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Growth Performance of Red Sokoto Goats Fed Cowpea Husk Supplemented with graded Levels of *Moringa oleifera* Leaves

Mafindi, U.M.,[1] Kibon, A.U.,[2] Zaklag, D.U.[3], Buba, I.G.[3]

[1]*Department of Animal Science, Taraba State University Jalingo, Nigeria.*
[2]*Department of Animal Science, Federal University Dutse, Jigawa State, Nigeria.*
[3]*Department of Animal Production Technology, Taraba State College of Agriculture Jalingo, Nigeria.*

Corresponding Author: *umarmafindi17@gmail.com (08069491921)*

Abstract

A twelve-week feeding trial was conducted to determine the growth performance of Red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves. Sixteen Red Sokoto bucks aged 8-10 months with mean live weight of 10 ± 0.5kg were subjected to four dietary treatments consisting of four animals per treatment in a completely randomized design (CRD). Four dietary treatments were formulated; cowpea husk only (T_1) control, cowpea husk plus 50g moringa leaves (T_2), cowpea husk plus 100g moringa leaves (T_3) and cowpea husk plus 150g moringa leaves (T_4), water and mineral lick were offered ad libitum. Data on feed intake, water intake, weight gain and digestibility were collected and analysed. Results indicated that moringa supplementation significantly ($P<0.05$) influenced the feed intake of the experimental animals across the dietary treatments in which animals in T_3 recorded the highest value (74.90g) however water intake was not significantly ($P>0.05$) affected. T_3 had the highest weight gain values (60.95g/h/day) and the best feed conversion ratio value (7.50). There were significant ($P<0.05$) difference in all the digestibility values measured across the dietary treatments in which goats in T_3 recorded the highest values. It can be concluded that supplementation of moringa leaves up to 100g will improve better feed utilization and growth performance of Red Sokoto goats.

Key Words: *Red Sokoto Goats, Cowpea husk, Moringa leaves, Intake, Weight gain*

Description of Problem

Goats are among the major economically important livestock in Nigeria. There are about 53.8 million goats in the country playing an important role in the livelihood of resource-poor farmers (1). They provide their owners with a vast range of products and services such as meat, milk, skin, hair, horns, bones, manure and urine for cash, security, gifts, religious rituals, medicine, etc. (2).They generally play indispensable role in the nutrition, social and economic life of Nigerians (3).

In spite of the above mentioned contributions, goat production and productivity in Nigeria is constrained by many factors such as; scarcity of feed, high mortality rates, inadequate veterinary coverage, long marketing channels and lack of market information, low product quality, absence or inadequate provision of credit services, Low average reproductive rates among others(2). Feed scarcity is the major limiting factor to small ruminant production in tropical Africa. In Nigeria, the feed resource base for goat production is natural grazing and crop residues but the quality and supply of these resources varied seasonally due to rainfall pattern (4).

Based on the poor quality and nutrient fluctuating nature of the tropical grasses, studies have shown that the use of grasses alone is not adequate to allow optimum production of sheep and goats (5). It has been reported that the use of browse and other feed resources (agro-industrial and grain processing

by-products) has proved satisfactory (6). Data have shown that average browse contains more crude protein and organic matter, but less fibre than tropical grasses and should therefore increase nutrient supply to the animal when combined with the poor quality forage (7).

Even though many researchers have revealed the use of browse plants in improving the quality of poor forages, but little attention is paid to the use of moringa leaves in feeding livestock despite its high nutrient content. (8) reported that moringa leaves is used as livestock feed, its twigs are reported to be very palatable to ruminants and have appreciable crude protein levels. In view of these considerations, the objective of this study was therefore to determine the performance characteristics of red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves.

Materials and Methods

Experimental site

The study was conducted at the small ruminant unit of the Teaching and Research Farm, Taraba State University, Jalingo Jalingo. Taraba State capital is located between latitude $8^0 11^I$ to $8^0\ 50^I$North and longitude $11^0 05^I$ to $11^0\ 25^I$ East in Guinea Savannah Zone of Northern Nigeria. There are two main seasons, dry and rainy season. Dry season starts early in November to end of March while wet season runs from April to October. The area has a mean annual rainfall of about 1000 to 1500mm, with a temperature that ranges from 30^0C to 38^0C depending on the season. It has undulating topography with complex groups of mountains and hills. The soil type ranges from sandy to sandy loamy which makes the rural inhabitants mostly farmers (arable and livestock), (9).

Source and Processing of the test ingredients

Cowpea husk was obtained from market in Jalingo, while Moringa leaves was obtained from villages around Jalingo. The leaves were harvested and dried in a well ventilated shade away from sunlight for fourty eight hours. After which it was put in bags and stored in a cool and dry place, ready for use.

