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# Ambient Stress Associated Variations in Total Serum Proteins and Total Fatty Acids in Marwari Goats

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**Abstract:** Ambient stress associated variations in serum metabolites of hepatic functions in 540 Marwari breed of goat were investigated by screening male and female goats of varying age groups during moderate, cold and hot ambiences. In each ambient temperature period 180 blood samples were collected and the animals were grouped into male (90) and female (90). Further each group was divided according to age as 5-10 months (30 male and 30 female); 1-2 years (30 male and 30 female) and 2.5-4 years (30 male and 30 female). The overall mean values for serum metabolites of hepatic functions (Total serum proteins (TSP) and Total fatty acids (TFA) included in the study were 73.8±0.50 g/l (63.1-84.3 g/l) and 2.25±0.10 mmol/l (0-3.5 mmol/l), respectively. The overall mean value of TSP was significantly ($p = 0.05$) lower during either hot or cold ambient temperature periods in comparison to the overall mean values of moderate ambient temperature. In each ambient temperature period, the sex effect was significant ($p=0.05$) for both metabolites TSP and TFA, the values were higher in male animals for TSP and higher in female animals for TFA. In each ambient temperature period the age effect was significant ($p=0.05$) for both metabolites, the values being highest in the animals of 2.5-4 years of age. In conclusion, the present study indicated that extreme ambience can stimulate the liver of the animals of both sexes and all age groups, which was reflected in the form of increased activity metabolites in the serum.

**Key words:** Ambient Temperature · Marwari Goat · Serum · Total Protein · Total Fatty Acids

## INTRODUCTION

Animals living in natural environment are exposed to drastic variations in ambient environment like temperature, humidity, rainfall and solar radiation affecting livestock. In general, animals are drastically affected at all levels of their organization by undergoing various physiological reactions, highly sensitive to the variations in the ambient temperatures [1]. These seasonal changes can produce economical losses to animal owners by affecting productivity and resistance to infectious diseases [2]. The metabolic changes can occur due to climatic conditions, sex and age. Thorough investigation of an animal by a clinician having knowledge of these variations is necessary to interpret the results. The serum metabolite profile helps in assessing the metabolic status of the body. Disease or environment may give rise to Stress goaded cortisol, affecting carbohydrate, protein and fat metabolism [3]. The variations in these metabolites depict hepatic functions fairly in clinical cases, since the liver is the hub of metabolic processes. These include glucose, total proteins, urea, cholesterol, total fatty acids and creatinine, reasonably representing the metabolism.

## MATERIALS AND METHODS

Five hundred and fourty apparently healthy Marwari goat of either sex, between 5 months to 4 years of age were screened to determine ambient temperature associated variations in serum metabolites

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of hepatic functions. Blood samples were collected during slaughtering from private slaughter houses (Bikaner, Rajasthan). It was carried out in morning hours during moderate, hot and cold ambient temperature periods. Duplicate blood samples were collected directly into clean, dry test tubes without any anticoagulant. After collection of the blood, test tubes were kept in the slanting position for 30 minutes and blood was allowed to clot. Then the clot was separated from the walls of each test tube with the help of sterilized stainless steel wire and then each test tube was centrifuged at 3000 rpm for 10 minutes. Supernatant clear serum was pipetted out into sterilized plastic vials. Only non-haemolysed serum samples were used.

The total experiment was divided into three periods:

- Period-I (Moderate ambient temperature, 34.34 ± 0.26°C) (October and November). This serves as control period.
- Period-II (Extreme cold ambient temperature, 6.83 ± 0.30°C) (December and January). The results of the period were compared with that of control period (moderate).
- Period-III (Extreme hot ambient temperature, 42.31 ± 0.32°C) (May and June). The results of this period were compared with that of control period (moderate).

The following parameters were analyzed to achieve the objectives. Serum metabolites of hepatic functions:

- Total serum proteins (TSP): It was determined by Lowry's method [4]
- Total fatty acids (TFA): It was determined by Stoddart and Drury and Peters and Van Slyke method [5].

The statistical analysis of the data collected was done by paired't' test [6].

