



## Post Natal Changes in the Concentration of certain Serum Biochemicals, Metabolic and Steroid Hormones in Male Assam Goats (*Capra hircus*) from Birth to Ten Months of Age

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### ABSTRACT

The mean concentration of blood glucose showed an increasing pattern with advancing age in the male Assam goats ranging from  $39.32 \pm 0.12$  mg percent at birth to  $51.92 \pm 0.05$  mg percent in 10 months old bucks. Serum cholesterol concentration showed a declining trend that varied from  $108.93 \pm 1.35$  mg percent at birth to  $62.23 \pm 0.66$  mg percent in 10 months old goats. Similarly, the levels of serum total protein increased from  $3.96 \pm 1.35$  to  $8.16 \pm 0.02$  g percent at birth and at 10 month of age, respectively. The serum thyroid hormones showed a declining trend in the male Assam goats with increasing age. The mean concentrations of Triiodothyronine ( $T_3$ ) and Thyroxine ( $T_4$ ) were recorded as  $1.65 \pm 0.03$  and  $114.38 \pm 0.62$  ng/ml at birth and  $0.81 \pm 0.01$  and  $24.47 \pm 0.31$  ng/ml at 10 months of age respectively. On the other hand, serum concentrations of testosterone hormone raised from  $0.11 \pm 0.01$  ng/ml in 2 months old kids to  $1.13 \pm 0.01$  ng/ml in the goats at 10 month of age. Testosterone could not be estimated in the serum of day-old kids because the level was too low to measure. Serum concentrations of all the hormones showed a highly significant ( $P < 0.01$ ) variation between different age groups under study.

**Keywords:** Postnatal changes, biochemicals, hormones, Assam goat

Studies on the different biochemicals in serum at various post natal ages is important to know the phases of growth in relation to the same. Studies had been conducted reporting blood biochemicals in Black Bengal goats (Shah *et al.*, 1998) and buffaloes (Kumar 1989) at different ages. Again, it was confirmed that certain serum biochemicals changed significantly at different ages in goats (Behera *et al.*, 1993). Similarly, Takarkhede *et al.* (1999) reported that the serum cholesterol level was significantly differing in ram then ewes at different stages of reproduction. Also, the concentrations of the metabolic hormones (Triiodothyronine and Thyroxine) and testosterone changes in various phases of post natal life in animals. The serum levels of metabolic and steroid hormones have been reported earlier in goats (Mehta *et al.*, 1987; Gupta *et al.*, 1998; Kumar *et al.*, 1994; Bilaspuri and Singh, 1992 and Kakoti, 1999). Similarly, Rajkumar and Srivastava (2008) and Agarwal *et al.* (1983) carried out estimations of  $T_3$ ,

$T_4$  and testosterone in bovines and equines. The present study is an endeavor to record the serum concentrations of different biochemicals,  $T_3$  and  $T_4$  and testosterone in male Assam goats from birth the ten months of age, which is the first work reporting the status of these hormones in Assam goat at various post natal ages.

### MATERIALS AND METHODS

A total of 18 male Assam goats varying in age from 0-day (at birth) to 10 months were used in the present study. The animals were divided into six age groups *viz.* group-I (0-day), group-II (2 months), group-III (4 months), group-IV (6 months), group-V (8 months) and group-VI (10 months) consisting of three animals in each group. The age of the goats were estimated from birth records. Approx. 8 ml of blood was collected from each animal of different age groups by venupuncture of the external jugular vein

using 10 ml DISPOVAN sterile disposable syringe and transported to the laboratory in ice boxes. Serum was separated and stored at ( $-22^{\circ}\text{C}$ ) in Deep Freezer (Ishin, Korea) for of biochemical and hormonal estimation. Serum glucose, Serum total protein and Serum cholesterol were estimated by standard method using glucose estimation kit (Merkotest, Merck Specialities Private Limited, India), total protein estimation kit (Babkit, Chemelex, Barcelona) and cholesterol estimation kit (Babkit, Chemelex, Barcelona), respectively. Hormonal assays were done in stored samples in Regional RIA Laboratory, Department of Veterinary Physiology, College of Veterinary Science, A.A.U., Khanapara, Guwahati-22. Total Triiodothyronine ( $\text{T}_3$ ) and Thyroxine ( $\text{T}_4$ ) concentrations were estimated by a RIA Kit (IMMUNOTECH, Czech Republic) using  $^{125}\text{I}$ -labeled  $\text{T}_3$  and  $\text{T}_4$  tracer and anti- $\text{T}_3$  and  $\text{T}_4$  monoclonal antibody coated tubes.

