Growth response, Carcass Yield and Meat quality of West African Dwarf sheep fed Graded level of Shea cake Meal

Abstract

Growth response, carcass characteristics and meat quality of West African Dwarf (WAD) sheep fed Shea Cake Meal(SCM) supplement was investigated. A total of 24 WAD sheep of average weight range of 11-12.65kg comprising of twelve (12) males and twelve (12) females were randomly allotted to four dietary treatments with six animals per treatment in a completely randomized design in a twelve (12) weeks experimental period. Treatment 1 was control and had no inclusion SCM. Treatments 2, 3 and 4 had 10%, 15% and 20% inclusion of SCM. Results were significantly affected ($P<0.05$) across treatments. Average weight gain ranged from 10.00kg (SCM-10) to 13.12kg (SCM-15). T3 recorded highest values for Average feed intake (AFI) at a record value of 63.50kg. T2 had the least Feed conversion ratio of 4.81. The carcass quality and sensory evaluation were significantly affected ($P <0.05$) across the treatments. Hot carcass weight (HCW) ranged from 18.90kg (SCM-10) to 20.85kg (SCM-15). Cold carcass weight recorded 18.05kg (SCM-10) and 19.95kg (SCM-20). Chilling loss recorded least value of 3.96 at SCM-15 inclusion level. Animals on SCM-15 inclusion recorded the highest value of 7.55, 7.25, for appearance tenderness and overall acceptability. SCM-20 had highest value of 7.50 for juiciness compared to SCM-10 and SCM-15 with record values of 6.80 and 7.20, respectively. The study showed that all dietary inclusion are satisfactory as feed for small ruminant without any deleterious effect on their performance. Inclusion level of SCM-15 supplement had highest overall performance when fed to (WAD) sheep.

Key words:WAD sheep**,** growth response, carcass characteristics, meat quality, shea cake meal.

INTRODUCTION

The major problem of ruminant in developing countries is inadequate supply of quality feed on a year round basis (1). This is as a result of poor quality of tropical grasses, during the dry season (2).Consequently, livestock production becomes very low both in quantity and quality, effect of which has resulted to inadequate consumption of protein of animal source to humans. Then the need for supplementation of natural forage with agro industrial by products such as residue from local farm as well as unconventional feed resource to improve livestock production cannot be

overemphasized, considering the increase in human population with their corresponding demand for animal protein. This becomes necessary due to the high cost of conventional concentrates required to boost the performance of these animals. Small ruminants play significant roles in animal protein generation via meat and milk production, as well a source of income to peasant farmers in rural communities. Improvements in performance of small ruminants using nutritious but yet untapped unconventional feed resource such as Shea cake is an effort in right direction. This crop discards have been studied to have potential benefit when used as feed ingredient in livestock production. Shea tree (*Vitellariaparadoxa*) which bears sheafruit, grows naturally in African savannah. The fruit has a thin nutritious pulp around a large, oil-rich kernel which is used to make shea butter. The fruit is tasty and rich in vitamins and antioxidants (3). The effluent of its fruit in the process of shea butter production solidifies; forming cake when dried. This cake is highly rich in nutrients, which instead of allowing it to be wasted and constitute nuisance can be utilized by the animals. This study therefore, aimed at investigating the potential of shea nut extracts as feed resources in the production and management of West African Dwarf (WAD) sheep.

Materials and Methods

Experimental site - The experiment was carried out at the small ruminant unit of Ladoke Akintola University of Technology, Ogbomoso, Oyo state. The location is on longitude $4^{o}5$' East of the Greenwich Meridian and latitude $8^{o}7$' North of the Equator in the derived savannah zone of Nigeria with a mean annual rainfall of 1247mm and mean annual temperature of about 27^{0}C. Laboratory analysis was carried out at the Animal Science Department laboratory, University of Ibadan

Preparation of Experimental Diets - Solidified effluent (Shea cake) was collected from Shea butter production factory in Saki, a popular community in Okeogun Area of Oyo State. The shea cake alongside cassava peels and palm kernel cakewere milled separately and mixed with other feed components, namely, wheat offal, Di-calcium phosphate, ruminant premix and salt. A diet tagged Shea Cake Meal (SCM) was then formulated at the inclusion level of 0, 10, 15 and 20% of shea cake, respectively, as contained in the table of gross composition of the experimental diets. Samples of the experimental diets were taken and stored in a covered plastic container for laboratory analysis; following the procedures of AOAC(4).

