PERFORMANCE AND BIO-ECONOMICS OF RED SOKOTO GOATS FED DIETS CONTAINING GRADED LEVELS OF CASSAVA (*Manihot esculenta*) PEELS MEAL AS SUPPLEMENT TO NEEM(*Azardirachta indica* LEAVES

[1]Bukola, O. A, [1]Yahaya, B, [2]Abel-Achimugu, J, [3]Sulim, P.Y, [1]Haruna, I.Y, [1]Jibrin, Y, [1]Gana, M.K and [1]Suleiman, A

[1]Department of Animal Science, Federal University, Kashere, Nigeria
[2]Department of Animal Science, Federal University, Lafia
[3]Department of Animal Production Technology, Bauchi State Polytechnic, Bauchi, Nigeria
Corresponding Author (Bukola, O.A : ojoadewale052@gmail.com)

ABSTRACT

The study evaluates the performance and feed bio-economics of 16 growing red Sokoto bucks fed diet containing graded levels of cassava peels meal as supplement to neem leaves. The buck aged between (8-9)month were sourced within Kashere and its environs. They were ramdombly allocated into four treatments of four goat each and fed with 300g of neem leaves per day per goat and 250g of concentrate diet per goat per day. Water was given ad-libitum, the experiment lasted for fifty (50) days after an adjustment period of one (1) week. Completely Randomized Design (CRD) was used as experimental design. The sample of the experimental feeds, cassava peels and neem leaves were analyzed for their proximate composition using the method outline by AOAC (2000). Data were subjected to one way analysis of variance and significant mean were separated using least significant difference(LSD) contained in statistical analysis system(SAS)9.04 (2018). Performance parameters examined showed significant (P<0.05) difference, the value for daily feed intake, daily weight gain and feed conversion ratio ranged from 50.83-60.26g, 4.00-15.00g and 0.05-0.25 respectively. The cost of forage showed no significant(P>0.05) difference, cost of supplement, actual cost of total feed intake, benefit live weight gain and cost benefit ratio values ranged from 82.84-98.60, 313.00-452.10, 500.00-3500.00, and 0.12-0.71 respectively. Inclusion of cassava peel meal at 15% in supplement diets for Red Sokoto goat had no adverse effect on performance and reduced cost of feeding significantly .It was recommended that further research should be carried out using other breeds of goats as well as other species of ruminants.

Keywords: Performance, Bio-economics, Red Sokoto bucks, Graded levels, Cassava peels meal, Supplement, Neem leaves.

INTRODUCTION

In Nigeria Goat are reared traditionally at subsistence level . They are usually left to scavenge and cater for their own nourishment (Ozung *et al* 2018). Goat are selective feeders (Steele, 1996 : Peacock, 1996). Goats are characterized by their efficient grazing behavior and functional digestive system and thrive well under the tropical arid and semi-arid regions. Compared to other farm animals, the population of goats has increased rapidly in the harsh environmental and feed scarcity zones of the tropics (Ibrahim *et al*, 2022a;\ ;, Ocheja, *et al* , 2021). Goats are considered superior to other ruminant species in their utilization of poor quality and high fibre feeds (ocheja et *al.*, 2020). Goats are by far the most important domesticated small ruminants in Nigeria (steele 1996). Cassava (Manihot esculenta.) is an important annual root crop renowned for its high supply of carbohydrates among staple crops. Cassava ranks fourth among food crops after maize, rice and wheat Sengar (2022) and the peel are produced in large qualities from the processing of cassava for human, industrial and export purposes. Unfortunately, this enormous feed resource has received very little attention and is often discarded as waste Several processing techniques such as drying, toasting, cooking, extraction, autoclaving, fermenting, alkaline treatment and use of enzyme can be used to improve the nutritive value as well as remove or reduce anti-nutritional factors. Cassava peels contain cyanogenic glycosides and phytate content and as such, should be processed prior to usage in ruminant feeding. Sun-drying, ensiling and soaking plus drying of cassava feel will reduce its cyanogenic glycosides and phytate content and further preserve the nutritive quality Ozung (2018). Cassava feel is rich in metabolizable energy (3.03 Mcal/Kg DM) (Anya and Ozung, 2018), thus serving as a good source of energy in ruminant feeding; either as a basal diet or as a supplement Ajagbe (2019). Cassava peels haves been documented as a valuable feed ingredient that significantly increased animal performance when added to ruminant diets; and is highly degradable in the rumen (81 percent dry matter degradability).