Treatments and experimental design

The animals were randomly allocated to four treatment diets with four animals per treatment in a Completely Randomized Design (CRD).

The treatment diets were;

a. Treatment one (T_1) cowpea husk alone *ad libitum* (control)
b. Treatment two (T_2) cowpea husk *ad libitum* plus 50g moringa leaves (ML).
c. Treatment three (T_3) cowpea husk *ad libitum* plus 100g moringa leaves (ML).
d. Treatment four (T_4) cowpea husk *ad libitum* plus 150gmoringa leaves (ML).

Both the cowpea husk and moringa leaves were presented to the animals in different containers, meanwhile minerals and water were given *ad libitum.*

Housing and management of the experimental animals

Sixteen Red Sokoto Goats (bucks) within the age range of 8 – 10 months with mean live weight of 10 $\pm$ 0.5kg were used for the study, they were purchased from Iware sheep and goat market near Jalingo, Taraba State. The animals were individually housed in pens measuring about $1.5m^2$ with concrete floors which was bedded with wood shavings. The top was roofed with zinc insulated with ceiling and sufficiently ventilated.

Before the commencement of the experiment, the animals were treated against both internal and external parasites using injectable Ivamectin. The animals were placed on the experimental diets for two weeks for adaptation with the diets and environment before data collection. The animals were fed

individually and the feeds were offered twice daily at 8:00 am and 4:00 pm, the feeding trial lasted for eighty four days.

Data collection

i. Feed intake

Data for voluntary feed intake of the experimental animals were determined by subtracting the left-over feed from the quantity offered per day.

ii. Water intake

Water intake was determined by subtracting the final volume of water from the initial volume offered.

iii. Live weight changes

Live weight changes were determined by subtracting the initial weight from the final weight of the experimental animals on weekly basis.

iv. Feed conversion ratio

Feed conversion ratio was determined by dividing the value of dry matter intake by the weight gained.

Proximate analysis

Proximate analysis of cowpea husk, moringa leaves and cowpea husk mixed with the respective graded levels of moringa leaves was carried out using procedure outlined (10), to determine dry matter (DM), crude protein (CP), crude fibre (CF), ether extract (EE) ash and nitrogen free extract (NFE).

Statistical analysis

Data generated were subjected to analysis of variance (ANOVA) using (SPSS) Version 17.0, after which the least significant difference (LSD) test was used to separate means differences (11).

Table 1: Proximate composition of the experimental diets

Parameters (%)	Treatments				
	T_1	T_2	T_3	T_4	ML
Dry matter	89.09	91.31	92.15	91.43	93.54
Crude protein	13.25	19.51	18.86	19.10	25.77
Crude fibre	30.39	20.70	19.01	19.85	11.09
Ether extract	7.86	8.15	7.89	7.90	8.38
Ash	6.65	4.80	6.80	6.10	2.95
Nitrogen free extract	30.94	38.15	39.59	38.48	45.45
Metabolisable energy(Kcal/Kg)	2225.28	2735.97	2742.33	2712.64	3237.23

T_1 = Cowpea Husk Plus 0g moringa Leaves, T_2 = Cowpea Husk plus 50g moringa Leaves, T_3 = Cowpea Husk Plus 100g moringa Leaves, T_4 = Cowpea Husk plus 150g moringa Leaves, ML= Moringa Leaves. Metabolisable Energy was calculated according to the formula of (12): ME = 37x % CP + 81 x % EE + 35.5 x NFE

Table 2: Growth performance of Red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves

Parameters	Treatments					
	T_1	T_2	T_3	T_4	LSD	LS
Average daily feed intake g/h/d	382.60	452.50	457.50	445.00	0.10	*
Daily water intake (lt)	0.83	0.92	0.88	0.75	0.36	NS
Average daily weight gain g/h/d	20.83	48.21	60.95	52.61	0.23	*
Initial weight (g)	10,500	10,570	10,500	10,500	1.51	NS
Final weight (g)	12,250	14,620	15,620	14,920	1.89	*
Feed conversion ratio	18.36	9.38	7.50	8.45	1.44	*

T_1 = Cowpea Husk Plus 0g moringa Leaves, T_2 = Cowpea Husk plus 50g moringa Leaves, T_3 = Cowpea Husk Plus 100g moringa Leaves, T_4 = Cowpea Husk plus 150g moringa Leaves, ML= Moringa Leaves. LSD= Least Significant Difference, * = Significant ($P<0.05$), NS = Not significant at ($P>0.05$).

