

Study on Blood Biochemical Profile in Relation to Age and Scrotal Biometry in Adolescent Surti Bucks

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Abstract

The study was undertaken on 11 Surti male kids of identical age and birth weight from 14 weeks of age till puberty and sexual maturity up to 47 weeks (12 months) of age. The scrotal biometry, i.e., length, width, circumference (cm) and volume (cm³) were recorded using standard procedures at 3 weeks intervals. The mean weight of animals at birth, 14 and 35 weeks of age was 1.53±0.05, 9.86±0.61 kg and 17.84±1.09 kg, respectively and thereafter it did not change much till 47 weeks of age. Similarly, the mean values of scrotal length, width, circumference (cm) and scrotal volume (cm³) at 14 weeks of age were 2.89±0.22, 2.05±0.17, 8.82±0.72 and 21.36±0.93, respectively, which then gradually increased with an advancing age till 35 weeks of age reaching 10.65±0.30, 7.55±0.24, 19.45±0.65 and 200.45±16.67, respectively, which later became almost stable. At puberty, the average age and body weight were 27.00±0.75 weeks and 15.16±0.56 kg, and at sexual maturity 38.18±0.90 weeks and 19.61±0.93 kg, respectively. Great individual variation was noted in all the biometric traits among bucks studied. The blood plasma profile studied at bimonthly intervals revealed significant increase in total protein and ALT, and decrease in cholesterol and cobalt concentrations with advancing age. However, the AST and macro-micro minerals did not vary, suggestive of acquiring adult profile by 6 months of age. Based on the age, scrotal biometry, semen quality and blood biochemistry, it could be inferred that the Surti bucks attained full reproductive potential at around 9-10 months of age with stable blood plasma profile.

Introduction

Goats often termed as the “poor man’s cows” are primarily kept for household income and food security of downtrodden rural mass. Surti goat is a medium sized dual purpose goat breed found in the middle and south Gujarat and adjoining areas of Maharashtra. Surti goats are famous for their fertility, prolificacy, meat and milk quality as well as adaptability to the hot humid condition. Age of onset of puberty and male fertility are important factors in caprine reproduction since

numerous does are generally bred to a single buck. Semen quality, fertility and scrotal measurements are of paramount importance to achieve breeding success (Hoflack *et al.*, 2006). The increased socio-economic importance of goats and the increased requirements for proper goat husbandry, demand best breeding bucks for profitable goat production.

There is need to establish measurable criteria for judging breeding soundness and guiding selection of males for breeding to facilitate

effective genetic improvement of goat breeds (Giri *et al.*, 1994 and Gogoi *et al.*, 2005). Scrotal circumference is an indirect measurement of testicular size and onset of active spermatogenesis (Bongso *et al.*, 1982). Scrotal biometry during the period of adolescence can provide fair indication to find out the age at which the male goats can be used for breeding purpose (Jadav, 2008). The growth phase of adolescent bucks is also associated with alterations in blood biochemical profile. The paucity of literature on these aspects in Surti goats from birth till attainment of puberty and sexual maturity prompted us to study the same, with an objective to determine the suitable age for their possible commencement in breeding and to determine the influence of age and scrotal biometry on blood biochemical profile in growing Surti bucks.

Materials and Methods

This study included 11 Surti male kids of identical age and birth weight born during 10 to 19 September 2016 at Surti Goat Breeding Farm, Ramana Muvada, Gujarat. The study plan was approved by the Institutional Animal Ethics Committee. The actual study was undertaken from 14 weeks of age till puberty and sexual maturity and beyond, up to 47 weeks of age. The initial work up to 6 months of age was carried out at Ramana Muvada and thereafter the pubertal bucks were transferred to Dept of Gynaecology, Veterinary College, Anand to study the scrotal biometry, sexual behaviour and blood profile. The live weight was recorded using digital weighing platform and scrotal biometry, i.e., length, width, circumference (cm) and volume (cm³) were recorded using standard procedures i.e., by using Vernier calliper, scrotal (tailor's) tape and water displacement technique, respectively (Hahn *et al.*, 1969), at 3 weeks intervals starting from 14 weeks till 47 weeks of age.