## RESULTS AND DISCUSSION

The present investigation was carried out on 540 apparently healthy Marwari goat of either sex, between 5 months to 4 years of age, to assess ambient temperature associated variations in serum metabolites of hepatic functions. Mean ± SEM values of Total proteins and total fatty acids are present in Table 1.

Table 1.Total serum proteins and total fatty acids in *Marwari goats*(Mean ± SEM) during different ambient temperatures.

| | | Metabolicconcentration | |
|---|---|---|---|
| S. No. | Effects | Total serum proteins(g/l) | Total fatty acids mmol/l |
| 1. | Overall (540) | 73.8±0.50 | 2.25±0.10 |
| 2. | Ambient temperature period | | |
| (A) | Moderate overall (180) | 76.0±0.84 | 2.26±0.052 |
| I | Sex | | |
| (i) | Male (90) | 80.7±1.08 | 2.04±0.041 |
| (ii) | Female (90) | 73.2±0.68$^{c}$ | 2.48±0.062$^{c}$ |
| II | Age | | |
| (i) | 5-10 months (60) | 70.4±0.81 | 1.23±0. 050 |
| (ii) | 1-2 Years (60) | 75.3±0.91$^{d}$ | 2.46±0.060$^{d}$ |
| (iii) | 2.5-4 Years (60) | 83.3 ±0.70$^{d}$ | 3.09±0.040$^{d}$ |
| (B) | Hot overall (180) | 70.4±0.39$^{b}$ | 1.97±0.10$^{b}$ |
| I | Sex | | |
| (i) | Male (90) | 74.3±0.24 | 1.51±0.10 |
| (ii) | Female (90) | 67.5±0.52$^{c}$ | 2.43±0. 10$^{c}$ |
| II | Age | | |
| (i) | 5-10 months (60) | 64.1±0.52 | 1.40±0.16 |
| (ii) | 1-2 Years (60) | 71.5±0.50$^{d}$ | 2.05±0.10$^{d}$ |
| (iii) | 2.5-4 Years (60) | 76.8±0.20$^{d}$ | 2.46±0.04$^{d}$ |
| (C) | Cold overall (180) | 72.0±0.30$^{b}$ | 2.54±0.051 |
| I | Sex | | |
| (i) | Male (90) | 76.5±0.50 | 2.08±0.063 |
| (ii) | Female (90) | 67.5±0.20$^{c}$ | 2.98±0.053$^{c}$ |
| II | Age | | |
| (i) | 5-10 months (60) | 66.5±0.50 | 1.41±0.020 |
| (ii) | 1-2 Years (60) | 74.1±0.50$^{d}$ | 2.84±0.08$^{d}$ |
| (iii) | 2.5-4 Years (60) | 78.9±0.10$^{d}$ | 3.34±0.05$^{d}$ |

**Total Proteins:** The overall mean value of total serum proteins was 73.8±0.50 g/l which w as obtained from 540 animals irrespective of sex and age. The range was 63.1-84.3 g/l. Moderate overall mean value was 76.0±0.84 g/l which was obtained during moderate ambient temperature period. The findings of present study were similar to the observations of [7-15] in goats; and higher than that of Mbassa and Poulsen [16] in goats.

Values of Total Serum Proteins (TSP) can be affected by season, sex, age, nutrition, disease etc. Chronic and inflammatory disease of liver may cause changes in the values of TSP [17].

**Effect of Hot and Cold Ambient Temperature on TSP:** The mean value of TSP was significantly (p = 0.05) lower during hot and cold ambient temperature periods in comparison to overall moderate mean value. Kataria and Bhatia [13] and Kataria *et al.*[18] observed season wise non significant variation in the mean values of total proteins in Marwari goats.

**Effect of Sex on TSP:** The mean values in all the ambient temperature periods were significantly (p = 0.05) higher in male animals than female animals. Kataria and Bhatia [13], Mbassa and Poulsen [16] reported non significant (p>0.05) variation whereas Sharma *et al.* [12] reported significant difference between genders. Testosterone influence could result in higher metabolism [19].

**Effect of Age on TSP:** Age effect showed a significant (p = 0.05) increase in the mean values being highest in the animals of 2.5-4 years of age. Earlier workers also reported the similar effect of age on TSP values in goats [9, 10, 16, 20, 21]. [22] suggested that many factors like breed, age, nutrition etc. can affect the serum protein values in animals.

