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Relationship among Body Weight, Testicular Traits and Linear Body Measurements of Red Sokoto Bucks Fed Different Levels of Sabara (*Guiera senegalensis*) Leaf Meals

Research Article

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ABSTRACT

This study was undertaken to investigate the effect of sabara leaf meal on body weight, testicular traits and linear body measurements. Live body and testicular measurements (body weight, height at withers, body length, heart girth, testicular circumference and testicular length were monitored on Red Sokoto bucks). Bucks were managed in a complete randomized design with 4 treatments and replicates. The sabara leaf meal (SLM) was fed at concentration of 0, 10, 20 and 30% in treatments 1, 2, 3 and 4 respectively. Bucks fed diets with 10-30% SLM gained weight ($P<0.05$) better than those fed the control diets. The body length, height at withers and testicular circumference all increased with level of SLM in the diets with bucks on 20% SLM being heavier, however heart girth and testicular length were not affected by the dietary treatments. All phenotypic correlations between body and testicular measurements were positive and significant ($P<0.01$). The highest correlation coefficient was found between testicular circumference and body weight. It could be concluded that SLM inclusion from 20-30% level gave high growth performance in terms of body and testicular measurements without any adverse effect on performance. More research is therefore needed to examine the fertility of bucks fed sabara leaf meal.

KEY WORDS body measurements, Red Sokoto goats, sabara, scrotal circumference.

INTRODUCTION

Goat production in recent times has received a renewed interest as it occupies a strategic position in the socio-economic life of the people of Nigerian villages. They are kept primarily for meat and contribute substantially to household income and food security in most rural areas (Raji *et al.* 2008). Of the three breeds of goats in Nigeria, Red Sokoto goats are the most predominant and widely used and distributed in the northern savannah belt of the country (Ngere *et al.* 1984). The availability of feed resources and their rational utilization for livestock and poultry represent possibly the most compelling task facing animal scientists in Nigeria and indeed most part of the developing countries of the world. In Nigeria today, there has been considerable growth in sheep and goat production but feed deficit represents a major constraint to animal production. Therefore it is imperative to look inwards for alternatives to the conventional feed resources by exploring feed materials that are not useful to human (Aletor and Ogunyemi, 1990; Owen *et al.* 2008). *Guiera senegalensis* is a member of family *Combrataceae* and is known locally as Sabara in northern Nigeria. It is a multipurpose shrub of the Sahel and Savannah region of west and central Africa

(Sanon and Laden, 2009; Das, 2009). Several literature reports that it has a wide range of traditional uses in both humans and animals to treat various illness. Some studies stated that the macerated leaves of the plant were used orally for the treatment of febrifuge as well as for hyperglycaemia and hypertension whereas the roots are used mainly as antileprotic agents. Silva *et al*. (1997) claimed that the plant is used by Fulani traditional healers to treat several disorders including veneral diseases. Furthermore, it was reported that *Guiera senegalensis* is used in animal diets aimed at increasing body weight, reproductive capacity and milk secretion in animals (Kerharo and Adams, 1974). However, research showed all extract from *Guiera senegalensis* inhibited the growth of Staphylococcus aureus, Salmonella typhi, Escherichia coli at all concentration (Onwuliri, *et al*. 2009).

Testicular traits such as testicular diameter, testicular length, scrotal circumference and scrotal length are used as indirect selection criteria for genetically improving fertility (Koyuncu *et al*. 2005). The scrotal circumference (cm) is the most accurate indicator of testicle size. It has been shown that testicular growth and development are closely related to body size. More so, Coulter and Foote (1977), Blockey (1980) and Bitto *et al*. (2006) reported that large testicular sizes are connected with the enhanced sperm production. Similarly, Bongso *et al*. (1984) and Raji *et al*. (2008) reported that males with higher values of testicular parameters had higher body weight. Body weight is often the most common and informative measure of animal performance (Adeyinka and Mohammed, 2004). Body size and shape (Conformation) as important traits in meat animals had been largely estimated quantitatively by scale weights, generally described by visual appraisal, given rise to objective scores and such description as blocky, rangy, compact etc.