Bi-monthly blood samples were also collected from Jugular veins of these animals at the age of 6, 8, 10 and 12 months to study plasma biochemical, enzymatic and mineral constituents. Plasma samples stored at -20°C till estimation of total protein, cholesterol, serum ALT-AST and macro-minerals, calcium, phosphorus and magnesium by using standard procedures and assay kits procured from Coral/Crest Biosystems,

Goa with the help of Chemistry Analyzer (Nova 2021, Analytical Technologies Pvt. Ltd., Vadodara). The micro-minerals, viz., zinc, iron, copper, cobalt and manganese were determined in tri-acids wet digested plasma samples on ICP-OES (Optical Emission Spectrometer; Model Optima 7000 DV; Perkin-Elmer, USA) machine against standard curves at the Micro-Nutrient Research Project (ICAR) of the University. Sexual behaviour of bucks was observed and semen was collected in AV on a dummy goat from the friendly/cooperative bucks from 7 months till 12 months of age. Data were analyzed statistically for ANOVA and DMRT by using SPSS software version 20.00.

Results and Discussion

Age, Body Weight and Scrotal Biometry

The average birth weight recorded was 1.53±0.05 kg for 11 Surti male kids selected for the study. The live weight of these kids at the age of 14 weeks was 9.86±0.61 kg, which gradually increased with an advancing age till 35 weeks of age (17.84±1.09 kg), and thereafter it did not vary much till the record period of 47 weeks of age. Similarly, the mean values of scrotal length, width, circumference (cm) and scrotal volume (cm³) at 14 weeks of age were 2.89±0.22, 2.05±0.17, 8.82±0.72 and 21.36±0.93, respectively. These values then gradually increased with an advancing age till 35 weeks of age reaching 10.65±0.30, 7.55±0.24, 19.45±0.65 and 200.45±16.67, respectively, which later remained statistically almost stable till 47 weeks of age, except scrotal volume, which showed increasing trend till 38 weeks of age and then did not show significant increase (Table 1). Moreover, great individual variation was also noted in all the biometric traits among bucks studied.

These observations on scrotal/testicular measurements with advancing age were in agreement with the reports of earlier workers (Bilaspuri and Singh, 1992; Kakoty, 1999; Gogoi *et al.*, 2005; Jadav, 2008; Akpa *et al.*, 2013) in different breeds of goat. The variations between studies could be attributed to difference in the breed, nutritional management, climate/season, body weight of bucks and individual variation. The significant age X buck interaction observed in our study indicated that the rate of increase

Table 1: Average scrotal biometry of Surti male kids in relation to age and body weight (Mean ± SE)

Age (wk)	Body wt (kg)	Scrotal length (cm)	Scrotal width (cm)	Scrotal circumference (cm)	Scrotal volume (cm ³)
14	9.86±0.61 ^a	2.89±0.22 ^a	2.05±0.17 ^a	8.82±0.72 ^a	21.36±0.93 ^a
17	11.46±0.70 ^{ab}	4.05±0.28 ^b	2.30±0.28 ^{ab}	8.42±0.49 ^a	24.09±1.13 ^a
20	11.87±0.74 ^{ab}	4.40±0.34 ^b	2.92±0.32 ^b	11.20±0.80 ^b	28.64±1.55 ^a
23	12.40±0.76 ^{ab}	5.74±0.39 ^c	4.45±0.33 ^c	12.48±0.75 ^{bc}	56.91±7.20 ^{ab}
26	12.88±0.82 ^b	7.24±0.39 ^d	5.55±0.34 ^d	14.35±0.86 ^c	84.18±12.60 ^{bc}
29	15.49±1.01 ^c	8.67±0.28 ^e	6.35±0.31 ^e	16.91±0.84 ^d	117.73±14.73 ^c
32	16.57±1.08 ^{cd}	10.41±0.31 ^f	7.27±0.27 ^f	18.64±0.71 ^{de}	172.73±15.13 ^d
35	17.84±1.09 ^{cde}	10.65±0.30 ^f	7.55±0.24 ^f	19.45±0.65 ^e	200.45±16.67 ^{de}
38	19.18±1.06 ^{de}	10.97±0.36 ^f	7.77±0.23 ^f	20.14±0.65 ^e	229.09±15.91 ^{ef}
41	19.47±1.02 ^e	11.19±0.32 ^f	7.98±0.20 ^f	20.71±0.60 ^e	237.82±14.23 ^f
44	19.65±0.98 ^e	11.26±0.37 ^f	7.95±0.22 ^f	20.59±0.60 ^e	239.00±14.41 ^f
47	19.98±0.92 ^e	11.17±0.37 ^f	7.94±0.19 ^f	20.58±0.56 ^e	245.45±13.22 ^f

Means bearing uncommon superscripts within the column differ significantly ($p < 0.05$).

in the scrotal dimensions with advancing age was not uniform in different bucks.

