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Gross Morphometrical Studies on the Testes of Dog During Different Seasons

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ABSTRACT

The present study was conducted on the testes of 18 adult dogs (mean body weight 20.28 ± 0.65 kg) during the summer, monsoon and winter seasons. Thirty-six (36) numbers of testes were collected, 12 in each season, from dogs operated for neutering at the Veterinary Hospital of Municipal Corporation. Gross anatomical and biometrical observations on testicular weight, volume, length, width, thickness and circumference were recorded. The paired testes were located in the scrotum halfway between the anus and the inguinal region. Inside the scrotum, the visceral layer of tunica vaginalis covered the testis and epididymis. The testes had their long axes oriented obliquely with a dorso-caudal direction. The reddish-coloured, roughly oval-shaped testes had two surfaces: lateral and medial, two borders: dorsal and ventral and two ends: proximal and distal. The epididymis was attached dorso-laterally to the testis. The seasonal effect was significant ($p<0.05$) for all biometrical parameters. Significantly lower ($p<0.001$) values were recorded during the summer season, while during the monsoon and winter seasons, the values were at par. The lower significant values of testicular biometrical parameters could be correlated with the inactive spermatogenesis in the seminiferous tubules of testis during the summer season.

Keywords: Biometry, Dog, Morphology, Testis

INTRODUCTION

Dogs (Canis familiaris) have been regarded as probably the best companion and most faithful pet animal, even more than a family member, since they provide unconditional love, devoted companionship and constant entertainment. It is well known that female dogs of recognized breeds are kept by pet owners and breeders for breeding purpose with commercial motive where-in natural or controlled breeding is practised to obtain off-springs of desired type. Knowledge of the morphology and morphometry of the testis is essential for understanding the normal physiology, surgical anatomy and breeding aspects of various animals. Testicular parameters suggest the level of sexual activity and sperm production potential (Leal *et al*., 2004; Hassan *et al*., 2009). Testicular size expressed as testicular weight, volume and diameter of testis and scrotal circumference are indicators that could be significantly correlated with sperm production, output and quality (Rege *et al*., 2000; Al-Ghalban *et al*., 2004). Testicular size is an indirect selection criterion for improving reproductive traits, as a correlation exists between testicular size and reproductive traits (Matos & Thomas, 1992). Thus, the current study was conducted to evaluate the seasonal influence on the testicular biometry.

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MATERIALS METHODS

The present study was conducted on the testes of 18 adult and apparently healthy non-descriptive dogs,

Table 1: Mean ± SE of body weight of dogs whose testes were collected in different seasons, along with weather details

Particulars	Summer	Monsoon	Winter	p-value
Months	April-May, 2024	September-October, 2024	December 2024 - January 2025	-
Weather ^{0}C R.H.%	Hot-dry 40.20^{0}C 47.5%	Hot-humid 33.00^{0}C 75.9%	Cold-dry 28.45^{0}C 53.65%	-
Body weight of dog (kg)*	21.39 ± 1.75	18.73 ± 0.53	20.73 ± 0.44	NS ($p>0.05$)
N	6	6	6	-
Overall body weight: 20.28 ± 0.65 kg				

*Mean body weight in different seasons did not differ significantly ($p>0.05$) as per one-way ANOVA & DUNCAN test

06 in each season; Summer: April-May, 2024 (hot-dry weather), Monsoon: September-October, 2024 (hot-humid weather) and winter: December, 2024 - January, 2025 (cold-dry weather), as detailed in Table 1. Samples were collected from adult (mean body weight 20.28 ± 0.65 kg) dogs captured and operated for sterilization - "Neutering"- at the Veterinary Hospital of Junagadh Municipal Corporation, Ivanagar, Junagadh. Tissue samples were collected from the testicles.

The gross anatomical observations viz., shape and colour of both the (left and right) testes of dog were recorded during different seasons.

