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GONADAL AND EXTRA-GONADAL SPERM RESERVES OF KANO BROWN BUCKS AS INFLUENCED BY SEASON AND FEEDING REGIME IN SEMI-ARID ZONE OF NIGERIA

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ABSTRACT
The study was conducted to evaluate the effect of season and feeding regime on reproductive parameters of Kano Brown bucks. A total of fourty eight (48) bucks were used for this study which comprised sixteen (16) bucks per season. At the end of this study twelve (12) bucks, three from each treatment were orchidectomised. Twenty-four right and left testes were harvested, testicular weight (g) and length (cm) were measured. Epididymis was carefully separated from the testes using scapel blade and then separated into three parts (*carput, corpus and cauda epididymides*) weight (g) and length (cm) were also measured. Testes and epididymis were used to determine gonadal and extra gonadal (x 10^6)/g/testis which was done in the laboratory. Data collected were subjected to analysis of variance using Completely Randomized Design. The results of gonadal sperm reserves (x 10^6)/g/testis differed significantly among the seasons, dry season recorded the highest mean value (2896.83 x10^6)/g/testis whereas rainy season had the lowest mean value (2350.15 x10^6)/g/testis. Similarly, for extra gonadal sperm reserves, dry season also recorded the highest values (1736.00 x 10^6) followed by harmattan season (1037.50 x 10^6). Based on the results of this study, it could be concluded that season and feeding regime had a significant effect on gonadal and extra gonadal sperm/spermatid reserves of Kano Brown bucks. Breeding bucks should be raised during rainy and harmattan seasons.

Keywords: Gonadal and extra-gonadal sperm reserves, Kano Brown bucks, season and feeding regime.

INTRODUCTION

In tropical and subtropical environments, small and large ruminants may often be under heat stress Marai, *et al.*, 2017. When the environmental temperature exceeds the upper critical level of 48°C, depending on the species, there is usually a drop in production or a reduced rate of weight gain. Furthermore, when the temperature falls outside the comfort zone, other climatic factors assume greater significance. Humidity becomes increasingly important as do solar radiation and wind velocity. In a hot-dry climate evaporation is rapid, but in a hot humid climate the ability of the air to absorb additional moisture is limited and the inadequate cooling may result in heat stress Marai, *et al.*, 2017. Too low humidity in the air will cause irritation of the mucous membranes, while too high humidity may promote growth of fungal infections Taha *et al.*, 2006. High humidity may also contribute to decay in structures. These environmental factors have significant effects on livestock production particularly small ruminant. In Sub Saharan Africa, small ruminants play a significant role in the livelihood of small holder farmers as a component of crop-livestock mixed farming system (Bianca, 1955; Malami *et al.*, 2006). Small ruminants, viz sheep and goat are numerically important domesticated animals due to their contribution of meat, milk, skin, fiber, manure and as the sole or subsidiary source of livelihood for a large number of subsistence farmers and landless laborers (Amann, 1970); they therefore, contributed significantly to subsistence and socio-economic livelihoods of a large human population in low-input small holder production systems in developing countries. Goats are the most numerous of all livestock species in Nigeria the population was estimated to be 57.8m goats and 38.5m sheep (FAO, 2012). Among the three breeds of goats in Nigeria, Red Sokoto goat is the predominant, the most widely used and distributed breed in the Northern Savannah belts of the country (Ngere *et al.*, 1984; Lombin, 2007). The breed has a uniform dark red color, short haired and with horns on both sexes. The animal has short ears and legs, the skin is very valuable among other goats. This study aimed at evaluating the effect of seasons and feeding regime on reproductive parameters of Kano Brown bucks.

MATERIAL AND METHODS

Study area

The study was carried out at the University Teaching and

Research Farm and Laboratory of the Department of Animal Science, Bayero University, Kano. Kano is located within the longitude 9º30 and 12º30 East and the latitude 9º30 and 8º42 North in Sudan Savannah region of Nigeria. The annual temperature and relative humidity ranged between 38ºC to 43ºC and 40 to 51.3%, respectively (Olofin, 2007). The region is characterized by tropical wet and dry climate; wet season (May to September) and dry season (October to April) with annual rainfall that ranges between 787 - 960mm (KNARDA, 2001).

