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Influence of Season on Semen Characteristics of Sahel Bucks in Borno State

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Abstract: The semen characteristics of Sahel bucks was investigated over a one year period to determine the influence of season on the ejaculate mass activity, motility, sperm concentration, percent live spermatozoa. These variables were significantly higher in the dry season than in the rainy season. Total spermatozoa per ejaculate averaged $4.74 \pm 0.99 \times 10^9 \text{ mL}^{-1}$ and $3.75 \pm 0.99 \times 10^9 \text{ mL}^{-1}$ for the dry and rainy seasons, respectively. Corresponding proportions of total morphologically defective spermatozoa per ejaculate were $6.48 \pm 1.13\%$ and $17.69 \pm 1.13\%$. Percent live spermatozoa were 87.5 ± 0.75 and $64.1 \pm 0.75\%$, while the corresponding sperm concentration were $3.73 \times 10^9 \text{ mL}^{-1}$ and $2.67 \times 10^9 \text{ mL}^{-1}$ for the dry and rainy season, respectively. All differences were statistically significant ($p < 0.05$). Ejaculate quality was better during the dry season. Consequently semen collected and frozen during the dry season may produce higher fertility rates in an Artificial Insemination programme.

Key words: Sahel, bucks, semen characteristics, season

INTRODUCTION

Selection of the male represents the starting point in a progeny testing scheme. The Artificial Insemination (A.I) programmes in Nigeria are based on the use of imported exotic bulls and semen and using them to cross breed and upgrade local cattle. Goats are said to be second to cattle in order of importance as a source of meat and milk in the tropics^[1]. Goats have high fertility and are of short generation interval. Therefore they can multiply their numbers within a short period. These characters amongst others make goats a high potential source of animal protein for man^[2].

There is a need to exploit the production potentials of sahel bucks so as to strengthen goat husbandry in Nigeria. This will enhance goat production and income by goat keepers from the sale of meat, milk and hides. There is also a need to improve the meat and milk yielding capacity of local breeds of goats in Nigeria. This can be achieved by selection, cross breeding and establishment of goat breeding and multiplication centres.

In order to improve the genetic makeup of goats, an attempt at studying the semen characteristics is of utmost importance, as this will enhance proper selection of proven sires. Ejaculate characteristic should be evaluated with regard to volume, colour, concentration, motility, live-dead counts and abnormalities^[3,4].

These characteristics of bull semen have been reported by several workers to be influenced by

seasonal weather conditions such as low and high temperatures. However Brito *et al.*^[5] reported that ambient temperature, month (season) and humidity did not significantly affect sperm production and semen quality probably because there was little variation in these variables. Kumi-Diaka *et al.*^[6] reported seasonal changes in semen quality of exotic but not indigenous bulls studied over a period of 12 months in a tropical environment. Ahmad and Noakes^[7] studied physical characteristics of semen quality in young British goats over a 12 month period and found effect of month and season of the year on all parameters of semen quality were significant.

Kumi-Diaka *et al.*^[6] studied seasonal and age related changes in semen quality and testicular morphology of bulls in a tropical environment. There was no significant seasonal variations in semen quality in indigenous bulls. Brito *et al.*^[5] studied effects of environmental factor, age and genotype on sperm production and semen quality in *Bos indicus* and *Bos taurus* A.I bulls. *Bos indicus* bulls had significantly greater sperm concentration and *Bos taurus* bulls had significantly fewer morphologically defective spermatozoa.

This study was undertaken to investigate the effect(s) of season on semen quality to determine the time of year when buck semen can be collected and used to achieve optimum fertility when subsequently used in an A.I. programme.

