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EFFECTS OF *Cyathus stercoreus*-TREATED *Balanite aegyptiaca* SEED MEAL ON GROWTH PERFORMANCE OF SAHELIAN BUCKS

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ABSTRACT

This study investigated the growth performance of, Sahelian bucks (SBs) fed Cyathus stercoreus treated, biodegradable Balanite aegytiaca seed meal (TBSM) and groundnut cake (GNC). Five dietary treatments were formulated as follows: control diet (T1) 0:100, 25:75 (T2), 50:50 (T3), and 75:25 (T4) and 100:0% TBMS:GNC. A 2.5 g of Cyathus stercoreus was added to 1 kg of ground Balanite aegyptiaca seed after been dissolved in 1 L of water. Thirty healthy SBs weighing 10.93 ± 0.51 kg of body weight (BW) and aged 7 to 8 months were assigned to five treatments. This was replicated six times in a completely randomized design (CRD). The experiment lasted for 120 days, the animals were given the same amount of feed two times a day, at 7:00 and 12:00. Water was offered Adlibithum. The animals' initial weights were determined prior to the commencement of the experiment. Weekly weight measurements were then recorded. Every day, the ort was removed and weighed before new feed was given. The results showed that average final weight, daily weight gain (DWG) (gram/day), were significantly ($p<0.05$) affected by treatment, while there were no significant difference ($p > 0.05$) between the DWG of T1 (34.64 g/d) to T4 (39.94 g/d) groups. There were significant differences ($p > 0.05$) in the Total feed intake and the daily feed intake (DFI). The DFI was low in T5 Feed conversion ratio decreased with an increased inclusion of treated Balanite aegyptiaca seed meal (TBSM) in the goats' diets. It can be concluded that, T5 (GNC: 0%, TBS: 100%) had a better, DWG, lower feed conversion ratio value Therefore, TBSM is recommended for Sahelian bucks.

Keywords: bucks; groundnut cake; Balanite aegyptiaca, Cyathus stercoreus growth performance

INTRODUCTION

Feed is the main factor restricting livestock productivity, particularly in developing nations. This has forced researchers to look for readily available and affordable feed sources for goats such as agricultural wastes and agroindustrial by-products (FAOSTAT, 2023). Balanites aegyptiaca, a tree commonly found in arid and semi-arid regions, has been recognized for its potential as a feed ingredients due to its nutritional composition including protein and fiber content (Adamou and Kabir, 2018). *Cyathus stercoreus*, a fungus capable of biodegrading plant materials has been explored for its ability to enhanced the nutritional value of feed ingredients (Kabir and Bama, 2018) In Nigeria, ruminants depends largely on crop residues at least during the long dry period of the year for maintenance as well as production of meat, milk and skin. The growth characteristics of Sahelian bucks are influenced by various genetic and environmental factors (Bustos- Perez and Baena,2021). However, animal performance with such feedstuffs can be poor due to low voluntary intake and digestibility, resulting from low protein concentration and high level of indigestible or slowly degradable fibre (Prasad, R. D. D., Reddy, M. R. and Reddy, G. V. N 1998). Various physical, chemical and biological treatments have been used to improve utilization of low quality forages such as crop residues (Abebe, Merkel, Animut,

Sahlu and Goestch, 2004). The fact that availability and benefits of this crop are numerous, it is still under-utilized. Thus, this study was aimed at determining the effects of feeding growing sahelian bucks on growth performance and feed intake with the diets containing treated *Balanites aegyptiaca* seed at graded levels.

MATERIALS AND METHODS

Study area

The study was conducted at Federal University, Gashua, Yobe State in Nigeria's Ruminant Unit of the Teaching and Research Farm of the Department of Animal Science. March and April are the hottest months, with average highs of 38 - 41.5°C, and June through September is considered the rainy season. With an average yearly rainfall ranging between 500 to 1000mm.

Treatment *Balanites aegyptiaca* seed with *Cyathus stercoreus*

Balanite aegyptiaca seeds (BS) were sourced from Garin Alkali Livestock Market of Yobe state, Nigeria. Subsequently, in accordance with the protocols of Musa, de Evan, Alao, Iglesias, Escribano, and Carro, (2020), a 1 L mixture of water with 2.5g *Cyathus stercoreus* was prepared and then added to 1 kg of *Balanite aegyptiaca* seed. Thereafter, the whole mixture was packaged to produce hemertic seal within thick polythene bags, it was sealed tightly, and was squeezed to remove and minimize air. To prevent the accumulation of volatile ammonia gas, the silage was opened and allowed to aerate overnight in the shade following 10 days of ensiling (Olafadehan *et al.*, 2016).

