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Performance, Heamatological Profile and Bio Economics of Weaner West African Dwarf Goats, Fed Diets Containing Cashew Nut Shell, with or without Additives

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Abstract: *15 weaner West African dwarf goats with weight range of 4.62-4.83 kg were randomly allotted to five dictary treatments of three goats each in a completely randomized design to test the effects of additives on feed intake, growth, hematological profile and biocronomics. Each goat was fed 600grams of pennisetum purpureum and 200g of the supplement. Two hours later water was provided adlibitum animals in T1 (control) were fed diet without cashewnut shell and additive, animal in T2 were fed diet containing cashew nut shell but without additive, T3, T4 and T5 were fed diet containg 20% cashew nut shell and 1% monosodium glutamate, dried pepper mealand sugar additives respectively daily weight gain ranged from 13.60-30.20g with T1 having the best. The values were significantly (p>0.05) different with T1 (102.79g) being the best and T2 (39.92g) being the least, T5 (51.88g) was however the best for treatment with additives. Feed conversion ratio ranged from 11.24 (T1) to 22.06 (T2) and were significantly (p<0.05) different. Feed cool/kg rayed from N17.31 (T1) to N38.59 (T3) and were significantly (p<0.05) different benefit/live weight gain and cost benefit rahoboth showed significant (P<0.05) with T1, having the best and T2 the least. Packed cell volume and Haemoglobin values were not significance (P> 0.05) different but were however within normal range for goats.T1 performed besting in terms of supplement intake, growth and cost benefit, while T2 was the worst T5 performed best in terms of supplement wake growth and cost benefit amongst treatments with additives but the use of additives was not cost effective, the use of additives is therefore not recommended, but the level of inclusion of cashew not shell in supplement diet for goats should be pegged at below 10%. Further research aimed at establishing the optimum level of inclusion of cashew nut shell in supplement diets for goats is imperative.*

1. INTRODUCTION

Livestock continue to make important contributions to global food supply livestock products account for about 30% percent of the global value of food production. In the same vein, 34 percent of protein and 16 percent of the energy consumed by man are provided by livestock meeting consumer demand for more meat, milk eggs and other livestock products is dependent to a large extent on the availability of regular supplies of appropriate cost effective and safe animal feeds consequently animal feeds have become an increasingly critical component of the integrated food chain (FAO, 2004). Component of the integrated food chain (FAO, 2004).

In Nigeria sheep and Goats play a significant socio-economic role in the life of the people.

An intensive approach to goat production would however entail the use of alternative feed sources other than the conventional ones. (Ojebiyi *et al* 2008). Recently there has been growing policy recognition of the role of non-conventional feed resources in livestock production (FAO 1999). Much can be achieved by reducing the quantity of expensive feed ingredients and making them up with non-conventional feeds stuffs or by products without compromising the quality of the feed. Agricultural by-products such as cassava peels cocoa husks maize cobs and wheat offals amongst others are now

widely used as animal feeds. The trend has changed from the situation in which these by-products were considered as waste one of such Agro by-product that appear to be promising in ruminant animal nutrition is cashew nut shell. Ocheja *et al* (2013[b]) reported the proximate composition of raw cashew nut shell to be crude protein 6.23%, ash 1.20%, crude fibre 23.05%, ether extracts 41%, nitrogen free extracts 28.51% dry matter 91.50% and PH 3.51. Ocheja *et al* (2013[9]) and Okolo *et al* (2012) both reported significant reduction in feed cost /kg with the inclusion of cashew nut shell in supplement diets for growing west Africa dwarf goat. They also however reported a sharp decline in supplements intake at 10% level of inclusion and beyond.

Ocheja *et al* (2012[a]) reported that inclusion of cashew nut shell in supplement diets for growing west African dwarf goats even at 30% level of inclusion had no adverse effects on Haematological and serum bio chemical indices

Ocheja *et al* (2012[b]) also reported superior carcass characteristics at 10% level of inclusion of cashew nut shell in supplement diets for growing West African dwarf goats.