The gross biometrical observation viz., testicular weight (g), volume (cm3), length (cm), width (cm), thickness (cm) and circumference (cm) of left and right testes were measured. Testicular weight was measured using a weighing scale. Testicular volume was measured using the graduated cylinder by water displacement according to the Archimedes' principle. Testicular length was measured from the anterior to the posterior extremity with a Vernier Caliper. Testicular width was measured from the lateral surface to the medial surface at the cranial, middle and caudal sides with a Vernier Caliper. The average of the three values was considered. Testicular thickness was measured from dorsal border to ventral border at the cranial, middle and caudal sides with a Vernier Caliper. The average of these three values was taken into account. Testicular circumference was measured at the thickest portion of the testis by a non-elastic thread and a measuring scale. All the data obtained were presented as mean ± standard error (SE). Data were analyzed statistically by one-way ANOVA and means of different seasons (Duncan's test) were compared by applying a suitable post-hoc test as per standard statistical procedure (Snedecor & Cochran, 1994).

RESULTS AND DISCUSSION

The testes are paired organs located in the pouch-like structure called the scrotum in the halfway from anus and the inguinal region. Inside the scrotum, the visceral layer of tunica vaginalis covered the testis and epididymis (Fig. 1). The testes had their long axis oriented obliquely with a dorso-caudal direction. The reddish-coloured, roughly oval-shaped testes had two surfaces: lateral and medial, two borders: dorsal and ventral and two ends: upper and lower. The epididymis was attached dorso-laterally to the testis; the head of the epididymis was attached to the upper end, while the tail of the epididymis was attached to the lower end of the epididymis. From the tail of the epididymis, the ductus epididymis continued as the ductus deferens on the medial surface of the epididymis (Fig. 2, A & B). In the sagittal section of the testis, at the central portion of the parenchyma, the fibrous extension of the tunica albuginea, the mediastinum, was observed (Fig. 3).

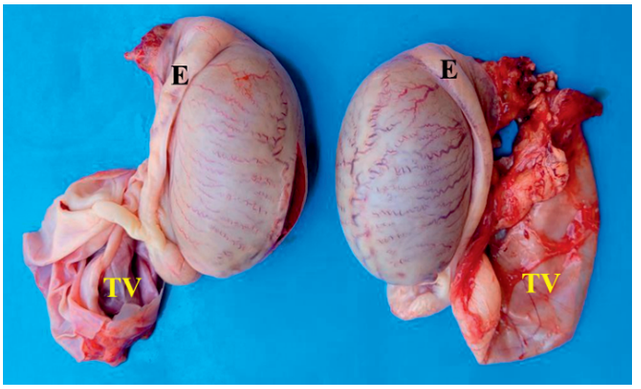

Fig. 1: Photograph showing the testis of a dog after removing the tunica vaginalis (TV) and exposed epididymis (E).

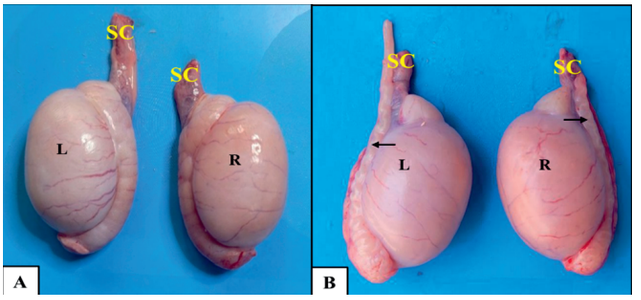

Fig. 2: Photograph showing A. lateral surfaces having epididymis (E) and spermatic cord (SC). B. Medial surfaces with the vas deferens (arrow) and spermatic cord (SC).

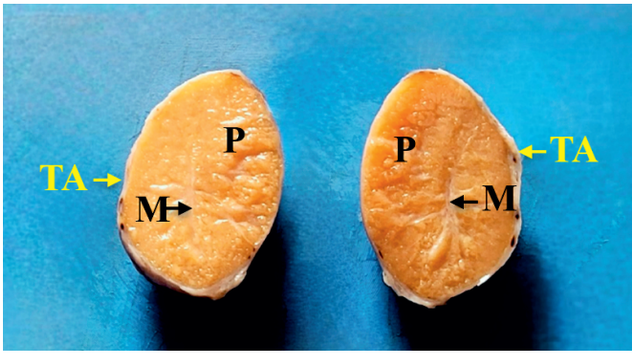

Fig. 3: Photograph of sagittal section of dog testis showing tunica albuginea (TA), parenchyma (P) and mediastinum (M).