Measurement, source and formulation of experimental diets

Five test diets were compounded and labelled as T_1, T_2, T_3, $T_{4 \text{ and } T5}$. The five dietary treatments included the control diet containing 0% TBSM (T1) and the biodegradable TBSM at varying percentage ratios of 25:75 (T2), 50:50 (T3), 75:25 (T4) and 0:100 (T5) g/kg of dry matter (DM). T1 was a typical diet without TBSM. The meal was given to each animal at a proportion of 5% of their body weight. The *Cyathus stercoreus* and dried cassava peels were acquired from a private farm in Katagum town of Zaki L.G.A and other feed components were purchased from the Gashua Agro-commodity market in Yobe State. *Table 1* presents the experimental diets in g/1,000g.

Experimental procedure, design and management of experimental animals

The experiment was conducted between April and August with a temperature range of 33-41.5°C with a rainfall of 500 to 1000mm and a relative humidity of 25-35%, respectively (CLIMATEMP, 2020).

For the study, thirty (30) Sahelian Bucks in good health and weighing 10.93 ± 0.51 kg of body weight (BW) were bought at the Garin-alkali market in Gashua, Yobe State. Following a veterinarian examination, the animals were divided into five nutritional groups using a completely randomized design (CRD), with six replicates for each treatment. Two bucks served as an experimental unit. To protect them from harsh weather, each animal was kept individually in a 1.2 m × 0.9 m open-sided ruminant pen that had good ventilation. Two weeks prior to the experiment, the experimental bucks received antibiotic treatments (ivermectin at 1 mL/50 kg of BW and oxytetracycline at 1 mL/10 kg of BW). The total mixed ration (TMR) provided to the animals was around 600 g per day per head (DM) at 5% of their BW. The animals were given the same amount of feed two times a day, at 7:00 and 12:00. Water was offered *Adlibithum*. The animals' initial weights were determined prior to the commencement of the experiment.

Weekly weight measurements were then recorded. Every day, the ort was removed and weighed before new feed was given. The feed conversion ratio, was calculated. After a two-week preliminary adaption period, the experiment was conducted for 120 days.

Chemical analysis

Samples from the five experimental diets consisting of TBSM and GNC were brought to the lab and were dried individually in an air-draft oven at 60°C for 96 hours. The samples were then ground separately in a Wiley mill, were passed through a 1 mm sieve, and were sampled for chemical analysis using the Association of Official Analytical Chemists' standard procedures (AOAC, 2006). Three copies of each analysis were completed. The samples were oven-dried for 24 hours at 100°C for assessement of the dry matter content. The Ankom fibre analyser was used to perform fibre fraction analysis, including neutral detergent fibre (NDF), acid detergent fibre (ADF), and acid detergent lignin (ADL), as reported by Van Soest *et al.* (1991).

Table 1: Gross Composition of Experimental Diets

Ingredients (%)	**T1** (0%)	**T2** (25%)	**T3** (50%)	**T4** (75%)	**T5** (100%)
Cassava peel	200	200	200	200	200
Groundnut haulm	150	150	150	150	150
Wheat offal	180	180	180	180	180
Groundnut cake	200	150	100	50	00
Balanites aegyptiaca meal	00	50	100	150	200
Rice husk	240	240	240	240	240
Sulphur	10	10	10	10	10
Bone meal	10	10	10	10	10
Salt	5	5	5	5	5
Ruminant Premix	5	5	5	5	5
Total	**100**	**100**	**100**		**1000**
	0	**0**	**0**	**1000**	

