

Semen quality of mature crossbred male goats during different seasons

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Abstract: This study assessed the influences of season on traits of semen collected from crossbred bucks during different seasons. Ejaculates of 4 mature proven fertile crossbred bucks (Nubian × Saanen) were collected with artificial vagina throughout three seasons (winter, summer, autumn). The semen samples were conventionally evaluated after collection. The results of this study demonstrated clearly that the season significantly influences ($p < 0.05$) the semen traits. The semen volume was significantly ($p < 0.05$) high in autumn compare to summer and winter. The sperm cells concentration and individual motility percent were significantly ($p < 0.001$) high in autumn, while the percentages of abnormal and dead sperms were the least. It is concluded that the mature crossbred bucks' semen quality is influenced with season and the semen quality is better when the semen is collected during autumn. Furthermore the least semen traits were observed in summer.

Keywords: Semen quality; mature; crossbred; male goats; season.

I. Introduction

Many exotic breeds of goats have been introduced to the Sudan to improve the local goat breeds and increase the economic level of many poor families that breed goats. On top of the imported breeds are Saanen and Toggenburg those are characterized with high milk yield. Consequently large numbers of local goat breeds were blindly bred to these exotic breeds especially the Nubian goat. This breeding has been done without extensive study of the hybrid properties in Sudan. This unregulated breeding may lead to emergence of undesirable reproductive and/or productive traits. This breeding process is associated with distribution of crossbred bucks to goat breeders without knowing their reproductive capabilities; especially their semen traits and its fertilizing abilities.

There is a consensus among researchers interested in breeding of goats; that the quality of bucks' semen is affected by various factors including but not limited to breed (Chimianeau, 1986); season (Karagiannidis et al., 2000; Barkawi et al., 2006) and source of protein supplemented to ration (Elhammali and Elsheikh, 2014). The researcher's opinions differ about the influence of season on semen characteristics. Some researchers say that semen quality is better in autumn and winter (Farashad et al., 2012); and others argue that the desired semen standards are met in autumn only; while the undesirable semen qualities are found during winter (Wang et al. 2014). Also the semen quality of Zaraibi breed of goats is reported as worse during winter and spring. (Barakawi et al. 2006). Seasonal variations lead to significant changes in the quality of sheep and goats semen (Bitto, 2006; Leboeuf, et al., 2000; Delgadillo, et al., 1992; Amir, et al., 1986; Elsheikh et al., 2013). Some Sudanese researchers argued that season effects on semen quality are minor and the semen quality remains in the range of good semen in all seasons (Adam 1996; Gubartallah 2004). However, the extreme high heat; especially during summer; affects the function of the epididymis, increases the alkalinity of semen, alters the semen pH (Salah, et al. 1992) and increases the percentages of abnormal and dead sperms (Elsheikh et al., 2013). Also Salah et al. (1992) found that high temperatures lead to testicular degeneration and even complete sterility. Some studies have shown that the sperm motility of pubertal bucks was high in autumn and low in summer season (Elsheikh et al., 2013). The percentage of dead sperms was high during spring and summer and less during autumn and winter (Ahmed and Noakes 1992, Karagiannidis, et al., 2000, Elsheikh et al., 2013). Also Tuli and Holtz, 1995 recorded low sperm motility in male Angora goats during spring. Some studies conducted in Sudan demonstrated that the percentage of dead and abnormal sperms increase in summer season and the sperm motility decreases; while in autumn the percentage of dead and abnormal sperms decrease and the sperm concentration increases (Adam, et al., 1997; Elsharif 2003; Elsharif and Makawi, 2004, 2005).

In a study conducted in Greece on Alpine and Saanen goat breeds; it was found that the percentage of abnormal sperms increases in spring and winter and decreases in autumn (Karagiannidis et al., 2000). The high concentration of sperm is always observed out of the breeding season, while the low concentration is observed in the breeding season (Delgadillo, et al., 1992). It also found that the males of Nubian goats bred in Sudan do not have a specific breeding season; while Saanen male goats have breeding season that starts from the beginning of autumn to the end of winter (Gubartallah 2004; Adam 1996).

