



GROWTH PERFORMANCE AND HAEMATOLOGICAL PARAMETERS OF GROWING YANKASA RAMS FED VARYING PROPORTIONS OF GROUNDNUT HAULMS AND COWPEA SHELL IN DIETS

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ABSTRACT

The study was conducted to evaluate the growth performance and haematological parameters of growing Yankasa rams fed varying proportions of cowpea shell and groundnut haulms in diets. A total of 20 Yankasa rams were assigned to five isonitrogenous dietary treatments (16% crude protein) formulated to include groundnut haulms and cowpea shell at varying proportions such that the two ingredients collectively contributed 40% of the diets. The experiment was conducted in a Completely Randomized Design, with five (5) treatments of four (4) animals each. The result indicated a significant ($P < 0.05$) difference in daily feed intake (DFI) of the animals across the treatments. DFI for animals on diet 1 (1309.00 g/day), 5 (1342.00 g/day) and 2 (1262.00 g/day) were similar and significantly higher than those on the other treatments (1282.00 and 1288.00 g/day for treatments 3 and 4). Water intake (litres per day and litres per kg dry matter intake) of the rams fed the various diets indicated a non-significant difference between the means in both cases. The values of water intake (l/day) range from 1.99 for treatment 5 to 2.28 for those on treatment 1. The result of daily weight gain (DWG) revealed a highly significant ($P < 0.001$) difference across the treatments. The mean value of the DWG for animals on treatment 1 (125.86g/day) was significantly higher than those for the other diets, followed by those on treatment 5 (93.86 g/day) and 4 (81.14 g/day). Animals on treatments 2 (73.57 g/day) and 3 (79.29 g/day) recorded the least DWG values. All animals gained weight, which indicated that, the intake of energy and proteins were well above maintenance requirements. Feed conversion ratio (FCR) values of rams fed the test diets indicated a significant ($P < 0.05$) difference across the treatments. Animals on treatment 1 gave the best FCR value (10.40) compared to those on the other diets. This was closely followed by those on treatments 4 (15.87) and 5 (14.30). Animals on treatments 2 (17.15) and 3 16.17 recorded the least FCR values. The results of haematological parameters indicated that most of the parameters were within the normal values recommended for sheep indicating that the animals were healthy. From the results of the current study, based on the higher weight gains of 125.86g/day, best feed conversion ratio of 10.40 and normal levels of haematological parameters, diet 1 (40% GH 0% CS) is recommended for growing Yankasa rams.

Keywords: Growth, Performance, Yankasa, Rams, Haematology

INTRODUCTION

Cowpea (*Vigna unguiculata*) and groundnut (*Arachis hypogaea*) are vital leguminous crops in Nigeria, cultivated either as monoculture or intercropped with cereals (Dan abba *et al.*, 2021). These crops serve a dual purpose in the agricultural system; their grains are used for human consumption, while the haulms (residues) are used as livestock feed (Abba *et al.*, 2024). The use of cowpea and groundnut residues as supplements to cereal stover in animal production has been well-documented (Ashiru *et al.*, 2010). On the other hand, the productivity of ruminant animals in tropical regions like Nigeria is often limited by deficiencies in protein, energy, and minerals. These deficiencies impair microbial protein synthesis in the rumen and



