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Research Paper

Measure the Serum Biochemical Profiles (Glucose, Protein, Cholesterol) of Female Black Bengal Goats during Growing and Pregnancy Period

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ABSTRACT

The serum biochemical profiles of the animals under three groups were estimated by serum glucose, total protein in blood and serum cholesterol levels. The glucose level varied from 65.66 to 77.11, 50.03 to 63.78 and 55.22 to 68.66 mg/dl for the first, second and third group, respectively, with higher value at the time of service. The total protein level did not vary much among the animals under three treatment groups (64.45 to 78.55 g/l). The serum cholesterol level varied between 50.17 to 110.05 mg/dl among all the animals irrespective of groups. During prepubertal period this value was low, but it was higher during pubertal period, time of several other services and towards pregnancy for all groups of animals.

Keywords: Biochemical, Glucose, Protein, Cholesterol, Pregnancy.

Goat keeping has several advantages, like diverse ecological adaptability over a wide range of agro climatic conditions, faster multiplicity, smaller body size, easy handling, efficient digestive and reproductive performances, better disease tolerance, substantial contribution in the rural economy in relation to nutritional contribution, as well as, crisis management etc. According to the FAO, India ranked second in goat population (125.7 million) after China (149.3 million) in the world (FAO, 2008). India ranked second in the goat meat production. There is no religious taboo regarding the consumption of goat meat in India. Goat milk is the source of protein and has medicinal value (www.agricultureinformation.com). The goat population in India is about 17 percent of the world's total goat population. As per the recommendations by Indian Council of Medical Research (ICMR), the daily allowance of meat is 34 g, but the per capita meat consumption is as low as 14 g per day. Black Bengal goats are found in West Bengal, north-eastern part of India and Bangladesh. Biochemical profiles exhibit age related changes with metabolic and endocrine changes occurring in the animal body (Bhooshan *et al*. 2010). The blood serum levels of glucose, protein and cholesterol are important parameters to be tested.

REVIEW OF LITERATURE

Kaneko (1989) found that the level of total serum protein ranged from 6.53 to 7.25 g/dl. The observed range of total serum protein in experimental goats was within normal range of 6 to 7.5 g/dl. The serum glucose level was between 45.42 to 49.08

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mg /dl. According to Veterinary Drug Handbook, written by D.C. Plumb, Iowa State University Press (1999), the reference value of blood glucose and total protein level were 60-100 mg/dl and 6.4 to 7.8 g/dl, respectively. Abosede (2006) experimented on Nigerian goats, and documented that blood glucose, total protein and cholesterol values were 42 to 51 mg/dl, 64.347 to 70.675 g/L and 106.479 to 111.758 mg/dl, respectively. Adamu *et al*. (2008) experimented on sheep, and stated that the normal serum cholesterol value was 4.32 mmol/L. Banik *et al.* (2008) experimented on sero-surveillance and PPR immunization of Black Bengal goats and determined that the blood glucose and total serum protein were 72.69 ± 15.61 mg/dl and 7.89 ± 0.92 g/dl, respectively. Sakha *et al.* (2009) experimented on Raini goats in Iran, and the blood glucose, total protein and blood cholesterol level were documented as 2.22 to 6.38 mmol/L, 60 to 97 g/L and 0.51 to 2.79 mmol/L respectively. Islam *et al*. (2009) studied the effect of polyunsaturated fatty acid on Black Bengal goat, and stated that the serum cholesterol level was 109.80 ± 0.64 to 105.20 ± 1.00 mg/dl. Opara *et al.* (2010) experimentally showed that the West African Dwarf (WAD) goats had blood glucose level from 25 to 38 mg/dl; total protein level 5.2 g/dl and blood cholesterol level from 41 to 51 mg/dl. Arikan *et al*. (2010) studied to evaluate the effect of cholesterol on progesterone production during long-term culturing of luteal cell subpopulations at early and late luteal stages of the goat corpora lutea and found that cholesterol was required for progesterone precursor and thus to maintain a high-level steroidogenesis. Bhooshan *et al.* (2010) worked on different age groups of Barbari goats, and found that the average value of blood glucose and blood cholesterol were 65.08 ± 1.36 mg/dl and 171.66 ± 3.31 mg/dl, respectively. Medani *et al.* (2011) conducted experiments on Nubian goats, and determined the total protein and blood glucose levels as 5.47 g/dl and 31.08 mg/dl, respectively Njidda *et al.* (2013) experimented on different breeds of goats from northern Nigeria and stated that, the blood glucose level ranged from 1.6 to 2.5 mmol/L; total protein level ranged from 47 to 84 g/L and blood cholesterol level ranged from 2.9 to 4.4 mmol/dl. Babeker and Elmansoury (2013) experimented on Sudanese desert goats and stated that the blood glucose level, as well as, total protein level were 65 mg/dl and 6.9 g/dl respectively. Shaikat *et al.* (2013) determined various haemato-biochemical parameters of Black Bengal goat. They stated that the average total protein content was 69.9 g/L in Black Bengal goat. Abu El-Ella and Kommonna (2013) studied on Damascus goats and found that total protein in blood serum varied between 5.8 to 10.1 g/dl, and blood cholesterol level varied between 46 to 140 mg/dl. The value of cholesterol concentration was reported by Hafid *et al.* (2013) and it varied between 0.50 to 0.65 g/L in various age groups, various seasons and different stages of reproduction. Kalio *et al.* (2014) worked on West African Dwarf (WAD) bucks, and found that the blood glucose and blood cholesterol level varied between 2.7 to 4.2 mmol/L and 1.50 to 1.73 mmol/L, respectively. This situation gave a clear indication that the WAD bucks were normal and not susceptible to heart disease, since a high level of serum cholesterol might be an indicator for diseases such as heart disease

