

Puberty of crossbred male goat kids

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Abstract: This study aimed to determine the characteristics of puberty of crossbred goat male kids (Nubian × Saanen). The following puberty characteristics: weaning weight, growth rate, age at complete separation of prepuce from the penis, scrotal circumference at puberty, weight and age at puberty, volume of the first ejaculate, individual and mass motility percent of semen, abnormal morphology spermatozoa and the concentration of spermatozoa, were evaluated. Furthermore, the correlation between body weight at birth and body weight at puberty, ejaculation volume and scrotal circumference and the age of puberty and scrotal circumference were also studied. Eight single born male kids (Saanen × Nubian) were used in this experiment. Their mean weight at birth was 3.80 ± 0.14 kg. The puberty characteristics were as follow: the average of weaning weight was 14.4 ± 0.73 kg, growth rate 82.9 ± 0.83 gm/day, age at complete separation of prepuce from the penis 16.3 ± 0.33 week, puberty age 30 ± 0.30 week with a mean body weight of 22.38 ± 0.94 kg and an average scrotal circumference of 23.4 ± 0.83 cm. The ejaculate volume, mass motility, individual motility percentage, the percent of live sperms, sperm cell concentration and the percentage of sperms with abnormal morphology were 0.68 ± 0.05 ml, 3.60, $76.30 \pm 3.41\%$, $87.30 \pm 1.63\%$, 2.8×10^9 and $5.7 \pm 0.71\%$, respectively. The correlation between the weight at birth and the weight at puberty was weak ($R=0.076$) but the correlation between scrotal circumference and the ejaculate volume was significant ($R=0.36$). No correlation between the age at puberty and the scrotal circumference ($R=0.009$) was found. Considering all the reported results of pubertal characteristics of goat male kids, it is concluded that the crossbred goat male kids attain puberty earlier and their growth rate is higher. Furthermore, the volume of their first ejaculated semen is directly correlated to scrotal circumference.

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1. Introduction

The Nubian goat breed, which produces good milk (Hassan and Elderani, 1990), is considered one of the best dairy goats in Africa (Devendra and Macleroy, 1982). The Nubian goat's population in the Sudan is 2.5 million out of 40 million head of goats (MAR, 2002). Recently goat's breeders introduced Saanen bucks to improve the productivity of Nubian goat. One of the most important steps, to achieve this goal, is their reproductive potentials be known and exploited. The weaning weight, growth rate, age at complete separation of prepuce from the penis, scrotal circumference at puberty, weight and age at puberty, volume of ejaculate, and individual and mass motility percent of semen, abnormal morphology spermatozoa and the concentration of spermatozoa are important puberty indicators in goats (De La Vega et al., 2001; Bezerra et al., 2009). When a male start to display sexual behaviors, mate and ejaculate semen containing enough viable sperm to

impregnate a female, it is said to be pubertal (Bezerra et al., 2009; Jimeno et al., 2001). To evaluate the reproductive efficiency of a male, it should be capable to express normal sexual behaviors that enable it to complete the mating successfully. Consequently semen can be collected from it and its reproductive capacity is evaluated and used for genetic improvement, if it comes from superior parents (Madani & Rahal, 1988; Bezerra, et al., 2009). The reproductive information of any animal breed is crucial to adopt any strategies for genetic upgrading of herds.

Thus, the objectives of the present study are to determine and record the following pubertal characteristics: weaning weight, growth rate, age at complete separation of prepuce from the penis, scrotal circumference at puberty, weight and age at puberty, volume of ejaculate, individual and mass motility percent of live semen, abnormal morphology

spermatozoa and the concentration of spermatozoa of crossbred buckling (Nubian × Saanen) in the Sudan.

2. Materials and methods

2.1. Study area and Animals

This study was carried out in a private goat farm in Shambat, Khartoum North, Sudan (Latitude 15° 36' N, Longitude 32° 32' E). A total of 8 newly born singletons crossbred male goats (Pure Nubian × Pure Saanen) were used in this study. Their mean body weight at birth was 3.80 ± 0.14 kg. They were born in January 2006.

2.2. Husbandry and management

The kids were kept with their dams to feed on milk till they age of 6 weeks. They were then given a concentrate made at the farm at a rate of 200 gm per day. This ration is formulated of 19 % groundnut cakes, 45% sorghum (Sorghum vulgare, vr. Fetarita), 31% molasses, 3% mineral mixture and 2% sodium chloride. They were offered water and Alfa alfa ad libitum. The kids were weaned at the age of 12 weeks. They were injected against ento- and endoparasites with 1ml/50 kg ivermectin (Ivomec, Merial Company, France).

