Original Research

Effect of Age, Sex and Physiological Stages on Biochemical Profile of Mehsana Goat (*Capra hircus*)

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Abstract

A study was conducted to determine the physiological baseline values for biochemical profile of Mehsana goat (Capra hircus) as well as to assess their alteration with age, sex and physiological stages. A total of 42 clinically healthy Mehsana goats were divided into seven groups with 6 number of animal per group: T_1 (male kids <1 year), T_2 (bucks >1 year), T_3 (female kids <1 year), T_4 (pregnant lactating does), T_5 (non-pregnant lactating does), T_6 (pregnant dry does), and T_7 (non-pregnant dry does). Blood samples were collected aseptically from all the experimental groups. As far as biochemical analytes are concerned, significantly ($p < 0.05$) higher values for serum concentration of glucose, total cholesterol, creatinine and triglyceride were recorded in bucks than kids. Significantly ($p < 0.05$) higher serum total cholesterol level was observed in pregnant does than non-pregnant does. Serum glucose concentration was found to be significantly ($p < 0.05$) lower in lactating does as compared to dry does, while pregnant dry and pregnant lactating does showed significantly ($p < 0.05$) higher serum glucose concentration than lactating non pregnant and dry non-pregnant does. The concentration of BUN and UAc did not ($p > 0.05$) differ significantly. Serum albumin concentration was found to be ($p < 0.05$) higher in female kids than dry non-pregnant does. The results of the present study demonstrate the normal biochemical indices of Mehsana goat at different physiological stages. Present results stated some significant variation of parameters among groups whereas some shows no significant variation at all.

Key words: Age, Biochemical Profile, Goat, Lactation, Pregnancy, Sex

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Introduction

Blood biochemical investigation provides valuable information and indication about the general health of animals. Observation of a deviation of certain biochemical parameters from their normal limits could be an indication for diagnosis or differential diagnosis of a diseased condition (Dessouky, 1992). Biochemical parameters are also important indicators of and nutritional status of the animals (Gupta *et al*., 2007). It is also well documented that biochemical profiles of animals vary during different physiological stages (Ahmad *et al*., 2003). Determination of "normal values" for biochemical indices thus become imperative for any disease monitoring programme as it forms the very basis for clinical interpretation of laboratory data (Zvorc *et al*., 2006). Nonetheless, there is great variation in the biochemical parameters observed between different goat breeds and in this regard it may be difficult to formulate a universal metabolic profile for goats (Daramola *et al*., 2005). These variations further underline the need to establish appropriate physiological baseline values for various goat breeds of Gujarat, which would help in the realistic evaluation of management practices, nutrition, health and the physiological status of the species.

In view of these, the present study was undertaken to determine the baseline values of different biochemical profile of clinically healthy Mehsana goat as well as to study the influence of age, sex, gestation, lactation and dry stage.

Materials and Methods

Present investigation was carried out on Mehsana goats during August to December 2014. The animals were maintained at Livestock research Station, SDAU. The climate of area is tropical and semi arid. A total of 42 (12 males and 30 females) clinically healthy Mehsana goats from LRS, were randomly selected and divided into seven groups with 6 number of animal per group- T_1 (male kids <1 year), T_2 (bucks >1 year), T_3 (female kids <1 year), T_4 (pregnant lactating does), T_5 (non-pregnant lactating does), T_6 (pregnant dry does), and T_7 (non-pregnant dry does). The goats were reared under standard feeding and management practices. All the animals were given anthelmintics before study. The health status of animals was regularly evaluated.

The 8 ml blood was collected to VACUETTE® Z Serum Clot Activator tubes and kept in slanting position for about 1 hour followed by centrifugation at 700xg for 15 minute to harvest the serum. After centrifugation, clear serum samples were collected in sterile screw tubes of 5 ml capacity. The separated serum samples were properly labeled and stored at -20°C till further analysis. Serum samples were