Table 3: Nutrient digestibility of Red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves

Parameters (%)	Treatments					
	T_1	T_2	T_3	T_4	LSD	LS
Dry matter	52.67	58.98	73.85	69.23	7.5 3	*
Crude protein	52.12	57.42	67.76	63.31	17.22	*
Crude fibre	50.71	56.57	74.79	68.90	15.49	*
Ether extract	55.01	56.15	70.20	73.81	14.44	*
Ash	48.68	54.08	73.88	49.21	15.07	*
Nitrogen free extract	53.15	59.21	69.95	68.85	13.47	*

T_1 = Cowpea Husk Plus 0g moringa Leaves, T_2 = Cowpea Husk plus 50g moringa leaves, T_3 = Cowpea Husk Plus 100g moringa leaves, T_4 = Cowpea Husk plus 150g moringa leaves, ML= Moringa Leaves. LSD= Least significant difference, LS= Level of significance, * = Significant.

Results and Discussion

The nutrient composition of the experimental diets and moringa leaves as presented in Table 1 shows that, the basal diet (Cowpea husk) used in this study contained; 89.09% DM, 13.25% CP, 30.39% CF, 7.86% EE, 6.65% ash and 30.94% NFE with metabolisable energy of 2,225.28 kcal/kg. The proximate content of cowpea husk obtained was closely similar and comparable to 87.30% DM, 14.24% CP, 30.00% CF, 9.60% EE, 5.65% Ash and 40.51% NFE reported by The variation observed indicated that the slight difference that existed was not up 2% in all the parameters, except for NFE where the difference was around 6%. The difference could however be due to variation in species,

varieties, environmental conditions or stage of growth (14).

The nutrient composition of the supplement (moringa leaves) were 93.54% DM, 25.77% CP, 11.09% CF, 8.38% EE, 2.95% ash and 45.45% NFE with calculated metabolisable energy of 3237.23 kcal/kg. The observed DM, CP, and ash values presented in this study were almost similar to the respective values of 95.5%, 26.74% 11.08% and 3.0% reported by (15) but however higher than the values (DM 25.00%, CP 22.20% CF 11.00% and NFE 41.00%) reported by (16). The variation in the nutrient composition could therefore be associated to climatic conditions, edaphic factors or agronomic practices (17).

The proximate composition of the experimental diet shows that supplementation of cowpea husk with graded levels of moringa leaves improved the quality of the nutrients progressively; the DM was improved from 89.09 to 92.15%, CP from 13.25 to 19.51%, EE from 7.86 to 8.15%, NFE from 30.94 to 39.59% and ME from 2225.28Kcal/kg to 2742.33% for T_1, T_2, T_3 and T_4 respectively.

The CP value (13.25%) of cowpea husk used in this study was more than the 8% level required for optimum rumen microbial activity (18), it however contained high CF (30.39%) which has a negative effect on the nutritive value of the feed (13). Supplementation of the cowpea husk with graded levels of moringa leaves therefore improved the CP content (from 13.25% to 19.51%) but higher than the range of values of 11.00% to 13.00% known to be capable of supplying adequate protein for maintenance and promotion of growth in goats (19). This was in agreement with (20) who stated that moringa can be used to improve CP and minerals required for goats. Additionally, the metabolisable energy (ME) was also improved from 2225.28 to 2742.68 kcal/Kg which was even above the 2340 kcal/kg recommended for goats (21).

Table 2 showed growth performance of Red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves. The average daily feed intake of the animals were; 382.60g, 452.50g, 457.50g and 445.00g per head per day for T_1, T_2, T_3 and T_4 respectively. The feed intake of the experimental animals fed supplemented diets varied significantly ($P<0.05$) across the dietary treatments in which animals on T_3 recorded the highest intake value (457.50g/d) while those on T_1 showed the least intake value (382.60g/h/d). All the observed values of feed intake were within the recommended daily feed intake of ruminants (3-4% body weight) (22). Apparently higher values were obtained in favour of moringa-supplemented diets (T_2, T_3 and T_4). The feed intake of the animals especially in T_2 and T_3 increased as the inclusion levels of moringa leaves increased in the diets. (23) reported that dry matter intake is an important factor in the utilization of feed by ruminants and is a critical determinant of energy and performance in small ruminants. Furthermore, (24) observed that the changes could be as a result of improvement in the protein status of the feed which enhances rumen micro-organism proliferation and then encourages a more rapid and thorough digestion of ingesta leading to assimilation. On the other hand the observed lower intake of cowpea husk could be explained by the reports that dry matter intake and digestibility are dependent on the fibre constituent (25). (26) also reported that there was a positive correlation between CP content and DM intake. The feed intake was therefore a reflection of CP content of the supplement. This was in line with the result obtained by (27) that diets with higher protein content increased intake in goats.

