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Bovine Testicular Biometrical Studies in Jimma Zone, Ethiopia

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Abstract: Cross sectional study was carried out from November 2015 to March 2016 with the objectives of determining the influence of age, body condition score and season on scrotal circumference and various testicular measurements of bulls to investigate the association between scrotal circumference and various testicular parameters. Flexible tape was used to measure the scrotal circumference antemortem when the animal restrained. Testes of 145 bulls were collected immediately after slaughter from Jimma and Agaro town municipal abattoirs to measure paired testes weights, testes volume and testes length and these measurements subsequently was taken on all bulls examined. The overall mean scrotal circumference was 26.35±0.17cm and showed significant difference (P<0.05) within age group, body condition scores and in season with highest values in adult bulls, in poor body conditioned bulls and in wet season, respectively. The overall mean paired testes weights was 302.51±5.1gm, paired testes volume was 301.80±5.3cm^3 and testes length was 14.92±0.17cm. The highest paired testes weights, testes volume and testes length were observed in adult bulls, however non-significant difference (P>0.05) was observed with age groups. Paired testes weight and paired testes volume were significantly (P<0.05) higher in wet season while length of testes slightly higher during dry season statistically with non-significant difference (P>0.05). Significant (P<0.05) body condition score effect was evident with the poor body condition score having the highest values of paired testes weight and paired testes volume and good body condition score being the least. Non-significant difference was observed between testes length and body condition scores (P>0.05), however the highest testes length was shown in poor body conditioned bulls. The increase of scrotal circumference was proportional to the increase in testicular length, volume and weight of the testicles and they were highly correlated (r= +1). In this study scrotal circumference is affected by age, body condition scores and season of the year. Determination of scrotal circumference is an essential aspect of breeding soundness examination and has great value as an indicator of total sperm production, semen quality and infertility of a bull. Compared to exotic cattle (*Bos taurus*) and with other zebu breeds (*Bos indicus*), Jimma zone local breed bull's testicular parameters and scrotal circumference were lower. It is recommended to investigate the correlation among scrotal circumference and sperm motility, sperm quality, volume, as well as sperm output.

Key words: Scrotal circumference · Testicular length · Testicular volume · Testicular weight

INTRODUCTION

Bulls play a key role in cow-calf production and represent an important source of bioeconomic capital in this activity. Herd's reproductive rates are greatly influenced by bull fertility. Since the bull has more genetic influence (80-90%) of calves he sires, bull fertility selection can be the most powerful method of improvement in the herd [1].

Bulls (15 to 25%) can have fertility problems due to various causes (physical condition, testicles, foreskin, musculoskeletal system, penis, etc. [2-5].

Loss of fertility by a bull can cause substantial loss to a potential calf crop since more than 90% of the cows have been reported [1] to be breed by natural service.

Determination of scrotal circumference is an essential aspect of breeding soundness examination and has great value as an indicator of puberty, total sperm production, semen quality, pathological conditions of the testes, as well as the subfertility or infertility of a bull [6-8].

More importantly, scrotal circumference is highly inheritable [8] and is related to age of puberty in daughter and half-sib heifers and their subsequent fertility and productivity [9].

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Reproductive performance depends upon the normal structure and functions of the genital organs. The information on this vital aspect of bull has not so far attracted the attention of research workers in Ethiopia, although a large number of studies have been carried out in other countries. There was no report on effect of scrotal circumference on various testicular parameters in the cattle in the country and, to the best of our knowledge; this is the first report on the effect of scrotal circumference on testicular parameters in Jimma zone bulls. Analysis of various testicular parameters such as testis length, volume and weight are important for extensive selection of bulls for future breeding program in the country. It is hoped that information thus gained will provide an insight into the understanding of existing male reproductive tract measurements of our local bull population and will get special attention of the researchers as well as the farmers. The present study, therefore, was designed to study the influence of age, body condition scores and season on scrotal circumference, paired testes measurements and to investigate the relationship between scrotal circumference and various testicular parameters.

MATERIALS AND METHODS

Study Area Description: The study will be conducted in urban and rural smallholder dairy farms in and around Jimma town, Jimma Zone. The altitude of the zone ranges from 880 meter above sea level in Omo valley to 3, 360 meter above sea level at Maygudo in Nadda-Dedo mountain chains. The average annual rainfall and temperature of the study area are 1, 637 ml and 11.43°C, respectively.

Study Animals: The study animals were 145 bulls which come to Jimma and Agaro municipality abattoir for slaughtering and it include bulls of all age group weather they are from intensive or extensive farming system. The animals examined were selected randomly. Majority of cattle were expected to come from Goma, Dedo, Seka, Kersa and Mana districts.