Taking into account the variability in semen characteristics that is affected by season, breed and sometimes vary from place to place (Rege et al 2000); and the few studies that have been conducted on semen characteristics of crossbred male goats in Sudan; this study aimed to determine the seasonal variations that occur in semen characteristics of mature crossbred male goats (Nubian × Saanen).

II. Materials and methods

2.1. Study area and animals

The study was carried out at Hamdan's goat farm in Shambat, Khartoum North, Sudan (Latitude 15o 36' N, Longitude 32o 32' E). Four crossbred bucks (Nubian × Saanen) with proven fertility; according to their field performance; were used to study the effect of season on semen characteristics. Their ages were between 1.5 - 3 years and were free of infectious and parasitic diseases.

2.2. Husbandry and Management

To exclude the influences of protein source each buck was offered daily 1 kg of farm made ration supplemented with the same protein source (500gm in the morning and 500 gm in the evening). This ration is formulated of 19 % groundnut cakes, 45% sorghum (*Sorghum vulgare*, vr. Fatarita), 31% molasses, 3% mineral mixture and 2% sodium chloride. They were offered water and Alfa alfa ad libitum. They were i.m. injected with 1ml/50 kg, Ivermectin (Ivomec ®, Merial, France) to control endo- and ectoparasites.

2.3. Semen collection and evaluation

Semen was collected using artificial vagina (Evans and Maxwell, 1987). The semen volume was recorded and the semen was immediately transferred to water bath at 37°C. The mass motilities and the individual motility percentages were recorded (Evans and Maxwell, 1987). The percent of live and abnormal sperms were determined with standard method (Blom, 1950). The sperm cells concentration was determined by counting sperms with a haemocytometer (Evans and Maxwell, 1987, Leboeuf et al., 2000).

2.4. Statistical Analysis

Data were subjected to ANOVA. Data are presented as means ± standard error of the mean (SE). Probabilities of $p < 0.05$ were considered significant.

III. Results

3. 1. Ejaculate volume

The results showed that the season has a significant ($p < 0.05$) effect on semen volume of mature cross-bred bucks. The mean semen volume collected during autumn was significantly high ($p < 0.05$) compared to those collected during winter and summer “ 1.06 ± 0.82 , 0.76 ± 0.33 and 0.83 ± 0.53 ml; respectively” (Fig. 1). There were no differences ($p > 0.05$) between semen volumes collected during winter and summer. The maximum semen volumes collected during autumn and summer were 2 ml each and during winter was 1 ml. The least semen volumes collected during the three seasons were similar (0.5 ml each).

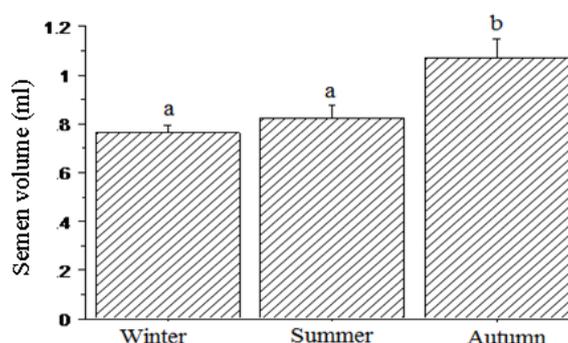


Fig. 1. The influence of season on semen volume of mature cross-bred bucks (^{a, b} $p < 0.05$).

3. 2. Sperm cells concentration

Figure (2) Shows that the season significantly ($P < 0.001$) influenced the sperm cells concentration of mature cross-bred bucks. The highest concentration of sperm cells was recorded in autumn, while the least concentration was recorded in summer. The average sperm cell concentrations recorded in summer, winter and autumn were 1.6×10^9 , 1.9×10^9 and 3.6×10^9 sperm cell/ml, respectively. The highest sperm cell concentration recorded in summer was 2.9×10^9 sperm cell/ml; in winter was 3.5×10^9 sperm cell/ml and in autumn was 3.9×10^9 sperm cell/ml, while the least concentrations recorded in the three seasons were almost equal (1×10^9 sperm cell/ml).

