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Original Research

Properties of Fresh Ejaculate and Correlation among Parameters in Sudanese Nubian Bucks

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Abstract

In this experiment, six proved fertile Nubian bucks were used to determine fresh semen characteristics and association of parameters in Sudanese Nubian bucks. Over the 9 weeks interval a total of 59 ejaculates were collected from bucks by using artificial vagina once a week. The ejaculate parameters such as: volume, colour, consistency, mass motility score, percentage of individual motility and proportion of live to dead sperm were evaluated. In addition, associations between the semen parameters were also investigated. The results showed creamy to milky semen colour; consistency was fairly uniform and thin. The ejaculate volume, mass motility score, progressive motility percentage and sperm viability were 1.03 ± 0.3 ml, 4.64 ±0.6, 93.48 ± 3.1% and 92.73 ±4.1%, respectively. Positive correlations of color with consistency (r = 0.64) and live sperm (r = 0.41) were found significant. There was also a negative correlation between colour and dead sperm (r = - 0.41).

Keywords: Correlation, Nubian Buck, Semen Quality

Introduction

The major goat breeds in Sudan are Nubian, Desert, Nilotic and Dwarf (El-Abid and Abu Nikhaila 2010). Nubian goats are classified as the best dairy breeds in Africa and best milk producers in Sudan. The majority of Nubian goats is reared in the northern part of Sudan and plays a vital role in the life of many milk-producing families (Hassan and EL-Derani, 1990).

Nubian goats tend to provide greater semen content than other breeds of goats and, in some traits; their semen was superior to that of desert sheep (Ali and Mustafa, 1986). The semen of Nubian bucks is white to creamy, averaged 1.5ml in volume and has 1.77 x 10^9 sperm \ml. The total spermatozoa per ejaculate are 2.7 x 10^9. 86% of sperms are viable, while primary and secondary abnormalities of sperms are 6.7% and 15.3%, respectively (Noakes *et al*., 2009). The concentration of fructose in semen is 213 mg /100 ml, citric acid is 68mg/100ml and alkaline phosphate activity is 218 iu/100 ml (Noakes *et al*., 2009). The pH of semen is also acidic (Noakes *et al*., 2009). The average size of the scrotum is 16.1 cm (lateral curved length) and the scrotal circumference is 20.6 cm (Ali and Mustafa, 1986). Gubartallah, *et al*. (2004) estimated that the ejaculate volume, mass motility, individual motility percentage, percent of live sperms and sperm cell concentration were 0.88ml, 3-4, 83%, 93.98% and 2.08 ×10^9, respectively. Average ejaculate volume was 0.77 ml in Saanen bucks under tropical climate (Ahmed *et al*., 1997). When repeated collections were carried out; the pooled seminal amount was higher in autumn than in other seasons. The mean sperm concentration was 2.77 × 10^9. The average mass motility was 3.19, individual motility was 68.57% and 15.5% of sperms were dead (Ahmed *et al*., 1997). Elhammali *et al.* (2013) evaluated the characteristics of semen in crossbred goat (Nubian × Saanen) at puberty. They recorded that ejaculate volume, mass motility score, individual motility percent, live sperm percent, sperm cell concentration and percentage of abnormal morphology sperm were 0.68 ± 0.05 ml, 3.60, 76.30 ± 3.41%, 87.30 ± 1.63 %, 2.8 × 10^9 and 5.7 ± 0.71%, respectively. In addition, the quality of semen in mature males (Nubian × Saanen) is affected by the season and is better when semen is collected during autumn (Elsheikh and Elhammali, 2015). In Tedy goat, Umar *et al.* (2018) observed that the mean percent motility and dead sperm percentage were 89.18 ± 0.37 % and 8.08 ± 0.29%, respectively.