Though no significant ($P>0.05$) difference were observed for the average daily water intake (ADWI) values across the dietary treatments but ranged from 0.759 to 0.924,

litres per head per day. However, the ADWI obtained in this study was higher than the values (0.680 litres) and (0.739 litres) reported by (28) and (29) respectively. The higher water intake recorded in the current study could be attributed to the dry matter content of the experimental diets. More so goat's water requirement varies with location, season, and productivity (28).

The mean live weight gains values of 20.83g, 48.21g, 60.95g and 52.61g per head per day were obtained for treatments T_1, T_2, T_3 and T_4 respectively, with goats on dietary treatment T_3 being significantly ($P<0.05$) highest and T_1 the lowest. The live weight gains of the animals on the supplemented diets (T_2, T_3 and T_4) varied significantly ($P<0.05$) across the dietary treatment in which animals on T_3 recorded the highest value (60.95g). The higher weight gains obtained from the supplemented diets may be due to higher quality and by-pass protein of moringa leaves (30).

The live weight gain values obtained in this study was higher than the values (21.43g/h/d) reported by (15) who fed WAD goats with *moringa oleifera, Gliricidia sepium and Leucaena leucocephala* dried leaves as supplements to cassava peels.

The observed difference in growth rates when compared with earlier studies could have been due to differences in the basal components of the diets, voluntary feed intake, efficiency of feed utilization and the physiological state of the animals (16). The result of this study was in line with earlier report which indicated appreciable live weight gains of the animals fed moringa leaves. This research therefore, confirmed that incorporation of moringa leaves into cowpea husk improved the weigh gains of Red sokoto goats.

The feed conversion ratio (FCR) values of the experimental animals is significantly ($P<0.05$) decreased across the dietary treatments but later increased with animals on T_4 Animals on T_1 recorded the highest FCR value (18.36) while the lowest value (7.50) was observed in those on T_3. The lowest FCR value obtained in T_3 was an indication that the feed were better utilized when compared with other dietary treatments. This was in consonance with the report of (32) who reported that the lower the feed conversion ratio (FCR) of a diet the better the diet. The result also revealed the higher ability of the animals on T_3 to convert the feed consumed to weight gain. The higher growth rates of the animals on T_3 in this study could be ascribed to their efficient utilization of feed and therefore reflecting lower feed conversion ratio (FCR).

The nutrient digestibility of Red Sokoto goats fed cowpea husk supplemented with graded levels of moringa leaves is presented in Table 3. The digestibility values of dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract of animals fed supplemented diets were significantly ($P<0.05$) varied across the dietary treatments. This implied that the digestibility values were enhanced by the inclusion levels of moringa leaves in the diets. Animals fed supplemented diets had better digestibility values when compared with those fed un-supplemented diet. The observed values might be due to addition of protein quality which must have provided adequate nitrogen as stated by (33) that the activities of rumen microbes is improved by nitrogen in supplemented diet leading high digestibility.

The crude fibre digestibility values ranged from 50.70 to 74.79% with goats in T_3 showing the highest value while the lowest value was observed in T_1. The crude fibre digestibility values obtained in this study were lower than the range of values (63.30 to 78.48%) reported by (34) who fed cowpea husk and Sorghum brewers grain as supplement to WAD goats. The observation above suggested that supplementation of

cowpea husk with moringa leaves improved its crude fibre digestibility. This concurred with the assertion of (35) that the digestibility of crude fibre can be augmented through energy-protein balanced and nitrogen free extract digestibility values of the Red Sokoto goats followed the same trend of variation as observed in crude fibre digestibility value. Ash digestibility values ranged from 48.68 to 73.88% while nitrogen free extract digestibility values ranged from was significantly ($P>0.05$) increased in the animals fed the supplemented diets than the control, where it improved from 48.68% to 73.88% and 53.15 to 61.21% respectively thus, T_3 and T_1 showing the highest and the lowest respectively It can be affirmed from the result of this study that the addition of moringa leaves influenced the digestibility values. This observation is logically harmonious with (16) who stated that moringa substitution improved the overall nutrient utilization of groundnut hay by West African dwarf goats. (36) similarly stated that moringa can be used as supplement to crop residues/poor roughage based diets. Additionally (37) and (38) affirmed that digestibility of nutrients varies with nutrients composition of the diet.

Conclusion and Applications

Based on the result of this study, it can be concluded that:

1. Supplementation of moringa leaves up to 100g to a basal diet of cowpea husk fed to growing Red Sokoto goats improved feed intake, daily weight gain and nutrient digestibility values.
2. Moringa leaves can be used to enhance the utilization of low quality crop residues especially cowpea husk so as to improve the production and productivity of goats.

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