The current findings on the gross morphology of the testis of dog were very well endorsed by the descriptions/reports of Sisson & Grossman (2012),

Miller (2013), Bhagyalakshmi *et al*. (2020), Deka *et al*. (2021) and Kumar *et al*. (2023).

Table 2: Biometrical parameters of testis in various seasons (Mean ± SE)

Biometrical parameters	Summer	Monsoon	Winter	p-value	Overall
N (6 Left + 6 Right)	12	12	12		36
Weight (g)	6.31^{b} ± 0.64	11.90^{a} ± 0.47	10.90^{a} ± 0.36	<0.001	9.69 ± 0.50
Volume (cm^3)	6.25^{b} ± 0.58	10.92^{a} ± 0.40	10.20^{a} ± 0.25	<0.001	9.11 ± 0.42
Length (cm)	2.67^{c} ± 0.07	3.04^{b} ± 0.06	3.34^{a} ± 0.07	<0.001	3.02 ± 0.06
Width (cm)	1.82^{b} ± 0.09	2.39^{a} ± 0.10	2.32^{a} ± 0.03	<0.001	2.17 ± 0.06
Thickness (cm)	1.98^{b} ± 0.07	2.45^{a} ± 0.06	2.37^{a} ± 0.04	<0.001	2.27 ± 0.05
Circumference (cm)	6.36^{b} ± 0.18	8.32^{a} ± 0.13	7.99^{a} ± 0.12	<0.001	7.56 ± 0.17

Means in a row with different superscript letters differ significantly (P<0.05)

Testicular weight (g)

The mean weight of the testis of dog was 6.31 ± 0.64, 11.90 ± 0.47 and 10.90 ± 0.36 g in summer, monsoon and winter seasons, respectively. The difference was significant (p<0.05) between summer (6.31 g) and the other two seasons (10.9 to 11.9 g). The testicular weight was minimum during summer and maximum during monsoon and intermediate during winter. As compared to summer, the testis was 88.6% heavier during the monsoon season. The testis weight was significantly (p<0.05) higher in monsoon (+5.59 g) and winter (+4.59 g) over that in the summer season (6.31 g), the magnitude of increase being 88.59% and 72.74%, respectively.

Testicular volume (cm3)

The testicular volumes during summer, monsoon and winter were 6.25 ± 0.58, 10.92 ± 0.40 and 10.20 ± 0.25 cm3, respectively, the differences being significant (p<0.05). It was significantly (p<0.05) lower in summer (6.25 cm3) in comparison to the other two seasons (10.2 to 10.9 cm3). Thus, testicular volume was minimum during summer and maximum during monsoon and intermediate during winter. The testis volume was significantly (p<0.05) higher in monsoon (+4.65 cm3) and winter (+3.95 cm3) as compared to summer (6.25 cm3), with increases of 74.40% and 63.20%, respectively.

Testicular length (cm)

The mean testicular length of the dogs was 2.67 ± 0.07, 3.04 ± 0.06 and 3.34 ± 0.07 cm in summer, monsoon and winter seasons, respectively. The values of testis length were significantly (p<0.05) different across all the seasons. The testicular length was minimum during summer and maximum during winter and intermediate during monsoon. The differences amongst the means were significant (p<0.05). The testis was found to be significantly (p<0.05) longer in monsoon (+0.37 cm) and also in winter (+0.67 cm) over that in summer (2.67 cm), these increases were to the tune of 13.86% and 25.09%, respectively.

Testicular width (cm)

During the summer, monsoon and winter seasons, the width of dog testis averaged 1.82 ± 0.09, 2.39 ± 0.10 and 2.32 ± 0.03 cm. Thus, the testis was significantly narrower during summer (1.82 cm) than the other two seasons, width being almost equal, 2.39 to 2.32 cm during monsoon and winter. There was a significant difference (p<0.05) between the mean of summer and those of the other two seasons. The testis was significantly (p<0.05) wider in monsoon (+0.57 cm) and winter (+0.50 cm) when compared with that in summer (1.82 cm), with increases of 31.32% and 27.47%, respectively.