Several factors affect livestock productivity, but the most important environmental factor that determines livestock productivity is feed Peacock (1996). Feeding goats well is of fundamental importance for the success of the whole goat enterprise, however provision of good nutrition is limited by feed procurement problems Ocheja ,2020 ;Torhemen, *et al.* 2020). Ruminant animal production is faced with seasonal fluctuations in feed materials especially in the dry season Ocheja *et al 2020*).

Without appropriate supplementation, ruminants on range tend to lose weight during the dry season and in some cases reproductive wastage occurs

The main aim of this study is to determine the performance and bio economics of growing red

Sokoto goat fed diets containing graded levels of cassava peel meal and specifically to dwell on the following.

i. To determine the performance of Red sokoto goat Fed diet containing graded level of cassava peel meal.

ii. To evaluate the bio economic of Red sokoto goat fed diets containing grades levels of cassava peel meal Nigerians should discover practical and economical ways of enhancing Animal performance especially Goat. Nigeria has numerous village, small scale and large factories that process cassava in to flour and garri. These factories generate large quantities of peels which are regarded as waste products. These waste products could be a cheap supplement to ruminant animals.

MATERIALS AND METHODS

Experimental site Becskei*et*

The study was conducted at the Teaching and Research Farm, Faculty of Agriculture, Federal University of Kashere in Gombe State, Nigeria. The state is situated within latitude 9º 54'46ºN and longitude 90º 46º'27ºE and 10º 57º E and altitude of 349m above sea level. The annual rainfall of Kashere ranges between 800mm-900mm per annum and is characterized by distinct dry season (October-May) and rainy season (June-September) seasons. The annual mean temperature ranges from 30-320C and it experiences a relative humidity of 17-90% (National Geospatial Intelligence Agency by (Utomo *et al.*, 2022) **Experimental Animals**

Sixteen (16) red Sokoto bucks aged between 8-9 months were sourced from within Kashere and its environs.

Experimental Management, Feed preparation and Experimental procedure

16 bucks were randomly allocated into four (4) Treatments of four (4) goats each. The animals were treated with Ivomectin for endo and ecto parasites control at 0.3ml each and oxytetracycline, hydrochloride and procaine penicillin at 2.0ml each to take care of scouring and nasal discharge and to provide a common health status. The cassava (*manihot esculenta*) peels used for this experiment was sourced from, kogi state. The experimental diets components consisted of Bambara nut shell meal (BNSM), Cassava peel meal (CPM), Maize offal (MO), Egg shell meal (ESM) and Table Salt (TS). These components were thoroughly mixed after pounding and grinding as the case may be.

Each treatment (4) goats, each goat was fed with 250g of the concentrate per day, and the use of available forage at 300g per Goat per day of which the concentrate was fed first in the morning hours, and then the forage is fed during afternoon hours, the Goats were served with water *Ad-libitum*.Treatment one (T1) was fed (0%) of cassava peel meal; treatment two (T2) fed (5%) of cassava peel meal; treatment three (T3) fed (10%) of cassava peel meal and Treatment four (T4) fed (15%) of cassava peel meal in the concentrate diet .The concentrate offered to the goats were weighed daily and the left over was also weighted and subtracted from the quantity of feed that was served to determine the feed intake of the animal. The experiment lasted for fifty (50) days.

The feed bio-economics was calculated using the current prices of the feed component and the prices of a kg of goat meat at N5000.00/kg, according to the steps outlined by Ocheja (2020).

The feed cost/kg cost of supplement consumed, benefit/live weights gain and cost benefit ratio were calculated.

Table 1 Composition of Experimental Diet %

Feed composition	%	%	%	%
	Treatments			
	TI	T2	T3	T4
Ground nut cake	25.00	25.00	25.00	25.00
Bambara nut shell meal	15.00	25.00	5.00	0.00
Cassava peel meal	0.00	5.00	10.00	15.00
Maize offal	58.00	58.00	58.00	58.00
Egg shell meal	1.00	1.00	1.00	1.00
Table salt	1.00	1.00	1.00	1.00
Total	100	100	100	100
CALCULATED NUTRIENT CONTENT				
Crude protein %	18.54	18.54	18.49	17.63
Crude fibre%	13.84	13.12	12.92	12.72
Metabolizable energy Kcal/kg diet	3182	3145	3150	3122

Chemical Analysis

Samples of the Experimental diet, neem leaves and cassava peels were analyzed for their proximate composition using the method outlined by AOAC (2000).