negatively affect animal performance (Asare-Agyapong *et al.*, 2019). Despite their potential, the utilization of cowpea and groundnut haulms as supplements is still undervalued in some areas of Nigeria, particularly in terms of their conservation and effective use in livestock production (Osafo *et al.*, 2013). The livestock sub-sector in Nigeria faces significant challenges in maintaining productivity, particularly during the long dry season when forage quality and availability are severely limited (Asare-Agyapong *et al.*, 2019). It is a very common practice to use crop residues and agro-industrial by-product such as cowpea shell, groundnut haulms, sorghum panicle, maize bran etc. as main feed source for sheep year-round in the Northeastern part of the country (Yerima *et al.*, 2023). The supplementation of cowpea and groundnut haulms could offer a viable solution to the nutritional deficiencies that limit ruminant productivity in tropical regions (Lee *et al.*, 1995). Optimizing the use of these readily available legume residues, could contribute to improving the growth performance, nutrient intake, and overall economic efficiency of smallholder livestock production systems (Abba *et al.*, 2024). However, the underutilization of these legume residues in livestock production contributes to suboptimal growth performance and economic returns for smallholder farmers (Abba *et al.*, 2024). Therefore, there is a need to evaluate the influence of cowpea shell and groundnut haulms in the diet of sheep on the growth performance and blood profile and rumen fluid of Yankasa rams. A possible explanation could be the increased requirement of water for the dilution of blood whose production increase with protein level of the diet. All the animals gained weight which indicated that the intake of energy and protein were well above maintenance requirements (Abubakar, *et al.*, 2005). The broad objective of the study was, therefore, to evaluate the growth performance and haematological parameters of growing Yankasa rams fed varying proportions of cowpea shell and groundnut haulms in diets.

MATERIALS AND METHOD

Experimental Site

The experiment was conducted at the Bauchi state College of Agriculture Teaching and Research Farm, Bauchi. Bauchi is located on Latitude 10° 17' N and longitude 9° 49' E, with an altitude of about 690.2 meters above sea level. Bauchi is bordered by seven states of Kano and Jigawa to the North, Taraba and Plateau to the south, Gombe and Yobe to the east and Kaduna to the West. It occupies a total area of 49,259.01sq kilometers, representing about 5.3% of the total land mass of Nigeria. The state fall within the Guinea savannah ecological zone with an annual rainfall of between 1000mm and 1300mm per annum, effective rainy season start from mid-May or sometimes early June. In contrast, the Northern tip of the State receiving a rain late June/July. Relative humidity ranges from about 12% in February to about 68% in August. At the beginning of the rainy season, relative humidity is about 37%. Bauchi state has an average temperature of 40.50c (around April) and 6.110c – 7.220c (around December and January) (Butswat *et al.*, 2000). The vegetation here is not uniform and grasses are shorter than is obtain further of the country. The South- West region of the state is mountainous as a result of spread in to region of Jos-Plateau while the Northern part is generally sandy. The soil is moderately deep, well drained and characteristically tropical sandy loam. The seasons in Bauchi are divided into four based on rainfall distribution pattern (Butswat, 1994): late dry season (January – March), early rainy season (April – June), late rainy season (July – September) and early dry season (October – December) (Butswat *et al.*, 2005). The climatic conditions of Bauchi exhibit two marked seasons which are rainy season and dry season. During the rainy reason, there are abundance of pastures and green grasses for animals to graze. The dry season lasts for a period of about 7 months (October to April). The months of October



to December are the period of harvest and there are a lot of animal feeds in form of crop residues (Butswat *et al.*, 2000).

Experimental Animals and their Management

A total of twenty (20) Yankasa Rams were used for the experiment. The animals weighed between 15.10kg to 25.20kg and averagely 19.10kg. They were procured from different markets in Bauchi. On arrival, the animals were quarantined for two weeks during which their body was spread with acaricide, using Amitraz® at the rate of 1ml/litre for external parasites. They dewormed with Albendazole at 12.5mmg/kg1 body weight for internal parasites respectively, also antibiotic, Oxytetracycline L.A (Kepro ®) 20%, at 1ml per 10kg body weight was injected intramuscularly. The animals were randomly allocated to the five treatments of four animals each. Initial body weights of individual animals were measured at the beginning of the trial and on weekly basis thereafter in the morning around 8:00 am throughout the experiment, before fresh feeds were offered to them using a very sensitive weighing scale.