## RESULTS AND DISCUSSION

### Glucose

The blood glucose level showed an increasing pattern in the male kids from birth (group-I) to 10 month of age (group-VI), the maximum concentration of glucose being estimated in 10 months old goats (Table 1). The variation of glucose concentration among various age groups was highly significant ( $P < 0.01$ ) (Table 2). The glucose concentration was  $39.32 \pm 0.02$  mg/100ml at birth (group-I) to  $51.92 \pm 0.05$  mg/100ml in 10 months old goats (group-VI). Bhat *et al.* (1990) also reported lower blood glucose level at weaning (3 month of age) compared to values at later ages in Beetal X Black Bengal kids. Low blood glucose level appeared to be associated with fermentation of almost all the dietary carbohydrates of ruminants to lower fatty acids (VFA) which largely replaced glucose as main metabolic fuel of tissues (Medway, 1969). Similarly, the mean values of blood glucose reported to be varied from  $39.83 \pm 1.16$  to  $49.06 \pm 2.66$  mg/100ml in Beetal X Black Bengal male kids, which was significantly lower at 3 month old kids than the values at 4,5,6 and 7 month of age (Shah *et al.*, 1998).

These findings were in close agreement with the present observations in Assam goats in which it was recorded that the level of glucose at 0-day ( $39.32 \pm 0.02$  mg/100ml) increased to  $51.92 \pm 0.05$  mg/100ml at 10 month of age

and the variation was significant ( $P < 0.05$ ) between each age group (Table 1).

### Total Protein

The serum total protein levels in male Assam goats in the present study increased significantly ( $P < 0.05$ ) from birth (group-I) up to 8 month (group-V) of age (Table 1). However, the variation of serum protein was not found to be significant between 8 and 10 month of age (groups-V and VI). These findings were in corroboration with the observations made in buffalo (Kumar., 1989), in which the serum total protein levels at various post natal ages increased with the advancing age of the animals. The mean serum total protein level in 10 months old goats (group-VI) recorded in the present work was  $8.16 \pm 0.02$  g/100ml which was comparable with the normal values of the same in serum reported earlier by different workers in small ruminants such as 5.7g/100 in sheep and 6.3g/100ml in goat (Medway *et al.*, 1969),  $5.85 \pm 0.16$  g/100ml in Bengal goat (Pyne *et al.*, 1982),  $9.0 \pm 0.02$  g/100ml in Assam goat (Sarma and Kalita, 1999),  $7.00 \pm 1.3$  g/100ml and  $7.09 \pm 1.2$  g/100ml in young WAD goat kids and adult bucks, respectively (Daramola *et al.*, 2005),  $7.1 \pm 0.1$  g/100ml in Red SOKOTO goat (Tambuwal *et al.*, 2002) and  $6.3 \pm 0.7$  g/100ml in WAD sheep (Oduye and Adadevoh, 1976). The overall values of serum total protein level estimated in all the age groups of Assam goats was  $6.39 \pm 0.32$  g/100ml which was closely comparable to the value of the same reported in Beetal X Black Bengal goats ranging from  $5.93 \pm 0.18$  to  $7.16 \pm 0.39$  g % at different ages of post natal life (Shah *et al.*, 1998).

### Cholesterol

The serum cholesterol levels decreased significantly ( $P < 0.05$ ) in the male kids between each age group from birth (group-I) to 6 month (group-IV) of age (Table 1). But, the decrease in the levels of cholesterol from 6 through 10 month of age (groups-IV through VI) was non-significant between the succeeding age groups. The significant depletion of serum cholesterol up to the age of 6 month (group-IV), which was the age of onset of puberty in male Assam goats as recorded in the present study, might be for its physiological use in the process of steroidogenesis needed for increased testosterone production during the time of puberty. These findings were in agreement with

**Table 1: Serum biochemical levels (Mean  $\pm$  S.E.) of male Assam goats at different ages**

Parameters	Glucose (mg/100ml)	Total Protein (g/100ml)	Cholesterol (mg/100ml)
0- day	39.32 <sup>a</sup> $\pm$ 0.02	3.96 <sup>a</sup> $\pm$ 0.04	108.93 <sup>a</sup> $\pm$ 1.35
2- months	40.84 <sup>b</sup> $\pm$ 0.04	5.89 <sup>b</sup> $\pm$ 0.15	101.18 <sup>b</sup> $\pm$ 1.51
4- months	45.00 <sup>c</sup> $\pm$ 0.08	6.18 <sup>c</sup> $\pm$ 0.04	88.81 <sup>c</sup> $\pm$ 0.64
6- months	48.42 <sup>d</sup> $\pm$ 0.32	7.05 <sup>d</sup> $\pm$ 0.03	66.93 <sup>d</sup> $\pm$ 0.82
8- months	50.14 <sup>e</sup> $\pm$ 0.08	7.13 <sup>de</sup> $\pm$ 0.04	64.75 <sup>de</sup> $\pm$ 0.56
10- months	51.92 <sup>f</sup> $\pm$ 0.05	8.16 <sup>f</sup> $\pm$ 0.02	62.23 <sup>ef</sup> $\pm$ 0.66

Means bearing similar superscript in a column do not differ significantly.