Crude Protein: The usual method employed in determination of protein in feed stuff was Kjeldahl method of nitrogen determination. The known quantity of sample was digested with sulphuric acid (H2SO4 and NaSO4 in the ratio of 1:20). The digested sample was then distilled after neutralizing excess of acid with alkali (40% NaOH), and thus the released ammonia can be trapped either in N/10 (in macro) or in 2% boric acid solution. The distillate was collected in standard acid (N/10 H2SO4 or standard N/10 HCl) and titrated against standard alkali (N/10 NaOH), the distillate was collected in 2% boric acid (micro method) this was titrated against standard acid (N/100 H2SO4. Crude protein was calculated by multiplying by the factor 6.25).

Crude fibre: This was estimated through digestion of dry and fat free amount of feed sample by boiling it in a weak solution of acids for 30minutes followed by boiling in weak solution of alkali for 30minutes and then deducting the ash from the residue obtained.

Ether extract: was estimated by extracting the amount of feed sample through fat solvents like petroleum ether for a period of 5-6 hours at 55-60^{0}c in specially made sohlet apparatus.

2**Moisture:** The moisture content of feed sample was determined by heating it to constant weight at 100^{0}C under atmospheric pressure the water content of feed was removed as vapour.

Ash: The feed contains both organic and inorganic matter in it. The sample was heated at 550^{0}c for 5 hours. The organic matter got oxidized as CO2. The remaining material left was the inorganic matter.

Nitrogen Free Extract (NFE): Contains soluble carbohydrate, hemicelluloses, part of lignin and acid insoluble ash. Value of NFE was derived by deducting the total value of crude protein, crude fat, crude fibre, moisture and ash from 100.

Data Collection

At the beginning of the experiment, the goats were weighed subsequently to determine their initial weight and then on a weekly basis. The final live weights were subtracted from the initial live weight to determine the weight gain of the animals. Feeds offered to the bucks were weighed daily and left over was also weighed to determine the feed intake of the animals. Weighing of the bucks took place in the morning (7.00 - 9.00am) prior to feeding each week. Both values were used to determine Feed Conversion Ratio (FCR)

Experimental Design and Statistical Analysis

Completely Randomized Design (CRD) was used in the experiment. Data were subjected to a one-way analysis of variance (ANOVA). And significant means were separated using Least Significant Difference (LSD) Contained in Statistical Analysis System (SAS) 9.04(2018)

RESULTS AND DISCUSSION

Proximate composition of Experimental Diets, neem leaf and cassava peels meal

The proximate composition of the experimental diets, neem leaves and cassava peels meal is summarized in Table 2

- The protein content of the neem and cassava peel meal, (9.40 and 6.50 %) were lower than the values of 12 – 18% recommended for growing ruminants in the tropics (NRC 1996). However, the protein content of the formulated concentrate values of 18.00 – 18.30 meet the recommended values of the lakpini *et al.,* (2002). Therefore, this will take care of the protein requirements. of the goats
- The crude fibre of cassava peel meal 10.42 and neem 19.01 were within recommended

range and adequate for the goat (Lakpini *et al* 2002).

- The ether extract of neem leaf and cassava peel meal were lower than the values reported by Bhomik *et al* (2018), however the ether extracts values of T1 – T4 ranged from 3.00 – 3.50 were adequate for growing goat. Diet containing ether extracts higher than 5 – 6% may impade appetide and fibre digestion (Maithison *et al*, 1997).

Table 2: Proximate Composition of Concentrate Diet Neem Leaves and Cassava Peel Meal

(%DM	T1	T2	T3	T4	NeemLeaves	Cassava Peel Meal
Crude Protein		18.30	18.10	18.05	18.00	9.40	6.50
Crude Fibre		12.80	12.85	12.89	12.90	19.01	10.42
NFE		61.20	61.00	60.96	60.51	59.69	71.98
Ether Extract		3.50	3.10	3.00	3.00	2.50	2.80
Ash		4.20	4.95	5.10	5.59	9.40	8.30

Performance data of experimental goat

Performance of red Sokoto goat fed with fresh neem leaves (*Azandirachta indica*) leaf and concentrate diet is presented in Table 3. Daily feed intake values (50.83-60.26g) Showed significant (P<0.05) difference. The feed conversion ratio values ranged from 0.251 – 0.051 and were significantly (P < 0.05) different. Ocheja *et al* (2020) reported significant values of 20.10 – 43.35, while Encolorunda *et al* (2020) obtained non-significant values of 8.23 - 8.59 for yearling west African dwarf goat fed diet containing graded levels of cashew nut shell as supplement to bamboo leaves, the values for total feed intake showed significant (P < 0.05) difference (Okolo., *et al* (2012) also obtained significant (P < 0.05) difference. In the daily feed intake these discrepancies could be due to the type of concentrate and browse forage fed to the goat as well as the age and breed of the goat used for the experiments values for daily body weight gain, daily feed intake, were all significantly (P < 0.05) different, and total value of feed intake values (kg) and feed intake per day showed that T1 and T2 were different (P<0.05)

The initial weight gain were not significant (P > 0.05) across treatment means. Final live weight gain was significant (P < 0.05) the higher weight observed in treatments 1 and 2 could be due to low level of inclusion of cassava peel in the diet as compared to the other treatments.

