic, antinoceptic, hepatoprotective, antibacterial and larvicidal activities in animals (Dubey et al*)*, the presence of the phytotoxins in *Balanites* may limit its intensive utilization in diets for man or livestock. Research on process treatments of *Balanites* seed cake have been reported to have less of this deleterious material.[4] when roasting soaking pretreatment is employed. *Balanites aegyptiaca* being a browse plant has been reported to improve the feeding potential of ruminant animals in the semi-arid.[5] Therefore, the objectives of this Research is to evaluate Growth and Carcass Performance of Growing Rabbit using *Balanites aegyptiaca* roasted seed cake as a replacement for ground nut cake.

Material and methods

Experimental design

The rabbits were allocated to four lots with five rabbits each .Each treatment contained 20 rabbits and these treatments' (T_1-T_5) each were replicated in four portions and each portion had five rabbit. Each treatment (T_1-$T_{5)}$ were replicated four times in a completely randomized design (CRD).

Experimental diets

Four experimental diets were formulated and designated as T_1, T_2, T_3, and T_4 respectively. T_1 (control) contain Groundnut cake as its protein source while T_2, T_3 and T_4 contain 25%, 50%, 75% and 100% *Balanites* seed cake replacing GNC in the diets. The gross composition of the experimental diets is shown in the Table 1 below.

Growth performance study

Rabbits were weighed individually at the beginning of the experiment and, thereafter, weekly for one month duration of the experiment using weighing scale. Weighing was done before the morning feeding. The parameters determined for the evaluation of growth performance were initial weight (g), average weekly feed intake (g), average weekly weight gain (g) and feed conversion ratio. Weight gain for each animal was calculated by subtracting the initial weight (g) from the final weight (g), while the feed conversion ratio was calculated by dividing the average feed intake (g) by the average weight gain (g) per week.

Carcass evaluation

At the end of the feeding trial, two rabbits per treatment were randomly selected for carcass evaluation. The rabbits were fasted overnight but allowed access to water thus emptying the gut and allow excretion of the undigested feed residue. They were weighed, slaughtered, defurred using flame (singering) and then eviscerated. Individual internal organ (heart, liver, kidneys, lungs, viscera and spleen) were weighed and expressed as percentage of the carcass weight. The dressed carcasses were weighed and dressing percentage was calculated as a percentage of the live weight using the formula.

$$Dressing\ percentage\ (\%) = \frac{Carcass\ weight\ X\ 100}{Live\ weight}$$

The carcass was subsequently cut into different portions viz: head, tail, feet, shoulder, rack/ribs, loin and hind legs, weighed on sensitive weighing scale and expressed as percentage of the carcass following the standard procedures described by Njidda et al.[6]

Table 1 proximate composition of raw and roasted *Balanites aegyptiaca* seed cake

Nutrients,%	*Raw	Roasted
Dry matter	93	92.83
Crude Protein	17.7	19.26
Crude fiber	5.95	5.2
Ether extract	11.02	10.55
Ash	9.1	10.25
Nitrogen free extract	49.71	49.57
Gross energy (Cal/100g)	4.31	4.12

Results and discussion

Table 2 revealed photochemical in cake from raw (A1) and roasted *Balanites* seed cakes (A). Alkaloid from roasted (4.20%), raw cake (29 %) samples shows reduced value however revealing reduce anti–microbial potency for feed use. The saponins content in the A1 and A samples showed a drastic reduction in saponins values. This revealed that in feed formulation, bitter associated compound from *Balanites aegyptiaca* may be reduced in roasted cake seeds formulated meals. Cake from roasted *Balanites aegyptiaca* seed cake may not cause hemolytic problem, precipitating and coagulation of red blood cells in animal when use as feed ration. The flavonoid values were low for roasted cake (2.03%) compare with the raw or control sample (13.40%). This confers that cake from *Balanites aegyptiaca* seed oil may be natural anti-oxidants and also keep feed products longer. Phenol values were low for roasted (10.40%) than the raw sample (108.05) phenol content. Roasting drastically reduced phenol contents of *Balanites* seed cake hence reducing its anti- nutritional efficacy. The ability of this cake to inhibit microbial growths or activities may be due to alkaloids content in the cake which has traceable microbial and toxicological inhibition on feed.