In the autumn, Zaraibi bucks reported the highest volume of ejaculates (0.98 ml) and the highest sperm concentration (4565 × 10^6), as well as a lower percentage of sperm abnormalities (8.8%) (Barkawi *et al*., 2006).In the case of fresh semen in Brazilian goats, the percentage of sperm with normal morphology was significantly higher ($P<0.001$) during the rainy season (86.9±1.8%) when compared to those collected in the dry season (82.8±2.5%), but ejaculate volume, sperm motility, vigor and sperm concentrations did vary between seasons (Aguiar *et al*., 2013). The present study was designed to investigate the characteristics of fresh semen and correlation between semen parameters in Sudanese Nubian bucks.

Materials and Methods

Study Area

This study was conducted in the sheep and goat research division of the Animal Production Research Center-Animal Resources Research Corporation, Ministry of Animal Resources and Fisheries, Hilt Kuku, Khartoum North (N 15° 37` 11.30", E 32º 33` 51.35").

Animals and Management

A total of six fertile Nubian bucks were used in this experiment. Their ages ranged between 1 to 3 years and their body weights ranged from 30 to 45 kg. Animals were fed on concentrates (500gm in the morning and 500 gm in the evening), 25% molasses, 40% sorghum, 28% wheat bran, 5% ground nut cake and 1% urea, 1%salt daily. Alfalfa hay and roughages were offered *ad-libituim*. The bucks were given free access to mineral blocks and fresh water during the study period. All the bucks were injected by one dose (1ml /10kg) of long acting oxtetracycline 20% i/m (Limoxin, Harjumaa, Estonia) and 0.5 ml / 50kg of ivermectin (ivermactin 10 Anglian-Nutrition Products company-United Kingdom) injected s/c 14 days apart to control internal and external parasites.

Semen Collection and Evaluation

A total of 59 ejaculates were obtained once a week for interval of 9 weeks using an artificial vagina. For male

stimulation, teaser doe goat injected by 1ml of $PGF_{2\alpha}$ (Estrumate, Essex Animal Health Friesoythe -Germany) i/m 48 hour before collection. Semen was put in a water bath (37 ° C) and immediately color, consistency and volume (ml) were observed using a gradual test tube. Mass motion of sperm (0-5 scale), percentage of individual motility and live - dead sperm (percent) were measured using eosin-nigrosin staining. (Noakes *et al*., 2009).

Statistical Analysis

The data were analyzed using Statistical Package for Social Sciences (SPSS) (version16.0). Results expressed as mean ± Standard deviation (Mean ± SD). The relationship between the semen parameters was assessed using Pearson correlation analysis.

Results and Discussion

The fresh semen parameters of Nubian bucks are shown in Table 1. The semen was creamy and milky in color (4.70±0.5). The average total volume was 1.03±0.3 ml. Semen consistency was fairly uniform and thin (creamy). The sperm mass motion was 4.64 ± 0.6 while the individual motility was 93.48±3.1 percent. The live and dead sperm was 92.73± 4.0 percent and 7.27± 4.1 percent, respectively. There were positive significant ($P \leq 0.01$) correlations with colour and consistency (r =0.64); and live sperms (r = .041). There were also negative significant ($P \leq 0.01$) correlation between dead sperm and colour (Table 2).

Table 1: Characteristics of fresh semen in Sudanese Nubian bucks (n= 59)

Semen parameters	Mean ± SD
Volume (ml)	1.03 ± 0.3
Colour (creamy and milky)	4.70 ± 0.5
Consistency (fairly uniform and thin)	3.76 ± 0.5
Individual motility (%)	93.48 ± 3.1
Mass motility	4.64 ± 0.6
Dead sperms (%)	7.27 ± 4.1
Live sperms (%)	92.73 ± 4.1

Table 2: Correlation matrix between the semen parameters in Sudanese Nubian bucks (n= 59)