MATERIALS AND METHODS

This study was carried out at the A.I unit in the Veterinary Teaching Hospital University of Maiduguri Borno State, Nigeria. From May, 2001 to February, 2002. Borno State is situated in the North Eastern region of Nigeria, approximately $10^{\circ} 0^{\prime}$ N and $13^{\circ} 45^{\prime}$ N. It consists of three ecological zones, the sahel Sudan and Guinea savannah. The sahel zone like other parts of Nigeria has a well defined wet and dry season. For the purpose of this study the harmattan was taken as part of the dry season. The two seasons were thus wet (June-September) and dry (November-February). The metrological conditions during the period of study are summarized in Table 1.

Experimental animals: Ten sahel breed of buck were selected for the experiment aged 3 months-1 year. The bucks were maintained on groundnut leaver $1\frac{1}{2}$ kg per head, maize bran 500 g, bean husks, 500 g and wheat bran 500 g, head⁻¹ daily, water was given *ad libitum*. The animals were also grazed for 5 daily. The routine animal health care of the bucks included deworming regularly with albendazole and use of ascaricides against ectoparasites.

Semen Collection: Semen collection was carried out by electro ejaculation in the reproduction laboratory of the large animal clinic. During collection the hindquarters of the bucks were raised and a small lubricated ejaculatory probe 20 cm long was inserted rectally to depth of about 8-10 cm. The probe was positioned so that the ring electrodes were oriented ventrally to press against the rectal wall in the region of the seminal vesicles and the prostate glands. Stimulation of the accessory sex glands was achieved by manipulation of the rheostat^[8]. Semen samples were collected in a graduated transparent collecting tube covered by an insulating jacket and kept in a water bath (37)^oC for further evaluation.

Semen evaluation: Semen was collected three times every 2 weeks from June-September to cover the wet season and November- February to cover the dry season. Each ejaculate was evaluated as described by Zemjanis^[3]. This included, Visual or gross evaluation of the ejaculate soon after collection in respect of volume, colour and presence or absence of foreign material and Microscopic examination of wave pattern, (gross motility), individual sperm motility, live-dead counts, sperm concentration and abnormal spermatozoa.

The volume was read from the graduated collecting tubes. Mass activity was estimated by examining a drop of raw undiluted semen on a prewarmed slide under a light

microscope at x 10 magnification. The estimate of the mass activity (gross motility of the spermatozoa was made based on the vigour of the wave motion. This was assessed on a 0-5 scoring system. Scores from least active ($\pm = 10 - 20\%$) to most active ($\pm = 90-100\%$) was given to wave motion of the spermatozoa according to the intensity of the swirling bands.

The percentage of spermatozoa with forward progressive motility was estimated by diluting a drop of semen with 4 drops of normal saline on a clean prewarmed 37^oC glass slide and covered with a clean cover slip. Observation was done under high (x40) power magnification of a microscope^[9] and colour changes were matched with the standard chart reflecting the pH values. A drop of semen was placed on the pH paper and immediate colour change or pH readings recorded.

The percentage of live spermatozoa was obtained by placing a drop of semen on a clean prewarmed glass slide and 2 drops of Eosin-nigrosin stain. This was mixed and a smear prepared from the mixture. Dead cells picked the stain, while live cells repel it^[10]. Two hundred cells were counted in different fields and an average calculated.

The abnormalities of the sperm cells were also assessed by examining the stained slide under (x 100 power magnification) with oil immersion.

Sperm cell concentration was determined by using the haemocytometer method^[11]. Semen sample was sucked into the red cell diluting pipette up to the 0.1 mark and the volume made up to the 101 mark with 10% formal saline followed by thorough mixing. By capillary action, the mixture was allowed to spread under the cover slip placed tightly on the haemocytometer after discarding few drops. The cells were allowed to settle before counting under (x 40 power magnification sperm cells were counted in 5 smaller squares of the improved Neubauer haemocytometer and the concentration determined using the formula.

Number of sperm cells mL⁻¹ = Number of sperm cells counted in 5 smaller squares x 5 x 10⁴ x dilution factor^[11].

Statistical Analysis: The results were analyzed by standard ANOVA procedures.