The aims of this work therefore were to test the effects of monosodium glutamate, dried pepper meal and sugar additives in supplement diets for weaner goats containing 20% cashew nut shell with a view to boosting feed intake and growth performance at reasonable feed cost/kg.

2. MATERIALS AND METHODS

2.1. Description of Experimental Location

This experiment was conducted at the sheep and goat unit of the Teaching and Research farm of the Kogi State University, Anyigba. Anyigba lies on latitude 7^0 15 and 7^0 29' N of the equator and 7^0 11' and 7^0 32' E of the Greenwich Meridian (Ifatimehin, *et al*., 2009).

The mean annual rainfall is 1260mm, with peaks in the month of July and September. A short dry period called August break is usually observed in the month of August which sometimes fall especially during the "harmattan" to temperature slightly below 27^0C, but how ever annual temperature does not exceed 38^0C (Kowal and Knabe, 1972).

2.2. Experimental Management

A total of 15 weaners West African dward goats were purchase from Anyigba and it environs the animals were randomly allotted in a completely randomized design to five (5) treatments. Each treatment had three (3) goats. The animals were weighed, ear tagged and treated with ivomec procaine penicillin and oxytetracychine HCl. They were assigned to five diets. Water was given to the animals *adilibitum*. The animals were fed the supplement at 200g/goat/day and forage (*Pennisetum Purpureum*) at 600g/goat/day. The experiment lasted for 50days after an initial adjustment period of three (3) days.

2.3. Preparation of Experimental Diets

Table 1. *Composition of Experimental Diets (%)*

Feed Ingredients	Treatments/Composition				
	T_1	T_2	T_3	T_4	T_5
Cashew nut shell	-	20.00	20.00	20.00	20.00
Burukutu waste	28.00	24.47	24.07	24.07	24.07
Bambaranut waste	33.00	34.53	33.93	33.93	33.93
Rice offal	38.00	20.00	20.00	20.00	20.00
Wood Ash	0.50	0.50	0.50	0.50	0.50
Table salt	0.50	0.50	0.50	0.50	0.50
Monosodium Glutamate	-	-	1.00	-	-
Dried pepper meal	-	-	-	1.00	-
Sugar	-	-	-	-	1.00
Total	100.00	100.00	100.00	100.00	100.00

Cashew nut shell was collected from the cashew nut processing plant in Kogi State University Anyigba. The cashew nut shell was pounded into smaller particles using mortar and pestle to ensure ease of grinding. Bambara nut waste, rice offal, table salt, Burukutu waste word ash drew paper meal, sugar and monosodium glutamate were obtained from the experimental location (Anyigba) and its environs. The crushed cashew nut shell was mixed with other feed ingredients. (Bambara nut waste, rice offal, table salt, Burukutu waste, and word ash) Treatment one and two were the control diets while treatment three, four and five contains the additives (dry pepper meal, sugar, mono sodium glutamate). Treatment one without cashew nut shell and additive while treatment two contains cashew nut shell without additives. Treatment 3, 4, 5 contains monosodium glutame, drew pepper meal additives at 0.4kg/50kg of diets.

2.4. Haematological Indices

Blood sample were collected from the jugular vein of each goat using syringes and needles into a bottle containing ethylene diamine tetra acetate (EDTA) anticoagulant. Uncoagulated blood samples were analyzed for haematological parameters such as packed cell volume (PCV), haemoglobin concentration (Hb), Red blood cell, Neutrophils and Eosinophils by the method of Baker and Silverton (1985).

2.5. Data Collection

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

The cost of supplement diets were calculated using the prevailing market price of feed stuff at the time the experimental diets were formulated.

The following were calculated

1. Cost of supplement consumed = cost of supplement /kg x total
2. supplement intake
3. Benefit/live weight gain = total weight gain x cost of a kg of goat meat at ₦800 (Ocheja *et al*., 2011c)
4. Cost benefit ratio = $\frac{\text{Actual cost of total feed intake (₦)}}{\text{Benefit/live weight gain (₦)}}$

2.6. Chemical Analysis

Samples of cashew nut shell, experimental diet and forage were analysed for their proximate composition using stand and procedure (AOAC, 2000).

