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Biometric Assessment of the Testis in Pakistani Adult Male Goats (*Capra hircus*)

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Abstract. The biometric analysis of the testes of adult male of the local breeds of goat is reported. The mean length, breadth, thickness and circumference of right testicle with epididymis recorded was 8.42±0.91 cm, 4.58±0.56 cm, 4.19±0.53 cm and 12.53±1.23 cm and those of left testicle with epididymis were 8.44±1.06 cm, 4.62±0.57 cm, 4.24±0.51 cm and 12.66±1.32 cm, respectively. The measurement of circumference of left testicle with epididymis were significantly (P < 0.05)

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higher than those of right testicle with the epididymis. The mean length, breadth, and circumference of right testicle without epididymis were 6.62 ± 0.83 cm, 4.38 ± 0.55 cm, and 12.36 ± 1.16 cm, whereas those of the left testicle without epididymis were 6.65 ± 0.84 cm, 4.41 ± 0.56 cm and 12.47 ± 1.18 cm, respectively. The mean weight of right and left testicle without epididymis was 59.36 ± 16.86 g and 60.35 ± 17.16 g, respectively. The breadth, circumference and weight of left testicle without epididymis were significantly ($P < 0.05$) higher than those of right testicle without epididymis.

Key words: Biometry, *Capra hircus*, testicle measurements.

Pakistan is the main goat producing countries in the world. Indigenous goats are primarily valued for meat, milk, skin, fiber, and other associated products. The by-products are blood, dung (a good fertilizer), bones and horns. The male goat is capable of propagating at one year age and the female at seven months; but the fruits of a generation so premature are generally weak and defective; their best time is at the age of two years or eighteen months at least. The goat is a short lived animal, full of ardour, but soon enervated. His appetite for the female is excessive, so that one buck is sufficient for one hundred and fifty female (Mackenzie, 1980).

The testis, epididymis and accessory organs are principal organs of mammalian male reproductive system. Functionally the testis is both exocrine and endocrine in nature producing the spermatozoa and the male sex hormone-testosterone. Available literature indicated that the testes vary somewhat from species to species as far as shape, size and location are concerned but the essential structure is the same (Frandsen, 1981).

The biometric assessment of the male genital tract is vital to determine the actual cause of reproductive failures of the animals leading to greater economic losses. Such information could help to design programs for the treatment of animals having various reproductive disorders and suggest the preventive remedies if possible to enhance reproductive ability of the male animals. Chronic

infection of Johne's Disease appears to interfere with the normal development of reproductive organs and functions of related endocrine glands (Singh *et al.*, 1986).

Extensive researches has been concentrated towards the enhancements of productivity and understanding of the domesticated animals of Europe and America (Bokonyi, 1983; Wing, 1983) whereas little or no attention has been given to the intellect of the animal's functional morphology of the indigenous stock. Currently many research workers investigated biometry of testis of male goats under different environmental condition (Kabiraj *et al.*, 2011; Ibrahim *et al.*, 2012; Oyeyemi *et al.*, 2012) in different region of world. Available literature regarding the biometry of testis in indigenous livestock is very limited. Khan *et al.* (2003) investigated the testicular size and dimension in male buffalo, Nisar *et al.* (1992) carried out research on the biometry of testis in bull, Siddiqui *et al.* (2005) evaluated the biometry of the ram testis. Currently there is dearth of reliable information on the reproductive parameters of testis of goats owned by farmers in different area of Pakistan. Recent review of literature indicated that the size of the testis and functional testicular characteristics are indicators of sexual activity and semen production from the daily sperm production potential of the animals (Hassan *et al.*, 2009; Leal *et al.*, 2004). Therefore the aim of this study was to describe in detail the biometric characteristic values of the testis of the local breed of the goat.

Materials and methods

One hundred reproductive organs of male goats of various ages slaughtered at different slaughter houses of Hyderabad district were collected for this study. The genital tract having no gross abnormalities or pathological lesions was removed from the carcasses, packed in polyethylene bags and brought to the Departmental laboratory within 2 hours of collection. The organs were cleaned and freed from adhering tissues and were placed on the surgical table in their normal position. The measurements of the length, breadth and thickness of the right and left testicles with and without epididymis were taken with the help of vernier-caliper. The circumference of testicles with

and without epididymis were measured with measuring tape or with the help of modified thick thread graduated with a measuring tape and the readings were noted against a centimeter scale.