Experimental Diets and Animal Feeding

Groundnut haulms, cowpea shell, cotton seed cake, maize offal, bone meal and salt licks which were used in this experiment were obtained from different markets in Bauchi and environs. Five (5) isonitrogenous diets (16% crude protein) were formulated in which groundnut haulms and cowpea shell were included at various levels such that the two ingredients collectively contributed 40% of the diets. Gross and chemical compositions of the feed ingredients and experimental diets are shown in Tables 1, 2 and 3. The animals were allowed 14 days period for adaptation to confinement. During the experiment, feeding was done every morning at about 0800hrs at approximately 10% in excess of individual consumption. Animals were provided fresh drinking water in graduated plastic buckets. The total daily allocation of the diets was adjusted on the basis of the previous day's intake. Total feed and water intake of each animal were estimated. The animals were weighed at the beginning of the experiment and weekly thereafter. The experiment lasted for 70 days

Table 1: Gross composition (%) of Experimental Diets

Treatments / Diets					
Ingredients	1	2	3	4	5
Cotton seed cake	17.00	18.99	21.02	23.00	25.00
Maize offal	40.50	38.50	36.48	34.50	32.50
Groundnut haulms	40.00	30.00	20.00	10.00	0.00
Cowpea shell	0.00	10.00	2.00	30.00	40.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Salt	0.50	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00	100.00

Data collection

Data were collected on the following parameters:

Feed and water intake

During the feeding trials, feed and intake were determined by subtracting the left over from the quantity provided on daily basis in all the experiments



Weight measurements

Initial body weights of individual animals were measured at the beginning of the trial and on weekly basis in the morning around 8:00 am, before fresh feeds were offered to the animals using a very sensitive weighing scale. Feed Conversion Ratio was calculated using feed intake and body weight gain.

Blood profile study

For haematological study, two animals from each treatment (total of 10) were used. During the last week of the experiment, blood samples were collected via jugular veins from three animals each per treatment (two for experiment 4) into an Ethylene Diaminetetra Acetic Acid (EDTA) Coated plastic tube for haematological study. . Blood plasma for biochemical analysis was harvested by centrifugation at rpm for 15 minutes in a centrifugated centrifuge and stored at -200C. The anti-coaglated blood was used to determined haemoglobin (Hb) concentrations, total white blood cells (WBC), red blood cells (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), mean haemoglobin concentration (MHC), lymphocyte and packed cell volume (PCV) automatically using Haematoric blood analyser (Sysmex KX-21 Automated Hematology Analyser). Haemoglobin content was determined as described by Jain (1993). Red blood cells and platelets of the samples were measured and calculated as described by Magyar (2005). Packed cell volume and erythrocyte count were determine as described by Egbunike and Nworgu (2006).

Chemical Analysis of Feed Ingredients and Experimental Diets

The chemical composition of the experimental feed ingredients and diets were determined in the Laboratory according to procedure described by AOAC (1999) and Van Soest *et al.* (1991).

Table 2: Chemical composition (%) of Experimental feed Ingredients

Nutrients	GNH	CPS	CSC	MO
Dry matter	95.48	91.87	94.65	94.87
Organic matter	76.10	80.79	84.20	79.81
Crude protein	15.89	12.34	34.70	10.89
Ash	23.90	19.21	15.80	20,19
NDF	69.10	81.00	79.61	46.90
ADF	38.30	46.76	48.30	26.79
Hemicellulose	30.80	34.24	31.31	20.11

GNH = Groundnut halms, CPS=Cowpea shell, CSC=Cotton seed cake, MO= Maize offal

Table 3: Chemical composition (%) of Experimental Diets

Nutrients	Treatments / Diets				
	1	2	3	4	5
Dry matter	93.74	95.43	96.10	94,87	95.20
Organic matter	80.10	78.50	81.80	84.50	82.50
Ash	19.90	21.50	19.20	15.50	17.50
Crude protein	16.42	16.20	15.80	16.35	16.39
N D F	42.56	39.89	40.60	41.90	43.10
A D F	23.69	22.36	19.90	21.79	23.40
Hemicellulose	18.87	17.53	20.70	20.11	19.70

N D F – Neutral detergent fibre, A D F – Acid detergent fibre



Experimental Design

The experimental design was a completely randomized design (Steel and Torrie, 1980), with five treatments of four animals each.