**Table 2 : Results of analysis of variance pertaining to glucose, cholesterol and total protein levels in blood showing significance of difference between various age groups of male Assam goats**

Parameters	Source	d.f.	S.S.	M.S.S.
Glucose	Age group	5	390.956	78.1913 <sup>**</sup>
	Error	12	0.6998	0.5831
Cholesterol	Age group	5	10274.2	2054.84 <sup>**</sup>
	Error	12	119.239	4.9683
Total Protein	Age group	5	30.9583	6.1917 <sup>**</sup>
	Error	12	0.3973	0.3311

**Table 3 : Serum hormonal levels (Mean  $\pm$  S.E. in ng/ml) of male Assam goats at different ages**

Parameters	T <sub>3</sub>	T <sub>4</sub>	Testosterone
0- day	1.65 <sup>a</sup> $\pm$ 0.03	114.38 <sup>a</sup> $\pm$ 0.62	0.00
2- months	1.14 <sup>b</sup> $\pm$ 0.02	41.18 <sup>b</sup> $\pm$ 0.89	0.11 <sup>a</sup> $\pm$ 0.01
4- months	1.18 <sup>bc</sup> $\pm$ 0.01	34.69 <sup>c</sup> $\pm$ 0.33	0.44 <sup>ab</sup> $\pm$ 0.01
6- months	1.32 <sup>bcd</sup> $\pm$ 0.33	28.58 <sup>d</sup> $\pm$ 0.93	0.82 <sup>c</sup> $\pm$ 0.01
8- months	0.86 <sup>c</sup> $\pm$ 0.02	26.28 <sup>de</sup> $\pm$ 1.10	1.04 <sup>d</sup> $\pm$ 0.02
10- months	0.81 <sup>ef</sup> $\pm$ 0.01	24.47 <sup>ef</sup> $\pm$ 0.31	1.13 <sup>d</sup> $\pm$ 0.01

Means bearing similar superscript in a column do not differ significantly.

earlier works of Shah *et al.* (1998) stating that there was a significant decline in serum cholesterol level with the advancing age in Beetal X Black Bengal bucks. However, Behera *et al.* (1993) reported that the cholesterol level at 3 month of age declined gradually up to 6 month of age (group-IV) and then stabilized from this age in male Black Bengal goats. The present work recorded the serum cholesterol level in Assam goat kids ranging from 62.23  $\pm$  0.66 mg/100 ml at birth (group-I) to 108.93  $\pm$  1.35 mg/100 ml in 10 months old goats (group-VI) with an overall mean of 82.14  $\pm$  3.46 mg/100ml in all the age groups. These values could be closely compared with the same which were reported as 97.4 mg/100ml in Pigmy goat (Castro *et al.*, 1985), 57.5 to 117.5 mg/100 ml from 3 months to 2

years of age in Black Bengal goats (Behera *et al.*, 1993), 61.6  $\pm$  3.59 to 97.60  $\pm$  2.00 mg/100 ml in male kids at different stages of growth (Shah *et al.*, 1998) and 54.98  $\pm$  01.54 mg/dl in rams (Takarkhede *et al.*, 1999). However, in buffalo, the serum cholesterol level was recorded as 27.0, 61.25 and 57.23 mg/dl at birth, 6 month and 1 year of age, respectively (Kumar, 1989), which was much less as compared to the present findings in Assam goats at various ages, which could draw the fact of species variations.

#### Triiodothyronine (T<sub>3</sub>) and Thyroxine (T<sub>4</sub>)

The serum concentration of T<sub>3</sub> recorded in the present study decreased significantly (P<0.05) from 0-day (group-I) to 2

month of age (group-II), then increased non-significantly (Table 3) from 2 month of age (group-II to 6 month of age (group-IV), to decrease again non significantly from 8 (group-V) to 10 months (group-VI) of age.