The weight of right and left testicles was estimated with a triple beam balance and the readings were recorded in grams. According to the technique used by Khan *et al.* (2003) and Oyeyemi *et al.* (2012) following methodology was adopted;

Testicle with epididymis: The length was measured from the caputal extremity to the caudal extremity, *breadth* from the free border to the epididymal border, thickness from the medial surface to the lateral surface; circumference was measured by encircling the thickest portion of the testicle along with the body of the epididymis by a graduated nylon tape.

Testicle without epididymis: The length was measured from the dorsal extremity to the ventral extremity (pole to pole); *breadth* from the free border to the attached border excluding epididymis, circumference was measured by encircling the thickest part of the testicle excluding epididymis by a graduated nylon tape.

The data collected regarding the biometry of the testis of male goat was subjected to statistical analysis as per method (Bhattacharyya and Richard, 1977). The following measures were computed for analyzing the data such as: mean standard deviation and range. Student's paired t-test was utilized to determine differences between means.

Results and discussion

Testicles with the epididymis

The biometric data on the testicles with epididymis are presented in Table I. The mean±S.D. Range of length, breadth, thickness and circumference of right testicle with epididymis were 8.42±0.91 cm (5.9-11.4 cm), 4.58±0.56 cm (3.5-6.4 cm), 4.19±0.53 cm (2.9-5.9 cm) and 12.53±1.23 cm (8.2-15.2 cm) respectively, and the left testicle with epididymis was 8.44±1.06 cm (4.5-11.6 cm) in length, 4.62±0.57 cm (3.5-6.5 cm) in breadth, 4.24±0.51 cm (2.9-5.8 cm) in thickness and 12.66±1.32 cm (6.75-15.5 cm) in circumference. The mean breadth, thickness and circumference of left testicle with epididymis were significantly ($P<0.05$) higher than those of the right testicle with

epididymis. On the other hand, no significance difference was observed for the length of the right and left testicles with the epididymis.

Testicles without epididymis

The biometric data on testicle without epididymis are presented in Table I. From these data it appeared that the mean±S.D. (range) of length, breadth and circumference of right testicle without epididymis were 6.62±0.83 cm (4.35-8.9 cm), 4.38±0.55 cm (3.2-6.1 cm) and 12.36±1.16 cm (9.3-15.1 cm) respectively, and the left testicle without epididymis was measured as 6.65±0.84 cm (4.8-8.7 cm) in length, 4.41±0.56 cm (3.1-6.15 cm) in breadth and 12.47±1.18 cm (9.2-15.2 cm) in circumference. The Mean±S.D. (Range) of weight of right testicle without epididymis was 59.36±16.86 g (24.8-118.3 g) and that of left testicle without epididymis was 60.35±17.16 g (23.9-120 g). The mean breadth, circumference and weight of left testicle without epididymis in the present study were significantly ($P<0.05$) higher than the right testicle without epididymis whereas no significant difference between the lengths of right and left testicle without epididymis was observed.

The testicular dimension is the important indicator of the present and future sperm production in animal. Also the basic biometric assessment of reproductive organs is vital in breeding soundness evaluation and potential fertility in breeding males (Togun and Egbunike, 2006). Additionally, morphometric evaluation of the testes is essential in estimating Spermatogenic function of any species or breed. Correspondingly, the mammalian testis has been demonstrated as reliable interpreters of spermatozoa production (Gage and Freckleton, 2003). In scientific literature the varying figures for length, breadth, circumference and weight of right and left testicle without epididymis have been reported by various workers in male goat and other domestic species. The findings regarding length and breadth of the right and left testicle without epididymis of male goat obtained in the current study were in close agreement with those reported for bucks by Mahmood *et al.* (1988) and Yaseen *et al.* (2010). According to them, the right testicle without epididymis of adult buck averaged 6.59±0.10 cm in length and 4.10±0.08 cm in breadth

Table I.- Biometric values of the right and left testicles of male goat and other animals.

