



ASSESSMENT OF TESTICULAR TRAITS OF UDA RAMS FED GRADED LEVELS OF PARKIA BIGLOBOSA (AFRICAN LOCUST BEAN) FRUIT PULP IN DRY SUB-HUMID ZONE OF NIGERIA

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ABSTRACT

An experiment was conducted to evaluate the effect of varying levels of *Parkia biglobosa* yellow pulp on the performance of Uda rams. The animals were fed diets containing 0, 10, 20 and 30% inclusion levels of *P. biglobosa* yellow pulp in a completely randomised experimental design replicated four times. Data were collected for 12 consecutive weeks on rectal temperature, and testicular traits. Result indicated no significant difference between the treatments on all the testicular parameters ($P>0.05$). However, there were significant difference in rectal temperature ($P<0.05$). It was concluded that the yellow fruit pulp of *Parkia biglobosa* could be incorporated up to a level of 30% in the diet of sheep without deleterious effect to the productive and physiological functions of the animals.

KEYWORDS: Testicular traits, Uda Rams, *Parkia biglobosa*, fruit pulp.

Introduction

Reproductive well-being and performance of farm animals is largely dependent on their nutritional status. It is well documented that adequate nutritional management is crucial for successful mating in sheep flocks (Fernandez et al., 2004; Smith and Akinbamijo, 2000). Several studies have documented the interrelationship between energy intake and reproductive performance in adult rams (Braden et al., 1974; Murray et al., 1990; Rowe and Murray, 1984) and there is no doubt that protein deficient feeds can reduce semen quality and sexual activity (Brown, 1994; Okolski et al., 1971). Carbohydrate, protein and nucleic acid metabolism and their deficiency may impair spermatogenesis, libido and fertility in males. Embryonic development and survival, post-partum recovery activities, milk production, offspring development and their survival could also be affected in females (Aljendro et al., 2002; Mitchell et al., 2003; Smith and Akinbamijo, 2000). The most important factor in determining profitability in sheep enterprise is production rate. General body growth and development are pre-requisite for the initiation of sexual function in males and females (Salisbury and VanDemark, 1961a). Testicular size may be useful as a selection criterion for improvement of the reproductive ability in rams. Body size on the other hand, is one of the primary factors to consider in any improvement measures for livestock. A quantitative measure for animal conformation is desirable, as it will enable reliable genetic parameters for traits to be estimated and permit its inclusion in breeding. It has already been established that nutrition affects testicular size (Braden et al., 1974; Martin et al., 1994; Masters and Fels, 1984; Moule, 1963; Parker and Thwaites, 1972; Salamon, 1964; Setchell et al., 1965), spermatozoa production (Cameron et al., 1988) and testicular morphometrics (Bielli et al., 2000; Mota et al., 2001; Salhab et al., 2002) in rams.

Generally, testicular measurements are important parameters utilized in breeding soundness evaluation. Knowing the body weight of an animal is important for a number of reasons such as breeding, correct feeding, health matters, growth as well as classification. Live body weight and testicular size have been found to generally indicate the production of viable spermatozoa by the male (Agga et al., 2011). The biometrical analysis of testicular development is of great importance since it is significantly correlated with reproductive activity (Emsen, 2005). Sperm competition is a common phenomenon across the animal kingdom and is recognized as a major factor in the sexual selection of males. Because the testes produce sperm and reflect investment in ejaculates, one of the predicted consequences of sperm competition is that the testes should be relatively large when the likelihood of sperm competition is high (Braden et al., 1974; Schulte-Hostedde et al., 2005). In the male for instance, there is the need to establish measurable criteria for judging breeding soundness and guiding selection of males for breeding. Since farmers may not be in a position to test ejaculate qualities of males before using them for breeding, a procedure that would utilize external testicular measure-

ments may provide a good guide to breeding soundness especially where males are reputed to have exceptionally high libido (Bolgen et al., 2010; Shoyombo et al., 2012; Ugwu, 2009). All else being equal, scrotal circumference as a highly heritable trait, could be used as an effective selection criterion in order to increase flock fertility and reduce the number of breeding rams required (Abbasi and Ghafouri-Kesbi, 2011).