**Total Fatty Acids:** The overall mean value of TFA was 2.25±0.1 mmol/l which was obtained from 540 animals irrespective of sex and age. The range was 1.0-3.5 mmol/l. Moderate overall mean value was 2.26±0.05 mmol/l which was obtained from 180 animals during moderate ambient temperature period.

The results corroborated the findings of Khaled *et al.* [23].

**Effect of Hot and Cold Ambient Temperatures on TFA:** The mean value of TFA was significantly (p = 0.05) lower during hot and significantly (p = 0.05) higher during cold ambient temperature periods in comparison to overall moderate mean value.

Christi [24] reviewed considerable amount of evidence to suggest that, lipid metabolism in ruminants is affected by exposure of the animals to high environmental temperature and one manifestation of this effect is an alteration in the composition of the plasma lipids. Influence of breed on the blood constituents is well documented [25]. High endogenous keto acids like pyruvate and ketones are common in plasma of ruminants [26]. Stress can cause mobilization of fatty acids. Environmental condition can be one of the factors in changing the concentration of fatty acids in animals [27].

**Effect of Sex on TFA:** The mean values in all the ambient temperature periods were significantly (p = 0.05) higher in female animals than males. This showed the higher requirement of fatty acids in female animals to satisfy maintenance, production and reproduction requirements. Scarcity of feed, higher metabolic needs or starvation can result into higher concentration of fatty acids in blood [28].

**Effect of Age on TFA:** In each ambient temperature period the age effect was significant (p = 0.05). Mean values of TFA increased significantly as the age advanced. The value was maximum comparatively in the animals of 2.5 years to 4 years of age. The mean value increased in each ambient temperature with advancement of age, the value being highest in 2.5-4 years of age. Probably the requirement of fatty acids was higher in old animals compared to young animals. Glucose concentration was higher to meet the demand [28].

- Figures in the parenthesis indicate number of goats.
- In ambient temperature effect, mean values of all the parameters of hot and cold ambient temperature periods have been compared with respective mean values of moderate temperature period.
- Superscript ‘b’ indicates a significant difference (p = 0.05) according to ambient temperatures compared to the moderate one.
- In sex effect, mean values of all parameters of female animals have been compared with respective mean values of male animals within ambient temperature.
- Superscript ‘c’ indicates a significant (p = 0.05) difference according to sex within one ambient temperature period for a parameter.

- In age effect, mean values of all the parameters have been compared to5-10 months age group.
- Superscript'd' indicates a significant (p = 0.05) difference according to age within one ambient temperature period for a parameter.

