

Breeding soundness examination of native Omani bucks

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Abstract

Goats are the most important livestock in the Sultanate of Oman. There are three major goat breeds in Oman: Dhofari, Batina, and Jabal Akhdar. At present, the breeding bucks are selected on basis of physical appearance. Taller and heavier bucks are preferred. No breeding soundness examination (BSE) is performed before animals are used for breeding. The objectives of the study were to evaluate reproductive potential of Omani bucks utilizing established criteria for BSE. Fifty bucks (19 Dhofari, 18 Batinah, 13 Jabal Akhdar), 1-5 years old were evaluated for breeding soundness, including physical examination, body weight (BW), scrotal circumference (SC), semen collection and evaluation. There was a significant difference in BW ($P < 0.001$) and in SC ($P < 0.01$) between Dhofari, Batinah and Jabal Akhdar. It is concluded that BSE should be performed to evaluate Omani bucks intended for breeding, and for semen preservation of genetically superior bucks; to facilitate artificial insemination for genetic improvement; and preservation of biodiversity in Omani goats.

Keywords: Omani bucks, breeding soundness examination, reproductive evaluation

Introduction

Goats are the most important livestock species in Oman, considering the largest number (15,571,148) of the livestock population, followed by sheep (351,066), cattle (301,588), and camels (117,299) in Sultanate of Oman.¹ There are three major distinct breeds of goats in Oman: Dhofari, Batinah, and Jabal Akhdar which contribute 40, 55, and 5% of the total goat population, respectively.²

Evaluation of the male for breeding soundness is an important part of a reproductive management of a herd. Breeding soundness evaluation also is a first step in semen preservation for long-term preservation of genetic material and preservation of biodiversity. Evaluation of the male for breeding soundness is based upon SC and motility and morphology of sperm. It has been shown that highly fertile rams settled ewes earlier in the breeding season, and resulted in production more twins. The quality of rams' semen was significantly correlated with the twinning rate.³ Since a large number of high quality spermatozoa are necessary for successful breeding in the sheep,⁴ sheep fertility is closely related to sperm production in the ram. Bongso, et al⁵ reported significant correlation between buck SC with age and BW. The rate of male sexual development seemed to vary with goat breed, birth weight and nutrition.

Currently, in Oman, the breeding bucks are selected only on basis of physical appearance. Taller and heavier bucks are preferred. No BSE is performed before bucks are used for breeding on the government farms or sold to private farm owners for improvement of their goat production. The Society for Theriogenology (SFT) has recommended measurable BSE criteria, including SC, sperm motility and sperm morphology in the bull and the ram.^{6,7} Based upon SFT criteria, bulls are declared satisfactory, questionable and unsatisfactory potential breeders. Although limited information is available on various aspects of BSE of different goat breeds^{5,8,9} but no reports are available on Omani goat breeds

The objectives of the current study was to evaluate reproductive potential of native Omani bucks utilizing established criteria of BSE, and to establish male BSE values for breeding recommendations. To the best of our knowledge, this is the first report on buck BSE of Dhofari, Batina, and Jabal Akhdar, the native Omani goat breeds.

Materials and methods

Fifty bucks 1-5 years old were evaluated for breeding soundness. The breed distribution was 19 Dhofari, 18 Batinah, and 13 Jabal Akhdar. The bucks were weighed and the scrotum was examined for presence of two normal testes. Scrotal circumference was measured using a standard scrotal metal-tape

(Nasco, Ft. Atkinson, WI) at the widest mid-scrotal point. Semen was collected using artificial vagina (AV) or electroejaculator (EE; Standard Precision Electronics, Denver, CO) as described earlier.¹⁰ Semen volume, sperm mass activity, individual sperm motility and morphology were evaluated by established techniques.^{7,11} In summary, sperm mass activity was evaluated by placing a drop of undiluted semen on pre-warmed microscope slide and evaluated for the wave motion under a microscope. The mass activity was graded from 0 to 3 (0 – no activity, 1 – slow/irregular, 2 – moderate, 3 – fast wave motion). For individual sperm motility, a small portion of semen was diluted 1:10 (semen: normal saline). A drop of diluted semen was placed on pre-warmed microscope slide, covered with cover slip and evaluated under microscope as percentage of sperm moving in a forward progressive manner. Sperm concentration in each ejaculate was calculated by utilizing dilution pipettes (Platelett Unopette®, B-D #5855, Becton, Dickinson and Company, Franklin Lake, NJ) and hemocytometer (Exodus Breeders Corporation, York, PA) and the number of sperm/ml was calculated. For sperm morphology, a drop of semen was placed close to an end of a microscope slide and mixed with a drop of eosin-nigrosin stain (Society for Theriogenology, Montgomery, AL), and smear was made. The smear was air-dried, and sperm were evaluated under oil immersion lens of a microscope at 1000x. Two hundred sperm were evaluated and abnormalities were classified according to Barth and Oko.¹² The primary abnormalities were considered as sperm head abnormalities, proximal cytoplasmic droplet, abnormal mid-piece, and tightly coiled tails; while the secondary abnormalities included distal cytoplasmic droplet, bent tails, and loose heads.

Statistical analysis

The original experimental design was a random 3×2 factorial design with three breeds of goats (Dhofari, Batinah and Jabal Akhdar) and two methods of collection (AV and EE). Data were analyzed using Microsoft Excel spreadsheets, SAS (2000). Mean statement was used to generate means, standard deviation, minimum and maximum values. GLM procedures on the SAS were used for analyses of variance to test for effects of breed, method and their interaction. Data were then pooled after finding no effect of method or interaction and analyzed by analyses of variance. Microsoft Excel was used to plot relationship between BW and SC and polynomial equation and R² were generated.