METHODOLOGY

The experiment was conducted in Completely Randomized Design (CRD) with three treatments, viz. i) Nutritional Effect and buck effect, ii) Nutritional effect and iii) Control. There were five female Black Bengal kids of three months of age in each group. The first group of animals was allowed to graze *ad lib* and the only were kept with a buck while the other two groups of animals were stall fed with the similar type of grass *ad lib*. The animals of TG-1 and TG-2 were also provided with concentrate feed supplement (21% CP) @ 10g per kg body weight per day in two divided doses. The animals under control group were neither provided the concentrate feed mixture nor kept with the buck. All the animals were placed in comfortable sheds and were under standard management practices. The data were analysed statistically by the analysis of variance (ANOVA) method, described by Cochroan and Cox (1967) and Panse and Sukhatme (1967). Error mean square by Fisher and Snedecor's F-test method was followed to test significance of different sources of variation. The standard error (S_e) and test of significance have been provided in the tables of results to compare the mean values. About 2 ml of blood samples were collected through puncture of jugular vein from fifteen female goats of treatment group 1, 2 and 3 for biochemical studies. Serum

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was separated out from those samples. Blood were collected into the 15 ml centrifuge tube, and kept in a slanting position at room temperature for a couple of hours. The serum samples were separated with pasture pipette from the tubes, and were kept in 1.5 ml eppendorf tube. The serum samples were stored in -20°C freezer and then carried to the Department of Animal Nutrition, West Bengal University of Animal and Fishery Sciences, Belgachia, Kolkata for estimation of biochemical parameters, viz., blood glucose, total protein and blood cholesterol. Measurement of glucose concentration was done from serum samples of the female goats to evaluate the carbohydrate metabolism. 'GOD-PAP' enzymatic photometric test method was followed for glucose estimation. Glucose estimation kit was used from Diatek Company, Kolkata. Glucose was estimated as per the standard protocol (Tilkian, 1979). Measurement of total protein was done quantitatively *in vitro* from serum samples of female goats on photometric system. Photometric test according to biuret method was used. Protein estimation kit was used from Diasis Diagnostik Sistemler Company, Turkey. Total protein was estimated as per the standard protocol (Tilkian, 1979). Measurement of cholesterol was done quantitatively *in vitro* from serum samples of female goats on photometric system. 'CHOD-PAP' enzymatic photometric test method was followed to estimate cholesterol. Cholesterol estimation kit was used from Diasis Diagnostik Sistemler Company, Turkey. Cholesterol was estimated as per the standard protocol.