Therefore, body weight has been found very effective in assessing the reproductive efficiency and performance in goats and it provide richly obtainable informative measures for selection, feeding and health care (Thiruvenkanden, 2005; Raji *et al*. 2008). Linear body measurement has been used to characterised breed, evaluate breed performance and predict body weight of animals (Ibe and Ezekwe, 1994; Ozoje and Herbert, 1997). This latter report is attributed to the high genetic correlations between body weight and linear body measurements (Obike *et al*. 2010). They further reported that the use of linear body measurement to predict that body weight of animals is perceived more reliably compared to the use of weighing scales which could introduce biases as a result of feed in the guts. In addition, body measurements are important data sources in terms of reflecting the breed standard (Riva *et al*. 2002) and are also important in given information about the morphological structure and development ability of the animals. Therefore, in most of the related studies, body weight, age and testicular characteristics have been considered in predicting equations (Rege *et al*. 2000; Raji *et al*. 2008). These measurements provide evidence for the growth of the breed and the properties that change with environmental effect and feeding factors. The evaluation of testicular characteristics and linear body measurements of Red Sokoto goats fed different level of Sabara leaf meal (SLM) will provide valuable information for its assessment and proper use as feed ingredients in ruminant feed, since there is very little information on the effect of Sabara on testicular and linear body measurements in goats. The current study was designed to determine the relationship between testicular traits, body weight and linear measurements of goats fed different levels of Sabara leaf meal.

MATERIALS AND METHODS

Location and climate

This study was carried out at the Small Ruminant Unit of the Teaching and Research Farm, Department of Animal Science, Kano University of Science and Technology, Wudil, located in the Sudan Savannah Region of Nigeria. The site is situated on latitude 12 ˚58 N and between longitudes 8 ˚25 E. The range of annual temperature and relative humidity is about 38-43 ˚C and 40-51% respectively. It has a mean annual rainfall ranges of 850-870 mm from May-October with a peak in August. Three distinct seasons are however, recognized viz: dry cold (October-January), dry hot (February-May) and wet (June-September).

Processing of leaf meals

Fresh matured Sabara (*Gueira senegalensis*) leaves were harvested in and around the Wudil town. The leaves were air dried for 7-9 hours every day for about 7 days until they became crispy while retaining the greenish coloration. The air dried leaves were then milled, using a hammer mill to produce Sabara leaf meal. Where hammer mill is not available, dried Sabara (*Gueira senegalensis*) leaves can be given as whole.

Experimental diets

Four experimental diets were formulated (Table 1) to contain 0% (control), 10, 20 and 30% Sabara leaf meal (SLM) for treatment 1, 2, 3 and 4 respectively.

Experimental goats

Twenty four post-pubertal goats Red Sokoto bucks aged between 8-12 months with body weights ranging between 12 and 14 kg were used for the experiment. The animals were purchased from the market and local households.

They were quarantined for 2 weeks before they were allowed into the goat pens of the research unit. Bucks were examined for any physical defects especially the testicles before they were purchased to ensure normal descent of the two testicles.

Goat management

The bucks were managed under intensive system in a cross ventilated pen within the animal house. They were supplemented with mineral salt lick. Routine health care practices such as vaccination / medication, ecto-parasite control and de-worming were carried out. Animals in treatment 1 were fed on the basal diet for the whole period of the experiment (no *Gueira senegalensis* leaves supplimentation). Animals in treatment two, three, and four were offered 100, 200, and 300 g/head/day of sun dried SLM supplement. They also underwent preliminary feeding trial using the basal diet for one week, to ascertain their average basal diet intake. Fresh drinking water was provided *ad libitum.* The experiment lasted for twelve weeks.

Chemical analysis of the ingredients and diets

Proximate analysis procedure was used in determining the percent crude protein (CP), dry matter (DM), crude fibre (CF), ether extract (EE) and ash contents of both the Sabara leaf meal and the diets (Table 1). The chemical analysis was carried out according to the AOAC (2000) procedure.

Table 1 Ingredients composition of experimental diets fed to Red Sokoto bucks

	Diets			
Ingredients	**T_1**	**T_2**	**T_3**	**T_4**
Maize	10.00	10.00	10.00	10.00
Cotton seed cake	16.00	13.00	10.00	0.00
Sabara leaf meal	0.00	10.00	20.00	30.00
Rice bran	10.00	10.00	10.00	10.00
Wheat offal	27.00	26.00	27.00	22.00
Cowpea husk	30.00	20.00	10.00	10.00
Chaff	6.50	10.50	12.50	17.50
Salt	0.50	0.50	0.50	0.50

Data collection

Linear body measurements

Linear body measurements and body weights were taken at two (2) weeks interval for a period of twelve (12) weeks. The body weight (BWT) was taken using a hanging scale. The animals were turned on their back in a Hessian bag and the weight taken as the difference between the final combined weight and the weight of the bag. Linear measurements were taken with the aid of a measuring tape. All measurements were done in the morning before feeding the animals. Each animal was gently restrained to hold it in an unforced position while taking the measurements. The linear traits studied were:

Body length (BL): measured as the distance between the occipital protuberances to the base of the tail.