RESULTS

The chemical composition of the control and TBSM/GNC-based diets were shown in *Table 2*. The DM obtained in this study ranged from 92.35-93.78%. A higher DM value was obtained in T5, while T3 had the least DM value. The CP value ranged from 15.98-16.53. A higher CP value was obtained in T1, while T5 had the least CP value. GNC had a CP value of 45%, while TBS had a CP value of 8.42%. The ether extract value obtained ranged between 4.87-5.13%. A higher EE value was obtained in T2, while T5 had the least EE value. GNC had an EE value of 9.16%, while TBS had an EE value of 12.76%. The crude fibre value ranged from 21.22-23.14. A higher CF value was obtained in T1, while T5 had the least CF value. GNC had a CF value of 3.81%, while TBS had a CF value of 31.58%. The nitrogen free extract value ranged from 48.05-51.40. Higher nitrogen free extract (NFE), neutral detergent fibre (NDF), acid detergent fibre (ADF), hemicellulose, and cellulose values were obtained in T5, while T1 had the least values for these parameters. Acid detergent lignin (ADL) DCP was higher in T5 and lower in T2. TBS had an NFE value of 41.12%, while GNC had an NFE value of 36.52%. The ash value ranged from 6.16-7.18. A higher ash value was obtained in T1, while T3 had the least ash value. GNC had an ash value of 5.51%, while TBS had an ash value of 6.12%. The NDF value ranged from 25.13-38.32. GNC had an NDF value of 16.10, while TBS had an NDF value of 29.42. The ADF value ranged from 18.29-25.91. GNC had an ADF value of 9.30, while TBS had an ADF value of 25.01. The ADL value ranged from 14.32.-16.17.

GNC had an ADL value of 4.11, while TBS had an ADL value of 7.32. The hemicellulose value ranged from 16.10 to 16.88. GNC had a hemicellulose value of 18.70, while TBS had a hemicellulose value of

23.11. The cellulose value ranged from 30.35-42.15. GNC had a cellulose value of 35.70, while TBS had a cellulose value of 42.68.

Table 2: Proximate Analysis of Test Materials and Experimental Diets

Ingredients (%)	T1	T2	T3	T4	T5	TBS	GNC	DCP
Dry Matter	93.17	93.10	92.35	93.51	93.78	94.65	92.11	91.12
CP	16.53	16.27	16.12	16.04	15.98	8.42	45.00	5.93
EE	5.10	5.13	5.08	5.00	4.87	12.76	9.16	3.88
CF	23.14	22.98	22.15	21.63	21.22	31.58	3.81	23.77
NFE	48.05	49.19	50.49	51.09	51.40	41.12	36.52	49.45
ASH	7.18	6.43	6.16	6.24	6.53	6.12	5.51	6.50
NDF	25.13	30.68	33.15	35.11	38.32	29.42	16.10	38.01
ADF	18.29	21.24	23.67	24.17	25.91	25.01	9.30	26.00
ADL	14.58	14.32	15.19	15.22	16.17	7.32	4.11	14.32
HCN	ND	ND	ND	ND	ND	ND	ND	26.54
(mg/kgDM)	16.10	16.17	16.31	16.88	16.63	23.11	18.70	9.90
Hemicellulose	30.35	32.11	35.98	37.33	42.15	42.68	35.70	11.68
Cellulose								

ND; Not done, EE: Ether extract, CP: Crude Protein, CF: Crude fiber, NFE; Nitrogen free extract, HCN; Hydro cyanide, NDF; Neutral detergent fibre, ADF; Acid detergent fibre, ADL; Acid detergent lignin, DCP; dried cassava peels, TBS; Treated *Balanite aegyptica* Seed, T1: Control diet 0 Treated *Balanite aegyptiaca* seed meal (TBSM), 200 Groundnut cake meal (GNCM). T2: 50 TBSM, 150 GNCM. T3: 100 TBMS, 100 GNCM. T4: 150 TBSM, 50 GNCM and 200 TBMS, 0 GNCM.

The growth performance of SBs fed TBSM at graded levels in their diets is shown in *Table 3*. The final weight (FW) was significantly ($p < 0.05$) different across the treatments. Higher FW was obtained in T5 and T1 had the least FW (14.81kg). Similarly, the weight gained at the end of the experiment was highest and least in T5 and T1, with the values of 52.59 g/d and 34.64 g/d, respectively. The average daily weight gain (g/d) was significantly ($p < 0.05$) different between T5, and other treatments, but statistically T1 – T4 are the same no significant difference between them. A better and least FCR was obtained in T5 (7.68) and the highest value was recorded in T3 (16.44). There was significant ($p > 0.05$) difference in the FCR across the treatments.

