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Research Article

BIOMETRY OF MORBID BUCK TESTICLES AND ITS CORRELATION WITH EPIDIDYMAL SEMEN QUALITY

HARI OM SINGH[1], BHOOPENDRA SINGH* and RAJESH KUMAR
[1]Department of Animal Husbandry, UP, India
Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science & Animal Husbandry,
Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya-224229, India

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ABSTRACT

The present study was carried out on ninety six pairs testicles (n=96) from mature bucks irrespective of breed presented for slaughter at local abattoir (Faizabad- 224229 and Sultanpur- 228001) of UP, and AL-Nafees protein PVT Ltd., Mewat-122103, Haryana. Various biometric parameters of testes and epididymis were estimated. Correlations among different seminal parameters were carried out. All biometric parameters of testes and epididymis were significantly ($p<0.05$) higher in left testicles than those of right contemporaries. The significantly higher cauda circumference was noted in left testicle than those of right one. The weight of caput, corpus and cauda was significantly higher in left side compared to right. Medium to high significant correlations were observed between testicular volume and epididymal semen volume (r=0.79), concentration (r=0.62), motility (r=0.89), viability (r=0.87), and HOS (r=0.86). However, testicular volume was highly negatively and significantly correlated with sperm abnormality (r= -0.86). In conclusion, in despite of available methods, desirable traits with high positive and negative correlations should be taken into consideration while selecting breeding bucks for breeding purpose and establishment of germplasm bank of valuable buck.

Keywords: Buck, Epididymis, Testicular diameter, Testicular circumference, Semen volume, Testicular weight

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Genetic improvement of farm animals may rely on the use of limited number of males for breeding (natural mating or artificial insemination) (Ibrahim *et al.*, 2012). Age of pubertal onset and male fertility have important bearings in caprine reproduction as single male is bred to many females (Chaudhary *et al.*, 2018). Breeding soundness examination of buck at early age is challenging task to any goat owner or breeder as both male and female equally contribute in high fertility and fecundity. Testicular measurements during period of adolescence can provide fair indication to figure out age at which male can be used for breeding purpose. Marked increase in testicular size reflects onset of active spermatogenesis (Bongso *et al.*, 1982). Testicular biometry is a good indicator of sperm production potential. Indeed, it is an important aspect of breeding soundness examination of male goat. Testicular biometry is also helpful in ameliorating infertility problems by assisting in diagnosis, control and treatment of sub-fertility or infertility in males (Baldaniya *et al.*, 2020). Testicular traits are markers of level of sexual activity and daily sperm production ability in buck (Leal *et al.*, 2004). Scrotal circumference and seminal attributes differed among different breeds as well as among individual of the same breed. Keeping the view of above, the present study was planned to evaluate testicular biometry of slaughtered buck and its correlation with seminal attributes.

*Corresponding author: drbsvet@gmail.com

MATERIALS AND METHODS

The experiment was conducted at deep frozen semen laboratory (DFS lab), Department of Veterinary Gynaecology and Obstetrics, College of Veterinary Science and Animal Husbandry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, UP. Total ninety six pairs of testes were collected immediately after slaughter irrespective of breed from local abattoir (at Faizabad and Sultanpur district of UP) and AL-Nafees Proteins PVT Ltd., Mewat, Haryana. The testes were collected and stored in plastic bags in ice chest at 4 ºC and immediately transferred to DFS lab. After arrival at lab, testes were cleaned with physiological saline solution, fascia, blood vessel and sheath were removed using BP blade and thumb forceps. Various biometric parameters namely testicular length (TL) along longitudinal axis of testis from one pole to another, testicular diameter (TD) at widest portion and epididymal length (EL) were measured using non-stretchable scrotal tape; testicular weight (TW) with and without epididymis were measured using sensitive digital weighing scale; testicular volume (TV) were measured using formula $TV = TD^2 \times TL \times 0.5$.

The cauda epididymal spermatozoa were harvested in 15 ml plastic vials by slicing and swim up technique (Joram *et al.*, 2016) and were analyzed for volume, colour, concentration, sperm count, motility, viability, morphology and HOS reactivity in fresh samples. The semen volume was measured by direct reading of graduated conical tubes,

colour determined by visual observation (colour other than white and yellow were excluded from the study), sperm concentration was estimated using hemocytometer method. In order to estimate progressive motility, a drop of epididymal semen was placed on prewarmed glass slide and covered with cover slip, the per cent progressive motile sperm was assessed subjectively at 37 ºC under high power (40X) magnification. Live sperm count were estimated using differential staining technique with eosin-nigrosin stain. To count abnormal sperm, semen sample suspended in formal saline solution stained with eosin-nigrosin stain, one drop of this mixture was put on the slide and covered with cover slip. The per cent abnormal sperm were estimated by counting total 200 spermatozoa under phase contrast microscope (100 X magnification with oil immersion).

Data were presented as mean and standard error (mean± SE). Analysis of variance was used to assess differences among the buck testicles and treatments. Tukey's HSD test was used to compare treatment means by Graphpad Instat Version 5 soft. Pearson's correlations were worked out between testicular volume and seminal attributes.