Results

Table 1 summarizes the mean (± SD) age, body weight, SC and semen evaluation parameters (semen volume; sperm mass activity, motility, concentration, and normal sperm). The semen parameters represent all semen samples collected from three breeds by AV or by EE. Out of 50 bucks, 16 (Dhofari 9, Batinah 4, Jabal Akhdar 3) were collected by AV, and the remaining 35 ((Dhofari 11, Batinah 18, Jabal Akhdar 13) were collected by EE. The analysis from all three breeds was combined because there was no significant difference between semen parameters between breeds (Table 2).

There was a significant difference (P<0.001) in BW between the smaller Dhofari and the larger Batina and Jabal Akhdar breeds. The SC showed significant (P<0.01) difference between Dhofari, and Batina and Jabal Akhdar. The SC difference represents the BW of each breed (Figure). Among the semen parameters tested, only sperm motility was significantly (P<0.01) different between Dhofari, and Batina and Jabal Akhdar (Table 2).

Discussion

The positive relationship between BW and SC found in the current study is in agreement with earlier studies.^{13,14} Bucks weighing 55-60 kg had significantly greater testicular size, semen volume and the total number of live sperm.¹⁴ In our study, the BW and SC of the bucks ranged from 22 to 77 kg and from 17 to 27 cm, respectively. In comparison with Zaraibi breed bucks¹⁵ with smaller BW (25-27 kg) had similar SC (25-27cm) as noted in our study. A similar trend in BW (60-75 kg) and SC (24-27cm) was noted in Saanen bucks under tropical conditions.¹⁶ In the study by Ahmad, et al,¹⁶ SC in Saanen bucks showed seasonal variation, with smallest SC (23.88 cm) during summer and the largest SC (26.54 cm) during autumn. Seasonal affects on reproductive performance is also reported in western Iran.¹⁷ Our study was conducted during January in northern Oman at 21° latitude.¹⁸ The goats raised in areas away

from equator are more affected by season.^{19,20} The goat breeds living in latitudes lower than 30° do not present significant differences in reproductive activity as a consequence of seasonal influence.²¹ The seasonal effect, if any on reproductive characters of Omani goats raised at 21° latitude is not known.

In conclusion, it is recommended that BSE should be utilized to evaluate Omani bucks intended for breeding. Breeding soundness evaluation would be a desirable first step for screening bucks for semen preservation of genetically superior bucks; to facilitate artificial insemination for genetic improvement; and preservation of biodiversity in Omani goats.

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Table 1: Accumulative values of breeding soundness examination of 50 Omani native breed bucks

| Variable | Mean \pm SD | Minimum | Maximum |
|------------------|---------------------|---------|---------|
| Age (days) | 712.83 \pm 479.21 | 123 | 1,724 |
| SC (cm) | 22.84 \pm 2.21 | 17 | 27 |
| BW (kg) | 45.25 \pm 13.44 | 21.40 | 77.00 |
| S. Vol (ml) | 1.12 \pm 0.24 | 0.50 | 1.50 |
| S. MA (0-3) | 2.31 \pm 0.87 | 0.0 | 3.0 |
| S. Mot (%) | 75.60 \pm 10.53 | 50 | 90 |
| S. Conc (bil/ml) | 1.62 \pm 0.78 | 0.1 | 3.7 |
| N. Sp (%) | 97.26 \pm 1.83 | 90 | 99 |

SC= Scrotal circumference, BW=Body weight, S. Vol. =Semen volume, S. MA=Sperm mass activity, S. Mot=Sperm motility, S. Conc. =Sperm concentration, N. Sperm = Normal sperm

Table 2: Breeding Soundness Examination parameters (Mean \pm SD) distributed by breed of 50 native Omani breeds bucks

| Variable | Goat Breeds | | | Breed effect |
|-------------------|------------------|------------------|---------------------|--------------|
| | <i>Dhofari</i> | <i>Batinah</i> | <i>Jabal Akhdar</i> | |
| BW (kg) | 32.22 \pm 2.03 | 52.34 \pm 2.23 | 58.53 \pm 2.62 | *** |
| SC (cm) | 21.53 \pm 0.49 | 24.01 \pm 0.57 | 23.80 \pm 0.66 | ** |
| S. Vol (ml) | 1.13 \pm 0.05 | 1.13 \pm 0.06 | 1.09 \pm 0.07 | NS |
| S. MA (0-3) | 2.03 \pm 0.19 | 2.66 \pm 0.25 | 2.43 \pm 0.28 | NS |
| S. Mot (%) | 68.96 \pm 2.10 | 79.35 \pm 2.68 | 79.50 \pm 3.08 | ** |
| S. Conc (bill/ml) | 1.58 \pm 0.18 | 1.85 \pm 0.23 | 1.65 \pm 0.26 | NS |
| N. Sp (%) | 96.94 \pm 0.40 | 96.76 \pm 0.51 | 97.33 \pm 0.59 | NS |

SC= Scrotal circumference, BW=Body weight, S. Vol=Semen volume, S. MA=Sperm mass activity, S. Mot=Sperm motility, S. Conc=Sperm concentration, N. Sperm=Normal sperm

Means on the same line which are denoted with no or similar superscripts do not differ significantly (P>0.05).

* : P<0.05; **: P<0.01; ***: P<0.001

Figure: Relationship between body weight and scrotal circumference in Omani goats of various breeds