analyzed for different biochemical profile viz. glucose (Glc), total protein (TP), albumin (Alb), globulin (Glb), albumin to globulin ration (A/G ratio), total bilirubin (Tbi), total cholesterol (TCh), creatinine (Cr), blood urea nitrogen (BUN), uric acid (UAc) and triglyceride (TG) using respective kits by Clinical Analyzer-635 (Systronics, India Ltd., India). Glucose was estimated by GOD-POD method (Barham and Trinder, 1972). Total protein was estimated by Biuret method (Anino, 1976). Albumin was estimated by BCG method (Doumas *et al.*, 1971). Globulin level in serum was calculated by subtracting albumin value from total protein value. Albumin/Globulin ratio in the serum was estimated by dividing albumin value by globulin value. Total bilirubin was estimated by modified J & G method (Tietz, 1976). Cholesterol was estimated by CHOD method (Zlatkis and Azk, 1953). Creatinine was estimated by Alkaline Picrate method (Toro, 1975). BUN was estimated by the method of Berthelot (1859) and Tietz (1987). Uric acid was estimated by enzymatic method (Fossati *et al.*, 1980). Triglyceride was estimated by GPO method (Fossati and Lorenzo, 1982; Young, 1990).

Statistical Analysis

Data collected were analyzed using analysis of variance (ANOVA) and significant means where separated using Duncan Multiple Range Test (Gomez and Gomez, 1985). Statistical Analysis Software (SAS, 1999) computer package was used. $p < 0.05$ was considered to be statistically significant.

Results and Discussion

The results (mean ± S.E.) of the biochemical profile of Mehsana goat are presented in Table 1.

Table 1: Concentration of biochemical profile of different experimental groups of Mehsana goats

Groups	Male Goats		Female Goats				
Parameters	Group I		Group II				
	T_1	T_2	T_3	T_4	T_5	T_6	T_7
Glucose (mg/dl)	69.10 ± 1.76^{c}	82.56 ± 1.05^{e}	70.16 ± 1.14^{c}	46.08 ± 1.31^{a}	66.71 ± 2.00^{c}	57.94 ± 3.09^{b}	75.53 ± 1.31^{d}
Total protein (g/dl)	7.80 ± 0.37^{abc}	7.98 ± 0.27^{c}	6.67 ± 0.22^{a}	6.83 ± 0.35^{ab}	7.35 ± 0.22^{abc}	7.52 ± 0.52^{abc}	7.57 ± 0.13^{bc}
Albumin (g/dl)	4.19 ± 0.11^{c}	4.25 ± 0.21^{c}	3.84 ± 0.22^{bc}	3.78 ± 0.09^{bc}	3.38 ± 0.12^{ab}	3.32 ± 0.22^{ab}	3.22 ± 0.20^{a}
Globulin (g/dl)	3.61 ± 0.35^{abc}	3.73 ± 0.30^{abc}	2.83 ± 0.18^{a}	3.06 ± 0.29^{ab}	3.97 ± 0.13^{bc}	4.20 ± 0.56^{c}	4.35 ± 0.23^{c}
A/G ratio	1.23 ± 0.16^{bc}	1.20 ± 0.17^{bc}	1.40 ± 0.13^{c}	1.29 ± 0.12^{c}	0.85 ± 0.02^{ab}	0.87 ± 0.16^{ab}	0.76 ± 0.08^{a}
Total bilirubin (g/dl)	0.19 ± 0.00^{ab}	0.22 ± 0.02^{bcd}	0.17 ± 0.00^{a}	0.24 ± 0.00^{cd}	0.23 ± 0.00^{d}	0.21 ± 0.01^{bc}	0.24 ± 0.00^{d}
Total cholesterol (mg/dl)	45.49 ± 0.98^{a}	65.18 ± 1.36^{c}	44.80 ± 0.27^{a}	69.88 ± 0.70^{d}	64.08 ± 0.38^{bc}	70.25 ± 0.69^{d}	62.28 ± 0.40^{b}
Creatinine (mg/dl)	0.66 ± 0.01^{a}	0.85 ± 0.02^{c}	0.63 ± 0.02^{a}	0.83 ± 0.02^{c}	0.81 ± 0.02^{bc}	0.81 ± 0.01^{bc}	0.77 ± 0.01^{b}
BUN (mg/dl)	20.20 ± 0.76^{a}	21.78 ± 0.71^{a}	20.47 ± 0.65^{a}	21.68 ± 0.33^{a}	22.01 ± 0.54^{a}	21.70 ± 0.56^{a}	21.70 ± 0.66^{a}
Uric acid (mg/dl)	5.74 ± 0.24^{a}	5.43 ± 0.14^{a}	5.35 ± 0.11^{a}	5.29 ± 0.10^{a}	5.43 ± 0.19^{a}	5.26 ± 0.18^{a}	5.28 ± 0.22^{a}
Triglyceride (mg/dl)	32.66 ± 0.65^{a}	52.66 ± 0.65^{b}	31.66 ± 0.65^{a}	57.66 ± 0.65^{c}	61.98 ± 0.38^{d}	71.27 ± 0.69^{e}	56.28 ± 0.95^{c}