2.3. Measuring puberty characteristics

The kids were weighted immediately after birth and their body weight was recorded weekly until they reached puberty. After weaning they were examined for preputial separation (Hovel, 1976; Bezerra et al., 2009). The scrotal circumference was measured weekly (Boundy, 1992). Trials of semen collection started immediately after preputial separation using artificial vagina (Evans and Maxwell, 1987). The semen volume was recorded and the semen was kept in a water bath at 37° C. The mass motility and the forward motilities were recorded (Evans and Maxwell, 1987). The percent of live, dead and abnormal sperms were determined after staining with eosin and negrosin stains (Blom, 1950). The sperm cell concentration was determined by counting sperms with a hemocytometer (Evans and Maxwell, 1987; Leboeuf et al., 2000). Onset of puberty was defined as the age at which an ejaculate containing motile spermatozoa was first collected from the kids.

2.4. Statistical analysis

Data are presented as means \pm standard error of the mean (SE). The correlation between body weight at birth and body weight at puberty, ejaculation volume and scrotal circumference and the age of puberty and scrotal circumference were determined by the Pearson partial correlation analysis.

3. Results

As shown in figure (1) the buckling body weight increased gradually in a sigmoid pattern until it reached the peak at puberty. The mean daily body gain was 82.9 ± 0.83 gm per day. The best growth rate was achieved during the 1st 16 weeks. At puberty slight decrease in body weight was observed. The body weight at puberty was 19.20 to 26.60 kg with a mean of 22.40 ± 0.9 kg. The puberty age was 29 to 31 week with an average of 30.00 ± 0.30 week. The mean age for preputial separation was 16.5 ± 0.33 week. The lowest age was 16 weeks and the highest was 18 weeks. The mean scrotal circumference was 23.40 ± 0.83 cm (range of 20 to 25.5 cm). The mass motility of the semen ranged from 3 to 4 (mean = 3.6). The individual motility range was 65% to 85% with a mean of $76.25 \pm 3.41\%$ and the percentage of sperms with abnormal morphology was $5.7 \pm 0.71\%$. A significant relation ($R = 0.36$) was observed between the scrotal circumference and the first ejaculate volume (Fig.2), while a weak relation ($R = 0.076$) was found between the birth body weight and the puberty weight (Fig.3). No relation was found ($R = 0.009$) between the age at puberty and testicular size (Fig.4).

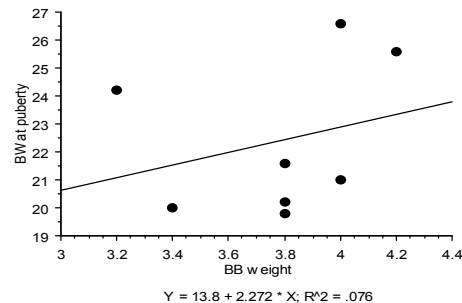


Fig. (1). The growth curve of cross bred male goat kids.

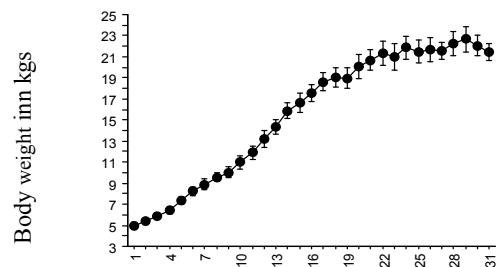


Fig. (2). The correlation of the first ejaculate volume with scrotal circumference. ($Y = -1.17 + 0.07 * X$; $R^2 = 0.36$)

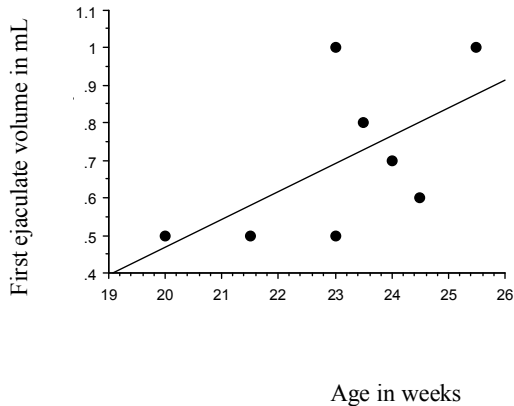


Fig. (3). The relation between birth body (BB) weight and body Weight (BW) at puberty.

