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Research Article

Effects of *Balanites Aegyptiaca* (del) Seed Cake on Growth and Carcass Performance of Growing Rabbit

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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 were 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.

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 Taiwo AA, Adejuyigbe AO, Adebowale AE, Oshatan JS and David OO [1]. It has been reported by Ayinde and Aromolaran [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 Locket CT, Calvert CC and Grivettic IE [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 (Hardman and Sofowora, 1972). *Balanites aegyptiaca* have been reported to have anti-inflamatory and analgesic, anthelmintic, antioxidant, antidiabetic, antinoceptic, hepatoprotective, antibacterial and larvicidal activities in animals (Dubey et al. 2011). 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 these deleterious material [4], when roasting soaking pretreatment are employed. *Balanite saegyptiaca* being a browse plant have been reported to improve the feeding potential of ruminant animals in the semi-arid [5]. Therefore, the objectives

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of this Research is to evaluate Growth and Carcass Performance of Growing Rabbit using balanites aeqyptiaca 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.

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.

Table 1: Gross composition of formulated experimental diets.

Ingredient	T1 (control)	T2 (25)	T3 (50)	T4 (75)	T5 (100)
Maize	50.00	50.00	50.00	50.00	50.00
Wheat offal	16.00	16.00	16.00	16.00	16.00
Fish meal	3.40	3.40	3.40	3.40	3.40
GNC	25.00	18.75	15.00	6.25	0.00
**Balanites*	0.00	6.25	12.50	18.75	25.00
Palm oil	2.00	2.00	2.00	2.00	2.00
*Premix	0.40	0.40	0.40	0.40	0.40
Limestone	1.00	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.10	0.10	0.10	0.10	0.10
TOTAL	100	100	100	100	100
Calculated nutrients (%)					
Energy (Kcal/kg ME)	2990.56	2898.02	2767.89	2706.99	2706.99
Crude protein (%)	16.45	16.09	16.45	16.17	16.17

*Premix in diets provided per kg: Vit. A 10000 IU, Vit. B 2000 IU, Vit. E 13000 IU, Vit. K 1500mg, Vit. B12 10mg,Riboflavin 5000mg, Pyridoxine 1300mg, Thiamine 1300mg, Panthothenic acid 8000mg, Nicotinic acid 28000mg, Folicacid 500mg, Biotin 40mg, Copper 7000mg, Manganese 48000mg, Iron 58000mg, Zinc 58000mg, Selenium 120mg, Iodine60mg, Cobalt 300mg, Choline 27500mg.

Proximate Composition of raw and Roasted *Balanites Aegyptica* seed Cake.

Nutrients,%	*Raw	Roasted
Dry matter	93.00	92.83
Crude Protein	17.70	19.26
Crude fibre	5.95	5.20
Ether extract	11.02	10.55
Ash	9.10	10.25
Nitrogen free extract	49.71	49.57
Gross energy (Cal/100 g)	4.31	4.12

*Annongu et al. (2009).

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.

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

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 and Isidahomen [6].

Results and Discussion

The proximate compositions of the raw, roasted cake from *Balanites aeqyptiaca* before the diet experimentation diets are presented in table 2. Proximate analysis of raw, roasted *balanites aegyptica* seed cake revealed the presence of dry matter(93%), crude protein(17.7%) crude fiber (5.95%), ash (9.10%), nitrogen free extract (49.71%) and energy (4.31%) for raw balanites seed cake flour while roasted cake had dry matter(92.83%), crude protein(19.26%) crude fiber (5.20%), ash (10.25%), nitrogen free extract (49.57%) and energy (4.12%). The crude protein and ash values of the roasted cakes values were high and more favorably than the control (raw) seed cake flour.

Table 2 revealed phytochemicals 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 saponin content in the A1 and A samples showed a drastic reduction in saponin values. This revealed that in feed formulation, bitter associated compound from *Balanites aeqyptiaca* may be reduced in roasted cake seeds formulated meals. Cake from roasted *Balanites aeqyptiaca* seed cake may not cause haemolytic 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 aeqyptiaca* seed oil may be natural anti-oxidants and also keep feed products longer. Phenolic values were low for roasted (10.40%) than the raw sample (108.05) phenolic content. Roasting drastically reduced phenolic contents of Balanites seed cake hence reducing its anti- nutritional efficacy. The ability of this cake to inhibits microbial growths or activities may be due to alkaloids content in the cake which have traceable microbial and toxicological inhibition on feed.

The result of the Growth performance of rabbits fed with roasted balaintes 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

Weight is gained as percentage substitution increased significantly. Treatment T_2

Table 2: Phytochemical (quantitative) analysis of *Balanites* Raw and roasted Seed Cake.

Sample	Alkaloid (%)	Saponin (%)	Flavonoid (%)	Tannin (%)	Phenol (%)
A1 (RBP)	29.0	30.0	2.03	0.069	108.05
A Cake	4.20	6.80	13.40	8.80	10.40

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

Table 3: Growth performance 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	0.10
Total weightgain (g)	696.7^{d}	1044.99^{a}	717.17^{d}	833.66^{c}	1023.08^{b}	0.18	0.36
Daily weightgain (g)	12.90	19.35	13.29	14.88	18.27	0.10	0.12
Total feed intake (g)	3222.90^{b}	3176.06^{d}	3357.90^{a}	3188.70^{c}	3090.95^{c}	0.10	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	0.00

^{abcd}= mean with different superscripts on the same row are significantly different (p<0.05), SEM= Standard error of mean, p >0.5 value

(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 energy in the cake treated 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 values 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 ($T_{2, 25\%}$). Treatment T_4 and T_5 showed the lowest total feed intake and daily feed intake ratios respectively. This variation may be due to traces of phytotoxins 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 T4 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 (Smith, 2001).

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.

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 fibre 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) fromT_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.

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	12.00	15.67	1.80	0.072
Thigh, (%)	7.57a	7.64a	6.51^{a}	5.79^{b}	7.98a	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}	3.83a	0.47	0.120
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

^{abc} = mean with different superscripts within the same row are significantly ($p<0.05$) different. SEM=standard error of mean.

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

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 saponin 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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