Materials and Methods

Experimental Site

The study was conducted at the Usmanu Danfodiyo University Livestock Teaching and Research Farm. The farm is located within the main campus of the University at about 10km North of Sokoto Metropolis in Wamakko Local Government Area of Sokoto State. Sokoto is located in the Sudano-Sahelian zone in extreme North-Western part of Nigeria. It lies between longitudes 4°8'E and 6° 54'E and latitudes 12°0'N and 13°58'N and at altitude of 350m above sea level (Mamman et al., 2000). The average annual environmental temperature is 28.3°C (82.9° F). However, the maximum daytime temperature are most of the year generally under 40°C (104.0°F). The low humidity of Sokoto state makes the heat bearable. Heat is more severe in the state in March and April. But the weather in the state is always cold in the mornings and hot in the afternoons except during the hamattan period (SSMIYSC, 2010). The warmest months are February to April, where daytime temperature exceed 42°C (107.6°F) (SSMIYSC, 2010). The rainy season is from late May to October. Rainfall starts late and ends early with annual rainfall ranging between 500mm to 700mm. There are two major seasons in the state namely: wet and dry seasons. The dry season starts from October and last up to April, in some parts of the state may extend to May or June. The wet season on the other hand begins in most part of the state in May and last up to September or October (SSMIYSC, 2010). The hamattan, a dry, cold and fairly dusty wind is experienced in state between November and February of each year. Due to low humidity, Sokoto is more suitable for livestock production than for any other agricultural activity.

Sources and Processing of Experimental Feeds

The locust bean powder used in this experiment was purchased from Achida market in the outskirts of the metropolis. The remaining feed ingredients that included maize, rice offal, cowpea husk, premix, bone meal, salt, cowpea haulms, cotton seed cake and salt were purchased from Sokoto Kara market within the metropolis. Maize, cotton seed cake and cowpea hay are crushed to reduce their particle size.

Experimental Design and Diet Formulation

A completely randomized experimental design (CRD) was used in this experiment with number of animals representing replication and graded levels of *P. biglobosa* fruit pulp representing treatments. Five animals were allocated to each treatment each animal serving as rep-

licate. The weight of the animals was balanced between treatments. Each animal was housed in a pen measuring 2m 1m, which was previously disinfected. Four complete experimental diets were formulated with graded levels of locus bean fruit pulp at 0, 10, 20, and 30% inclusion levels. The four experimental diets are used to feed the animals. The diets were designated as treatments 1, 2, 3 and 4 in the experiments. Each group was assigned to one of the experimental diets and fed *ad libitum* in the morning for 12 weeks. Water was offered *ad libitum*. The gross compositions of the experimental diets are shown in Table 1. The diets were isonitrogenous and isocaloric.

Table 1: Gross composition of the experimental diets

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Locust bean	0	10	20	30
Maize	17.00	10.00	4.25	0.80
Cowpea husk	7.60	9.60	9.70	9.90
Cowpea haulms	17.20	17.70	17.70	7.50
Rice offal	12.45	5.45	0.15	3.30
Cotton seed cake	42.25	43.75	44.70	45.00
Salt	0.5	0.5	0.5	0.5
Premix	0.5	0.5	0.5	0.5
Bone meal	2.5	2.5	2.5	2.5
Total	100	100	100	100

Experimental animals and their management

The apparently healthy rams were after purchase stationed at the Livestock Teaching and Research Farm Usmanu Danfodiyo University Sokoto, for 7 days for adaptation and for Quarantine. The animals were dewormed using Albendazole[®] based on the manufacturer's recommendation; the animals received oxytetracycline injection for possible bacterial infection. The feeding pens were cleaned regularly and disinfected prior to the commencement of the experiment. Faeces and urine of the animals were removed every day from the feeding pens to ensure adequate hygiene, prevent ammonia accumulation and minimum discomfort of the experimental animals. Feed and water troughs were cleaned every morning before feeding.

Data Collection

Scrotal measurements

All the rams were weighed individually weekly, using a weighing scale. The mean weekly live weight of each treatment group was computed. Live weight, body length, heart girth, scrotal length and scrotal size are measured on weekly basis. Linear measurements (body length and hearth girth) were measured in centimetre (cm) using flexible tape as described by Alphonsus et al.(2009). Testicular length was measured with a flexible tape in cm as the distance along the caudal surface of the scrotum from its point of attachment to the tip of scrotum, testicular circumference was taken as the maximum dimension around the pendulous scrotum as reported by Akpa et al.(2006). Testicular width was obtained by dividing scrotal circumference by 2, testicular weight was obtained from the formula $TWT = 0.5533 \cdot TL \cdot TW^2$ (Bailey et al., 1996) where:

TWT= testicular weight

TL= testicular length

TW= testicular width and 0.5533 is constant,

So also the testicular volume was obtained from the formula

$TV = 1/6 \cdot \pi \cdot TL \cdot TW^2 \cdot 0.945$ (Stagger and Wrobel, 1994) where

TV= testicular volume

TL= testicular length

TW= testicular width

Rectal Temperature

Daily rectal temperature of each animal was recorded daily using digital clinical rectal thermometer. The mean rectal temperature is calculated on weekly basis.

Statistical Analysis

All the data collected are subjected to Analysis of variance using completely randomized design (Steel and Torrie, 1980). Least significant difference (LSD) was used to separate the means. Correlation analysis procedure was used to assess the relationship between the measured variables. Statview statistical package (SAS, 2002) was used in data analysis.