Table 3: Growth Performance of Sahelian Bucks Fed Diets Containing *Cyathus stercoreus* Treated *Balanite aegyptica* Seed Meal at graded levels

Parameters	T1	T2	T3	T4	T5	SEM
Initial Weight (kg)	10.93	11.07	11.01	11.44	11.00	0.26
Final Weight (kg)	14.81^{b}	15.08^{b}	15.12^{b}	15.79^{b}	16.89^{a}	0.30
Daily Weight Gain (g/d)	34.64^{b}	35.80^{b}	36.69^{b}	39.94^{b}	52.59^{a}	3.31
Total Feed Intake (kg)	61.86^{a}	62.65^{a}	67.56^{a}	69.75^{a}	45.26^{b}	2.94
Daily Feed Intake (g/d)	552.32^{a}	559.38^{a}	603.21^{a}	622.77^{a}	404.11^{b}	33.07
Feed Conversion Ratio	15.94^{a}	15.63^{a}	16.44^{a}	15.59^{a}	7.68^{b}	1.00

[abc] = means on the same column having different superscript are significantly different ($p<0.005$). SEM: Standard error of the mean. T1: Control diet 0 Treated *Balanite aegyptiaca* seed meal (TBSM), 200 Groundnut cake meal (GNCM). T2: 50 TBSM, 150 GNCM. T3: 100 TBMS, 100 GNCM. T4: 150 TBSM, 50 GNCM and 200 TBMS, 0 GNCM.

DISCUSSION

The study's dry matter levels are in line with those of a previous study (Ogori A.F, Makinde O.J and Ogori J, 2020) that fed Rabbits diets consisting of variously Balanites aegyptiaca. The Ash content was less than that of the previous study. The CP levels were lower than those reported by ogori *et al.* (2020). The diets' CP contents are adequate to satisfy the developing goats' nutritional needs. The study's results for HCN, NFE, and ADL were consistent with those published by Abatan, Adebayo, Kolawole, Shamusideen, Olusiji, and Chryss. (2015); however, the NDF, hemicellulose, and cellulose were lower. For the study by Asaolu, Binuomote, Akinlade, Aderinola and Oyelami, (2012), the DCP had an HCN value of 26.54 mg/kg, which falls within the recommended level for feeding small ruminants. The study uses air-dried DCP and the addition of sulphur to lower the peels' HCN content. This was incomformity with the assessment of Niayale, Addah, and Ayantunde. (2020) where they assessed the impact of DCP silage on various fermentation parameters and the growth characteristics of sheep raised on farms. The ADF was less than that stated by Ukanwoko, Ironkwe, and Nmecha. (2013), whose study involved feeding oil palm leaf meal and diets based on DCP to WAD goats. The ADG of 46-58.89 g/day observed in this experiment is similar to that reported by Bawala, T.O, Adegoke, Ojekunle, Adu, and Aina. (2007), where they fed sabara (*Guiera senegalensis*) leaf meal (32-50 g/day) to RSBs. The results of this study's analysis of AFW, WG, and ADG were similar to those published by Abatan *et al.* (2015), where WAD goats were given a ration containing DCP and foliage. This might be because the goats used in the research were of different breeds and it has been documented that breeds differ in both their birth weight and growth rate (Ramatu and Abdulmumin, 2020).

The replacement of GNC with TBSM to the SBs' meals significantly affected the TFI or DFI values which contradicts the report by Musa, Makinde. Maidala, Bishir, Abubakar, Mua'zu, Abdullahi, Idrissa, Hannatu and Zango. (2024) but they were higher than those found in the study by Musa *et al*., (2024) that fed Red Sokoto goats *Saccharomyces cerevisiae*-treated groundnut haulm and dried cassava peel based diets. This may be explained by the fact that each animal is unique, as well as the type of feed that the test animals were given.

It was observed that FCR in this study was high in T3 which indicates lower utilization. This conversion and utilization of bio-meal from balanites may be due to low ant- nutritional factor from processing approach on the cake as well as inability to obtain enough energy from the percentage inclusion (Smith, 2001).

CONCLUSION

The findings showed that adding more TBSM in sahelian bucks diets improved the growth rate and lowered feed intake. Goats fed T5 showed to be the best performing. Furthermore, the findings showed that the FCR is adversely affected by including high level of TBMS replacing GNC in the sahelian diets which is an indication of higher utilization. Sahelian bucks can be sustainably fed with Cyathus treated Balanite aegyptiaca seed meal at graded levels, especially when forage is scarce.

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