High at withers (HAW): measured vertically as the distance from the surface of a platform to the withers using a metal measuring ruler.

Heart girth (HG): measured by taking the measurements of the circumference of the chest with a tape rule.

Testicular measurement

The testicular dimensions studied were scrotal circumference (cm) and testicular length (cm). The scrotal circumference (SC) was measured as per method recommended by the Society of Theriogenology.

The testes were first retracted into the distal part of the scrotum and its circumference was measured with a flexible tape at the widest scrotal diameter after both testicles have been positioned beside each other in the scrotum to prevent separation of the two testicles. The length of the testes (TL) was measured with a flexible tape after forcing it against the scrotum.

Experimental design

The animals were allocated to into four treatment groups of three replicates each containing 2 bucks. There were thus 6 bucks per group in the Completely Randomized Design experiment.

Statistical analysis

Data collected were subjected to Analysis of variance (ANOVA) using the general linear model (GLM) procedure of Statistical Analysis System SAS (1998). Were significant differences were observed between treatments, the means were compared using Duncan multiple range test (Duncan, 1955). The following models were used.

$$Y_{ij} = \mu + T_i + E_{ij}$$

Where:

Y_{ij}: observations.

μ: overall mean.

T_i: treatment ($_i$=1, control, $_i$=2, 10% SLM, $_i$=3, 20% SLM and $_i$=4, 30% SLM).

E_{ij}: experimental error.

RESULTS AND DISCUSSION

The chemical composition of the experimental diet is shown in (Table 2). The crude protein (CP) content of the diet was approximately 16%. The CP value of SLM in the present study (17.17) was higher compared to the treatment diets. Our diet had a higher crude protein content than recommended by ARC (1980) and NRC (1985) for optimum

microbial gut activities. Some studies however indicated that the ARC and NRC levels are too low and suggests that 10-12% CP in the diet is necessary for better production in ruminant.

Table 2 Chemical composition of the experimental diets and Sabara leaf meal (SLM)

	Treatment (diets)				
Constituents (%)	**T_1**	**T_2**	**T_3**	**T_4**	**SLM**
Dry matter (DM)	96.90	97.10	96.70	97.70	98.10
Crude protein (CP)	15.40	15.80	15.90	16.20	17.17
Crude fibre (CF)	33.00	25.00	29.00	32.00	28.00
Ether extract (EE)	3.00	4.00	3.00	3.00	3.00
Ash	3.00	3.00	4.00	3.00	3.00
Moisture	3.10	2.90	3.30	2.30	1.90

SEM: standard error of the means.

Therefore, the experimental diet of the current study likely provided adequate nitrogen for the rumen microbes to maximally digest the dietary fibres and thereby generating adequate levels of volatile fatty acids (Lamidi *et al*. 2010). The dry matter (DM) contents which varied from 96.70-98.10 was quite high. The dry matter (DM) content which appreciates with increasing level of SLM in the diet was higher compared with the ranges of 92.8-93.6% (Turner *et al*. 2005) or 93.1-95.2% (Belewu and Yahaya, 2008). The highest crude fibre (CF) level was recorded in diet T_1 followed closely by diet T_4, T_3 and T_2 in that order. The crude fibre content in this experiment was higher than the result reported for goat diets (9-11.1%) (Okoruwa *et al*. 2012) probably due to differences in non-conventional protein fractions. The ether extract (EE) or ash level observed ranged from 3.00-4.00. This was higher than the values reported by Abbator, (2013). The highest moisture content was recorded for diet T_4. However, the moisture content of the latter experimental diet was higher than that of the Sabara leave meal in our study (2.3-3.3%).

Table 3 shows the mean body weight, linear body measurements and testicular traits of different groups of the Red Sokoto goats. The inclusion levels of sabara leaf meal in the diets of red sokoto goats resulted in significantly ($P<0.05$) higher body weight than the control goats. The increase in body weight across the dietary treatment groups (1-4) observed in this study implied that there is efficient utilization of the feed, since growth rate was generally lower in the control group (T_1) than in bucks fed sabara leaf meal. This is in agreement with the reports of Hassan (2011) that fed goats with different levels of groundnut haulms. Since all the diets adequately met the recommended nutrients for growing male goats, the above effect is very likely caused by SLM since it posses antibacterial property. It was earlier reported (Onwuliri *et al*. 2009) that phytochemical screening of the powdered from the leaves of *Gueira senegalensis* showed it contain resins, alkaloids, tannins, saponins, glycosides and terpenes, possibly this could explain reason for the somewhat curvilinear response to T_4 (30% SLM).