In our study, for the eleven adolescent Surti bucks studied, the average age and body weight at puberty were 27.00±0.75 weeks (6.5 months) and 15.16±0.56 kg, respectively, and those at sexual maturity with stable scrotal biometry and semen quality were observed to be 38.18±0.90 weeks (9 months) and 19.61±0.93 kg, respectively. There was a vast variation in individual bucks in respect of age and body weight at attaining puberty and sexual maturity. All the scrotal measurements were significantly affected by age and body weight. This observation suggested that bucks with heavier body mass might possess larger testicular size, which may invariably result into a good reproductive capability and improve the fertility of the animal (Akpa *et al.*, 2013). It could be inferred from the body weight and scrotal biometry that the highest reproductive potential in Surti bucks is attained at around 9-10 months of age.

Blood Biochemical Profile of Adolescent Bucks

The blood plasma profile of certain biochemical, enzymatic and mineral constituents

studied in adolescent Surti bucks at bimonthly intervals from 6 to 12 months of age (Table 2) revealed significant increase in the concentrations of total protein and ALT, and decrease in the concentrations of cholesterol and cobalt with advancing age. However, the other constituents mainly AST and macro-and micro-minerals did not differ much. These findings suggested that Surti bucks studied acquired the blood profile of mature or adult animals by 6 months of age.

Jadav (2008) recorded similar variations in blood plasma profile of protein, cholesterol and minerals in Surti bucks of different age groups, i.e., 3, 6 and 9 months and mature ones. Total protein reported in present study was similar with previous findings of Sorathiya *et al.* (2016), Hassan *et al.* (2013), Mahore *et al.* (2013). The level of cholesterol was similar to that reported earlier (Mahore *et al.*, 2013). According to Zubcic (2001) and Kaneko *et al.* (1997) cholesterol is not affected by feeding system and it shows an increasing trend after puberty. In the present study also the level of serum cholesterol increased after six to eight months of age.

Calcium and magnesium did not vary significantly (Pandey *et al.*, 2006). ALT is an

Table 2: Blood biochemical profile of adolescent Surti bucks till sexual maturity

Plasma Profile	Age of bucks			
	23 wk (n=11)	32 wk (n=11)	41 wk (n=11)	47 wk (n=11)
Total protein, g/dl	6.72±0.12 ^a	6.74±0.09 ^a	7.38±0.08 ^b	7.64±0.11 ^b
Cholesterol, mg/dl	108.71±3.40 ^a	100.56±1.03 ^b	103.14±1.68 ^{ab}	106.70±2.65 ^{ab}
AST, U/L	104.39±1.05	103.90±1.10	102.79±1.53	103.34±1.78
ALT, U/L	34.67±1.15 ^a	36.51±1.04 ^{ab}	40.42±0.83 ^b	38.66±0.84 ^{ab}
Calcium, mg/dl	9.18±0.19	8.93±0.18	9.16±0.21	8.99±0.34
Phosphorus, mg/dl	5.27±0.19	5.13±0.28	5.15±0.28	4.98±0.34
Magnesium, mg/dl	2.72±0.12	2.68±0.10	2.72±0.12	2.76±0.23
Zinc, ppm	1.20±0.03	1.21±0.04	1.22±0.03	1.17±0.03
Iron, ppm	2.41±0.20	2.28±0.10	2.40±0.06	2.46±0.01
Copper, ppm	1.09±0.03	1.12±0.03	1.08±0.03	1.09±0.05
Cobalt, ppm	0.72±0.04 ^b	0.66±0.04 ^b	0.64±0.05 ^b	0.46±0.02 ^a
Manganese, ppm	0.07±0.01	0.07±0.01	0.06±0.01	0.06±0.01

Means bearing uncommon superscripts within the row differ significantly (p<0.05).

enzyme found in the highest amount in liver and typically used to detect liver injury. AST is an enzyme abundantly found in liver and heart muscles and plays an important role in amino acid metabolism. The ALT and AST were in accordance with other reports (Kiran *et al.*, 2012; Shaikat *et al.*, 2013). Elitok (2012) studied blood biochemical parameters in different age groups and concluded that age did not affect on these parameters and concluded that blood biochemical parameters approach to normal adult range after 6-8 months of age.

Conclusions

The findings of the study showed that the adolescent Surti male kids attain puberty and sexually maturity at around 27.00±0.75 and 38.18±0.90 weeks of age, and 15.16±0.56 and 19.61±0.93 kg body weight, with scrotal circumference of 16.91±0.84 and 20.14±0.65 cm, and scrotal volume 117.73±14.73 & 229.09±15.91 cm³, respectively. The blood plasma profile studied at bimonthly intervals from 6 to 12 months of age showed significant increase in the concentration of total protein and ALT, and decrease in cholesterol and cobalt with advancing age. However, the AST and macro-micro minerals did not vary, suggestive of acquiring adult profile by 6 months of age.

