



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 1470-1474
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www.thepharmajournal.com

Received: 07-02-2023

Accepted: 11-03-2023

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Study of the correlation between biometry of testes and serum testosterone level in Deccani Ram

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Abstract

The present study was performed on 30 apparently healthy Deccani rams around Shirwal village, which were grouped into of prepubertal (4-6 months of age), pubertal (9-12 months of age) and sexually mature (More than 1.5 years of age). The scrotum of these animals was long and pendulous with hairy fleshy in pubertal and sexually mature groups. The testis was oval in shape all the age groups of study. The biometrical parameters increased with age advancement and differ significantly ($p < 0.05$) between the right and the left testis and also between the within the age groups. The positive correlation was observed between serum testosterone level and various biometrical parameters of testis ($r \geq 0.80$). The average values for serum testosterone level in prepubertal, pubertal and sexually mature groups was 0.68 ± 0.18 ng/ml, 4.14 ± 0.89 ng/ml and 8.41 ± 0.27 ng/ml, respectively, which were differed significantly ($p < 0.01$).

Keywords: Deccani Ram, testis, biometry, testosterone

Introduction

The testis is the main organ responsible for the production of testosterone and spermatozoa. In male testicular size is criteria from the physiological, genetic, and practical perspective to improve the reproductive performance of related females (Walkley and Smith, 1980) [30]. The size of the scrotal circumference is closely related to total sperm output (Ahmed and Noakes, 1995) [1]. The testosterone along with its stimulating effects on male reproduction induces a positive effect on body growth (Hafez, 1980) [10]. Measurements of scrotal circumference had great value as indicator of onset of puberty, total semen production, semen quality, pathological conditions of testis and the potential sub fertility or infertility. Testosterone is essential for sexual behaviour in rams, which is responsible for the development of primary and secondary sexual characteristic and sperm production. The increase in the testosterone level is associated with increase in testicular volume and diameter. Considering the importance of conservation and improvement of Deccani breed of sheep in its home tract and also, scanty information available on morphological characterization of this breed in correlation with testosterone the present research work was undertaken.

Material and Methods

The testes for this experiment were collected from 30 apparently healthy Deccani rams. The specimens were collected immediately after the slaughter of the animals from the local slaughter house nearby Shirwal. The age of animals has calculated from dentition (Hillson, 1986) [13]. These animals were divided into three groups according to their age viz., Prepubertal (4 to 6 months), Pubertal (9-12 months) and Sexually mature (1.5 years and above). The weights of the animals and scrotal circumference were taken before slaughter of animals. The maximum circumference of the scrotum of each testis was measured by a non-stretchable thread and recorded in centimeters with the help of a scale. The length and width of testes were measured between two extremities of the testis with the help of a digital Vernier Caliper and recorded in centimeters.

The blood samples of the experimental animals were collected at the time of slaughter in wide test tubes for estimation of serum testosterone in November, 2021. These test tubes were kept in a slanting position (45° angled) for two hours so as to allow maximum surface for serum collection. The separated serum was centrifuged for ten minutes at 3000 rpm to get good serum samples. The collected serum samples were kept in deep freeze at -20°C .

The serum testosterone was estimated by the Radioimmunoassay technique (RIA) as described by Preston *et al.* (2012)^[21] at Centre of Nuclear Medicine, Department of Veterinary Medicine, Mumbai Veterinary College, Parel, Mumbai 12. The statistical analysis of the obtained data of biometrical parameters was carried out as per the methods described by Snedecor and Cochran, (1994)^[27].

Results and Discussion

Body weight of animals (kg)

The body weight of the prepubertal, pubertal and sexually mature rams ranged between 10.50-14.50kg, 20.00-24.00kg and 26.50-34.50kg, respectively. The average values for the body weight of the prepubertal, pubertal and sexually mature rams were 12.10±0.41kg, 22.55±0.49kg and 31.00±0.80kg, respectively.

Similar observations were recorded by Hassan *et al.* (2009)^[11] in native sheep of Bangladesh, Kumbhar *et al.* (2017)^[18] in Osmanabadi goat, Ali *et al.* (2019)^[2] in Arrabi sheep, Saurabh *et al.* (2018) in buffalo bull, Sahi *et al.* (2019) in indigenous bucks of Algeria, Mabu *et al.* (2020)^[19] in Balami and Yankasa rams. However, Maksimovic *et al.* (2016)^[20] recorded higher body weight in Meat Institute Sheep 36.62 kg at three months of age and 87.95 kg at thirteen months of age. Higher body weight in the above studies could be related to the genetic potential of exotic breed and balanced ration to breed, specially maintained for meat purpose.