The result of the Growth performance of rabbits fed with roasted *Balanites* seed cake replaced with groundnut cake is presented in Table 3. The results showed that all parameters measured were not significantly ($P<0.05$) different at level of inclusions except feed conversion ration.

Table 2 phytochemical (quantitative) analysis of Balanites raw and roasted seed cake

Sample	Alkaloid (%)	Saponin (%)	Flavonoid (%)	Tannin (%)	Phenol (%)
A1 (RBP)	29	30	2.03	0.069	108.05
A Cake	4.2	6.8	13.4	8.8	10.4

Results are mean from duplicate samples.
Key
A1= Raw Balanites seed powder sample
A= Roasted Balanites Oil seed cake sample

Table 3 Growth performances of growing rabbits fed diets containing BASM as substitute for groundnut cake

Parameters	T1 (0%)	T2 (25%)	T3 (50%)	T4 (75%)	T5 (100%)	SEM	P-value
Initial weight,(g)	806.62_a	805.01_c	805.90_a	804.98_b	805.83_b	0.08	0.12
Final weight, (g)	1503.33_c	1850.00_b	1523.07_c	1637.64_a	1828.09_b	0.26	0.1
Total weight gain (g)	696.7_d	1044.99_a	717.17_d	833.66_c	1023.08_b	0.18	0.36
Daily weight gain (g)	12.9	19.35	13.29	14.88	18.27	0.1	0.12
Total feed intake (g)	3222.90_b	3176.06_d	3357.90_a	3188.70_c	3090.95_c	0.1	0.11
Daily feed intake(g)	59.68_b	58.82_d	62.18_a	59.05_c	55.19_d	0.39	0.29
Feed conversion ratio	3.62	3.04	3.68	3.99	3.74	0.02	0.19
Mortality	0	0	0	0	0	0	0

Weight is gained as percentage substitution increased significantly. Treatment T_2 (25%) is significantly higher ($p>0.05$) compared to the control and the other treated samples. However T_5 (100%) was significantly similar with other treatments and treatment T_0 (0%).The observed increase in weight with increased of inclusion of seed cake may be due to high matabolizable energy in the cake compared to the control sample treatment (T_0).

Treatment (T_2, 25%) *Balanites* inclusion gave significant value at $p>0.05$ for daily weight gain. Treatment (T_5, 100%) showed a greater value in weight gain on a daily basis which is significantly higher than the treatment T_1, T_3 and T_4 respectively. The low value observed in Treatments T_1, T_3 and T_4 revealed fiber interaction with the meal formulation.[7–9]

The total and daily Feed intake of treatment (T_3, 50%) had the highest value and this was followed significantly by treatment (T_1, 25%). Treatment T_2 showed the lowest total feed intake and daily feed intake ratios respectively. This variation may be due to traces of saponins content or other anti-nutritional factors in the cake.

The feed conversion ration depict that treatment (T_4, 75%) is significantly ($P>0.05$) greater than treatment T_1 .This increase was followed by treatment T_5 and T_3 percentage treatment respectively. The energy conversion in Treatment T_4 is higher than the other treatments. This conversion and utilization of bio-meal from *Balanites* may be due to low ant- nutritional factor from process approach on the cake as well as inability to obtain enough energy from the percentage inclusion.

There was no mortality during the growth evaluations period, this maybe because of the bioactive and anti-microbial ingredient inherent in the cake at the process stage.