Study Design: A cross-sectional survey was carried out to study effects of age, body condition score and season on scrotal circumference and paired testes measurements. Animals were selected randomly as they had entered slaughtering slabs. The animals examined was also grouped in to two age group (<5) as young and (>5) years as adult by dentition according to the modified method described by De-Lahunta and Hable [10]. Body condition was scored following the guidelines set by Nicholson and Butterworth [11]. Accordingly, animals were classified as poor (emaciated and thin), medium (average) and good (fat and very fat) body condition scores.

Data Collection Instruments: Flexible tape was used to measure the scrotal circumference antemortem at the maximum point of the scrotum when the animal restrained as described by Butswat [12]. For measurement of scrotal circumference, the testicle was pushed firmly into the bottom of the scrotum by placing the thumb and fingers laterally on the side of the neck of the scrotum and pushed ventrally. Testicular length was measured by placing the fixed arm of the calliper at the proximal end and the sliding arm at the distal end of the testes. Care was taken to exclude the epididymis.

Testes were collected immediately after slaughter, preserved in ice box and taken to Jimma University School of Veterinary Medicine laboratory. Adhering connective tissue and fat coverage was carefully trimmed off, length (cm), weight (gm) and volume (cm^3) of intact testes was measured. Water displacement method using Archimedes principles was adopted in determining testes volumes.

Data Analysis: All data were entered into Ms-Excel after the completion of data collection work from the study areas. Then the analysis work was done using SPSS version 20. The data obtained were presented as (Means ±S.E). The analysis of variance (ANOVA) test was used to evaluate the effects of age, body condition scores and season as on Scrotal Circumferences (SC), testicular length, paired testicular volume, paired testicular weight. The relationship between Scrotal Circumferences (SC) and the various testicular measurements were compared by the linear regression equation.

RESULTS

Over All Mean Testicular Parameters: In the present study overall mean scrotal circumferences was 26.35±0.17cm, paired testes weights was 302.51±5.1gm, paired testes volume was 301.80±5.3cm^3 and paired testes length was 14.92±0.17cm.

Testicular Parameters Based on Age: The highest scrotal circumferences, paired testes weights, Paired testes volume and Paired testes length were observed in adult bulls, while the lowest scrotal circumferences, paired

Table 1: Means±SE by age and paired testes measurement of bulls

		Paired Testes			
Age	N.	Scrotal circumferences (cm)	Weight (gm)	Volume (cm^3)	Llength (cm)
Young bulls	77	26.03±0.19	297.81±6.33	296.97±6.6	14.80±0.26
Adult bulls	68	26.72±0.28	307.84±8.2	307.27±8.3	15.06±0.2
Total	145	26.35±0.17	302.51±5.1	301.80±5.3	14.92±0.17

Table 2. Mean ±SE by body condition score and paired testes measurement of bulls

		Testes			
Body condition score	N.	Scrotal circumferences (cm)	Weight (gm)	Volume (cm^3)	Length (cm)
Poor	58	26.98±0.3	317.64±9.2	317.11±9.5	15.10±0.32
Medium	10	26.70±0.4	331.50±14.2	333.40±13.8	15.05±0.44
Good	77	25.83±0.2	287.35±5.96	286.17±6.1	14.77±0.2
Total	145	26.35±0.17	302.51±5.1	301.80±5.3	14.92±0.17

Table 3: Mean ±SE by season and paired testes measurement of bulls

		Paired Testes			
Seasons	N.	Scrotal circumferences (cm)	Paired testes weight (gm)	Scrotal circumferences (cm)	Testes length (cm)
Wet	73	26.90±0.26	329.8±7.6	332±7.6	14.9±0.2
Dry	72	25.79±0.19	274.9±4.9	271.2±5	15.4±0.2
Total	145	26.35±0.17	302.5±5.1	301.8±5.3	15.1±0.13

testes weights, Paired testes volume and Paired testes length were observed in young bulls. Statistical analysis revealed highly significant difference between scrotal circumferences and age groups ($P<0.05$) while non-significant difference were observed among paired testes weights, Paired testes volume, Paired testes length and age groups ($P>0.05$) (Table 1).

Testicular Parameters Based on Body Condition Score (BCS): Significant ($P<0.001$) body condition score (BCS) effect was evident with the poor BCS having the highest values of scrotal circumferences, paired testes weight and paired testes volume followed by medium BCS and good BCS being the least. Non-significant difference was observed between testes length and body condition scores ($P>0.05$), however the highest testes length was shown in poor body conditioned score followed by medium BCS and good BCS being the least (Table 2).

Testicular Parameters Based on Season: The Scrotal circumferences was significantly ($P<0.05$) higher in wet season compared with dry season. Paired testes weight and paired testes volume were significantly ($P<0.05$) higher in wet season while length of testes slightly higher during dry season statistically with nonsignificant difference (Table 3).