Maximum circumference of the scrotum (cm)

The maximum scrotal circumference of the prepubertal, pubertal and sexually mature rams ranged between 5.81-7.87 cm, 26.60-28.00 cm and 29.43-32.20 cm, respectively. The average values for the maximum scrotal circumference of the prepubertal, pubertal and sexually mature rams were 6.27±0.18 cm, 27.33±0.16 cm and 30.50±0.25 cm, respectively. Similar observations were recorded by Samrah *et al.* (1997)^[24] in 36 crossbred bucks. Koyuncu *et al.* (2005)^[17] in rams, Tabbaa *et al.* (2006)^[29] in Awassi rams, Hassan *et al.* (2009)^[11] in Bangladesh native sheep and Al-Kawmani (2019)^[3] in growing Naemi Rams. However, Raji *et al.* (2008)^[22] recorded the scrotal circumference was 23.99±0.17 cm in red Sokoto breed of goat. Divya *et al.* (2013)^[9] recorded 26.29±0.53 cm scrotal circumference in adult ram. This difference in the values of scrotal circumference may be due to the species variation.

The maximum scrotal circumference found increased as age advanced and differ significantly ($p<0.05$) from prepubertal to pubertal groups, but it increased slowly from pubertal to sexually mature group. The increase in the maximum scrotal circumference was correlated with the increased level of serum testosterone in pubertal and sexually mature groups (significant at 1% level).

Length of the testis (cm)

The length of the right testis and left testis ranged between 2.90-4.19 cm and 2.94-4.20 cm in prepubertal group, 7.74-8.12 cm, 7.94-8.23 cm in pubertal group and 8.84-9.22 cm and 9.20-9.54 cm in the sexually mature group, respectively.

The average values for the length of the right and the left testis were 3.36±0.11 cm and 3.38±0.11 cm in prepubertal group, 8.05±0.09 cm and 8.11±0.04 cm in pubertal group, while it was 9.09±0.04 cm and 9.31±0.04 cm in the sexually mature group, respectively. This observation was in

agreement with the records of Hassan *et al.* (2009)^[11] in Bangladesh native sheep, Yaseen *et al.* (2010)^[31] in Marwari goats, Kabiraj *et al.* (2011)^[15] in Black Bengal bucks (Bangladesh), Al-Mahmodi *et al.* (2018)^[4] in adult ram and buck, Karimi *et al.* (2019)^[16] in Gezel rams, Sahi *et al.* (2019) in indigenous bucks (Algeria), Soori *et al.* (2019)^[28] in Lori sheep (Iran) and Baldaniya *et al.* (2020)^[5] in buck. However, Siddiqui *et al.*, (2005)^[26] in mature ram recorded the length of the left testis was 6.72±1.59 cm, while it was 6.72±1.60 cm in the right testis. Ibrahim *et al.* (2012)^[14] in Balami, Uda and Yankasa sheep breeds of Nigeria recorded the average length of the paired testis; 12.51±1.01 cm.

Width of the testis (cm)

The width of the right testis and the left testis ranged between 0.98-1.34 cm and 0.99-1.36 cm in prepubertal group, 3.71-4.10 cm and 3.91-4.24 cm in pubertal group and 4.51-4.89 cm and 4.65 to 5.10 cm in the sexually mature group, respectively.

The average values for the width of the right and left testis were 1.13±0.03 cm and 1.17±0.03 cm in prepubertal group, 3.95±0.04 cm and 4.08±0.03 cm in pubertal group and 4.71±0.04 cm and 4.86±0.05cm in the sexually mature group, respectively. Similar observations were recorded by Siddiqui *et al.* (2005)^[26] in sheep, Baldaniya *et al.* (2020)^[5] in the buck. However, Karimi *et al.* (2019)^[16] in Gezel rams recorded 6.30±0.00 cm and 6.40±0.90 cm in right and left testis, respectively. Hedia and El-Belely (2021)^[12] in Ossimi ram lambs recorded that the width of the testis was 34.51mm.

Weight of the testis (gm)

The weight of the right testis and the left testis ranged between 14.60-20.20 gm and 14.80-23.60 gm in prepubertal group, 63.20-73.50 gm and 64.10-75.45 gm in pubertal group and 102.60-112.69 gm and 103.60-116.87 gm in the sexually mature group, respectively.