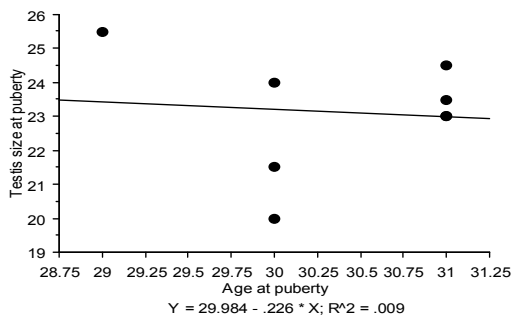


Fig. (4). The relation between puberty age and testicular size.

4. Discussion

This study revealed that the pubertal characteristics of crossbred Nubian bucklings agree to some extent with that of other breeds with slight discrepancies. The average weight at weaning found in this study is slightly higher than that reported in desert goats native to Kordofan in west Sudan (Alamin, 2003). The weaning weight reported here is much higher than that reported in the Damascus goats (Karagiannidis et al., 2000). This is probably due to the different management, breed and the environment. The average age of full detachment of the prepuce is less than that of all the previous studies except the results of Bezerra et al., (2009). Most of the previous studies considered the age of preputial detachment as the age of puberty, while in this study full detachment and exit of penis does not mean age of puberty. Preputial detachment means a period when only penis separation, erection and mounting take place without ejaculation.

In this study, the average age and weight of crossbred goat bucklings at puberty (Saanen × Nubian) is

identical with that of Sinaloa goat bucklings (Comloav, et al., 1992), the Anglo Nubian bucklings (Chakraborty, et al., 1999), the Marwari bucklings (Mehta et al. 1992) and almost equal with that of Botswana bucklings ((Aganga, 2005). Contrary, the results are higher than that of Syrian mountain goat's bucklings (Habib, 2001) and the Peral Cashmere bucklings (Wolde, et al., 1989). The results of this study are much less than that of Kutchi goats (Mittal, 1991).

The average daily growth of crossbred male goats (Saanen × Nubian) is comparable to that report elsewhere (Elabid, 1996; Wilson, 1976; Khalaffalla and Elshafie, 1988). Contrary, the average daily growth is greater than what mentioned by Alsayed, (2001) and Aganga, (2005). The scrotal circumference which is an indicative for testicular size was almost equal to that reported in Toggenburg, Alpine and Saanen buckling (Ahmed and Noakes 1992) and greater than that of Marwari and Surti (Mehta, et al., 1992).

The semen volume reported here is similar to what was reported in Saanen bucklings in India ((Shamsuddin, et al., 2000), in Sudan (Adam, 1996; Ahmed et al., 1997), less than that reported in Alpine and Saanen (Karatza, et al., (1997) and Boer goats (Tuli et al., 1991). These differences with previous studies in semen volume are due to the differences of estimating age of puberty, collection methods, as well as breeds.

Individual motility reported in this study is identical with what was found in Nubian bucks in the United States and in Alpine and Saanen (Karatza et al., 1997). The semen volume in this study is less than that reported in Nubian bucks in Sudan (Gubartallah et al., 2004). This difference is perhaps due to the combined effects of age, breed and management. The mass motility recorded in this study was almost identical to what is recorded in most previous studies (Gubartallah 1998, Gubartallah et al., 2004). The percent of live sperms is similar to that of all the previous studies.

The average concentration of sperm in this study is in agreement with that of Alpine male goats in France (Delgadillo et al., 1991) and that of Angora bucklings (Montaldo et al. 1981). The sperm concentration in this study is less than that of Boer buckling (Tuli et al., 1991) and higher than that of Nubian buckling reared in the United States (Skal et al., 1988).

The percentage of sperms with abnormal morphology agrees with that of Nubian buckling in Sudan (Gubartallah, 1998) and that reported in Damascus bucklings in Greece (Karagiannidis et al., 2000). The abnormalities reported here are less than that reported in Sokoto bucks (Daudu 1984) and

Nubian bucklings in the United States (Skal et al., 1988).

The differences in the puberty characteristics of this study and the previous studies are attributed to the differences among breeds, climate, nutrition, management and also the methods of estimating the age of puberty and semen collection method employed.

Considering all the reported results of pubertal characteristics of goat male kids, we concluded that the crossbred male goats attain puberty earlier and their growth rate is higher. Furthermore, the volume of their first ejaculated semen is directly correlated to scrotal circumference.

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