2.7. Statistical Analysis

Data collected were subjected to a one way anova (analysis of variance). Treatment means, with significant different as were separated using least significant different (LSD) with the aid of SPSS (16th version).

3. RESULT AND DISCUSSION

3.1. Proximate Chemical Analysis

The proximate chemical composition of experimental diets, cashew nut shell and elephant grass (pennisetum pruprureum) are presented in table 2.

The crude protein and crude fibre contents of 7.60% and 25.70% reported for cashew nut shell were higher than 5.00% crude protein and 20.75% crude fibre obtained by Ocheja, *eta al*., (2011a) the crude protein value was slightly lower than the critical level of 8.00% crude protein level for ruminant as reported by NRC (1996). The nitrogen free extract content values of 28.00% and 37.50% respectively were both lower than the 32.91% and 40.25% respectively reported by Ocheja *et al*.,

(2011a). However, the ash and dry matter contents of 1.20% and 92.52% respectively was comparable to the 1.09% ash and 92.21% dry matter reported by Ocheja *et al.*, (2011[a]).

In using cashew nut shell as a feed ingredient a fairly high protein source is required to raise the protein content to recommended levels.

The crude protein content of 10.55% obtained for was comparable to 9.70% obtained by Osakwe and Udeogu (2007) but lower than 36.33% reported by Amakiri *et al*., (2011).

The dry matter content of 35.50% reported for pennisetum purpureum in this study was higher than that obtained by Amakiri et at., (2011) who reported the dry matter content of elephant grass to be 23.20%. This disparity could be due to the variety as well as stage of maturity of the grass. The differences observed in the proximate composition of these by – products can be attributed to source and variety and the method of preparation which may affect their composition.

The experimental diets were iso-nitrogenous with crude protein value ranging from 18.02% – 18.95%. T_1 had the highest crude protein value (18.95%). The crude fibre content of their diets were similar with T_5 having the highest (15.66%). The crude protein content of 18% obtained for the experimental diets fell within the range of 12-18% recommended for growing ruminants in the tropics. They were also well above the critical protein requirement for goats as reported by NRC (1996).

Table 2. *Proximate Composition of Experimental Diets, Cashew*

Nut shell and Pennisetum Purpureum (Dry matter Basis)							
Nutrients (%)	**Composition/Treatments**					**Pennisetum Purpureum**	**Cashew Nut shell**
	T_1	**T_2**	**T_3**	**T_4**	**T_5**		
Crude Protein	18.95	18.55	18.70	18.22	18.02	7.35	16.56
Crude Fibre	15.46	15.50	15.56	15.42	15.66	21.60	23.65
Nitrogen Free extracts	55.70	50.53	50.68	50.10	50.90	31.10	37.45
Either extracts	5.37	11.68	12.00	11.20	11.38	38.70	3.80
Ash	4.52	3.79	3.06	3.06	3.59	1.25	18.54
Total	100	100	100	100	100	100	100
Dry Matter	90.35	91.65	91.88	91.20	91.38	92.55	54.44
PH	6.85	6.45	5.90	5.80	6.50	3.10	-
Gross energy (Kcal/kg Dm) (calculated)	3079.87	3398.87	3435.24	333.14	3368.53	4526.79	2219.92

3.2. Performance

Table 3. *The Performance Data Are Summarized*

Performance Data of Experimental Animals						
	Treatments					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
Numbers of goats	3	3	3	3	3	-
Duration (days)	50	50	50	50	50	-
Initial (kg)	4.73	4.83	4.74	4.72	4.62	0.05
Final weight (kg)	6.24[a]	5.51[b]	5.43[b]	5.16[b]	5.67[b]	0.11
Total weigh (kg)	1.51a	0.68c	0.69[c]	0.84ab	1.05[b]	0.12
Daily weigh gain (g)	30.20[a]	13.60[c]	13.80 [c]	16.80c	21.00[b]	2.48
Daily forage intake (g)	237.04	260.23	240.44	242.83	241.86	5.30