Results and Discussion

Rectal temperature and testicular measurements of Uda rams fed graded levels of *P. biglobosa* fruit pulp

Results (Table 2) show no significant difference ($P > 0.05$) between the treatments in scrotal length and circumference, testicular volume, testicular weight and width. Rectal temperature is significantly higher ($P < 0.05$) for animals in control diet (Treatment 1).

Table 2: Overall Rectal temperature and Testicular traits of Uda rams fed graded levels of *P. biglobosa* fruit pulp

Parameter	Treatments				SEM
	1	2	3	4	
Rectal Temperature °C	39.26 ^a	38.85 ^b	38.88 ^b	39.09 ^{ab}	0.24
Scrotal circumference (cm)	29.50	27.08	29.38	28.56	1.19
Scrotal length (cm)	19.13	16.43	18.42	18.08	1.18
Testicular width (cm)	14.75	13.54	14.69	14.28	0.43
Testicular weight x 10 ³ (g)	2.431	1.993	2.260	2.290	133.7
Testicular volume (cm ³)	141.77	117.23	134.32	134.86	5.61

a,b,c means in the same row with different superscripts are significant ($P < 0.05$) different

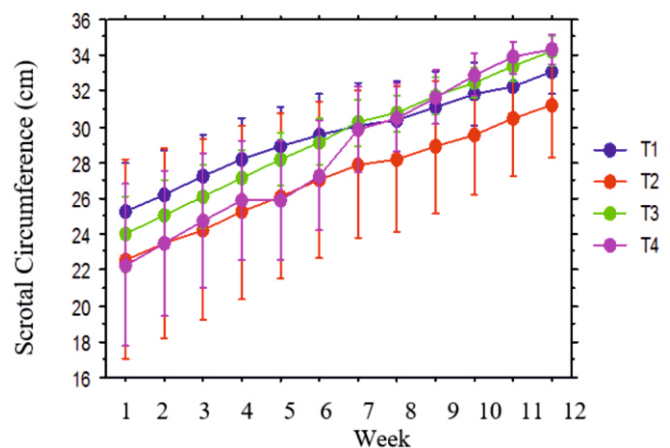


Fig 1. Scrotal circumference changes of Uda rams fed graded levels of *P. biglobosa* fruit pulp

Fig 1 indicated no significant difference ($P > 0.05$) in scrotal circumference for animals in treatments 2 and 4 from the beginning to week 6 the end of the experiment. There were no significant difference ($P > 0.05$) in scrotal circumference between animals placed on treatments 1, 3 and 4 from week 7 to week 10 and also between treatments 3 and 4 in the last two weeks of the experiments. There is a slight drop for scrotal circumference for animals placed on treatment 4 in week 5. The figure indicate a steady increase in scrotal circumference from the beginning to the end of the experiment for animals placed on treatments 1, 2 and 3 while for animals on treatment 4 a steady increase was observed from week 7 to the end of the experiment.

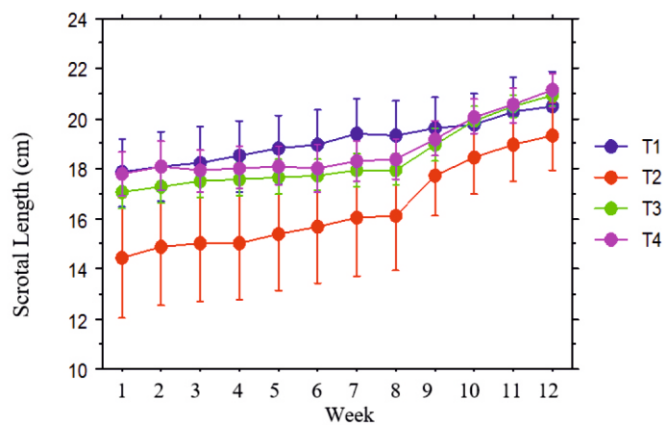


Fig 2. Scrotal length changes of Uda rams fed graded levels of *P. biglobosa* fruit pulp

There is no significant difference ($P>0.05$) in scrotal length for animals in treatments 1 and 4 in the first three weeks of the experiment and also between treatments 1, 3 and 4 in the last four weeks of the experiment (fig. 2). The figure showed linear pattern in scrotal length of animals placed on the control diet. The same observation was made for treatments 2, 3 and 4 from week 1 to week 8. A steady increase in scrotal length from week 8 to the end of the experiment.