Variable	Side	Adult male ^a	Steer ^b (1-3 year)	Marwari goat ^c	Pashmina buck ^d
Length of testis with epididymis (cm)	Left	8.435±1.06		10.59±0.26	
	Right	8.422±0.911		10.16±0.24	
Length of testis without epididymis (cm)	Left	6.652±0.840	7.59±0.13		6.70±0.11
	Right	6.618±0.832	7.52±0.13		6.59±0.10
Breadth of testis with epididymis (cm)	Left	4.619±0.571*		5.72±0.17	
	Right	4.583±0.565		5.30±0.17	
Breadth of testis without epididymis (cm)	Left	4.407±0.557*	3.71±0.08		4.17±0.09
	Right	4.384±0.832	3.76±0.08		4.10±0.08
Thickness of testis with epididymis (cm)	Left	4.237±0.509**			
	Right	4.190±0.528			
Circumference of testis with epididymis (cm)	Left	12.657±1.330**			
	Right	12.531±1.233			
Circumference of testis without epididymis (cm)	Left	12.476±1.186**	11.46±0.20		
	Right	12.361±1.166	11.52±0.21		
Weight (g) of testis without epididymis	Left	60.346±17.246**	61.56±2.89	97.94±1.59	
	Right	59.360±16.942	60.86±2.16	96.94±1.61	

*and ** represent the significant level at 0.05% and 0.01% respectively

a, Present study; b, Nisar *et al.*, 1992; c, Yaseen *et al.*, 2010; d, Mahmood *et al.*, 1988.

and the left testicle without epididymis averaged 6.70±0.11 cm in length and 4.17±0.09 cm in breadth. Likewise in Marwari goat, Yaseen *et al.* (2010) reported average length, width and weight of left testes were 10.59±0.26 cm, 5.72±0.17 cm and 97.94±1.59 g, whereas the same parameters for right testes were 10.16±0.24 cm, 5.30±0.17 cm and 96.94±1.61g, respectively. On the other hand, Roberts (1971) and Nickel *et al.* (1973) reported much higher length, breadth and weight of the testicles of ram and buck than present findings. The higher values might be due to change of specie of the ram and different breeds of bucks having different genetic make reared under better management and nutritional conditions.

The present observations were in close vicinity with those reported for steers aged 1-3 years by Nisar *et al.* (1992). They reported the average length, of right testicle without epididymis as 7.52±0.13 cm, breadth 3.76±0.08 cm, circumference 11.52±0.21 cm and weighed 60.86±2.16 g and the left testicle without epididymis averaged 7.59±0.13 cm in length, 3.71±0.08 cm in breadth 11.46±0.20 cm in circumference and weighed 61.56±2.89 g. The findings of the present study in male goat were also in partial agreement with those reported for Indian buffalo males by Joshi *et al.* (1967).

According to them, the right testicle without epididymis of Indian buffalo male averaged 7.60 cm (6.00-8.90 cm) in length, 4.30 cm (3.30-5.30 cm) in breadth, 12.20 cm (9.50-15.00 cm) in circumference, and 74.86 g (38.20-116.45 g) in weight, and the left testicle without epididymis averaged 7.87 cm (5.70-9.80 cm) in length, 4.33 cm (3.30-5.50 cm) in breadth, 12.29 cm (9.00-15.90 cm) in circumference and 79.06 g (36.00-120.40 g) in weight. In the present study it was found that the weight of the left testicle without epididymis was significantly higher than the right one. The results of this study that the left testicular weight was more than the right one in adult buck, confirmed the findings of Siddiqui *et al.* (2005) and Ott *et al.* (1982) in the Ram.

It is well established that testicular size is considered as measure of the reproductive growth status, spermatogenesis yield and the semen producing ability of the animal (Daudu, 1984; Hassan *et al.*, 2009; Leal *et al.*, 2004). In addition, it has been demonstrated that heavier testes produce more spermatozoa than the smaller ones (Brito *et al.*, 2004). It seems reasonable from these reports including our current finding that the significant (p<0.05) higher testes size and weight of adult male goat could contain more seminiferous tubule where

sperm production occur and Interstitial endocrine cells where testosterone is produced. In order to establish the functional significance of the seminiferous tubules and the interstitial endocrine cells with spermatozoa production, further study would be needed to elucidate the correlation of these biometric measurements with histological assessment of testis of local goat population.

In conclusion, this study demonstrated the distinctive biometric assessment of both caprine testicles. The breadth, thickness and circumference of left testicle with epididymis and breadth, circumference and weight of left testicle without epididymis were significantly higher than those of right testicle with and without epididymis respectively.

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Conflict of interest

All authors have no conflict of interest with any one about this manuscript.

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