RESULTS

The mean ambient temperature during the wet season 33.3^oC was not significantly different from that of the dry season (33.0)^oC. Table 1 shows the monthly mean maximum temperature and rainfall for the period under study. The colour of the ejaculates was mostly creamy. The gross motility ranged from good vigorous movement to fair swirls with slow moving waves. The individual

Table 1: Monthly mean maximum temperature and rainfall data for Maiduguri study period

Months	Temperature (0C)		Rainfall (CM3)	
	2001	2002	2001	2002
January	31.6	28.5	0.0	0.0
February	33.0	34.0	0.0	0.0
March	38.5	39.1	0.0	0.0
April	41.1	41.9	Trace	2.2
May	40.2		37.1	
June	36.0		119.3	
July	33.0		110.1	
August	30.9		244.4	
September	33.3		216.8	
October	35.3		Trace	
November	35.7		0.0	
December	33.6		0.0	

Table 2: Semen Characteristics Mean±SEM of Sahel bucks as influenced by season

Season	Wet season	Dry season
Characteristics	n = 10	N = 10
Volume (mL)	1.08±0.48	1.01±0.48
Colour	Creamy	Creamy
pH	7.06±0.03	7.11±0.03
Mass activity	3.04±0.05b	3.93±0.05a
Motility (%)	60.7±0.82b	82.2±0.82a
Conc mL ⁻¹ ×10 ⁹	2.67±0.51b	3.73±0.51a
% Live	64.1±0.75b	87.5±0.75a
% Rudimentary tail	3.50±0.17	2.70±0.17
% Protoplasmic droplet	3.06±0.19a	0.85±0.19b
% Coiled tail	3.64±0.25a	0.68±0.52b
% Looped tail	3.40±0.21a	1.00±0.21b
% Detached head	3.15±0.21a	0.84±0.21b
% Simple bent tail	0.94±0.10a	0.41±0.10b

a, b values differently superscripted within a row differ significantly (p<0.05)

motility ranged from good (rapid rectilinear) to slow and erratic motion. The total mean percentage morphological defects were significantly higher (p<0.05) during the wet season than the dry season with values of 17.69±1.13% and 6.48±1.13%, respectively.

There was no significant seasonal differences (p>0.05) in volume, colour and pH, the semen gross motility, individual motility, sperm concentration, morphological sperm defects and percentage live were significantly influenced by season (p<0.05) (Table 2).

DISCUSSION

The ejaculate characteristics obtained in this study were similar to those reported by Karagiannis *et al.*^[12] who reported a significant variation in both semen quantity (volume/concentration) per ejaculate and quality (percentage of motile spermatozoa, percentage of abnormal spermatozoa and rate of progressive mortality). The best semen was produced during the breeding season (late summer and autumn). The improvement in semen quality seen during the dry season may be due to age-season interaction, as the bucks were young during the wet season.

Kumi-Diaka *et al.*^[6] reported seasonal variations in ejaculate characteristics of exotic breeds, but not indigenous breeds due to climatic adaptation. Most tropical regions are characterized by varied seasonal fluctuations that affect livestock performance. The climate of Borno State is characterized by a short rainy season and long dry season. For survival and productivity, certain adaptive characteristics have been developed by the Sahel goats depending on prevailing climatic factors^[13]. The Sahel goat is well adapted to the arid region through its predominantly white colour and short hair, Coat^[14] and could be a part of the special adaptation since coat type is reported to have effect on thermoregulation and coat colour likely to have influence on heat loss^[15]. Others inherited characteristics of goats are resistance to dehydration, preference for browse and wide razing feeding habits enabling them to thrive in regions that receive minimal rainfall and wide climatic adaptation. In temperate region, goats are seasonal breeders and the sexual activities of bucks as well as the quantity and quality of semen are affected unlike the tropics where goat breeds year round^[16]. Finally, those regions located in latitudes 10° do not present significant difference in reproductive activity because of seasonal influence. In these areas, the photo period fluctuates within closer limits and reproductive changes are rather more influenced by climate especially humidity and food availability^[17].

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