In contrary to these findings, Gupta *et al.* (1998) reported that serum  $T_3$  level did not differ significantly between the Black Bengal goats of 8 month, 1 year and 2 years of age. This might be due to use of goats of lower ages in the present study. However, earlier works conducted in male buffalo calves (Agarwal *et al.*, 1983) at different ages (from 30 to 120 days) revealed that there was no consistent age trend in thyroid hormone levels, but there was some significant differences between various age groups. This was in agreement with the present findings in Assam goat.

The  $T_4$  showed a decreasing pattern of concentration in serum from birth (group-I) to 10 month of age (group-VI) in Assam goats. The declination of serum level of  $T_4$  was recorded to be significant ( $P < 0.05$ ) between each age group up to 6 month of age (group-IV). However, the reduction in values of the same was not significant between 8 and 10 months old (groups-V and VI) goats. Similar findings were also reported earlier in male buffalo calves aged 30 to 120 days (Agarwal *et al.*, 1983) and in Black Bengal goats at 8 month, 1 year and 2 years of age (Gupta *et al.*, 1998).

The serum  $T_3$  and  $T_4$  concentrations in day old (0 day) (group-I) male kids were found to be highest in the present study. Such high levels of thyroid hormones in new born foals was also reported which might be responsible for their extremely high thermogenic capacity and rapid pre and postnatal rates of growth especially of musculo-skeletal and nervous systems (Irvine and Evans, 1976). This might be true in case of male kids too as new born male kids were extremely playful and the body weight increased significantly during early phase of post natal life in goats (Bilaspuri and Singh, 1992; Kakoti, 1999).

The ratio of  $T_3 : T_4$  showed a decreasing pattern from 0-day (group-I) to 6 month of age (group-IV) which were recorded as  $1: 69.36 \pm 1.41$  and  $1: 28.98 \pm 1.11$ , respectively. Thereafter, the ratio exhibited slight increase ( $1: 30.65 \pm 1.99$ ) at 8 month of age (group-V) to again decline a little to  $1: 30.21 \pm 0.18$  in 10 months old goats (group-VI). The ratio was the maximum in day-old kids. Similar findings were also observed in Murrah buffalo calves (Mehta and Verma, 1983). Again, the ratio was recorded as  $1: 30.21$

$\pm 0.18$ ) in 10 months old Assam goats, which could be compared to the same ( $1: 35.4$ ) estimated in Gaddi goats (Kumar *et al.*, 1994).

### Testosterone

In the present study, concentration of serum testosterone hormone could not be detected in day-old kids (group-I) as it was too low to be estimated using Radio Immuno Assay (RIA). The concentration of serum testosterone exhibited an increasing trend with the advancement in the age (Table 3) of the male goats and the rise in its concentration was significant ( $P < 0.05$ ) between 4, 6 and 8 months old goats (groups-III, IV and V). This elevated levels of testosterone hormone might be to meet its increased demand needed for optimum development of the male reproductive organs and for onset and completion of spermatogenesis as the present study confirmed the presence of sperm cells in the lumina of the seminiferous tubules of the testes at 6 month of age (group-IV) indicating the onset of puberty to occur at this age in Assam goats. Similar significant rise of testosterone level in serum was seen in male buffalo calves, but at much higher ages (between 18-24 months) as reported by Agarwal *et al.* (1983). In contrast to the present findings, an elevated level of serum testosterone was recorded in Black Bengal bucks between 4 and 4.5 month of age (Mehta *et al.*, 1987), which might be due to breed and geographical variations. The mean concentration of serum testosterone in 10 months old Assam goats was recorded as  $1.13 \pm 0.01$  ng/ml which was close to the value of the same recorded ranging from  $1.11 \pm 0.26$  to  $1.15 \pm 0.20$  ng/ml in Black Bengal bucks (Gupta *et al.*, 1999). On the contrary, the present value of serum testosterone in 10 months old Assam goats was lesser than the same which was reported to be ranging from 1.2 to 1.24 ng/ml in 12-14 months old male goats (Ahmad *et al.*, 1996), but almost similar to the same ranging from  $1.11 \pm 0.26$  to  $1.15 \pm 0.20$  ng/ml in Black Bengal goats (Gupta *et al.*, 1998).

### CONCLUSION

This study shows that the serum glucose and total protein concentrations increased with advancement of post natal age, but serum cholesterol showed a declining trend. Thyroid hormones increased with increasing age (from birth to ten months of age). On the other hand, serum concentrations of testosterone hormone raised from 0.11

$\pm 0.01$  ng/ml in 2 months old kids to  $1.13 \pm 0.01$  ng/ml in the goats at 10 month of age. Such variation of these hormones was significant at various post natal ages.

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