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Effect of Feeding Varying Levels of Cotton Seed Cake as Replacement for Groundnut Cake on Growth Performance of Sheep in Sabon Gari Local Government Area, Kaduna State, Nigeria

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Abstract

Prohibitive cost of feeds especially proteinous feeds is a major challenge to profitable livestock production in the tropics. A study to determine the effect of feeding varying levels of cotton seed cake (CSC) as replacement for Groundnut cake (GNC) on growth performance of growing sheep was conducted in the Small Ruminant Section of the Experimental Unit of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna state. The aim was to determine the best level of CSC a cheaper source of protein to use in feeding sheep as replacement for GNC in sheep production. Twelve (12) growing sheep were assigned to four experimental diets containing 0% CSC, 50% CSC, 75% CSC and 100% CSC as replacement for GNC with Beans offal (BO) as the basal diet in a Completely Randomized Block Design (CRBD) with three replicates. Feed intake, weight gain and feed conversion ratio were determined. There was no significant ($P<0.05$) differences between initial weight (IW) and daily weight gain (DWG) among the experimental animals but there was significant ($P>0.05$) difference in final body weight (FBW) and feed conversion ratio (FCR) across the treatments. FBW increased as the level of replacement of GNC with CSC increased up to 100% level. Feed conversion ratio was significantly higher for the sheep fed diet containing 75% CSC; also best economic return was obtained from sheep fed diet with 75% CSC. It was therefore, concluded that growing sheep can be fed diet containing up to 75% CSC as replacement for GNC for better weight gain and positive economic return.

Keywords: *Cotton seed cake, Growing sheep, Growth performance, Sheep production*

Introduction

Nutrition is one of the most important factors affecting sheep production in the tropics. Livestock production is faced with the problem of meeting needs of man and livestock for the scarce conventional food stuffs like the cereals, pulse and root crops. The rapid increase in human population has resulted to a deficit in concentrate feeds available to livestock (Maigandi *et al*., 2004). The high cost and sometimes unavailability of the conventional feeds all the year round coupled with shortages in the foreign exchange and poor quality feeds have rendered livestock production an expensive venture in Nigeria (Ndamitso *et al.,* 2010). It is therefore necessary to look for alternative sources of feed ingredients in order to optimize animal performance (Maigandi, 2004).

The importance of small ruminants in the tropics is generally well recognized (Williamson and Payne, 2001). Small ruminant suffer scarcity of feed supply and pasture quality in the humid region of West Africa, especially during the dry season when the natural vegetation is of poor nutritive value (Aye, 2007). For a long time, GNC has been the major ingredient used in the formulation of highly efficient diets for ruminants.

Despite the availability of abundant land and human resources in Nigeria, yield per hectare from groundnut production has been declining over the years and there is a shortfall of over 90 percent of groundnut requirement by the companies involved in processing it as revealed by (RMRDC,

2004), and from this finding it has lead to increased prices and less availability of groundnut cake, sheep farmers therefore, need a suitable and viable alternate protein supplement to groundnut cake or full fat soybean (extruded). Among the alternatives cotton seed meal (solvent extracted) is one which contain 38-44% crude protein, though it contain less protein than groundnut cake (47%) but matches to groundnut full fat as a protein source (38%). It is rich in protein, energy, vitamin and the various nutrients required for the growth of the animal. Cottonseed cake is a traditional protein and energy supplement in sheep ration and as an alternative to groundnut cake contains 68.31% total digestible nutrients (TDN), 38.03% crude protein (CP), 34.92% neutral detergent fiber (NDF) and 20.37% non-fibrous carbohydrates (Detmann, Valadares, Pina, Campos, Paulino, Oliveira and Silva 2006). Sehgal and Makkar (1994) reported that cottonseed cake (undecorticated) has higher degradable protein (47.0%) compared to groundnut cake.

Previous studies by Osti and Pandey (2006) reported positive results when cotton seed meal is supplemented on ruminant animal diet. It also has good palatability and is available at a lower cost than soybean meal, thereby making its use in animal feed a viable alternative (Lana, 2000)

This study was therefore, carried out to determine the effect of CSC as replacement for GNC on the growth performance of growing sheep.

Materials and Methods

The experiment was conducted between April-June, 2018 at the Experimental Unit of the Department of Animal Science Ahmadu Bello University, Zaria. Zaria is located within the Northern Guinea Savanna Zone of Nigeria. It is located on latitude 110 33' N and longitude 70 42'E and at a height of about 22, 100m above sea level. The climate is relatively dry with a mean annual rainfall of 1102 to 1904 mm, occurring between the months of April and September. The mean temperature fluctuates from 31^0C (88^0F) maximum in dry season to 18^0C (65^0F) minimum in wet season (Google Earth, 2012).

