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Comparative Studies on Reproductive Performance of Nubian and Saanen Bucks under the Climatic Conditions of Khartoum

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Abstract: Six mature Saanen bucks imported from the Netherlands for upgrading of local Sudanese goats and six, mature Nubian bucks were chosen from the Small Ruminant Research Centre at Kuku, Khartoum North were used. The experiment was designed to investigate the effect of climate and seasons on the mating behaviour and semen characteristics. Semen was collected by an Artificial Vagina (AV) at weekly intervals and ejaculate volume, spermatozoa motility, concentration and percentage of dead and abnormal sperm cells were monitored. The Saanen bucks were found to have a definite breeding season (early autumn to winter), libido was significantly higher ($p<0.05$) in autumn with and average value of 61.98 sec. The observation of Nubian bucks indicated normal libido (summer and autumn) with an average value of 35.2 sec. The semen of Saanen and Nubian bucks were characterized by an ejaculate volume of 0.77 and 0.88 mL, concentration 2.77^{10} and 2.08^{10} sperm cell/mL, mass activity score of 3.19 and 3.42%, sperm were active 68.7 and 82.78%, 15.49 and 6.1% were dead and 8.56 and 5.68 had abnormal morphology. The poorest quality semen was collected during summer with the highest incidence of abnormality (19.32). No seasonal effect on mating behaviour or libido of Nubian bucks was observed.

Key words: Saanen bucks, nubian bucks, mating behaviour, semen characteristics

INTRODUCTION

The Sudan is predominantly an agricultural country with the largest livestock population in the Arab world and second to Ethiopia in Africa. The latest estimate of livestock is about 103 million[1-2]. Despite this large population there is insufficient supply of milk and other animal products. This is mainly due to the poor genetic make up of local breeds, lack of proper feeding, poor management and disease.

Four local breeds of goats exist in Sudan. Nubian, Desert, Nilotic dwarf and Taggari goats. The Sudanese Nubian goat is the only specialized milk breed[3]. The goat plays a substantial economic role in the livelihood of many Sudanese families. Three exotic pure breeds of goats (Saanen, Toggenburge and Anglo Nubian) were introduced into Sudan in 1976 as part of technical aid of the Overseas Development. Unfortunately, information on the reproductive performance and adaptability of these exotic breeds in Sudan is scarce. For rapid genetic improvement of animal on large scale the most important single technique devised is the Artificial Insemination (AI). Using AI frozen semen from a single buck can impregnate many thousands of does per year[4].

The Economic advantage of processing semen locally provides a continuous supply of semen from a reliable source at lower cost than importing semen or buck. It is cheaper to a small holder to make use of AI than to buy or maintain a buck of high genetic value .The objective of the present study was to investigate and compare the reproductive capacity and sexual behaviour between Saanen and Nubian bucks.

MATERIALS AND METHODS

Six mature Saanen bucks and six Nubian bucks were used in this study. The body weight of Saanen and Nubian bucks were 50 and 45 kg, respectively. The bucks were accommodated individually in shaded pens and fed ad lib on Berseem hay (*Medicago sativa*) supplemented with concentrate feed at the rate of 0.5 kg /head/day according to the recommendation of National Research Council[5]. The bucks tested weekly for libido by recording their sexual interest and mating urge when introduced to sexually active doe. Libido was determined by recording the reaction time of the buck. This was measured in seconds from the time buck was presented to the doe until ejaculated into an Artificial Vagina (AV). The scrotal circumference was measured monthly by grasping the neck of the scrotum with the hand using the fingers to push the testicles ventrally to eliminate any wrinkles. The measuring tape was passed around the scrotum and tightened at the greatest width of the two testicles and measured in centimeters.

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Semen quality and quantity: Collection of semen was done at weekly intervals by means of standard artificial vagina for small ruminants' semen.

Production was assessed as the total volume of semen delivered by the bucks. Semen quality parameters included volume, colour, consistency, mass activity, and individual motility of ejaculates, sperm cells concentration, percentage live and abnormalities. The volume, colour and activity consistency were assessed directly from the graduated collecting tube of the AV. Mass and individual spermatozoa motility's were done according to the methods of Evans and Maxwell[6].

For sperm cells concentration a drop of semen diluted to rate of 1, l 625 in a normal saline was placed in the counting chamber of a haemocytometer. Five larger squares each containing sixteen smaller squares were counted under a light microscope (Olympus BH-2 8300 Landshut, Germany). The concentration of the spermatozoa was then determined using the following formula:

Number of spermatozoa/mL of semen=N ×31250 ×10^3.

Where N was number of spermatozoa counted in the five large squares of the haemocytometer.

To determine the percentage of dead and abnormal spermatozoa a semen droplet was stained with a nigrosen-eosin mixture (2/1) and examined microscopically.

Statistical analysis: Statistical analysis of data was carried out according to the method of Sendecor and Cochran[7]. Methods used were analysis of variance one-way and two ways classification. Student t-test and Least Significant Difference (L S D) were used to separate the difference among the means and least- squares analysis using the SAS Program[8].