a, b, c, d, e: Means along the same row with any identical superscripts are not significant (P > 0.05). No. of observation (6) (Where: T_1 - Male Kids, T_2 - Bucks, T_3 - Female Kids, T_4 - Lactating pregnant does, T_5 - Lactating non-pregnant does, T_6 - Dry pregnant does and T_7 - Dry non-pregnant does)

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The male kids had non-significantly ($p > 0.05$) lower serum glucose level than female kids. However, significantly ($p < 0.05$) higher concentration of serum glucose was recorded in the bucks as compared to kids irrespective of sex which was in agreement with findings of Kiran *et al*. (2012). The lactating non-pregnant does showed significantly ($p < 0.05$) lower serum glucose level than dry non-pregnant does. The lower level of blood glucose recorded in the lactating non-pregnant does may be ascribed to the utilization of large amount of blood glucose by mammary gland for the synthesis of lactose (Schultz, 1968). It is reported that lactose synthesis and milk yield show a linear positive correlation with glucose uptake and thus the lactose synthesis potential is accompanied by greater glucose uptake by lactating mammary gland (Afshar and Fathi, 2012). However, the glucose concentration was lowest in pregnant does as compared to all other groups of does, which was in line with findings of Bamerny (2013). This may be due to utilization of glucose for optimum fetal growth and development as well as nourishment. Many factors including type of food, breed, age, season and the physiological status of the animal affect the blood glucose level. Rastogi and Singh (1990) reported that glucose does not vary with the breed and they attributed this to efficient energy utilization by the different breeds. Moreover, Mbassa *et al.* (1991) in Landrace Danish goats, Sharma *et al.* (1990) in Pashmina Cheghu goats and Sakah *et al.* (2009) in Raini goats were found that the mean values of glucose concentration did not show any significant intersex variation.

A significantly ($p < 0.05$) higher serum total protein concentration was seen in bucks than female kids and lactating pregnant does. There was no significant ($p > 0.05$) difference observed among different groups of female does. Further, there was no significant ($p > 0.05$) difference for serum total protein values of male and female kids which was same as reported by Sharma (1990). The albumin concentration of male and female kids did not vary significantly ($p > 0.05$), but they were apparently lower than bucks. Similarly, non-significant ($p > 0.05$) variation for albumin values was also noticed among pregnant and non-pregnant does. Significantly ($p < 0.05$) higher albumin concentration was seen in female kids than the dry non-pregnant does. It was also observed that the albumin concentration recorded in lactating goats was slightly higher than that of the dry does. Serum albumin is a very sensitive and early nutritional indicator of protein status (Agenas *et al*., 2006) because its turnover is only 16 days and claimed that neither the breed nor the age have any statistically significant effect on the serum albumin and globulin values. The globulin concentration observed in male and female kids were statistically at par with each other, but these values were non-significantly ($p > 0.05$) lower than that of bucks which was in line with findings of Bhat *et al*. (2011). Dry (pregnant and non-pregnant) does had significantly ($p < 0.05$) higher globulin levels than lactating pregnant does but not significantly ($p > 0.05$) higher than the lactating non-pregnant does. Sakah *et al.* (2009) showed that there are no significant ($p > 0.05$) differences between male and female goats regarding serum concentration of albumin and globulin. Castro *et al.* (1977) also

reported no significant ($p > 0.05$) differences in albumin, globulin and total protein concentration in Pygmy goats of both sexes.

The A/G ratio of female kids was non-significantly ($p > 0.05$) higher than that of male kids and bucks, which was in corroboration with findings of Bhat *et al*. (2011). Dry pregnant does had apparently higher A/G ratio than the dry non-pregnant does. The A/G ratio was found to be significantly ($p < 0.05$) higher in lactating pregnant does than any other groups of the does. However, no significant ($p > 0.05$) difference was observed between groups of lactating non-pregnant, dry pregnant and dry non-pregnant which was in line with findings of Bamerny (2013). A non-significant ($p > 0.05$) difference in total bilirubin concentration was seen among bucks and kids which was consistent with research findings of Elitok (2012). The same trend also prevailed among different groups of does irrespective of their physiological status. It is also revealed that total bilirubin levels were significantly ($p < 0.05$) higher in adult goats than that of kids which was also in line with findings of Elitok (2012).