## REFERENCES


1. Al-Bassam, L.S., S.M. Azwai, O.E. Abdouslam, S.A. Al-lzzi and A.M. Al-Dawek, 2007. Effect of season on haematological parameters in clinically normal Llamas (*Lama glama*) raised in Libya. J. Camel Prac. Res., 14(2): 187-194.
2. Kataria, A.K. and N. Kataria, 2005. Stress induced changes in serum vitamin A and enzyme levels in Rathi calves. The Indian Cow, 2(5): 16-19.
3. Gottam, G.S., N. Kataria, A.K. Kataria and L. Singh, 2005. Serum metabolic profile of goats during stress. Vet. Pract., 5(2): 156-158.
4. Greenberg, D.M., 1928. J. Biol. Chem. 82: 454. (Cited from Frankel, S., S. Reitman and A.C. Sonnenwirth. Gradwohl's Clinical Lab. Methods and Diagnosis. Volume 2nd, CV Mosby Company, Saint Louis, US, pp: 1020.
5. Varley, H., 1988. Tests in liver and biliary tract disease. In: Practical Clinical Biochemistry, 4th edn. CBS publishers, New Delhi, pp: 158-467.
6. Snedecor, G.W. and W.G. Cochran, 1967. In: Statistical Methods (Ed. 6), (New Delhi, Oxford and IBH Publishing Co., 1967, pp: 45-83.
7. Kaneko, J.J., J.W. Harvey and L.B. Michael, 1999. In: Clinical Biochemistry of Domestic Animals. 5th edition. Harcourt Brace and Company, Asia Pvt. Ltd., pp: 327-352, 890-899.
8. Radostits,O.M., C.C. Gay and D.C. Blood. 2007. In: Veterinay Medicine. 9th Edition, Saunders, pp: 1726-1727.
9. Sakha, M., M. Shamesdini and F. Mohamad-zadeh, 2009. Serum Biochemistry Values in Raini Goat of Iran. The Internet J. Vet. Med., 6(1): 27-31.
10. Castro, A., D.S. Dhinsa, A.S. Hoversland and J. Metcalf, 1977. Serum proteins and protein electrophoretic pattern in normal Pygmy goats. Am. J. Vet. Res., 38(5): 665-667.
11. Benjamin, M.M., 1989. Outline of veterinary clinical pathology. 3rd Edition, Iowa state university press, pp: 55-75.
12. Sharma, B., J.C. Biswas and M. Lal, 1990. Some biochemical parameters in serum of Chegu goats. Indian J. Anim. Sci., 60(11): 1340-1341.
13. Kataria, N. and J.S. Bhatia, 1991. Activity of some enzymes in the serum of dromedary camels. Res. Vet. Sci., 51(9): 174-176.
14. Pareek, S. and N. Kataria, 2002. Effect of water restriction on total serum proteins and albumin in Marwari goat. Vet. Pract., 3(1): 43-45.
15. Misra, V., J. Kumar, A. Pathak, D.K. Johari and S.K. Garg, 2008. Biochemical analytes of cerebrospinal fluid and sera of goats. Indian J. Vet. Res., 17(2): 17-21.
16. Mbassa, G.K. and J.S. Poulsen, 1993. Reference ranges for clinical chemical values in Danish Landrace goats. Small Rumin. Res., 10(2): 133-142.
17. Alemu, P., G.W. Forsyth and G.P. Searcy, 1977. A comparison of parameters used to assess liver damage in sheep treated with carbon tetrachloride. Canad. J. Compar. Med., 41: 420-427.
18. Kataria, A.K., N. Kataria and A.K. Ghosal, 1993. Blood metabolic profile of Marwari goats in relation to seasons. Indian Vet. J., 70: 761-762.
19. Wotron, E., 1971. Stress mechanisms and metabolism in animals. 2nd edn. S. and A. Baker Ltd. London, pp: 35-37.
20. Deangelino, J.L., M.M. Ishizuka, L. Ribeiro, T.V. Tucci and E.H. Birgel, 1990. Standard serum biochemical values of healthy goats reared in Saopaulo state, Braz. J. Vet. Res. Anim. Sci., (1): 91-97.
21. Kataria, A.K., N. Kataria and A.K. Gahlot, 2007. Radioimmunometric quantification of serum IgE of small ruminants naturally infected with gastrointestinal worms. Indian J. Anim. Sci., 77(2): 136-138.
22. Kataria, N., M. Sareen, A.K. Kataria and J.S. Bhatia, 1992. A qualitative study of electrophoretic pattern of serum proteins in some ruminants. Indian Vet. J., 69(3): 265-266.
23. Khaled, N.F., J. Illek and S. Gajdusek, 1999. Interactions between nutrition, blood metabolic profile and milk composition in dairy goats. Acta. Vet. Brno., 68: 253-258.
24. Christi, W.W., 1981. Lipid metabolism in ruminant animals. Pergamon press New York.
25. Shaffer, L., J.D. Roussel and K.L. Koonce, 1981. Effect of age, temperature, season and breed on blood characteristics of dairy cattle. J. Dairy Sci., 64: 62-70.

26. Kaneko, J.J., J.W. Harvey and L.B. Michael, 1999. In: Clinical Biochemistry of Domestic Animals, 5th edition. Harcourt Brace and Company, Asia Pvt. Ltd., pp: 327-352.
27. Kumar, V. and P. Kumar, 2006. Blood glucose and plasma non-esterified fatty acids levels during oestrous cycle in Murrah buffalo heifers. Indian Vet. J., 83: 38-40.
28. Purser, D.B. and W.G. Bergen, 1968. Glucose utilization and hepatic enzyme activities in young Gnotobiotic Ruminants. J. Dairy Sci., 52(6): 790-795.