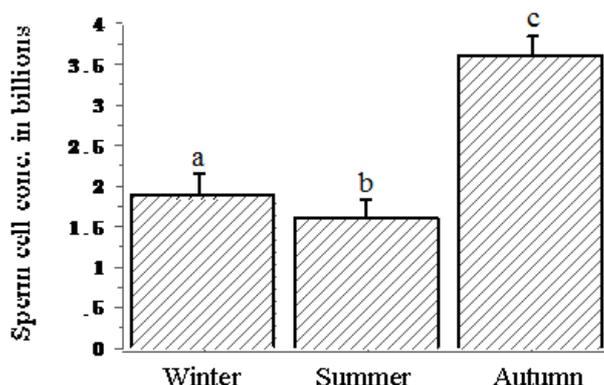


Fig. 2. The effect of season on sperm cell concentration in the semen of mature cross- bred bucks (a, b, c p<0.001).

3.3. Abnormalities of spermatozoa

The study showed that the season has a significant ($P < 0.001$) effect on the incidence of sperm abnormality percentage in the semen of mature cross-bred bucks (Fig. 3). The mean percentages of sperm abnormality were $9.2 \pm 0.25\%$, $11 \pm 0.66\%$, $4.9 \pm 0.45\%$ for winter, summer and autumn; respectively. The highest proportion of abnormal sperms was detected in summer (16%), while the lowest was detected in autumn (1%). The abnormalities of the tail were the highest, while the middle piece abnormalities were the least.

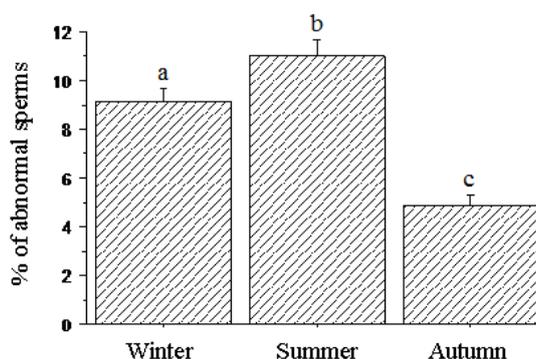


Fig. (3). Illustrates the influence of season on the percentage of abnormal sperms in mature cross- bred bucks' semen (a, b, c p<0.001)

3. 4. Percent of live sperms

The study showed that the percent of live sperms in the semen of cross-bred bucks is significantly ($P < 0.001$) influenced by season (Fig. 4). The mean percentages of live sperms recorded were 88.7 ± 0.94 , 78.7 ± 1.1 , $92.1 \pm 0.7\%$ for winter, summer and autumn, respectively. The highest percentages recorded were 96, 92, 94 % and the least percentages were 88, 75, and 85 % for autumn, summer and winter; respectively.

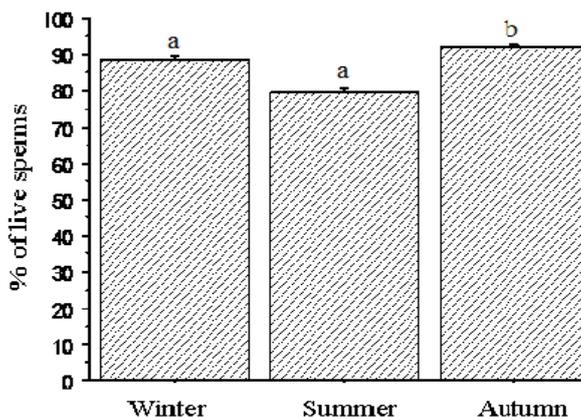


Fig. (4) The effect of season on the percentage of live sperm in the semen of mature cross- bred bucks (a, b P<0.001)

3.5. Sperm motility

The study showed no significant differences ($P > 0.05$) in the mass motility of semen during the three seasons. The maximum mass motility reported during each season was 4 and the minimum was 3. The individual motility differed significantly ($P < 0.001$) with seasons (Fig. 5). The mean individual motilities recorded were $74.88 \pm 0.66\%$, $69.500 \pm 0.66\%$, $77.89 \pm 1.09\%$ in winter, summer and autumn; respectively.