RESULTS AND DISCUSSION

Testicular length: Testicular length with epididymis (mean± SE) was significantly ($p<0.05$) higher in left testicle than those of right contemporaries (9.65±0.18 vs 9.15±0.18 cm) (Table 1). Many previous workers observed the same trend in different breed of goat (Yaseen *et al.*, 2010; Kabiraj *et al.*, 2011; Al-Mahmodi *et al.*, 2017; Chaudhary *et al.*, 2018; Baldanya *et al.*, 2020). Furthermore, similar trends were also recorded in donkeys (Bansal *et al.*, 2003), musk deer (Choudhary *et al.*, 2008), ram (Bhattacharya *et al.*, 2010; Al-Mahmodi *et al.*, 2017) and Murrah bull (Kumar *et al.*, 2017). Contrary to present findings, Oyeyemi *et al.* (2012) recorded higher testicular length in Sahel buck; Patni *et al.* (2016) reported non-significantly longer left testicular length than those of right one among different age groups in local Pantja goats; Gemeda and Workmahu (2017) recorded lower mean testicular length in three native breed of Ethiopian goat. The difference observed in current findings might be due to difference in age, breed, health status, soundness of sex organs and geographical locations. Moreover, Kabiraj *et al.* (2011) recorded non-significant difference between left and right testicular length in black Bengal buck, however, the values were higher than present study which might be due to breed difference.

Testicular circumference and diameter: Testicular circumference was non-significantly higher in left testicles as compared to right one (10.66±0.18 vs 10.16±0.18 cm; $p<0.05$; Table 1). Testicular diameter (mean ± SE) was significantly ($p<0.05$) higher in left testicles (3.39±0.06 vs 3.23±0.05 cm; Table 1) than those of right one. Current trends were also observed in Sahel bucks (Oyeyemi *et al.*, 2012), non-descript bucks (Baldaniya *et al.*, 2020), rams (Al-Mahmodi *et al.*, 2017), Murrah bull (Saurabh *et al.*, 2018). Furthermore, Yaseen *et al.* (2010) and Al-Mahmodi *et al.* (2017) reported significantly higher TD in left testicles compared to right contemporaries in goat.

Testicular volume: Testicular volume (mean±SE) differed significantly between left and right testicles (57.41±2.56 vs 49.41±2.32; $p<0.05$; Table 1). The current trends were also observed in camel (Abdullahi *et al.*, 2012), ram (Al-Mahmodi *et al.*, 2017), and buck (Al-Mahmodi *et al.*, 2017; Baldaniya *et al.*, 2020). The difference observed in present findings as compared to previous reports in goat were might be due to difference in age, breed, health status, season and soundness of sexual organs.

Testicular weight: Testicular weight with or without epididymis (mean±SE) differed significantly between left and right testicles (56.94±1.03 vs 55.04±1.01 g; $p<0.05$). Similar to current trends, higher TW were also observed in Marwari bucks (Yaseen *et al.*, 2010), black Bengal buck (Kabiraj *et al.*, 2011), Sahel bucks (Oyeyemi *et al.*, 2012), Pantja goats (Patni *et al.*, 2016) and non-descript bucks (Baldaniya *et al.*, 2020). Furthermore, higher TW were also observed in donkeys (Bansal *et al.*, 2003), ram (Bhattacharya *et al.*, 2010), and Murrah bull (Saurabh *et al.*, 2018) in left testicles as compared to right contemporaries. Contrary to present trends, significantly higher TW were reported in right testicle than those of left one in bucks and ram (Al-Mahmodi *et al.*, 2017) and in camel (Abdullahi *et al.*, 2012). Testicular weight varies with breed, age and season of year etc. Furthermore, Soderquist and Hulten (2006) observed that Gotlandic breed of rams with heavier testes tend to sire daughters which attain puberty at an earlier age and ovulate more ova. Current trends were in agreement with Ibrahim *et al.* (2012) who recorded significant difference between weight of left and right testes. Furthermore, significant difference of testicular weight of left and right testes as well as among different breeds were recorded in Balami, Uda and Yankassa breed of ram in Nigeria (Ibrahim *et al.*, 2012) and Ethiopian local goat breed namely Afar, Long-eared Somali and Woyt (Gemeda and Workalemahu, 2017).

Epididymal length (EL), width (EW) and circumference (EC): The EL, EW and EC of caput, corpus and cauda the values were significantly higher in left epididymis as

compared to right counterparts (Table 1). Unlike present findings, Oyeyemi *et al.* (2012) recorded higher epididymal length than present findings which might be due to difference in age, breed, and season of the year.

Epididymal weight: The weight (mean±SE) of caput, corpus and cauda of left testicles were significantly higher than those of right one (Table 1). Similarly, Ibrahim *et al.* (2012) recorded significant difference between left and right epididymal weight, furthermore they also observed significant difference of epididymal weight between Balami, Uda and Yankassa breed of ram in Nigeria.