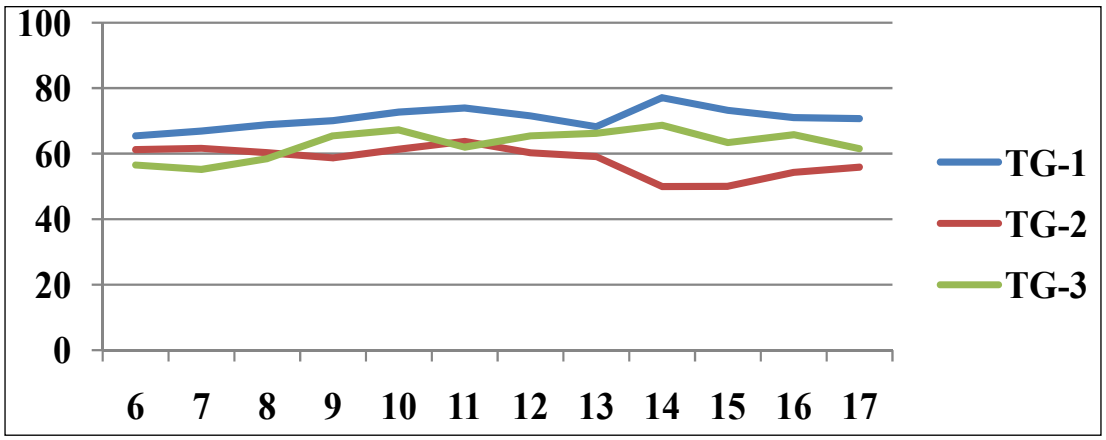
RESULTS AND DISCUSSION

Serum biochemical profiles of experimental animals

The biochemical profiles namely, blood glucose, total protein of blood and blood cholesterol of the animals under different treatment groups were studied at monthly interval from six to seventeen months.

Serum glucose levels

The serum glucose levels were estimated at monthly intervals from six to seventeen months to know the metabolic status of the animals under different treatment groups (Fig. 1). In the present study it, was observed that the serum glucose level varied between 49.97 mg/dl to 77.11 mg/dl among the animals irrespective of their treatments, which falls under the normal serum glucose level of various breeds of goat (Kaneko, 1989; Plumb, 1999; Abosede, 2006; Banik *et al.* 2008; Opara *et al.* 2010; Bhooshan *et al.* 2010; Medani *et al.* 2011; Babeker and Elmansoury, 2013). This result suggested that the animals were physiologically normal and not in diseased condition. The serum glucose level of the animals under the first treatment group varied from 65.46 mg/dl to 73.96 mg/dl within the experimental period when different physiological conditions like first service, stress due to laparotomy operation, pregnancy, parturition happened. The serum glucose level of the second group of animals was lower than that of the first group, and the third group was further lower than that of the second



[X-axis represents stage (month) of the animal and Y-axis represents the level of serum glucose (mg/dl)]

Fig. 1: Average glucose level (mg/dl) in blood serum of animals under different treatments at different stages

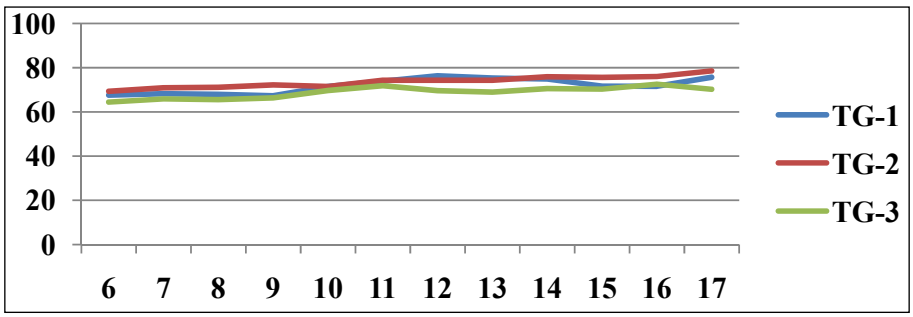
group. The serum glucose levels of the animals under three treatment groups were high at the time of first service consistently, which was 68.87 mg/dl, 63.78 mg/dl and 68.66 mg/dl for animals of the first, second and third treatment groups at eight months, eleven months and fourteen months of age respectively. It was also noted that among the three treatment groups the serum glucose level varied significantly at one percent or five percent level during the period of experimentation. The third group of animals showed lowest range of serum glucose level (55.22 mg/dl to 68.66 mg/dl) among the three treatment groups. This might be explained by the fact that, all animals of this group did not become pregnant due to operational stress and nutritional stress and it was reflected by lower serum glucose level than that of the other group of animals. The animals under all the treatment groups required several services to attain successful pregnancy. The high levels of serum glucose were also evident during the time of particular service to attain the successful pregnancy, which were 73.96 mg/dl and 54.33 mg/dl at eleven and sixteen months respectively for the first and second treatment group. After parturition, the glucose level decreased (71.02 mg/dl) at sixteen months of age for first group, which might be due to feeding of the kids.