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Conflict of Interest

Authors declare that they have no conflict of interest.

References:

- Akpa, G.N., Ambali, A.L. and Suleiman, I.O. (2013). Body conformation, testicular and semen characteristics as influenced by age, hair type and body condition of Red Sokoto goat. *New York Sci. J.*, **6**(7): 44-58.
- Bilaspuri, G.S. and Singh, K. (1992). Developmental changes in body weight and testicular characteristics in Malabari goat kids. *Theriogenology*, **37**(2): 507-520.
- Bongso, T.A., Jainudeen, M.R. and Siti Zahrah, A. (1982). Relationship of scrotal circumference to age, body weight and onset of spermatogenesis in goats. *Theriogenology*, **18**: 513-524.
- Elitok, B. (2012). Reference Values for Hematological and Biochemical Parameters in Saanen Goats Breeding in Afyonkarahisar Province. *Kocatepe Vet. J.*, **5**(1): 7-11.

- Giri, S.C., Mohanty, B.N., Ray, S.K.H. and Mohanty, D.N. (1994). Biometry of scrotum and testicles in Black Bengal and Ganjam breed of bucks with relation to fertility. *Indian Vet. J.*, **71**: 561-564.
- Gogoi, Chandan, Deka, B.C., Biswas, R.K. Nath, K.C., Baruah, P.M. and Sarmah, B.C. (2005). Testicular biometry in Beetal x Assam bucks during Adolescence. *Indian J. Small Rum.*, **11**(1): 24-27.
- Hahn, J., Foote, R. H., & Seidel, G. E. (1969). Testicular growth and related sperm output in dairy bulls. *J. Anim. Sci.*, **29**(1): 41-47.
- Hassan, D.I., Musa-Azara, I.S., Mohammed, J. and Zanwa, I.A. (2013). Influence of age, sex and season on hematology and serum chemistry of Red Sokoto goats in Lafia, Nasarawa state Nigeria. *Int. J. Agric. Sci & Vet. Med.*, **1**(4): online journal ISSN 2320-3730 www.ijasvm.com
- Hoflack, G., Van Soom, A., Maes, D., De Kruif, A., Opsomer, G. and Duchateau, L. (2006). Breeding soundness and libido examination of Belgian Blue and Holstein Friesian artificial insemination bulls in Belgium and The Netherlands. *Theriogenology*, **66**: 207-216.
- Jadav, P.V. (2008). Blood biochemical and hormonal profiles in relation to different age groups in Surti bucks with semen studies. M.V.Sc. thesis, Anand Agricultural University, Gujarat, India.
- Kakoty, D. (1999). Studies on body measurements, testicular biometry, age at puberty, sexual behaviour and semen characteristics in Beetal X Assam local male kids. M.V.Sc. thesis, Assam Agricultural University, Khanapara, Guwahati, India
- Kaneko, J.J., Harvey, J.W. and Bruss, M.L. (1997). *Clinical Biochemistry of Domestic Animals*. Academic Press, Inc., San Diego, London, Boston, New York, Sydney.
- Kiran, S., Bhutta, A.M., Khan, B.A., Durrani, S., Ali, A., Ali, M. and Iqbal, F. (2012). Effect of age and gender on some blood biochemical parameters of apparently healthy small ruminants from Southern Punjab in Pakistan. *Asian Pac. J. Trop. Biomed.*, **2**(4): 304-306.
- Mahore, J. and Mahanta, S.K. (2013). Certain haematological and biochemical parameters in local Bundelkhandi goats. *The Indian J. Small Rumin.*, **19**(1): 36-39.
- Pandey, V., Sareen, M., Moolchandani, A. and Singh, R. (2006). Age related changes in serum mineral and electrolyte profile in Marwari goats. *Indian J. Anim. Sci.*, **76**(9): 694-696.
- Shaikat, A.H., Hassan, M.M., Khan, S.A., Islam, M.N., Hoque, M.A. Bari, M.S. and Hossain, M.E. (2013). Haemato-biochemical profiles of indigenous goats (*Capra hircus*) at Chittagong, Bangladesh. *Veterinary World*, **6**(10): 789-793.
- Sorathiya, L. and Fulsoundar, A. (2016). Haemato-biochemical profiles, body condition and FAMACHA scores at various ages and their interrelations in Surti goats. *Indian J. Anim. Prod. Mgmt.*, **32**(3-4): 206-210.
- Zubic, D. (2001). Some biochemical parameters in the blood of grazing Germanim proved fawn goats from Istria, Croatia. *Veterinarski Arhiv.*, **71**(5): 237-244.

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