Experimental animals and their management

Fourty-eight (48) Kano Brown bucks with average initial body weight of 10± 2 kg and aged 12 months old were purchased at Wudil market. The scrotum and testis of each bucks were visualized, palpated and carefully inspected before selection so as to rule out any form of abnormalities. The general health status of experimental animals was examined and quarantined before the commencement of the study. Animals were given antibiotics prophylaxis using 20% Oxytetracycline (long acting) at the dose rate of 10 mg per kg body weight, experimental animals were also dewormed using Albendazole suspension at the dose rate of 7.5 mg per kg weight, they were vaccinated against *peste des pestits ruminants* (PPR) using PPR Vaccine at dose rate of 0.5 ml per animal subcutaneously. Animals were housed in a group (Four bucks per treatment) allowing two week's adaptation period before the commencement of the experiment. The experimental pens were thoroughly cleaned and disinfected with detergent and izal before the arrival of experimental animals, pen sanitation was carried out regularly throughout the experimental period.

Experimental design and treatments

The studies were conducted for a periods of 12 weeks (84 days) in each of the three experiments. Sixteen (16) Kano Brown bucks were allotted to four dietary treatments in a 3 x 4 factorial randomized complete block design with four treatments and four bucks per treatment. Treatments evaluated were:

Treatments	**Feeding regime**
Treatment I:	Browsing only (No supplementation)
Treatment II:	Supplementation in the morning with browsing
Treatment III:	Supplementation in the morning and in the evening with browsing
Treatment IV:	Zero browsing (Supplementation only)

Experimental feeds

Treatment diets were formulated using cotton seed cake, cowpea husk, maize offal, wheat offal and salt. Clean water and mineral salt lick were also provided. The supplementation was offered at the rate of 1.5% body weight of each animal, therefore quantity offered is adjusted on weekly basis after weighing. Hay was offered *ad-libitum* to treatment four only throughout the experimental period. Feed ingredients were purchased from the market in Kano metropolis. The composition of the concentrate includes 19% maize offal, 30% cotton seed cake, 30% wheat offal, 20% cowpea husk and 1% salt which gave 16% CP and 2381 kcal/kg energy

Determination of gonadal and extra gonadal sperm/spermatids reserves (x10^6)/g/testis

At the end of the experiment twelve (12) bucks, three from each treatment were orchidectomised and the testes were used to determine the gonadal and extra gonadal sperm/spermatids reserves as described by Rekwot *et al.* (1987, 1994); Igboeli and Rekwot *et al*. (1987). Twelve (12) testes were harvested and used for gonadal sperm reserves. Right and left testes were labelled and appropriately used to determine the gonadal and epididymal sperm reserves. Right and left testes weight (g), length (cm) and volume were recorded accordingly. The epididymis, visceral vaginal tunic and tunica albuginea were carefully separated from the testes using scapel blade.

Gonadal sperm reserves (x10^6)/g/testis

Left and right testes were homogenized separately using high speed blender operate for 2 minutes in 50 ml normal saline that contained 100 IU/ml of Sodium Penicillin G and 1g/ml Streptomycin. The Homogenate volume was measured after rinsing the blender with 20 ml of effluent. It was further diluted with 80 ml of normal saline after transferring 5 ml of the homogenate to a conical flask. The homogenate was stored overnight at 5ºC. The sperm concentration was determined using hemocytometer as described by (Rekwot *et al.,* 1987).

Extra gonadal (Epididymal) sperm reserves (x10^6)/g/testis

The epididymis from each testis was carefully separated with scapel blade and the length and weight of whole epididymis were measured. It was then carefully seperated into three (3) parts (*caput, corpus and cauda epididymides*) length and weight of each parts were measured and minced in 20 ml of normal saline using sharpe scissors and stored overnight at 5ºC. The minced epididymal parts were filtered using gauze and filtrate volume was measured. One millimeter (ml) of the filtrate was placed in a test tube and further diluted with 2 ml of normal saline. The epididymal sperm reserves was determined using hemocytometer as described by Retwot *et al.* (1987) and Gyang (1990). Sperm reserves were expressed in billions using the procedure of (Osinowo *et al.,* 1982; Bustwat and Zaharaddeen, 1994). Testicular and epididymal weight was obtained using electronic weighing scale while length was measured using a meter rule in centimeters (cm).

Weather information of the experimental site

Temperature and relative humidity of experimental pens and the surrounding environment were monitored across the three seasons. Minimum and maximum temperature were recorded at 8:00 am and maximum in the afternoon at 2:00 pm respectively using digital thermo-hydrometer (Brannan England). Two (2) digital thermo-hydrometer (Brannan England) were used. One (1) was hung on the wall inside the experimental pens at 120 cm above the ground and the other one was kept outside to provide the record of the temperature and relative humidity experienced by the animals at the periods of experiment. Data obtained for temperature and relative humidity was used to develop an index for measuring thermal comfort zone for the bucks. It was measured according to the following equation (Marai *et al.*, 2001): THI = db^{o}C – {(0.31 - 0.31 RH) (db^{o}C – 14.4). Where db^{o}C is the dry bulb temperature (^{o}C) and RH is

relative humidity (RH %) /100. Information on macro climate was also obtained from Aminu Kano International Airport, metrological station on the minimum and maximum temperature 26 to 42ºC, relative humidity 20 and 65% and rainfall 698 to 985 mm from November, 2016 to December 2017.