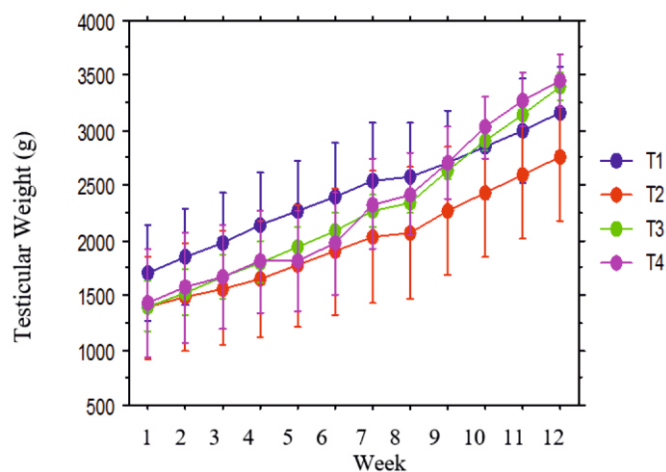


Fig 3. Testicular weight of Uda rams fed graded levels of *P. biglobosa* fruit pulp

There was no significant difference ($P>0.05$) in testicular weight for animals in treatments 2, 3 and 4 in the first two weeks of the experiment (fig. 3). There was a drop in testicular weight in animals placed in treatment 4 in week 5. The figure showed a steady increase in testicular weight throughout the experiment. Treatments 3 and 4 have the same testicular weight at the end of the experiment ($P>0.05$).

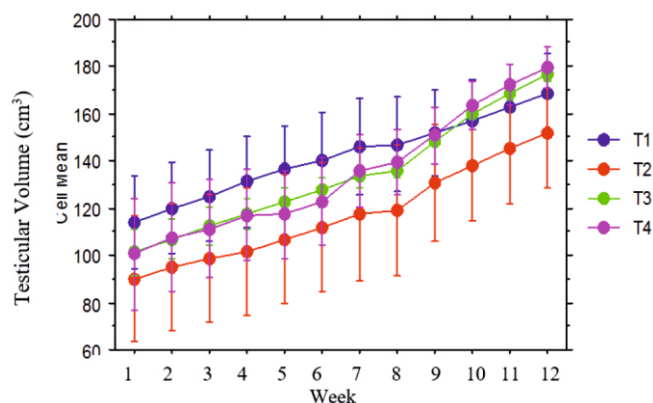


Fig 4. Testicular volume of Uda rams fed graded levels of *P. biglobosa* fruit pulp

Fig 4 indicated no significant difference ($P>0.05$) in testicular volume for animals in treatments 2, 3 and 4 in the first two weeks of the experiment. There was a drop in testicular volume for animals placed in treatment 4 at week 5. The figure showed a steady increase in testicular volume throughout the experiment.

Rectal temperature and Testicular traits of Uda rams fed graded levels of *P. biglobosa* fruit pulp

A better utilisation of *P. biglobosa* by the animals is a determining factor in testicular growth across the treatments. Fourie et al.(2004), reported that a diet with higher energy and protein complementation will improve reproductive traits in sheep. Fernandez et al.(2004), showed that significant differences in testicular size were found upon comparing diets with different protein contributions: the values recorded for scrotal circumference and testicular volume were lower in sheep that consumed less nutrients levels compared to those fed higher nutrients diets. However, the findings of the study is similar to the reports of Bielli et al.(1999), who failed to find any significant effects on testicular dimensions upon improving the forage or increasing the protein in the diet of rams. It was found that testicular dimensions responded better to the ingestion of higher digestible energy than to the availability of CP in the diet (Murray et al., 1990). Isocaloric and isonitrogenous diets consumed by animals in the present experiment could be responsible for the non-significance difference in testicular growth.

The values obtained for scrotal circumference is above those reported by Avellaneda et al.(2006); who reported the scrotal circumference at the onset of puberty was 23.8, 22.9, 20.8 and 23 cm for the Romney Marsh, Mora Colombian, Creole and Hampshire breeds, respectively. In the present study, testicular volume was between 117.23 cm³ to 141.77 cm³, which were higher than the values reported by Mert et al.(2009) when evaluating the testicular characteristics of Ile de France x Akkaraman rams, with average SC measurements of 23.8±0.55 cm and TV of 51.7±2.76 gonad, respectively. Furthermore, the values are similar to those reported by Herrera-Alarcón et al.(2007) and Stagger and Wrobel, (1994).

The rectal temperature of the experimental animals is within the normal value. The significant differences observed between the control diet and other treatments in the rectal temperature could be attributed to the heat increment due to the combustion of the feed consumed as digestible energy which increases with increase in the level of *P. biglobosa* fruit pulp owing to the reduction in indigestible lignin brought about by addition of *P. biglobosa* fruit pulp.

Conclusion

It was concluded that *Parkia biglobosa* fruit pulp has potentials of improving testicular traits of Uda rams which could enhance the fertility of the male animals.

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