Statistical analysis

Data collected were subjected to Analysis of variance (ANOVA) as described by Steel and Torrie (1980) using MINITAB 16 (2014). Where significant differences existed between means, Duncan's new multiple range test (DMRT) was used to separate them.

RESULTS AND DISCUSSION

Growth Performance of Yankasa Rams Fed with Groundnut Haulms and Cowpea Shells in the Diets

The results of the performance of Yankasa Rams fed varying proportions of Groundnut haulms and Cowpea shell in diets is shown in Table 4. The results of the total feed intake (TFI) indicated a non-significant difference among the treatments. The TFI values ranged from 88.35 g/day for treatment 2 to 93.97 for those on treatment 5. However, the result of the daily feed intake indicated a significant ($P < 0.05$) difference in the daily feed intake (DFI) of the animals across the treatments. DFI for animals on diet 1 (1309.00 g/day), 5 (1342.00 g/day) and 2 (1262.00 g/day) were similar and significantly higher than those on the other treatments (1282.00 and 1288.00 g/day for treatments 3 and 4). Water intake (litres per day and litres per kg dry matter intake) of the rams fed the various diets indicated a non-significant difference between the means in both cases. The values of water intake (l/day) ranged from 1.99 for treatment 5 to 2.28 for those on treatment 1. The results of the daily weight gain (DWG) of the animals revealed a highly significant ($P < 0.001$) difference across the treatments. The mean value of the DWG for animals on treatment 1 (125.86g/day) was significantly higher than those for the other diets, followed by those on treatment 5 (93.86 g/day) and 4 (81.14 g/day). Animals on treatments 2 (73.57 g/day) and 3 (79.29 g/day) recorded the least DWG values. All animals gained weight, which indicated that, the intake of energy and proteins were well above maintenance requirements. Chesworth (1992) categorized CSC as a type of concentrate supplying both degradable (RDP) and undegradable (UDP) protein and gave the RDP and UDP levels of CSC to be 27.4% and 18.3% respectively (for a 45.7% CP, CSC). Feed conversion ratio (FCR) values of rams fed the test diets indicated a significant ($P < 0.05$) difference across the treatments. Animals on treatment 1 gave better FCR value (10.40) compared to those on the other diets. This was closely followed by those on treatments 4 (15.87) and 5 (14.30). Animals on treatments 2 (17.15) and 3 16.17 recorded the least FCR value. The increase in FCR value with increasing roughage level as obtained with rams fed CSC/SDBL ration (8.08), due to its high fibre level compared to the other diets is in conformity with earlier reports by Adeleye (1982) who fed high roughage diets to sheep. This is indicative of the fact that high roughage diets were less efficiently utilized than low roughage rations.

Table 4: Performance of Yankasa Rams fed varying levels of Groundnut haulm and Cowpea shell in diets

Treatments						
Parameters	T1	T2	T3	T4	T5	SEM
Initial weight (kg)	19.32	18.17	18.67	19.92	19.22	2.76ns
Final weight (kg)	28.13	23.32	24.22	25.60	25.79	4.01ns
Total weight Gain (kg)	8.81 ^a	5.15 ^c	5.55 ^c	5.67 ^b	6.56 ^b	3.18*
Daily weight gain (g/day)	125.86 ^a	73.57 ^c	79.29 ^c	81.14 ^b	93.86 ^b	0.71*
Total feed intake (kg)	91.65	88.35	89.75	90.20	93.97	0.94ns
Daily feed intake (g/day)	1309.00 ^a	1262.00 ^{ab}	1282.00 ^b	1288.00 ^b	1342.00 ^a	0.94*
Total water intake (ml)	159.52	150.22	151.92	148.17	139.57	3.36ns
Daily water intake (ml)	2.28	2.14	2.17	2.12	1.99	0.48ns
Feed conversion proportion	10.40 ^a	17.15 ^c	16.17 ^c	15.87 ^b	14.30 ^b	3.74*