Testicular thickness (cm)

The mean thickness of the testis of dog was 1.98 ± 0.07, 2.45 ± 0.06 and 2.37 ± 0.04 cm in summer, monsoon and winter seasons, respectively. Thus, the testis was thinner during summer (1.98 cm) as compared to the other two seasons, width being almost equal, 2.37 to 2.45 cm during monsoon and winter. The differences amongst the means were significant (p<0.05). The testis was significantly (p<0.05) thicker in monsoon (+0.47 cm) and winter (+0.39 cm) over summer (1.98 cm), the magnitude of increase being 23.74% and 19.70%, respectively.

Testicular circumference (cm)

During the summer, monsoon and winter seasons, the circumference of dog testis was 6.36 ± 0.18, 8.32 ± 0.13 and 7.99 ± 0.12 cm, respectively. Thus, testicular circumference was minimum during summer, maximum during monsoon and intermediate during winter. There were significant differences (p<0.05) between the means of summer (6.36 cm) and those of the other two seasons (8 to 8.3 cm). The increase in testis circumference was

significantly ($p<0.05$) higher in monsoon (+1.96 cm) and winter (+1.63 cm) over summer (6.36 cm), with increases of 30.82% and 25.63%, respectively.

The mean of testicular weight (9.69 ± 0.50 g) of adult dog recorded in the present investigation was comparatively lower than those (14.4 to 15.0 g: left side, 14.95 ± 0.23; right side,14.38 ± 80.26 g) reported by Yogesh *et al*. (2023) in adult indigenous dog of Mumbai. The difference in body weight/size, health and environment, as well, in both studies, could be the probable reason for the difference in testicular weight.

The values of length (3.02 ± 0.06 cm), width (2.17 ± 0.06 cm) and thickness (2.27 ± 0.05 cm) of testis of dog observed in the present study were in general, lower than those (length, 3.47 to 3.73 cm; width, 2.42 to 2.51 cm; thickness, 1.72 to 1.77 cm) reported in dog by Bhagyalakshmi *et al*. (2020) and also those (length, 3.21 to 3.35 cm; width, 2.30 to 2.53 cm; thickness, 2.03 to 2.80 cm) recorded in indigenous dog of Mumbai by Yogesh *et al*. (2023).

Ortega *et al*. (2006) also found significant seasonal differences in testicular weight and volume of dog in the tropics. They found lower weight (9.5 ± 0.3 g) and volume (11.2 ± 0.3 cm3) in the warm-humid (July to October) season as compared to the warm–dry (March to June) and fresh–humid (November to February) seasons (10.5 to 10.6 g and 11.6 to 12.3 cm3) and the same was attributed to environmental factors. The results of the seasonal differences in testicular biometry observed in the present study were in line with those of Ortega *et al*. (2006). Significantly lighter and shorter, narrower and thinner testis with lesser circumference during summer indicated reduced spermatogenesis in the summer (non-mating) season. Significantly heavier, longer and wider testes with greater circumference, especially during monsoon.

In the study of Dufour *et al*. (1984), the seasonally significant impact was observed in Desert Sand (DSL) and Suffolk adult rams. The smallest testis diameter was recorded in May and June, while the maximum diameter of the testis was observed between August to October. Kulaksiz *et al*. (2020) recorded the highest testicular length, testicular width and testicular volume of right and left testis of Gurcu bucks in autumn and the lowest values in spring. Thus, the results of Dufour *et al*. (1984) in ram and Kulaksiz *et al*. (2020) in buck with reference to seasonal differences in testicular biometry supported the findings of the current study in the dog.

CONCLUSIONS

The testes were paired organs with long axis oriented obliquely in dorso-caudal direction. The testis were reddish in colour, oval-shaped, and had two surfaces (medial and lateral), two borders (dorsal and ventral) and two extremities (proximal and distal). The epididymis was attached dorso-laterally to the testis. The values of testicular weight, volume, length, width, thickness and circumference were significantly ($p<0.05$) lower in the summer season and higher during monsoon and winter seasons. It can be concluded that under the influence of the summer season, testicular inactivity results in lower values of biometrical parameters.

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