Table 3 The effect of dietary treatment on body weight, body and testicular measurement of Red Sokoto bucks

	Treatments (diets)				
Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Mean initial body weight (kg)	11.50	11.63	11.43	12.07	0.42^{ns}
Final body weight (kg)	14.00^{b}	15.60^{a}	16.67^{a}	15.87^{a}	0.71^{*}
Body length (cm)	40.38^{b}	44.25^{a}	44.13^{a}	43.50^{ab}	1.84^{*}
Heart girth (cm)	54.38	55.13	57.12	57.25	1.95^{ns}
Height at withers (cm)	54.13^{ab}	52.63^{b}	56.50^{a}	56.50^{a}	1.40^{*}
Testicular circumference (cm)	19.00^{b}	18.75^{b}	20.25^{a}	19.86^{ab}	0.65^{*}
Testicular length (cm)	12.50	12.00	11.88	12.13	0.77^{ns}

The means within the same row with at least one common letter, do not have significant difference ($P>0.05$).
SEM: standard error of the means.

The inclusion levels of SLM in the diets also tend to increase height at withers (HAW) with T3 and T4 (56.50) being superior to the control. The results of feeding various level of SLM in this study had significant ($P<0.05$) effects on wither heights of bucks, indicating that an increase in the level of SLM inclusion leads to an increase in the body measurements of the animals. The results of the present study corroborate the findings of Nora and Mukherjee (1997) and Hassan (2011). Similarly, significant difference ($P<0.05$) was obtained for testicular circumference among the treatment groups. Bucks on 20% SLM supplementation had the highest value, but similar to those on 30% SLM. Animals on 10% SLM supplementation had the least value for testicular circumference. The effect of feeding SLM in this study significantly improved testicular circumference of the experimental animals. This is in agreement with the findings of Negussie *et al*. (2000) in Ethopian highland rams fed different levels of Leucaena leaf hay as supplement. Similar findings had been reported by Tegegne *et al*. (1995) who indicated an increase in testicular growth rate of bulls from 0.31 to 0.38 mm/day as a result of protein supplementation. The body length of the animals in treatment groups (2-4) were similar and significantly ($P<0.05$) superior to the control group (T_1). The significantly longer body length of goats in the present study supports the finding of Nora and Mukherjee (1997). However, the inclusion of SLM in the diets of bucks did not result in any significant difference from the control diets in heart girth and testicular length. The correlation coefficient for the body weight and testicular measurements is presented in Table 4. In general, all the parameters were significant ($P<0.01$) and positively correlated at each other. As shown, body weight was highly ($P<0.01$) correlated with body and testicular measurements ($r=0.467-0.951$).

Table 4 Correlations matrix between body weight, body measurement and testicular dimension of Red Sokoto bucks

	BW	BL	HG	HAW	TC	TL
Body weight	-	-	-	-	-	-
Body length	0.84**	-	-	-	-	-
Heart girth	0.89**	0.77**	-	-	-	-
Height at withers	0.46**	0.65**	0.62**	-	-	-
Testicular circumference	0.95**	0.57**	0.69**	0.79**	-	-
Testicular length	0.84**	0.60**	0.51**	0.64**	0.82**	-

** (P<0.01).

Of the body and testicular measurements, heart girth and testicular circumference respectively, were the most related traits to body weight and the correlation between these two traits were (r=0.891 and 0.951) respectively, indicating strong relationships or degree of association between those variables. The heart girth in the present study was found to predict body weight with higher precision and also better than the other measurements (e.g. height at withers and body length). This observation agrees with the reports of Afolayan *et al*. (2006) in Yankasa sheep. Similarly, researchers (Sengonca and Gucuk, 1991; Ozturk *et al*. 1994; Boztepe and Dag, 1995) stated that live weight could be estimated accurately using the heart girth parameters in sheep and goat. Thus, measurements of girth may be a better indicator of weight than height as suggested by Vargas *et al*. (2000) for Brahman cattle.

The significant and positive correlation among testicular and body measurements in the present study had excellent similarity with the findings of Tabba *et al*. (2006) and Waheed *et al*. (2011). Therefore, selection for large testicular circumference and heart girth will result in faster growth and more weight of the bucks.

CONCLUSION

It can be concluded that sabara leaf meal in this study was a good nutrient for optimizing goat meat production. It is abundantly available and is a cheaper alternative source of protein. Up to 30% sabara leaf meal can be included in the goat diets without any adverse effect on growth and performance. More so, the high correlations between body weight, testicular and body measurements would imply that the live weight could be predicted fairly accurately from both heart girth and testicular circumference than other body measurements, considering the correlation coefficient in Red Sokoto bucks.

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