NS = Not significant, $P < 0.05 = *$, SEM=Standard Error of the Mean,

Haematological Parameters of Yankasa Rams Fed Varying Proportions of Groundnut Haulms and Cowpea Shell

Hematological Parameters of Yankasa Rams Fed Varying levels of Groundnut Haulm and Cowpea Shell is shown in Table 5. The packed cell volume (PCV) obtained in the present study (26.23 – 34.80%) fall within the normal values (27 – 45 %) reported for sheep (Jain, 1993). This indicated the animals were in a healthy condition. The range of values of 9.60 to 15.96 g/dL recorded for haemoglobin in the current study was comparable to the standard values reported for sheep (Ukanwoko *et al.*, 2020). This is an indication that the diets were adequately capable of supporting oxygen transport within the animal cells and sheep (Njidda *et al.*, 2014). The range of White blood cell (WBC) values reported in this study (6.20 to 12.28 $\times 10^9/L$) were in conformity with the values of 3.2 – 15.80 $\times 10^9/L$ reported by Jawaresh *et al.* (2010) for growing rams. The WBC values obtained in the current study indicated that the animals were healthy and devoid of parasites in the circulatory system. The range of values for red blood cell (RBC) ranged from 8.95 to 12.55 $\times 10^{12}/L$ observed in this study were within the normal range of 3.5-13.5 $\times 10^{12}/L$ reported by (Ukanwoko *et al.* 2020). The implication for this is that the animals in the current study were not susceptible to anaemia related disorders (Ikhimioya and Imasuen, 2007). The range of values for red blood cell (RBC) ranged from 8.95 to 12.55 $\times 10^{12}/L$ observed in this study were within the normal range of 3.5-13.5 $\times 10^{12}/L$ reported by (Ukanwoko *et al.* 2020). The range of values for Mean Corpuscular Volume (MCV) (22.84 - 34.07 fl), Mean Corpuscular Haemoglobin (MCH) (8.11 – 13.56 g/dL) and Mean corpuscular haemoglobin concentration (MCHC) (27.59 - 61.75g/dL) were comparable to the standard values reported by Jain (1993) except for MCHC which were outside the normal range of 31 – 34 g/dL. MCV, MCHC and MCH are characteristics of RBC indicating average cell size, average cell haemoglobin content and average cell haemoglobin concentration, respectively (Russel and Rousell, 2007). Changes in these values could be attributed to factors such as breed and age of animal (Adili and Melizi, 2013).



Table 5: Hematological Parameters of Yankasa Rams Fed Varying levels of Groundnut Haulm and Cowpea Shell

Treatments						
Parameters	T1	T2	T3	T4	T5	*Standard values
PCV (%)	27.50	27.55	33.60	26.23	34.80	27–45
HGB (g/dL)	9.60	11.42	8.98	15.96	9.45 ^b	9–15
WBC (10 ⁹ /L)	6.20	11.50	8.35	12.28	10.75	4–8
RBC(10 ⁶ /μL)	10.95	8.95	11.00	11.84	12.55	9–15
MCV (fL)	25.02	30.97	34.07	22.84	28.78	28–40
MCH (g/dL)	8.85	12.74	8.72	13.56	8.11	8–12
MCHC (g/dL)	30.95	41.98	27.12	61.75	27.59	31–34

PCV=Packed Cell Volume, HGB= Heamoglobin, WBC=White blood cell, RBC=Red blood cell, MCV= Mean Corpuscular Volume, MCH = Mean Corpuscular Haemoglobin, MCHC= Mean corpuscular haemoglobin concentration *(Jain, 1993)

CONCLUSION AND RECOMMENDATION

The inclusion of varying proportions of groundnut haulms and cowpea shell into the diets of growing Yankasa rams at up to 40% level had no adverse effects on growth performance and haematological parameters. From the results of the current study, based on the higher weight gains of 125.86g/day, feed conversion ratio of 10.40 and normal values for most haematological parameters, diet 1 (40% GH 0% CS) is recommended for growing Yankasa rams.

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