RESULTS AND DISCUSSION

The mean values for reaction times were compared among the different seasons for Saanen and Nubian bucks, (Table 1).

A significantly higher value (75.97 sec) was observed in summer than winter (53.76 sec). The sexual derive of the Saanen bucks decreased steadily from March to culminate in an abrupt cessation of sexual interest in the middle of May.

A period of sexual quiescence in which all bucks refused to mount and copulate was observed between mid-May and mid July. However, in spite of the negligible variation of seasonal day light hour, the Saanen bucks kept under the tropical climate of Khartoum seemed to maintain their congenital seasonal reproductive pattern. This finding is consistent with that of Chemineau *et al.* [4] who stated that temperate breeds of goats experienced no dramatic change in the duration of their sexual season when transported to tropical climates. Compared to Nubian bucks the reaction time 34 sec was lower than that of Saanen. The wide variation in the reaction time between the breed (Saanen) and local Nubian might be attributed climatic conditions and breed difference. The significant seasonal variation of the scrotal circumference was consistent with the findings of Ritar[9]who related the decrease in sperm quality during summer to increase in day length and consequent decrease in testicle size. Compared to Nubian bucks no significant seasonal effect was observed between summer and winter.

The mean seminal volume per ejaculate was 0.77 mL and 0.885 mL for Saanen and Nubian bucks, respectively. No significant seasonal variation between individual ejaculates occurred, a finding which was not in accord to that of Perry[10] and Loubser *et al*[11] who reported greater seminal volume per ejaculate in the breeding season. The findings of this study were within the normal range of tropical breeds[12-13]. No significant difference between summer and winter of pooled ejaculates of semen were observed for Saanen and Nubian bucks (Table 2).

The scores of average mass activity were 3.19×0.34 and 3.42×0.32 for Saanen and Nubian bucks, respectively with no significant seasonal change.

Table 1: Effect of season on libido, scrotal circumference and semen characteristics of Saanen and Nubian bucks kept under the climatic conditions of Khartoum

Parameters	Reaction time (sec)	Scrotal circumference (cm)	Volume (mL)	Mass activity	Individual motility %	Conc. /mL ×10	Dead%	Abnormality%
Saanen								
Overall mean season	61.98 ±7.033	25.32 ±1.89	0.77 ±0.28	3.19 ±0.79	68.57 ±10.54	2.77 ±1.12	15.49± 6.00	8.50± 2.77
Summer	75.97 ±9.07	23.88 ±1.5	0.74 ±0.23	3.03 ±0.88	65.57 ±11.2	3.24 ±2.00	19.32± 8.72	11.61±3.36
Winter	53.76 ± 6.83	25.54 ±1.86	0.73 ±0.079	3.22 ± 0.79	68.41 ± 11.47	2.38 ± 0.87	15.00± 4.98	8.17± 2.23
Nubian bucks								
Overall	34.25 ±2.2	25.1 ± 2.1	0.885± 0.02	3.42 ±0.13	82.78 ±0.8	2.08±0.2	6.0 ± 0.30	5.68±0.45
Summer	34.5 ±2.1	23.87±1.18	0.89 ±0.041	3.42 ±0.13	82.91 ±1.08	2.08±0.8	5.92 ± 0.32	5.75± 0.40
Winter	34.0 ±2.4	26.0 ± 1.1	0.88 ± 0.044	3.42 ±0.14	82.60 ±0.98	2.07±0.2	6.09 ± 0.34	5.60± 0.45

Table 2: Average pooled ejaculated seminal volume (mL) from individual bucks (Saanen- Nubian and their test of means (LSD)

Season	Summer	Winter	LSD
Saanen bucks	0.95± 0.28	0.18± 0.49	0.157
Nubian bucks	0.885 ± 0.004	0.885± 0.005	NS

NS Not Significant

The average sperm cell concentration in the current study was comparable with that of exotic goat breeds kept under other tropical area [12-14].The strong correlation observed between semen consistency and sperm cell concentration Is in agreement with the findings of Evan and Maxwell[6]. The percentages of dead and morphologically abnormal spermatozoa were higher in summer. The increase in the percentage of sperm cell abnormalities in summer might be due to the effect of heat stress. According to Chemineau *et al*[4] the detrimental effect of high temperature on sperm occurs mainly as a result of an increase in testicular temperature which provokes degeneration with the appearance of abnormalities at specific and critical step of the spermatogenetic cycle. Compared to Nubian bucks the percentage of the dead and abnormal spermatozoa fell within the normal range for good quality buck semen[4-6] who agreed that good quality semen should contain a maximum percentage (20%) of abnormal spermatozoa.

CONCLUSIONS

The Saanen bucks kept under climatic conditions of Khartoum were found to have a definite breeding season (early autumn to winter) and yield semen of good quality only during that period, In spite of the seasonal variation in sperm quality, semen of the Saanen buck was good throughout the period of sexual activity since the proportion of abnormal and dead spermatozoa well within the accepted range for good quality semen. The semen collected from the Nubian bucks was optimum and could be used satisfactorily for control breeding.

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