The data of the previous studies showed that the serum glucose level of Nigerian goats ranged from 42 to 51 mg/dl (Abosede, 2006). In Black Bengal goats it was 72.69 ± 15.61 mg/dl (Banik *et al.* 2008) which was quite similar with the data of the present study. Different age groups of Barbari goats had 65.08 ± 1.36 mg/dl serum glucose level (Bhooshan *et al.* 2010). Sudanese desert goats showed 65 mg/dl serum glucose, which was also similar like Black Bengal goat (Babeker and Elmansoury 2013). On the other hand, it was also reported that some breeds of goats had low level of blood glucose in contrast to the present study. In West African Dwarf (WAD) goats it ranged from 25 to 38 mg/dl (Opara *et al.* 2010) and in Nubian goats it was about 31.08 mg/dl (Medani *et al.* 2011).

Total protein levels in blood serum

The total protein levels in blood serum were studied at monthly intervals from six to seventeen months to know the health status and physiological condition of the animals under different treatment groups (Fig. 2). In the present study it was observed that the serum total protein level varied between 64.45 to 78.55 g/L among all the animals irrespective of any treatment. The total protein level of serum did not differ much in the animals of different treatment groups significantly. The average serum protein level of the third group of animals was to some extent lower that of the first and second treatment group. The second group of animals which were provided with good plane of nutrition had consistently higher serum protein level than that of the rest of the groups. Although the first group of animals had same type of nutritious feed, they had lower level of serum protein than the second treatment group, which might be due to experiencing various physiological stresses due to several services, pregnancy and parturition from eight months to sixteen months of age. On the contrary, the animals of the second group had lack of physical exercise due to stall feeding and experienced less number of services due to lack of buck effect, which was evidenced by higher level of total serum protein than that of the first group.

The findings of the present observations were corroborated with some previous ones. As per the findings of several workers, serum protein level



[X-axis represents stages of study and Y-axis represents level of total protein (g/L) in blood]

Fig. 2: Average total protein level (g/L) in blood serum of animals under different treatments at different stages

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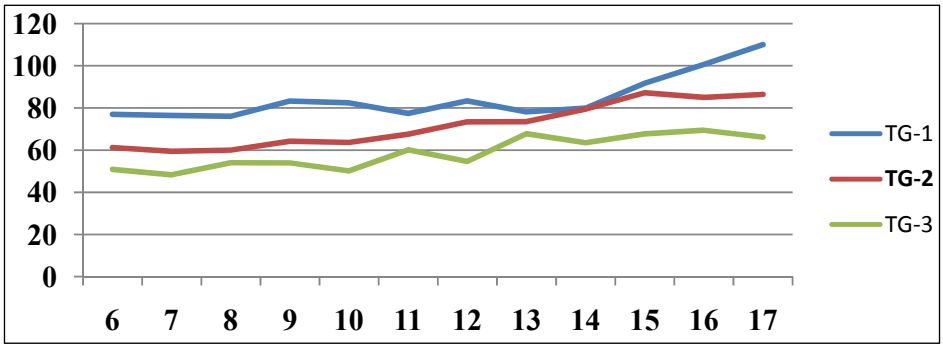
ranged from 6.53 to 7.25 g/dl (Kaneko, 1989); 6.4 to 7.8 g/dl (Plumb, 1999); 64.347 to 70.675 g/L in Nigerian goats (Abosede, 2006); in Black Bengal goat 7.89 ± 0.92 g/dl after PPR immunization (Banik *et al.* 2008); 5.2 g/dl in West African Dwarf (WAD) goat (Opara *et al.* 2010); 69.9 g/L in Black Bengal Goat (Shaikat *et al.* 2013) and 5.8 to 10.1 g/dl on Damascus goats (Abu El-Ella and Kommonna 2013).