Dm						
Daily supplement intake (g) Dm	102.79[a]	39.92[c]	46.30[c]	41.57[c]	51.88[b]	7.58
Daily Dry matter intake (g)	339.66a	300.15b	286.45b	284.40b	293.74b	7.27
Feed conversion ratio	11.24[a]	220.6[c]	20.76[c]	16.93[b]	13.98[ab]	2.23

The values obtained for total weight gain were significantly (P< 0.05) affected by treatments. T_2 and T_3 were similar while T_4 and T_5 is not statistically different (table 3). The daily weight gain was significantly (P < 0.05) affected by treatments and treatment means of T_1 and T_5 were statically different while T_2 and T_3 were similar. The total and daily weight gain obtained in this study were lower than 4.5 – 5.2kg and 84.9 – 94g respectively reported by Olomola *et al*., (2008) and daily weight gain of 31.27 – 42.26g reported by Eniolorunda *et al*., (2008). These differences may be due to experimental diets used, as well as breads of goats used. Animals in T_1 had the highest growth rate which might be attributed to highest feed (supplement) intake and feed utilization while animal in T_2 had the lowest weight gain which may due to lowest supplement intake and feed utilization. The values obtained for daily supplement intake were significantly different, (P < 0.05) with T_3 and T_4 being statistically different. Treatment had no significant effect (P > 0.05) on forage intake. The feed intake in T_1 was higher than in the other treatment which possibly led to a higher weight gain. This effect of feed intake on weigh gain is in line with the finding of Tolera *et al.,* (2000) who stated that supplementation of forages with concentrate feed stuff is a necessity in improving goat producing. T_1 had the highest supplement intake (102.79g) which might be attributed to the palatability of the feed as well as a high protein to energy ratio. Treatment effect on daily dry matter intake was significant (P< 0.05). T_3 and T_4 were similar and T_1 and T_5 being statistically different. The values obtained for daily dry matter intake (2844.40g – 300.15g) lower than 235.91-388.32g Dm obtained by Ifut *et al.,* (2011). Feed conversion ratio did not follow any definite trend but showed significant (p < 0.05) different with T_1 having the best feed conversion ratio value which might be attributed to highest feed utilization exhibited by the animals in this treatment. This result was in line with that of Okolo *et al.,* (2012).

3.3. Bioeconomics

Table 4. *Bioeconomics data are summarized*

Bioeconomic Data of Experimental Animals						
	Treatments					
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**T_5**	**SEM**
Cost of Supplement kg (₦)	17.31cd	14.02[d]	38.59[a]	31.63b	20.84[c]	2.46
Cost of Supp. Consumed (₦)	97.14a	35.41[c]	97.30[b]	47.31[d]	57.43[c]	7.75
Cost of forage /kg (₦)	3.00	3.00	3.00	3.00	3.00	-
Actual Cost of Total Feed intake(₦)*	162.45a	107.12[b]	152.83	114.23[b]	124.03[b]	6.43
Benefit/Live weight gain (₦) **	1208a	544[d]	552[d]	672[c]	840[b]	98.91
Cost Benefit ratio ***	0.13[a]	0.20[b]	0.28[c]	0.17[b]	0.15a[b]	0.03

a,b,c,d = Treatment means on the same row with different superscript difer signficantly (p < 0.05)

SEM = Standard error of mean

* = *Cost of supplement intake plus cost of forage on actual basis*

** = *Total weight gain X cost of a kg of goat meat at ₦800 Oche et al., 2011c*

*** = *Actual cost of total feed intake ((₦) divided by benefit/weight gain (₦)*

The cost of supplement/ kg (₦) was significantly (P < 0.05) affected by treatment T_3 had the highest cost of supplement/kg

This could be attributed to the high cost of additive (monosodium glutamate) in this treatment. T_5 had the lowest cost of supplement./kg This could be attributed to the low cost of sugar. T_3 and T_4 were similar while $T_1$are T_5 is statistically different. Cost of supplement consumed (₦) decreased from T_1 (97.14) to T_5 (57.43) and the values showed significant (P < 0.05) differences. Values obtained for benefit live weight gain (₦) did not follow any definite tread and showed significant (P < 0.05) differences and ranged from 544(₦) – 1208 (₦). Cost benefit ratio showed significant differences with T_1 having the best. This was in line with the results of earlier studies by Bawa *et al*. (2003) Abeke (2005) and Ogundipe *et al*. (2003) who reported that the need to lower feed cost in order to produce affordable meat and other animals produce for the populace cannot be over emphasized in the face of dwindling standard of living. T_1 had the highest benefit/ live weight gain.