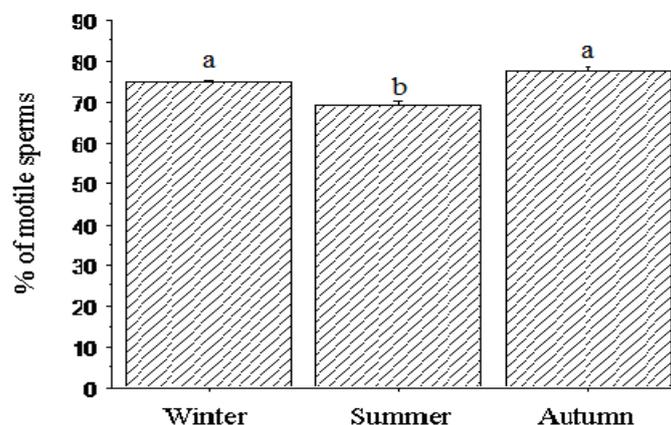


Fig. (5) . Shows the effect of season on individual sperm motility of mature cross-bred bucks (^{a, b} $P < 0.001$).

IV. Discussion

The results of this study indicated that the traits of semen collected during autumn are superior to those of semen collected in summer and winter.

The semen volume of mature crossbred bucks varies with season. The semen volume is high in autumn (the reproductive season) and lower in summer and winter. This result is consistent with that of Elsharif (2003), Elsharif and Makawi (2004) and Gubartallah (2004). Also the results are comparable to those of bucks from different goats' breeds (Perez, 1992; Leboeuf, et al., 2000; Wang et al., 2014).

The mass motility was not influenced by season, however in autumn it was high while in summer it was low. This finding agrees with previous studies conducted on pure Nubian bucks and hybrids with Saanen (Elsharif, 2003; Elsharif and Makawi 2004; Ahmed et al., 1997; Adam, 1996) and pubertal cross-bred bucks (Elsheikh et al., 2013; Elhammali et al., 2013; Elhammali and Elsheikh, 2014).

The hot summer season has a negative effect on the individual sperm motility. Similar results were reported by Ahmed et. al., 1997; Elsharif, 2003; Elsharif Makawi and 2004 as well as Rekwot, (1987) and Ahmed and Noakes, (1996).

Also the season had a clear impact on the concentration of sperm in the semen of mature cross-bred bucks. The highest concentration of sperm in the semen was recorded in autumn while the least concentration was in summer. This result is consistent with that reported for Nubian bucks and cross-bred bucks (Ahmed et al., 1997; Adam, 1996; Elsharif, 2003; Elsharif and Makawi, 2004). The same result was recorded in Syrian Damascus bucks (Daker and Suleiman, 2004). Also the results match with what reported by Delgadillo et al. (1992), Perez, et al., (1992) and Rekwot, (1987).

The highest dead sperm percentage recorded in this study was in summer while the lowest percentage was in autumn. This finding agrees with the findings of previous studies (Ahmed et al. 1997; Adam et al., 1996; Delgadillo et al., 1992; Elsharif and Makawi, 2004; Elsheikh et al., 2013; Wang et al., 2014).

In this study also the percentage of abnormal sperms increased in summer and winter compared to autumn. This is because the low temperature has an effect as does high temperature has on semen characteristics (Roca et al., 1991; Adam, 1996; Ahmed et al., 1997; Elsharif and Makawi, 2004; Elsharif and Makawi, 2005; Elsheikh et al., 2013).

V. Conclusion

Under Sudan conditions the semen traits of mature cross-bred bucks (Nubian × Saanen) in autumn are better than those of winter and summer. The least semen traits were observed in summer.

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