Sample collection: Samples were taken from four locations to ensure evenness and creates record for variation in the proximate if exists. The samples were collected from Ofiki, Ipapo, Ogbooro and Igbeti and each sample location represent a treatment before the best was selected and fed to the animal at varied levels.

Experimental Animal Management - A total of twenty four (24) growing West African dwarf sheep comprising of 12 males and 12 females weighing between 11 – 12.65kg were used for the study. They aged between 5-6 months as dentition was used to estimate the age. The experimental animals were purchased from Okeogun region of Oyo State of Nigeria. On arrival, animals were given prophylactic treatments, using standard procedure of health management but were introduced to the experimental diets two weeks before prior to the commencement of experiment and data recording after weight balance for even distribution. Four experimental diets Shea cake meal (SCM) at inclusion levels of 0,10, 15 and 20% were offered to the experimental animals in individual pen in a completely randomized design of 6 replicates per treatment. The experimental animals were allowed to graze on guinea grass paddock for 1 hour every day, followed by shea cake meal supplement at 5% of their body weight. The orts was weighed at 08:00am every morning and deducted from the quantity offered for intake determination prior to serving new feed daily. Individual animal was tagged for the purpose of identification. The feeding and relevant data collection lasted for 12 weeks.

Measurement of growth - Weight of individual animal was measured at the onset of the trial and subsequently on weekly basis. Feed was offered at 5% body weight of individual experimental animals. The intake and orts were measured daily to determine weekly average intake.Weights were taken weekly to determine growth change of the animals. Data collection lasted for 84 days.

Slaughtering, Processingof Carcass and Sensory Evaluation - At 84^{th} day, representatives from each treatment were randomly selected and weighed to obtained slaughter weight (SW), and thereafter slaughtered. After bleeding, the skin, head and limbs were removed before the carcass was eviscerated. The hot carcass weight (HCW) were obtained before the carcasses were taken to the cold chamber for 24hours at 4^0C for cooling to obtained cold carcass weight (CCW) and chilling losses (CL) was quantified using the formula of Maciel*et. al*. (5).

$$CL(\%) = \frac{HCW - CCW}{HCW} \times 100$$

However, hot carcass yield (HCY) and cold carcass yield (CCY) were computed using the formulas of Urbano*et. al*. (6).

$$HCY(\%) = \frac{HCW}{SW} \times \frac{100}{1}$$

$$CCY(\%) = \frac{CCW}{SW} \times \frac{100}{1}$$

Sensory Evaluation - Cooked meat from loin chops were served in plates to a 12member taste panel drawn from the staff and students population to judge the test for appearance, flavor, tenderness, juiciness and overall acceptability of meat samples on a 9- point hedonic scale where (1) corresponds to extremely dislike and (9) to extremely like. Panelists were trained prior to the evaluationtest.

Statistical Analysis - Data obtained were subjected to analysis of variance (ANOVA) using the procedure of SAS (7) package to determine the effect of dietary treatments on the various parameters studied. Significant means were separated using Duncan multiple range test of the same software at 0.05 significant level

Results and Discussion

Table 1 presents the proximate composition of shea caketaken from four locations in the Derived Savannah Area of Nigeria, since each location represent a treatment.The dry matter value ranges from 87.02 – 89.65%; with the sample on T3(Sample from Ogbooro) recording the highest value (89.65%). T2 (Ipapo) recorded the least dry matter of 87.02 %. The least value recorded by T4 was just in comparison among samples from other location as its value (87.02%) and not of less quality for use in ruminant feed composition or formulation. The dry matter value across the treatment is an indication of good shelf life and storage value of shea cake. Crude protein (CP) values on the other hand recorded a value range of 7.00 (T2) - 8.75 (T3). This agreed with the findings of Enaberue*et. al*. (8) in a research on shea fruit pulp. The CP values recorded justified shea cake as a good feed resource in ruminant nutrition. The ether extract (EE) recorded was

high across treatments. The values ranged from 19.20% (T4) – 22.00% (T2). This could be linked to the nature of shea tree (*Vitellariaparadoxa*); being an oil rich tree.Comparatively, Shea cake from Ogbooro (T3) had best results among other treatments, and was considered for use in this study at various inclusion levels.