Serum cholesterol level

The serum cholesterol levels were studied at monthly intervals from six to seventeen months to know the physiological status of the animals under different treatment groups (Fig. 3). The serum cholesterol level was observed to vary between 50.17 mg/dl to 110.05 mg/dl among the animals irrespective of their treatments in the present study. This level was within the normal range suggesting the normal physiology of the animals under three treatment groups (Abosede, 2006; Adamu *et al*. 2008; Islam *et al*. 2009; Opara *et al.* 2010; Bhooshan *et al.* 2010; Abu El-Ella and Kommonna, 2013; Hafid *et al.* 2013; Kalio *et al.* 2014). The serum cholesterol value of the animals under first treatment group was consistently higher than that of the second and third group. It was noted that the serum cholesterol level of the animals first treatment group was lower during six to eight months of age (76.98 to 76.06 mg/dl), which was prepubertal period. This lower level might be explained by the fact that, the steroid hormones, estrogen and progesterone in female, were less active during this time. The level was higher during nine to ten months (83.26 to 82.44 mg/dl), which was the time of puberty. After some fluctuations between eleven to fourteen months, the cholesterol level gradually increased from fifteen months onwards. In case of second group of animals the serum cholesterol value was low from six to ten months (61.18 to 63.66 mg/dl), which was also the prepubertal period for them. At the time of puberty, *i.e.* during eleven to twelve months it was higher value (67.58 mg/dl) and then it showed gradual increasing trends up to seventeen months (67.58 to 94.50 mg/dl). The serum cholesterol value of the animals under third treatment group was lower than that of the other groups (50.87 to 66.16 mg/dl). It was again noticed that, the serum cholesterol value showed increasing trends from thirteen to seventeen months (67.79 to 66.16 mg/dl), which was the pubertal period. Higher level of serum cholesterol is important to maintain the progesterone level in blood and that had positive effect to maintain pregnancy. The first and second groups were provided good plane of nutrition, which might help them to maintain the cholesterol at required level and this condition helped them maintain their pregnancy. The third group was deprived of good nutrition and the low level of serum cholesterol level reflected the same and thus all the animals failed to conceive even after some services. Higher level of serum cholesterol level during puberty might be explained by the activity of the steroidal hormones.

According to the previous studies, serum cholesterol level varied between 41 to 111 mg/dl). Cholesterol was required for progesterone precursor and thus to maintain a high-level steroidogenesis (Arikan *et al*. 2010). As per several previous workers, the serum cholesterol level was between 106.479 to 111.758 mg/dl in Nigerian goats (Abosede, 2006); 4.32 mmol/l. in sheep (Adamu *et al*. 2008); 0.51 to 2.79 mmol/L in Raini goats (Sakha *et al.* 2009); 109.80 ± 0.64 to



[X-axis represents stages of study and Y-axis represents level of total cholesterol (mg/dl) in blood]

Fig. 3: Average cholesterol level (mg/dl) in blood serum of animals under different treatments at different stages

105.20 ± 1.00 mg/dl in Black Bengal goat (Islam *et al*. 2009); 41 to 51 mg/dl. in West African Dwarf (WAD) goats (Opara *et al.* 2010); 171.66 ± 3.31 mg/dl in Barbari goats (Bhooshan *et al.* 2010); 46 to 140 mg/dl in Damascus goats (Abu El-Ella and Kommonna 2013); 0.50 to 0.65 g/L in various age groups, various seasons and different stages of reproduction (Hafid *et al.* (2013).

CONCLUSION

Investigation was also carried out to know the serum biochemical profiles of the animals under three treatment groups from 6 to 19 months. Serum glucose, total protein in blood and serum cholesterol levels were estimated. The first treatment group of animals had higher levels of serum glucose than that of the second group and the third group showed lowest value among the three groups. The Glucose level varied from 65.66 to 77.11 mg/dl, 50.03 to 63.78 mg/dl and 55.22 to 68.66 mg/dl for the first, second and third group, respectively. There was higher value of serum glucose at the time of service for all the treatment groups. The total protein level did not vary much among the animals under three treatment groups (64.45 to 78.55 g/l). The serum cholesterol level varied between 50.17 to 110.05 mg/dl among the animals under three treatment groups. The serum cholesterol value of the animals under first treatment group was consistently higher than that of the second and third group. During prepubertal period the serum cholesterol value was low (~ 76, ~ 62 and ~ 60 mg/dl for first, second and third group, respectively). After that the value increased for all the groups from pubertal period, time of several other services and towards pregnancy for all groups of animals. The levels of all the biochemical parameters tested were within the normal range, suggesting that all the animals were physically normal and not in diseased condition.

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