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The result of the carcass characteristics of rabbit fed with *Balanites* cake as a replacement with groundnut cake is presented in Table 4. There were no significant (P<0.05) differences in the parameters measured except treatment T_1, T_2. Rabbit live weight showed a significant increase in (T_5, 100%) BASM inclusion. This significant increase was followed by treatment T_2m and T_1 .Treatment T_4 revealed low live weight. The low live weight observed may be due to inclusion level and conversion synergy at inclusion and inherent fiber blend utilization,[10] After slaughtering, the carcass weight on treatment T_5, T_1 and T_2 revealed a significant slaughter weight (p>0.05) compare to treatment $T_2$and T_3.The dressed weight revealed that there were no significant difference for treatment T_1, T_2 and T_5 carcass treatments respectively. This trend was also revealed in carcass weight at (p>0.05) significant level .The dressing percentage further revealed that T_5, T_2 were not significant at (p>0.05) compared to treatments T_0,T_1, T_3 and T_4 respectively .The chest percentage carcass dressed ,thigh, lion and hind leg were significantly different (P>0.05)from T_5 treatment. This was followed by treatment T_3, T_2 and T_1 percentage inclusion treatments. The organ weight from carcass evaluation showed that rabbit fed with treatment T_5 inclusion as well as treatment T_2 and T_1 were significantly different.

The kidney weight of carcass further revealed that there were no significant difference in kidney weight between T_5 and T_2. The treatments T_5, T_2 were significantly different from treatment T_1, T_3 and T_4 *Balanites* included samples. This observation may be because of the absorbable nature of protein moieties from the ration treatment compare to treatment T_1

Table 4 Carcass characteristics of growing rabbits fed diets containing BASM as substitute for groundnut cake

Parameters	T1 0%	T2 (25%)	T3 50%	T4 (75%)	T5 (100%)	SEM	P-value
Live weight(g)	1450.00_b	1733.33_a	1625.98_{bc}	1726.67_c	1832.3_a	128.67	0.001
Slaughter weight(g)	1400.00_a	1648.34_a	1535.00_{ab}	1607.01_b	1748.9_a	135.33	0.001
Dressed weight(g)	1255.65_a	1542.41_a	1483.34_{ab}	1590.90_b	1654.4_a	137.88	0.003
Carcass weight(g)	1010.00_a	1381.67_a	1358.07_b	1356.60_b	1504.6_a	131.27	0.002
Dressing percentage%	69.66^b	79.71_a	72.25_b	69.83_b	80.57_a	2.51	0.001
Chest,(%)	14.94	15.49	14.98	12	15.67	1.8	0.072
Thigh, (%)	7.57^a	7.64_a	6.51_a	5.79_b	7.98_a	0.93	0.061
Loin, (%)	18.75_a	20.62_a	20.63_a	13.05_b	19.45_a	1.89	0.002
Hindleg, (%)	3.81_b	6.24_a	5.19_a	2.90_b	5.98_a	0.84	0.091
Foreleg, (%)	3.80_a	3.82_a	3.81_a	2.89_b	3.83_a	0.47	0.12
Organs weight							
Lungs, (%)	0.54_a	0.63_a	0.50_b	0.40_b	0.57_a	0.12	0.067
Kidney, (%)	0.62_c	0.71_a	0.66^c	0.52_d	0.77_a	0.11	0.071
Liver, (%)	2.17_b	2.55_a	2.31_b	1.54_c	2.56_a	0.52	0.062
Spleen, (%)	0.03_c	0.04_b	0.04_b	0.02_c	0.07_a	0.01	0.051
Heart, (%)	0.23_b	0.28_a	0.23_c	0.16_c	0.32_a	0.07	0.091
Intestine weight, (%)	16.26_a	18.75_a	17.26_a	11.58_b	18.67_a	1.79	0.0001

The liver weight showed a high value in treatment T_5 and T_2 .The treatment on T_3 and T_2 are significantly different from other samples. The spleen and heart also revealed similar trend in weight except on treatment T_5 and T_2 which revealed no significant difference. There exit significant difference in spleen and heart for treatment T_1, T_2 and T_4 spleen and heart carcass weight compared to T_0 and $T_3$and T_5 respectively. This may be due to traces of saponins and alkaloid that may not have been deactivated during *Balanites* cake roasting, improper roasting.

Conclusion

From the study, *Balanites Aegyptiaca, seed cake* showed potentials to replace ground nut cake at 25% inclusion with no negative implication or effect on rabbit growth and carcass performance for growing Rabbit.

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Conflict of interest

There is no conflict of interest among the authors

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