Experimental Animals

Twelve (12) growing sheep from a local market in Zaria was used for this study, among which 8 are male while 4 are females. The animal average age was 10 months. The animals were divided into four (4) treatments; each treatment having three (3) animals, in a Completely Randomized Block Design (CRBD) and allowed a period of 1 week adjustment period in their different pens after undergoing deworming using appropriate wormer, prophylactic treatment consisting Ivomectin 0.5ml/25kg body weight was given subcutaneously against ecto and endo parasites, and Terramycin 1mg long acting antibiotic, 1.0ml/10kg body weight given intramuscularly against bacterial infection.

Treatments

Four experimental diets consisting of maize offal, Brewer's dry grain (BDG), Groundnut cake (GNC), Cotton seed cake (CSC), bone meal and salt was formulated and used for this study. CSC was used to replace groundnut cake at varying level of 0% to 100% in the treatments 1 to 4 respectively.

Feed and Feeding:

The animals were individually offered the experimental diets and beans offal as basal diet. Each animal received a total of 5% of their body weight as daily allowance out of which the experimental diets and beans offal were 40% and 60% respectively. Experimental diets where given at 07:00 hours, while the beans offal was offered 3 hours later daily. This was deliberate to encourage

maximum intake of the experimental diets. The left- over from each animal was measured and recorded the following day before feeding throughout the experimental period. The feeding trial lasted for 12 weeks (84 days) and records of feed intake, body weight, feed conversion ratio and cost of feeding were taken. Animals were weighed weekly using a hanging scale. The experimental diet and beans offal were adjusted weekly at 5% of body weight. The quantities of feeds offered and left-over were weighed daily to determine feed intake. Fresh clean drinking water was offered daily free-choice to the animals.

Table 1: Composition of Experimental diet Formulated with varying levels of Groundnut Cake replaced with Cotton Seed Cake

	Treatment (% level CSC replacement of GNC)			
Ingredient(kg)	**0**	**50**	**75**	**100**
Maize offal	60.0	60.0	60.0	60.0
BDG	17.0	17.0	17.0	17.0
GNC	20.0	10.0	5.0	0.0
CSC	0.0	10.0	15.0	20.0
Bone meal	2.5	2.5	2.5	2.5
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

GNC: Groundnut cake, BDG: Brewer's Dry Grain, CSC: Cottonseed cake

Statistical analysis

All data collected from this study were subjected to analysis of variance using (ANOVA) and their means compared using Duncan Multiple Range Test (SAS, 2005). Proximate analysis of feedstuffs and diets, feed intake, body weight and body weight changes and cost- benefit analysis of feeds was done.

Results and discussions

The crude protein content of the diets analyzed was at the range of 9.41 – 15.60%. The above levels of CP falls below the levels reported by Thomas (2014), according to this author the CP requirement of growing lamb should be 22-25%, with a TDN of 70-80%. Also the chemical analysis of the experimental diets showed that increasing levels of CSC resulted in decreased level of crude fiber (CF)(Table 2). This result is contrary to that of Sehgal and Makkar (1994), who reported that CF in CSC is significantly higher than that of GNC. This difference in CF in CSC and GNC may be attributed to different methods of processing these feed ingredients or on the variety of cotton seed used in producing CSC.

Table 2: Proximate and Chemical Composition of Basal Diet and Diet containing different levels Cotton Seed Cake as Replacement for Groundnut Cake

	Treatments (levels of cotton seed cake)				
Parameters	**Basal diet**	**T1 (0%)**	**T2 (50%)**	**T3 (75%)**	**T4 (100%)**
DM (%)	91.15	89.25	89.90	90.27	90.86
CP (%)	18.79	15.60	13.65	11.25	9.41
CF (%)	21.45	13.21	10.41	10.47	9.35
EE (%)	0.93	4.51	2.34	2.00	0.95
Ash (%)	8.60	7.14	8.03	8.49	8.69
NFE (%)	50.23	59.54	65.57	67.76	71.70

DM= dry matter, CP= crude protein, CF= crude fiber, EE= ether extract, NFE= nitrogen free extract. Source: Biochemical Laboratory Dept. of Animal Science, ABU, Zaria (2018).

Table 3: Performance of Growing Sheep fed diets containing different Levels of Cotton Seed Cake (GNC) as replacement for Groundnut Cake (CSC):-

Treatments (%) Level of Cotton Seed Cake replacement of Groundnut Cake						
Parameter	**0**	**50**	**75**	**100**	**SEM**	**LOS**
Initial weight (kg)	16.67	16.33	16.16	14.00	1.76	NS
Daily weight gained (g)	82.03	63.50	71.43	50.27	12.48	NS
Final Body weight (kg)	18.50^{c}	19.33^{bc}	20.33^{b}	21.83^{a}	0.65	*
Basal diet intake (kg)	30.11^{a}	26.36^{ab}	25.52^{b}	20.17^{c}	1.20	*
Concentrate intake (kg)	17.22^{a}	16.46^{a}	13.48^{b}	17.92^{a}	0.80	*
Daily feed intake (g)	751.27^{a}	689.53^{a}	679.57^{a}	534.07^{b}	21.73	*
Total feed intake (kg)	47.33^{a}	42.81^{a}	33.65^{b}	43.44^{a}	1.37	*
Feed Conversion Ratio	8.83^{ab}	10.89^{ab}	7.72^{a}	18.93^{b}	3.12	*

kg = kilogram, g = gram, a,b,c means in the same row bearing different superscripts are significantly different (P<0.05) level, * = significant at P<0.05; and NS = not significant at P>0.05. SEM= Standard error of means, LOS= Level of significance