Table 3: Performance of Red Sokoto Goat fed Diet Containing Graded Level of Cassava Peel Meal

Parameters	T1	T2	T3	T4	SEM	LOS
Initial Weight (kg)	9.00	8.40	8.00	8.00	0.19	NS
Final Weight (kg)	9.40^{a}	9.10^{a}	8.10^{b}	8.20^{b}	0.20	*
Total feed intake (kg)	3.01^{a}	2.99^{b}	2.98^{c}	2.54^{d}	0.05	*
Feed intake per day (g)	60.26^{a}	59.79^{b}	59.51^{b}	50.83^{c}	0.01	*
Total body weight gain (kg)	0.40^{b}	0.70^{a}	0.10^{d}	0.20^{c}	0.08	*
Daily body weight gain (g)	8.00^{b}	15.00^{a}	8.00^{b}	4.00^{c}	0.02	*
Feed conversion ratio (kg)	0.12^{b}	0.25^{a}	0.05^{d}	0.08^{c}	0.02	*

Note: a,b,c,d means within row with different superscript are significantly different (P<0.05), SEM = standard error of means

.**Feed bioeconomics of Red Sokoto goat fed with neem leaves (*Azadirachta indica* and cassava peel meal based concentrate diet at graded levels.**

The bioeconomic data of growing red Sokoto goats fed with neem leaves and a concentrate containing graded level of cassava peel meal diet is presented Table 4. The cost of supplement across the treatment ranged from 82.84 – 98.60 Naira/kg, the cost of forage (neem leaves) across the treatment was N50 Naira/kg and the values were not significantly (P > 0.05) differencet the cost of supplement consumed, actual cost of total feed intake and benefit/live weight gain were also significantly (P < 0.05) different,this was in line with the report of Okolo *et. al*., (2012). the cost benefit ratio (CBR) ranged from 0.12 – 0.71 and were better than 0.84 – 1.63 obtained by Ocheja *et al (*2020) for west African dwarf goats fed diet containing graded levels of cashew nut shell as supplement to bamboo leaves and 1.18 – 1.21 reported by Okpanachi *et al* (2016) for west African Dwarf Goats fed with cashew nut pulp meal best diet, but inferior to 0.053 – 0.060 reported by Eniolorunda *et al* (2020) this could be due to differences in the breeds of goat used and the concentrate as well as the forage used for the experiments.

Table 4: Bio-economic data

Parameters	T1	T2	T3	T4	SEM	LOS
Cost of supplement N/kg	98.60[d]	92.40[c]	88.55[b]	82.84[a]	0.014	*
Cost of supplement Consumed N	297.10[d]	275.40[c]	227.57[b]	213.00[a]	4.214	*
Cost of forage N/kg	50.00	50.00	50.00	50.00	0.00	N.S
Cost of forage consumed N	155.00[d]	140.50[c]	127.50[b]	100.00[a]	0.264	*
Actual cost of total feed Intake N	452.10[d]	415.90[c]	355.10[b]	313.00[a]	11.717	*
Benefit live weight gain N	2000.00[c]	3500.00[d]	500.00[a]	1000.00[b]	367.63	*
Cost benefit ratio	0.23[b]	0.12[a]	0.71[d]	0.31[c]	0.046	*

a,b,c,d, means on the same row with different superscript differ significantly ($P < 0.05$)
SEM = Standard Error of Means:

- Actual cost of total intake (ACTFI = Cost of supplement intake + cost of forage on actual basis
- Benefit/live weight gain (BLWA) = Total weight gain x cost of a kg of goat meat
- Cost benefit ratio (CBR) = Actual cost of total feed intake/ Benefit live weigh gain

Conclusion and Recommendation

. **Conclusion**

Inclusion of cassava peel meal in supplement diets for Red Sokoto goats has no adverse effects on performance. Inclusion of cassava peel meals in supplement diet for Red Sokoto goats reduced the cost of feeding significantly.

Recommendation

Cassava peels meal can be included in supplement diets for Red Sokoto Goats at 15% level to reduce cost of feeding.

It was recommended that further research work can be carried out with different breed od goat such as West African Dwarf goat, Sahelian goat e.t.c as well as other species of animals such as sheep and cattle.

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