There was no significant ($p > 0.05$) difference for total cholesterol levels observed between male and female kids which were similar with findings of Sharma (1990). Serum cholesterol concentration increased with age in both the sexes. Females showed significantly higher cholesterol concentration than males in higher age groups, though there was no significant ($p > 0.05$) sex difference in lower age groups (Sharma, 1990). Moreover, dry pregnant does had non-significantly ($p > 0.05$) higher value for total cholesterol than lactating pregnant. Similar results were observed by Ling *et al.* (2003). They found that cholesterol content was the lowest in early stage of lactation and then increased gradually during lactation. A significantly ($p < 0.05$) higher level of total cholesterol was found in the pregnant does than non-pregnant does which was in agreement with findings of Bamerny (2013). Similarly, previous studies also reported that elevated cholesterol level was common during pregnancy (Qureshi *et al*., 1999 and Kalllio *et al*., 1992). In fact, cholesterol levels rise in the second trimester of pregnancy and peak during the third trimester. It is important for optimum brain development of the fetus (Qureshi *et al*., 1999). Further, Coles (1986) and Smith *et al*. (1988) reported that the females registered significantly ($p < 0.05$) higher concentration of cholesterol than males and concluded that cholesterol increased with the age.

Creatinine is most commonly used as an indicator of renal function. Serum creatinine concentration varies with animals diet, breed, muscle mass and sex (Otto *et al*., 2000 and Miller *et al*., 2004). Castro *et al.* (1977), Otto *et al.* (2000), Miller *et al.* (2004) and Sakah *et al.* (2009) observed that males had significantly higher concentration of creatinine than the females. It was observed that serum creatinine levels of male and female kids were statistically at par, whereas the creatinine level of bucks was significantly ($p < 0.05$) higher than the male kids, which was in line with findings of Elitok (2012). Sharma (1990) also reported that creatinine values of both sexes increased significantly with age. Further, it was noticed that the creatinine value recorded in bucks was the highest amongst all experimental

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groups, similar with Piccione *et al.* (2010). However, there was no significant ($p > 0.05$) difference among pregnant and non-pregnant groups of does which was in agreement with findings of Waziri *et al.* (2010).

The results indicated non-significant ($p > 0.05$) difference in BUN levels in all groups of experimental goats which was in line with findings of Elitok (2012), Piccione *et al*. (2010) and Waziri *et al*. (2010). It may be concluded that the age, sex and physiological stages has no significant ($p > 0.05$) effect on the concentration of BUN. On the contrary, Reinartz and Hofmann (1989) found that serum urea concentration was significantly influenced by the lactation stage. It is also recorded that the efficiency for utilization of metabolisable protein for milk production is less than that of maintenance (McDonald *et al*., 1995). As the milk production increases, the overall protein utilization efficiency decreases, which consequently leads to more drainage of nitrogen in terms of urea through urine and milk (Roy *et al*., 2003). However, an increase in urea value was further observed in the first 8 weeks of lactation (Ndibualonji and Godeau, 1993) and found to be peak at 12 weeks postpartum, which decreased slowly thereafter (Rajcevic *et al*., 1993). It appeared that the uric acid concentration did not vary significantly ($p > 0.05$) between the groups of goats studied which indicated that the age, sex and physiological status of the animals did not affect the concentration of uric acid significantly. The serum triglyceride levels of both male and female kids were statistically at par, which was in line with findings of Bhat *et al.* (2011), whereas the triglyceride level of bucks was significantly ($p < 0.05$) higher than male kids, which was also in agreement with Elitok (2012). Further, it was noticed that the triglyceride value recorded in case of dry pregnant does was the highest amongst all experimental groups. Similar findings were also observed by Qureshi *et al*. (1999) and Kalllio *et al*. (1992) who reported that elevated triglyceride level was common during pregnancy.

Conclusion

The results of the present study demonstrate the normal biochemical profile of Mehsana goat at different physiological stages. Present results stated some significant variation of parameters among groups whereas some shows no significant variation at all. However, further investigation is required to verify the values depending on season and other climatic conditions.

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