Table 2 presents the gross composition of experimental diets. Shea cake at the inclusion level of 0, 10, 15 and 20% was mixed with other feed ingredients. These include wheat offal, Di-calcium phosphate, ruminant premix and salt to form experimental diets tagged shea cake meal (SCM).The weight change of the experimental animals were significantly different ($P<0.05$) across treatments (Table 3). Animals on all treatments recorded appreciable values for intake and weight gain with animals on 15% (SCM-15) having the highest value of average weight gain of 13.12kg comparedto T1, T2 and T4. The feed intake recorded across treatments reflects on the weight gained by the animals, as well as feed conversion ratio was an indication of good efficiency and availability of nutrients embedded in SCM to the animals which was maximally utilized by the animals. This result agreed with the findings of Okunlola(9) where Baobab fruit meal supplement was fed to Red Sokotosheep with highest weight gain of 13.3kg and Aina(10), where the best efficiency in goat was traced to feed supplementation. Results obtained in this study shows that shea cake meal supplement improved the performance of WAD sheep.

Table 4 presents carcass characteristics and sensory evaluation of West African Dwarf sheep fed shea cake meal. There were no significant difference ($P>0.05$) in the hot carcass and cold carcass weights of T2(10%) and T4(20%). The Hot Carcass Weight (HCW) is highest at T3 (SCM-15) with record value of 20.85Kg. This is higher than the value obtained by McGregor (11), 13.4kg for angora sheep with a live weight of 30kg, and carcass weight of 14kg in a study which involved grazing Saanen (diary) sheep. Meat consumers generally prefer lean meat. Butchers need consistent products that always meet specification, while producers of sheep for meat are in the business of growing saleable carcasses. According to the result obtained in this study, tissue composition highly affects commercial quality of the carcass at various level of SCM inclusion. This makes the experimental suitable as feed supplement in goat production for meat purpose. Study have shown that goat have muscle between 69-50% and 11.8% bone (12). SCM-15 in this study recorded the highest value of tenderness (7.25), appearance (7.55), and overall acceptability (7.25). Appearance (colour) is an important attribute that affects consumer purchase

and willingness to buy, Tenderness often affects consumer acceptability and satisfaction, the metabolic- biochemical reaction that happen after rigor mortis let a progressive tenderization (11)McGregor 1985). The sensory evaluation in this study clearly justified shea cake meal as a good supplement to promote quality of WAD sheep mutton. Worthy of note of the meat quality in thus study was appreciable reduction in odour associated with mutton with increase in level of SCM inclusion. This further led to high level of acceptability especially at T3 (SCM-15) inclusion level. This study has shown that an increase in shea cake meal supplement up to 20% of the total diet improves the carcass quality in terms of carcass yield and overall acceptability of West African Dwarf sheep.

Conclusion and Recommendation

The results from this study showed Shea cake meal as profitable supplement in WAD sheep diets as there was no deleterious effect on the performance of the experimental animals. Shea cake meal promotes rapid growth and as such makes it appropriate in fattening program. Its inclusion in ruminants feed will supply the nutrients required for healthy performance. Its useswould reduce cost of production because it is available free at shea butter production factory. Its use would reduce environmental pollution, thereby enhance promotion of health in humans. Supplementing WAD sheep feed with SCM increased the acceptability, table and market value of mutton. Its use in this experiment removed bias associated with mutton due to its odour which repels some consumers, thereby making them reject its consumption.