The average values for the weight of the right and the left testis were 15.99±0.56 gm and 16.50±0.84 gm in prepubertal group, 66.21±0.99 gm and 67.50±1.06 gm in pubertal group, while it was 105.80±0.92 gm and 107.79±1.18 gm in the sexually mature group, respectively. However, Siddiqui *et al.* (2005)^[26] in mature ram recorded the weight of the left testis was 76.77±48.03 gm and the right testis 77.28±48.03 gm. Boukhlique *et al.* (2018)^[8] recorded that the testis weight varies between 170 to 250 gm in rams and between 130 to 160 gm in bucks. Al-Mahmodi *et al.* (2017)^[4] found the mean values of the left testis in the ram and buck for the weight (150.2±33.80 gm and 140.9±88.40 gm). Ali *et al.* (2019)^[2] recorded the testicular weight 50.40±0.07 gm in the right testis and 48.60±0.06 gm in the left testis in Awassi sheep. Karimi *et al.* (2019)^[16] reported the right and left testis weight was 158.90±78.30 gm and 164.20±78.50 gm, respectively in Gezel rams.

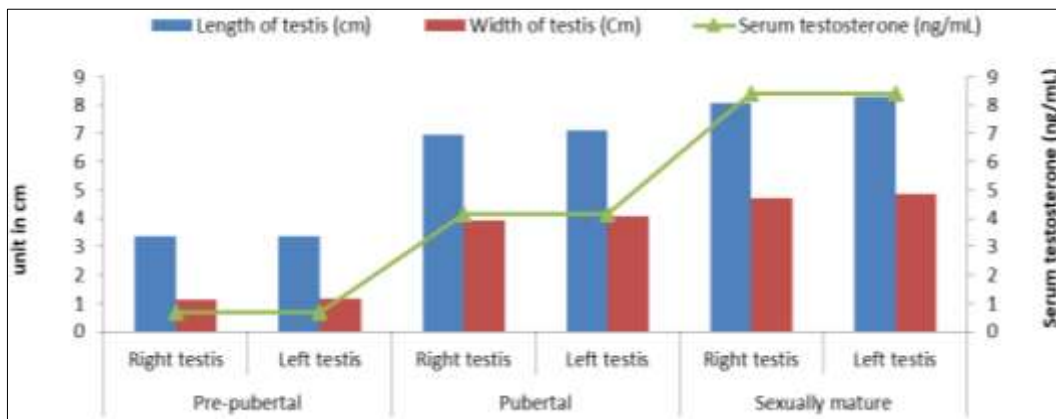
The variation in values of the different biometrical parameters of the testis in Deccani ram mentioned by various works may be due to the breed and species differentiation, variation in the climatic conditions, routine management and nutrition.

The statistical data analysis revealed a significant difference ($p<0.05$) in the length, width and weight of the right and left testis in all the age groups. The values for the length, width and weight of the left testis was found higher than the right testis in all the age groups. The similar observation was mentioned by Yaseen *et al.* (2010)^[31] in Marwari goats,

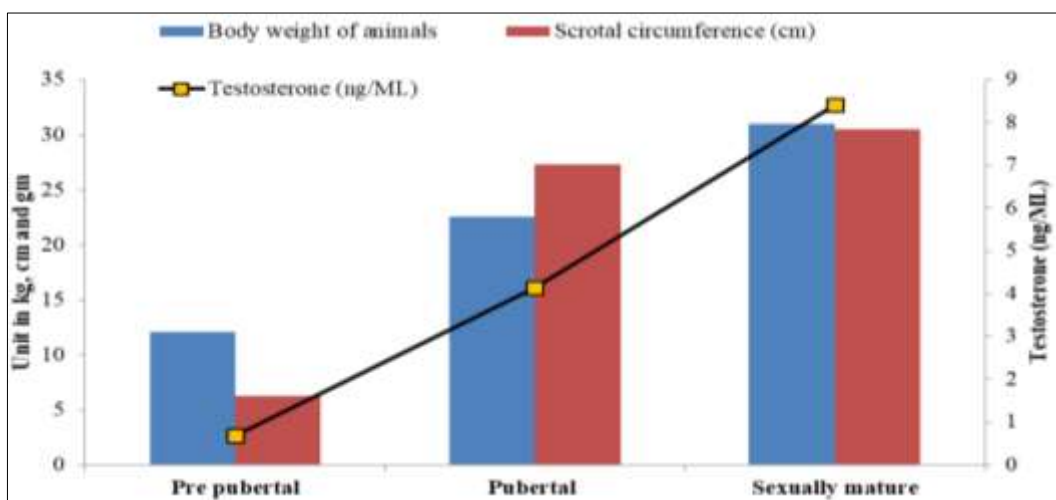
Kabiraj *et al.* (2011)^[15] in Black Bengal buck, Al-Mahmodi *et al.* (2017)^[4] in adult Ram and Buck, Karimi *et al.* (2019)^[16] in Gezel rams.