Correlation coefficient between testicular volume and epididymal seminal characteristics: Testicular Volume was significantly ($p<0.01$) positively correlated with ESV ($r = 0.79$), ESC ($r = 0.62$), ESR ($r = 0.80$), initial motility ($r = 0.89$), sperm viability ($r=0.87$), and HOS reactivity ($r=0.86$), however, it was significantly ($p<0.01$) negatively correlated with abnormal count ($r = -0.86$) (Table 2). Furthermore, Shyombo *et al.* (2011) recorded significantly positive correlation between testicular volume and testicular weight ($r = 0.06$) in Savannah brown buck. Moreover, Gemeda and Workalemahu (2017) observed significant positive correlation of testicular volume with testicular length ($r=0.61$) and testicular weight ($r=0.64$) in indigenous buck breed of Ethiopia. Contrary to present findings, Baldaniya *et al.* (2020) reported highly negative correlation of testicular volume with sperm motility in non-descript buck. Epididymal semen volume (ESV) was significantly ($p<0.05$) positively correlated with ESC ($r = 0.58$), ESR ($r = 0.97$), initial motility ($r = 0.79$), sperm viability ($r=0.79$), and HOS reactivity ($r = 0.83$), however, negatively correlated with abnormal count ($r = -0.77$). Furthermore, Kabiraj *et al.* (2011) recorded strong positive correlation of semen volume with testicular weight ($r = 0.867$) and length (($r = 0.793$) in Black Bengal bucks. Epididymal semen concentration (ESC) was significantly ($p<0.05$) positively correlated with ESR ($r = 0.76$), initial motility ($r = 0.70$), sperm viability ($r = 0.71$), and HOS reactivity ($r = 0.66$), however, negatively correlated with abnormal count ($r = -0.60$). Similarly, Kabiraj *et al.* (2011) recorded strong positive correlation of semen concentration with testicular weight ($r = 0.840$) and length ($r = 0.600$) and semen volume ($r =0.769$) in Black Bengal bucks. Epididymal semen recovery (ESR) was significantly ($p<0.05$) and positively correlated with initial motility ($r = 0.82$), sperm viability ($r = 0.82$), and HOS reactivity ($r = 0.85$), however, negatively correlated with abnormal count ($r = -0.79$).The sperm motility was significantly ($p<0.05$) positively correlated with sperm viability ($r = 1.00$), and HOS reactivity ($r = 0.96$), however, negatively correlated with abnormal count ($r = -0.89$). The sperm viability was significantly ($p<0.05$) positively correlated with HOS reactivity ($r = 0.96$), however, negatively correlated with abnormal count ($r = -0.88$). The HOS reactivity was significantly ($p<0.05$) negatively correlated with abnormal count ($r = -0.90$).

In conclusion, despite of available methods, desirable traits with high positive and negative correlations should be taken into consideration while selecting breeding bucks for breeding purpose and establishment of germplasm bank of valuable buck.

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Table 1

Testicular Biometry (Mean ± S.E.) of left and right testicle of slaughtered buck

Attributes	Left testicle (n=96)	Right testicle (n=96)
Testicular length with epididymis (cm)	9.65±0.18*	9.15±0.18
Testicular length without epididymis (cm)	7.94±0.16*	7.55±0.16
Testicular circumference (cm)	10.66±0.18*	10.16±0.16
Testicular diameter (cm)	3.39±0.06*	3.23±0.05
Testicular volume (cm^3)	57.41±2.56*	49.41±2.32
Caput Length (cm)	4.02±0.09*	3.79±0.08
Caput Width (cm)	3.33±0.10*	3.00±0.08
Carpus Length (cm)	6.30±0.14*	6.00±0.15
Carpus Width (cm)	0.50±0.01*	0.44±0.01
Cauda Circumference (cm)	4.36±0.07*	4.08±0.07
Weight of Caput (gm)	3.48±0.09*	3.17±0.09
Weight of Corpus (gm)	2.56±0.06*	2.30±0.07
Weight of Cauda (gm)	3.70±0.09*	3.40±0.09
Weight of Testicles with epididymis (gm)	56.94±1.03*	55.04±1.01

*$p<0.05$ between left and right testes.

Table 2

Correlation coefficient of (r = value) different cyto-morphological seminal attribute and HOS positive spermatozoa in epididymal semen of buck

Parameters	Testicular Vol. (cm3)	ESV (ml)	ESC (million/ml)	ESR (million)	Sperm motility (%)	Sperm viability (%)	Abnormal count (%)
ESV (ml)	0.79**						
ESC (million/ml)	0.62**	0.58*					
ESR (million)	0.80**	0.97**	0.76**				
Sperm motility (%)	0.89**	0.79**	0.70**	0.82**			
Sperm viability (%)	0.87**	0.79**	0.71**	0.82**	1.00**		
Sperm Abnormality count (%)	-0.86**	-0.77**	-0.60**	-0.79**	-0.89**	-0.88**	
HOS (%)	0.86**	0.83**	0.66**	0.85**	0.96**	0.96**	-0.90**

* Significant at 5% ** Significant at 1%

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