Parameters		Volume	Color	Consistency	Individual Motility	Mass Motility	Sperms	Live Sperms
Volume	Correlation							
	Sig.(2-tailed)							
Color	Correlation	0.076						
	Sig.(2-tailed)	0.567						
Consistency	Correlation	-0.203	0.644**					
	Sig. (2-tailed)	0.122	0					
Individual motility	Correlation	0.011	0.083	-0.016-				
	Sig. (2-tailed)	0.934	0.53	0.904				
Mass motility	Correlation	0.175	0.147	0.001	0.163			
	Sig.(2-tailed)	0.184	0.267	0.994	0.217			
Dead sperm	Correlation	-0.069	-0.413**	-0.164	-0.102	-0.133		
	Sig.(2-tailed)	0.603	0.001	0.215	0.441	0.314		
Live sperm	Correlation	0.069	0.413**	0.164	0.102	0.133	-1.000**	
	Sig.(2-tailed)	0.603	0.001	0.215	0.441	0.314	0	

*** Pearson correlation is significant at (P ≤ 0.01)*

In this study, the parameters of fresh semen in Sudanese Nubian bucks were measured. The semen had creamy colour, an averaged volume of 1.03 ± 0.3 ml and fairly uniform consistency (thin creamy). These findings are similar to previous studies were conducted in Nubian goats (Ali and Mustafa, 1986; Gubartallah *et al*., 2004; Noakes *et.*

al., 2009). These authors found that the normal colour of semen in the bucks to be white to creamy, uniform consistency and volume ranging between 0.8-1.5 ml. The amount of semen is also comparable to that reported in Zaraibi bucks (0.98 ml) (Barkawi *et al*., 2006), mature crossed goat (1.06 ± 0.82 ml) (Elsheikh and Elhammali, 2015) and in Brazilian goats (0.9 ± 0.1 ml) (Aguiar *et al*., 2013).

On the other hand, finding of volume in these results is contrary to those recorded by Ahmed *et al*. (1997) in Saanen goat (0.77 ml); Elhammali *et al*. (2013) in crossbred male at puberty (Nubian × Saanen) (0.68 ± 0.05 ml); Yotov (2015) in Bulgarian Bucks (1.87±0.18 ml); Hahn *et al.* (2019) in Peacock bucks (0.48 ± 0.11ml). These variations may be due to difference in age of bucks, breeds, climate and frequency of collection. In present results, the mass motility score and individual motility were 4.64 ±0.6 and 93.48±3.1%, respectively. These findings are consistent with Gubartallah, *et al*. (2004); Ustuner *et al*. (2014); Khalifa and Abdel-Hafez (2014); Yotov (2015) who reported sperm wave motion in the range of 3-5 and individual motility is more than 80% in sheep and goats. Conversely, the finding of progressive motility is inconsistent with that found in Saanen bucks (68.57%) (Ahmed *et al*., 1997); mature crossed males (74.88 ± 0.66%) (Elsheikh and Elhammali, 2015); Gaddi and Chegu bucks (70%) (Sharma *et al*., 2020). The variation is attributed to difference in age of bucks, breeds and season. The proportion of live (92.73±4.0 %) and dead sperms (7.27±4.1%,) found in the present study falls within the normal range of good semen quality in the buck (Chemmeau *et al*., 1991; Gubartallah, *et al.*, 2004; Maina *et al*., 2006; Elsheikh and Elhammali, 2015; Umar *et al*., 2018; Hhan *et al*., 2019). In contrast, Ahmed *et al*. (1997); Zamiri and Heidari (2006) stated that the percentage of dead sperm in Saanen and Rayini bucks was 15% and 22-40%, respectively. The difference in sperm viability could be attributed to the disparities in breeds and season of year.

Positive relations of color with consistency and live sperms were found in the present study; inverse correlations were also found between color and dead sperm ($P \leq 0.01$). These findings are close to those reported by Webb *et al*. (2004) in Gorno Altai Cashmere and South African indigenous goats, found positive correlations between live sperm percentage and semen volume and colour. Chandler et al. (1988) also revealed that the volume and concentration of the semen were significantly correlated, as were all parameters of viability in dairy goats. On the other hand, these findings presented differ from those reported in Anglo-Nubian goats by Souza *et al*. (2011), positive correlations with color and sperm mass motion; and progressive individual motility were noted.

Conclusion

The Sudanese Nubian bucks have good quality of fresh semen. Strong correlations exist between color; consistency and sperm viability.

Conflict of Interests

There is no conflict of interest.

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