Table 3 shows the feed intake and growth performance of growing sheep fed the experimental diets. There were no significant difference in initial weight and daily weight gained. But there was a significant difference in Final body weight, Basal diet intake, Concentrate intake, Daily feed intake, Total feed intake and Feed Conversion Ratio. However, the intake of the concentrate declined as the level of supplementation with CSC increased from 16.46kg in 50% CSC to 17.92kg in 100% CSC level. According to Van Soest (1994), Orskov (2000) and McDonald *et al.* (2002), the factors that could affect the nutrient digestibility would be feed intake, the proportion and degradability of the cell wall, the composition of the feed component, feed composition, feed preparation, protein-to-energy ratio, rate of degradability and factors inherent to the animal.
The final body weight gain of the experimental animals was found to be 18.50 kg in T_1, 19.33 kg in T_2, 20.33 kg in T_3 and 21.83 kg in T_4 respectively. Total weight gained in T_1 was 1.83 kg, 3.00 kg in T_2, 4.17 kg in T_3 and 7.83 kg in T_4 respectively. This implied that the final body weight of animals fed with CSC was highest at 100% replacement level. Feed conversion ratio as seen in Table 3, was highest in treatment 3 where GNC was replaced with 75% CSC. This finding agrees with that of Osti and Pandey (2006) who reported that production performance of ruminant in terms of body weight gain are not affected but rather improved with supplementation with CSC meal.

Table 4: Cost Benefit Analyses and Best Level of Cotton Seed Cake (CSC) for profitable Sheep Production

Treatment (% levels of CSC replacement of GNC)				
Parameter	**T1 (0)**	**T2 (50)**	**T3 (75)**	**T4 (100)**
Weight gained (kg)	5.17	4.00	4.50	3.17
Total feed intake (kg)	47.33	42.81	33.63	43.44
Feed conversion ratio	8.83	10.89	7.73	18.93
Feed cost (₦/ kg)	83.25	78.80	76.80	74.80
Cost of feeding (₦)	3,959.2	3,373.4	2,584.3	3,241.1
Return from sales (₦)	6,180	4,800	5,400	3,804
Gross margin	2,220.8	1,426.6	2,815.7	562.9

Cost of feed = feed cost * feed intake; Return = weight * cost of a kg of mutton (1200), Gross margin = Return – cost of feeding.

The cost and return analysis of feeding Cotton Seed Cake (CSC) to growing sheep is shown in Table 4. The result showed that feed cost per kg decreased as the level of CSC increases in the experimental diet. This is due to the fact that CSC is less expensive compared to GNC and it can easily be used by sheep as a ruminant animal.

The cost feeding of growing sheep as presented in Table 4 showed that ₦3,959.2 was spent to feed the control group with a gross margin of ₦2,220.8. The sheep fed 50% CSC was fed at the cost of ₦3,373.4 with the gross margin of ₦1,426.6. Sheep fed 75% CSC was fed at the cost of ₦2,584.3 with the gross margin of ₦2,815.7 while the cost of feeding 100% CSC to growing sheep was ₦3,241.1 with a gross margin of ₦562.9.

The result obtained in this study showed that growing sheep performed best at 75% level of inclusion of CSC, considering the weight gained (kg) and the cost of feeding. This may be due to effective utilization of feed nutrients in the diet. This finding is in line with that of Chowdhury (2001) who reported that a minimum of 35% of CSC can be used to replace other sources of crude protein in the diets of ruminants without any negative effect on them.

Summary and Conclusion

Twelve growing sheep of average age of 10 months were used in a trial to determine the effect of CSC in the growth performance of growing sheep at 4 different levels. Beans offal was the basal diet while cotton seed cake and other ingredients were used to formulate the experimental diets. The diets were offered to animals at 5% of body weight after weighing them on a weekly basis. Proximate and chemical analysis of the experimental diets showed that CSC contains enough feed nutrients for proper nutrition of ruminants like sheep. It was concluded that performance of growing sheep fed varying levels of CSC was good and the best level of replacement of GNC was at 75% level. It was therefore, recommended that CSC can be used to reduce the high cost expended in feeding sheep in Nigeria; 75% replacement level gave a relatively better result in this experiment in terms of body weight gain and cost of feeding the animals.

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