Actual cost of total feed intake (₦) was significantly (P < 0.05) affected by treatments. T_2 and T_5 were similar while T_1 and T_5 were statistically different.

3.4. Haematological Profile

The effect of the diets containing graded levels of cashew nut shell on the blood composition is presented in table 4 below.

Table 4. *Haematological Characteristics of Experimental Animals*

Parameters	Treatments					SEM
	T_1	**T_2**	**T_3**	**T_4**	**T_5**	
Packed cell Volume (%)	37.80	38.24	35.81	37.24	37.55	0.06
Haemoglobi (g/l)	201.33	201.00	178.67	192.33	195.33	3.69
Red blood cell (x 10^{12}/l)	7.98^{b}	8.40^{ab}	10.77^{a}	8.77^{ab}	9.81^{ab}	0.39
White blood cell (x 10^{9}/l)	9.28b	12.78a	10.20^{ab}	6.40c	0.68	0.39
Neutrophils (%)	49.66^{a}	40.67^{c}	48.00^{ab}	40.00^{c}	44.00^{b}	1.17
Basophlis (%)	0.33	0.33	0.67	0.33	0.67	0.13
Eosinophilis (%)	0.67^{b}	1.00^{b}	1.00^{b}	2.00^{a}	1.00^{b}	0.13
Lymphocyte (%)	44.00	47.00	43.00	48.00	48.50	1.02
Monocyte (%)	5.33	7.33	7.00	7.33	6.67	0.40

a,b,c, = Treatment means on the same row with different superscript differs significantly (p< 0 .005).

SEM = Standard Error of Means.

There was no significant (P<0.05) dietary effect on packed cell volume, Haemoglobin, Neutrophils, Eosinophils and lymphocytes. And the values for these parameters were comparable with the values reported by Okolo *et al*., (2012). The Red Blood cell (RBC) values differed significantly (P<0.05), the value obtained in this study (7.98-10.77x10^{12}/l) fell within the range of 6.77-12.87x10^{12}/l reported by Ocheja *et al.*, (2012) and 5.86-14.00x10^{12} /l reported by Kauffmam, (1980). There were significant differences (P<0.05) in the value of white blood cell, the range of 6.40 to 12.78x10^{9}/l obtained in this study were similar to 8.65 to 9.74x10^{12}/l reported by Ocheja *et al.*, (2012). There was significant differences (P<0.05) in the values of neutrophils, with T_1, T_2 and T_3 being similar. The range of

40.00% to 49.66% was lower than the range reported by Ocheja *et al*., (2012). There were significant differences (P<0.05) in Eosinophils, the range of 0.67-2.00 obtained in this study were at variance with 2% reported by Ocheja *et al*., (2012). All the haematological values however, fell within normal range for West African Dwarf goats.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

- ❖ All the additives used had no adverse effect on hematological parameter of weaner west African dwarf Goats.
- ❖ Treatment I performed best in terms of feed intake growth and bio economics
- ❖ Treatment 5 (sugar additive) had the best performance in terms of feed intake and growth as well as lowest feed cost/ kg for the treatments with additive (T3, T4 and T5). Treatment 2 however had the least feed cost/kg as well as overall least values for feed intake and growth performance.
- ❖ The use of additive only improved supplement intake, growth performance and Bio economic indices marginally, and hence the use of additive were not cost effective

4.2. Recommendations

The use of additives in supplement diets containing cashew nut shell for goats is not recommended.

Further research should focus on establishing an optimum level of inclusion of cashew nut shell in supplement diets for goats from points of view of cost, supplement intake, growth performance, safety and carcass quality.

Processing of cashew nutshell, so as to improve intake is also recommended.

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