Table 1: Mean temperature (0^C) and relative humidity (%) of the experimental site

Variables	Seasons		
	Dry	Rainy	Harmatttan
Temperature (ºC)	39.37±2	28.32±2	26.21±2
Relative humidity (%)	20.05±2	68.79±2	32.89±2

Statistical analysis

Data collected was subjected to analysis of variance (ANOVA) using General Linear Model (GLM) procedure of SAS (2002, version 9.1) where significant differences observed mean was compared using Duncan multiple range test (DMRT, 1955).

RESULTS AND DISCUSSION

The results of gonadal sperm reserves of Kano Brown bucks are presented in Table 2. Significant ($P < 0.05$) difference was observed among the seasons. Highest mean value (2896.83 $x10^6$) /g /testes for right testis and (3015.08 $x10^6$)/g/testes for left testis sperm concentration were recorded during dry season whereas lowest mean value (2350.15 $x10^6$) /g/testes was obtained during rainy season. Table 2 shows that season feeding regime has a significant effect on extra gonadal sperm reserves ($x10^6$)/g/testis. The result obtained in this study favored by dry season. This report agreed with the findings of Martin *et al.* (2004) and Samuel and Salaku (2007) observed highest mean values of sperm concentration in rams fed graded levels of protein diets during dry season.

Table 2: Gonadal sperm reserve ($x10^6$) /g/testes of Kano brown bucks influenced by season and feeding regime

Parameters ($x10^6$) /g / testes	Seasons			
	Dry	Rainy	Harmatttan	SEM
Right testis	2896.83[a]	2350.15[b]	2364.14[b]	31.25
Left testis	3015.08[a]	2380.15[b]	2378.58[b]	4.16

[ab] means within the same rows with different super script are significantly different ($P < 0.05$)

The results of extra gonadal sperm reserve of Kano Brown bucks are presented in Table 3. Significant ($P < 0.05$) differences were observed among seasons for left and right caput, corpus and cauda epididymides. Highest mean values (1734.00 $x10^6$) /ml was observed during dry season whereas lowest mean value (1017.67 $x10^6$) /ml for right caput epididymides was obtained during rainy season for right caput epididymides. Left cauda epididymides mean value (2651.17 x 10^6) /ml was higher during dry season whereas (1194.32 $x10^6$) /ml was the lowest mean values recorded during rainy season. The mean values of gonadal sperm reserves obtained in the present study shows the highest mean values in treatment three (3). The value agreed with the values (specify the values reported from the previous findings if possible for comparison) reported by Tibbo (2006) and Nasir *et al.*, 2014). This observation is also consistent with previous workers reported by Coulson *et al.* (1980; Sakesena and Salmonsen (1982); Velesquez Pereira *et al.* (1998); Taha *et al.* (2006). High sperm concentration was observed in treatment three (3) right and left testis. This could be due to morning and evening supplementation. This is in agreement with the findings of Hassan (2010) who observed an increase in semen volume, color and concentration with an increased in dietary protein level in yearling Kano Brown bucks.

Table 3: Extra gonadal sperm reserves ($x10^6$)/ml of Kano Brown bucks as affected by season and feeding regime.

Parameters ($x10^6$) / ml	Seasons			
	Dry	Rainy	Harmattan	SEM
Right caput epididymides	1734.00[a]	1017.67[c]	1037.50[b]	2.39
Left caput epididymides	1755.25[a]	835.50[c]	853.50[b]	4.14
Right capus epididymides	1617.00[a]	1120.33[b]	1119.99[b]	3.27
Left capus epididymides	1611.33[a]	1112.83[b]	1119.99[b]	4.07
Right cauda epididymides	2423.67[a]	1667.25[b]	1112.83[c]	6.01
Left cauda epididymides	2651.17[a]	1194.32[c]	168850[b]	16.19

[abc] means within the same row with different super script are significantly ($P < 0.05$) different

CONCLUSION

Reproductive parameters of Kano Brown bucks as affected by seasons and feeding regime observed in this study differed significantly among the seasons of the year under different feeding regime. Therefore, it could be concluded that bucks could performed best during dry and harmattan season especially when placed under morning and evening supplementation. However, could be recommended that animals should be placed on high level of nutrition and could be raised at temperature of 26-39^{o}C without any physiological effects on reproductive parameters.

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