The length, width and weight of the testis increased rapidly and differ significantly ($p < 0.05$) from prepubertal to pubertal animals, but it increased gradually from the pubertal to sexually mature animals. Similar findings were mentioned by

Siddiqui *et al.* (2005)^[26] in native sheep of Pakistan. The increase in the values of all above mentioned biometrical parameters of the testis in Deccani ram showed positive correlation with the increased level of serum testosterone during the growth from pubertal and sexually mature age (significant at 1% level).



Graph 1: Showing length and width of testis in relation with serum testosterone of ram in all the age groups.



Graph 2: Showing body weight, scrotal circumference and serum testosterone of ram in all the age groups

Table 1: Statistical analysis of biometrical observations of the right and left testes of ram in all the age groups

Sr. No	Parameters	Pre-pubertal				Pubertal				Sexually mature			
		Right testis		Left testis		Right testis		Left testis		Right testis		Left testis	
		Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE	Range	Mean±SE
1	Bodyweight of the animals	10.50-14.50	12.10±0.41 ^a	-	-	20-25	22.55±0.49 ^b	-	-	26.50-34.50	31.00±0.80 ^c	-	-
2	Maximum circumference of scrotum	5.81-7.87	6.27±0.18 ^a	-	-	26.60-28.00	27.33±0.16 ^b	-	-	29.43-32.20	30.50±0.25 ^c	-	-
3	Serum testosterone level (ng/ml)	0.11-1.60	0.68±0.18 ^a	-	-	0.15-8.00	4.14±0.89 ^b	-	-	7.50-9.50	8.41±0.27 ^c	-	-
4	Length of testis (cm)	2.90-4.19	3.36±0.12 ^{aA}	2.94-4.20	3.38±0.11 ^{aB}	6.74-7.12	6.96±0.05 ^{bA}	6.94-7.34	7.11±0.04 ^{bB}	7.84-8.22	8.09±0.04 ^{cA}	8.15-8.54	8.31±0.04 ^{cB}
5	Width of the testis (cm)	0.98-1.34	1.13±0.03 ^{aA}	0.99-1.36	1.17±0.04 ^{aB}	3.71-4.10	3.95±0.04 ^{bA}	3.91-4.24	4.08±0.03 ^{bB}	4.51-4.89	4.71±0.04 ^{cA}	4.65-5.10	4.86±0.05 ^{cB}
6	Weight of testis (gm)	14.60-20.20	15.99±0.56 ^a	14.80-23.60	16.50±0.84 ^a	63.20-73.50	66.21±0.99 ^{bA}	64.10-75.45	67.50±1.06 ^{bB}	102.60-112.69	105.8±0.92 ^{cA}	103.60-116.87	107.79±1.18 ^{cB}

Mean (±SE) bearing different superscripts (a, b, c) differ significantly ($p < 0.05$) between the three groups

Mean (±SE) bearing different superscripts (A, B) differ significantly ($p < 0.05$) between left and right testes

Estimation of serum testosterone (ng/mL)

The average serum testosterone level in prepubertal, pubertal and sexually mature rams was 0.68 ± 0.18 ng/mL, 4.14 ± 0.89 ng/mL and 8.41 ± 0.27 ng/mL, respectively with the range

between 0.11-1.60 ng/mL in prepubertal, 2.00-8.00 ng/mL in pubertal and 7.5 to 9.5 ng/mL in sexually mature animals. This finding matched with reports of Borazen *et al.*, (2007)^[7] in Ankara breed, Benia *et al.*, (2013)^[6] in Algerian rams,

Saaed and Zaid. (2018)^[23] in Awassi male lambs. The values for biometrical parameters were rapidly increased as the serum testosterone level increased in pubertal and sexually mature groups, which indicated the strong positive correlation and significance of testosterone in the development of testis in Deccani ram.

The significant ($p < 0.01$) and high positive correlation ($r \geq 0.80$) of serum testosterone level with various biometrical parameters of the testis was observed in present study.

The highest serum testosterone level was observed in the sexually mature group. It was increased almost by four folds in pubertal group as compared to pre pubertal group and almost by eight folds in sexually mature group as compared to prepubertal group. It was almost doubled in sexually mature group than in pubertal group. The data analysis for the serum testosterone level showed high variability and showed a trend of linear increase in serum testosterone level with the advancement of age.

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