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Seasonal Dynamics of Testicular Blood Flow and Their Association with Reproductive Performance in Rams

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Abstract

The present detailed study aimed to establish for the first time reference values for ultrasound measures of testicular dimensions and Doppler measures of blood flow in the suprastesticular artery (STA) of rams over a 12-month period, and to investigate a possible association between monthly changes in dynamics of testicular blood flow from one hand and testicular volume, plasma testosterone and estradiol -17 β concentrations as well as semen characteristics from the other hand. Five fat-tailed rams weighing 45-60 Kg and aging 2-4 years old were subjected to semen collection, jugular blood sampling, ultrasonographic scanning of the testes and Doppler examination of testicular artery twice monthly for a period of one year. Testis dimensions were measured by a linear-array ultrasound transducer (7.5 MHz) whereas Doppler indices, including resistive index (RI) and pulsatility index (PI), were measured by color pulsed-wave Doppler. The overall mean (\pm SD) values of testicular volume, calculated by using the formula: length \times thickness \times width \times 0.71, as well as RI and PI, respectively were 71.84 \pm 5.33 mm³, 0.378 \pm 0.102 and 0.642 \pm 0.208. Both ultrasound testicular volume and Doppler measures displayed a definite trend throughout the study period. Average testicular volume was the lowest in June (59.44 \pm 6.83 mm³) and reached its maximum (84.43 \pm 8.52 mm³) in November after 42.2% increase ($p < 0.01$). Mean values of RI were lowest between September and March (range 0.100-0.400), increasing significantly ($p < 0.01$) in April (53%) reaching highest value in June (0.564 \pm 0.158). From the lowest value recorded in October through February (range 0.200-0.600), the average PI values increased significantly ($p < 0.05$) in March (41%) to reach maximum value in July (0.940 \pm 0.368). The overall mean values of plasma testosterone and estradiol -17 β concentrations were, respectively 4.53 \pm 0.34 ng/ml and 227.50 \pm 18.36 pg/ml. The semen quantity traits were characterized by an overall mean of 0.71 \pm 0.06 ml, 2.88 \pm 0.40 $\times 10^9$ /ml and 2.18 \pm 0.28 $\times 10^9$ /ejaculate, respectively for ejaculate volume, sperm cell concentration and total sperm output. The average semen characteristics were 3.79 \pm 0.26, 71.14 \pm 6.87%, 82.05 \pm 7.26% and 14.90 \pm 0.45%, respectively for mass motility score and percentages of individual motility, live sperm and total sperm abnormalities. Day length and monthly average temperature were correlated ($p < 0.01$) negatively with testicular volume and plasma testosterone and estradiol -17 β levels as well as positively with RI and PI. The semen quantity variables correlated ($p < 0.01$) negatively with photoperiod length whereas the quality ones correlated ($p < 0.01$) negatively with monthly average temperature. In conclusion, the monthly definite changes in the studied parameters evidenced four novel findings: (1) plasma testosterone concentrations, which increased significantly ($p < 0.05$) at late summer (August), was the potential initiator for resuming the breeding season (October-March) in rams via stimulating spermatogenic activity and maximum testicular volume during this period, (2) resulting values of testicular volume and testicular blood flow profiles all year round provide useful reference values for predicting testicular function in rams, (3) the marked increase in testicular blood flow volume, i.e. remarkable decrease in both RI and PI values, during the breeding season could be regulated by the marked increase in testicular volume and plasma estradiol -17 β levels during this period, and (4) semen of superior quantity and quality especially collected during the period from October through February was effectively used for improving fertility in fat-tailed rams under Egyptian subtropical conditions.

Keywords: Season; Testes; Doppler; Testosterone; Semen; Rams.

DEDICATION

TO MY Father,

My Mother,

My Brother,

My Sister,

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