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Table 1: Proximatecomposition of Shea Cake (SK) in the Derived Savannah Area of Nigeria

Parameters (%)	Ofiki (T1)	Ipapo (T2)	Ogbooro (T3)	Igbeti (T4)
Dry matter	89.15^{b}	88.50^{d}	89.65^{a}	87.02^{c}
Crude protein	7.60^{b}	7.00^{c}	8.75^{a}	7.26^{ab}
Crude fibre	4.00^{b}	4.00^{b}	4.50^{a}	4.22^{ab}

Ether extract	20.00[b]	22.00[a]	21.50[a]	19.20[c]
Ash	4.55[b]	4.60[b]	5.05[a]	4.30[c]
Moisture	10.85[b]	11.50[b]	10.35[c]	12.98[a]
Nitrogen free extract	53.00[a]	50.90[b]	49.85[c]	52.04[a]

[abcd] *Means within each row with different superscripts are significantly different (p<0.05*

Table 2 - Gross composition of experimental diets

Component/Treatment	**T_1 (SCM-0)**	**T_2 (SCM-10)**	**T_3 (SCM-15)**	**T_4 (SCM-20)**
Shea cake	0.00	10.00	15.00	20.00
Salt	1.00	1.00	1.00	1.00
Ruminant premix	0.50	0.50	0.50	0.50
Di-calcium phosphate (DCP)	0.50	0.50	0.50	0.50
Palm Kernel Cake (PKC)	5.00	5.00	5.00	5.00
Wheat offal	18.00	18.00	18.00	18.00
Cassava peel	75.00	65.00	60.00	55.00
Total	100.00	100.00	100.00	100.00

SCM-0: diet without Shea cake , SCM-10: diet with 10% Shea cake, SCM-20: diet with 20% Shea cake.

Table 3 : Intake, growth and feed conversion ratio of West African Dwarf sheep Shea cake meal

	T R E A T M E N T S				
Treatment/Parameter	**T_1 (SCM-0)**	**T_2 (SCM-10)**	**T_3 (SCM-15)**	**T_4 (SCM-20)**	**SEM**
Initial body weight (kg)	12.50[a]	11.00[b]	12.65[a]	11.80[b]	1.50
Final body weight (kg)	22.50[c]	23.90[b]	25.77[a]	23.85[b]	1.26
Average feed intake (kg)	60.20[c]	62.00[b]	63.50[a]	60.75[c]	5.00
Average weight gain (kg)	10.00[c]	12.90[b]	13.12[a]	12.05[ab]	1.05

Feed conversion ratio (FCR)	6.02[a]	4.81[b]	4.84[b]	5.04[b]	0.75

[abcd] *Means within each row with different superscript are significantly different (P<0.05)*

SCM-0: diet without Shea cake , SCM-10: diet with 10% Shea cake, SCM-20: diet with 20% Shea cake.

Table 4 : Carcass characteristics and sensory evaluation of West African Dwarf sheep fed Shea cake meal

Parameters	Treatment diets			SEM
	(SCM-10)	**(SCM-15)**	**(SCM-20)**	
Carcass characteristics				
Slaughter weight (kg)	23.90[b]	25.77[a]	23.85[b]	1.05
Hot carcass weight (kg)	18.90[b]	20.85[a]	18.95[b]	0.75
Cold carcass weight (kg)	18.05[b]	19.95[a]	18.20[b]	0.05
Chilling losses (%)	4.50[a]	4.32[a]	3.96[b]	0.55
Hot carcass yield (%)	79.08[b]	80.91[a]	79.45[a]	1.00
Cold carcass yield (%)	75.52[c]	77.42[a]	76.41[b]	0.75
Sensory evaluation				
Appearance	7.20[b]	7.55[a]	7.50[a]	0.25
Flavour	6.95	7.00	7.00	0.35
Tenderness	6.50[c]	7.25[a]	7.00[b]	0.45
Juiciness	6.80[c]	7.20[b]	7.50[a]	0.20
Overall acceptability	6.00[b]	7.25[a]	7.00[a]	0.45

[abc] Means with different superscripts along the same row are significantly different ($P < 0.05$). SEM = standard error of mean. SCM-0: diet without Shea cake , SCM-10: diet with 10% Shea cake, SCM-20: diet with 20% Shea cake.