Comparison of Scrotal Circumferences of Testicles with Other Testicular Measurements: Correlation coefficients were measured among the different testicular measurements and scrotal circumference for the 145 bulls. All correlation coefficients were highly significant ($p<0.05$). The increase of scrotal circumference was proportional to the increase in testicular length, volume and weight of the testicles and they were highly correlated. The correlation coefficients of +1 has been observed between scrotal circumference and testis weight, testis length and testicular volume of Jimma zone cattle bulls.

DISCUSSION

The overall mean scrotal circumference observed during the present study was lowest (26.35±0.16 cm), which is smaller than to previous reports by Younis [13] (33.3±3.9 cm), Anzar *et al*. [14] (34.0 cm). In the report of Addass *et al*. [15] in four common zebu breeds of cattle in Nigeria: Rahaji breed (31.44±0.15cm), Bunaji breed (30.22±0.14cm), Adamawa Gudali breed (29.59±0.14cm) and Sokoto Gudali breed (29.96±0.15cm) that is higher than our finding. This might be due to the inherent bull breed differences.

Scrotal circumference was increased with age and the highest scrotal circumferences were observed in adult bulls, with statistically significant difference ($P<0.05$) between age and scrotal circumferences. This finding was comparable to those of Younis [13], who also observed lower ($P<0.05$) scrotal circumferences in young bulls

(31.6±0.4 cm) compared with adult (35.1±0.1 cm) and old (34.4±0.9 cm) bulls. Similarly, Anzar [16] reported scrotal circumferences of 36.4 cm in adult bulls. In a later study, Ahmad *et al*. [17] reported higher scrotal circumferences (37.5 cm) in adult bulls. Similarly, a much greater scrotal circumference (39.00 cm) has been reported by Asghar *et al*. [18]. Addass *et al*. [15] also reported Age group ≥ 4years recorded the highest values while age group 21/2 – 3 years had the least. Variations in scrotal circumferences in different reports might be due to the effect of nutrition or a difference in the season of study and perhaps also due to variations in the number of bulls included in different studies.

In the current study, the scrotal circumferences was significantly (P<0.05) higher in wet season compared with dry season. During the wet (rainy) season the availability of lush green fodder, rich in vitamin-A and minerals, increases the plasma oestradiol level, which plays a vital role in the activation of hypothalamic-pituitary axis, with an ultimate increase in plasma testosterone levels causing activation and enhancement of spermatogenesis, leading to an increase in testes size [19, 20]. And during the dry season high ambient temperature causes thermal degeneration of testes [21]. Furthermore, adhesions of tunica albuginea may occur in dry hot season, causing testicular degeneration that can reduce scrotal circumferences without any clinical signs [22].

Body condition score variability (P<0.001) on paired testicular measurement of bulls in the study area was in agreement with what was reported by Hansen [23] and Addass *et al*. [15]. The highest measurement of scrotum circumferences and other paired testicular measurement of bulls were recorded in poor body conditioned bulls that might be due to bull can lose up to several kg body weights during breeding time.

Correlation coefficients measured among the different testicular measurements and scrotal circumference for the 145 bulls. All correlation coefficients were highly significant (?? < 0.05). Scrotal circumference of the testes was highly correlated with other testicular measurements. The increase of scrotal circumference was proportional to the increase in testicular length, volume and weight of the testicles and they were highly correlated. The positive correlation coefficients of +1 has been observed between scrotal circumference and testis weight, testis length and testicular volume of Jimma zone cattle bulls is similar to the values of 0.94 reported by Perumal [24] and between 0.90 to 0.96 reported by Ahmed *et al*. [25] for various comparisons between testicular dimensions and weight.

CONCLUSIONS

Testicular diameter along with scrotal circumference is excellent indicators of spermatogenic function and should be used for breeding soundness evaluation. Compared to exotic cattle (*Bos taurus*) and with other zebu breeds (*Bos indicus*), Jimma zone local breed bull's testicular parameters and scrotal circumference were lower. In this study scrotal circumference is affected by age, body condition scores and season of the year. Determination of scrotal circumference is an essential aspect of breeding soundness examination and has great value as an indicator of total sperm production, semen quality and infertility of a bull. In the present study, the results revealed that scrotal circumference of local breed bulls of Jimma zone have been highly correlated with other testicular parameters. The measurement of scrotal circumference in Jimma zone bulls is very useful to predict the testicular parameters and should be used in breeding to select suitable breeding male for breeding purpose. Further study should be carried out to investigate the correlation among scrotal circumference and sperm motility, sperm quality, sperm volume, as well as sperm output.

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