



Effect of extreme hot climate on liver and serum enzymes in Marwari goats

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ABSTRACT

A study was conducted to investigate liver and serum enzymes i.e. aspartate amino transferase (AST) and alanine amino transferase (ALT) during moderate (Jan/Feb) and extreme (May/ June) climatic conditions in three hundred Marwari goats. In each climatic condition, 150 animals were taken. They were categorized in to males (70 of 0-1 year, and 30 of above 1 year) and females (30 of 0-1 year, and 20 of above 1 year). Blood samples were collected aseptically using EDTA containing vials and after separation of serum the serum transaminases were determined. Liver tissues were collected after slaughter of the animal and all the analyses were carried out at the same day of collection of fresh sample.

Liver AST and ALT (IU/L) ranged from 210.56 to 610.10 (average 579.65±11.33) and from 170.11 to 562.70 (average 402.09±21.34), respectively. Serum AST and ALT ranged from 56.70 to 215.00 (average 186.76±7.87) and from 20.15 to 85.77 (average 57.54±1.24), respectively. Season had significant ($P\leq 0.05$) effect on both liver and serum ALT. Liver ALT showed significant ($P\leq 0.05$) effect on sex in both climatic conditions and age group in moderate climatic condition. Higher values were observed in liver AST and ALT in males in comparison to females in both climatic conditions. Higher values of liver AST and ALT were observed in 0–1 year age group animals than above 1 year age group in both climatic conditions except in extreme climatic condition values of ALT observed higher in above 1 year age group animals.

Serum AST showed significant ($P\leq 0.05$) effect of sex in both climatic conditions but mean while, serum ALT showed significant ($P\leq 0.05$) effect on age group in extreme climatic condition only. Higher values of serum AST was observed in male while serum ALT values were higher in female of both climatic conditions.

Key words: Alanine amino transferase (ALT), Aspartate amino transferase (AST), Extreme climatic condition, Liver, Moderate climatic condition, Serum

Extreme environmental temperature, particularly high temperature, when combined with scarcity of feed and water may contribute to heavy economical losses to marginal and landless farmers due to mortality in kids (Young 1988). The capacity of liver is dependent on the combination of many enzymatic activities that take place within the hepatic cells. The enzymes of importance are aspartate amino transferase (AST) and alanine amino transferase (ALT). These enzymes are present in hepatic cells and their levels in serum increases during diseases (Gahlot 1988). Clinical enzymology for example is commonly used in the laboratory to diagnose cell integrity in human and veterinary medicine, but these parameters are not yet established in Marwari goats. Marwari is an important-medium size goat breed found predominantly in Marwar region of Rajasthan. This goat is primarily of meat type and also suitable for milk production.

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The information on this aspect is meager in goats particularly in Marwari breed. Rajasthan is one of the most important states, which provides the largest number of goats for meat purpose (Rai *et al.* 2000). Combination of determination of AST and ALT simultaneously in liver tissue and serum is helpful in bringing out the commendable diagnosis for the welfare of animals particularly goats. It becomes very essential to monitor their health as it is related with the economy as well as health of human population. Therefore, to parry the extrapolation, of scientific know how to other species and breeds to Marwari goats, the present investigation was planned to study the liver and serum AST and ALT during extreme hot climatic condition in Marwari goats.

MATERIALS AND METHODS

Goats (300) of both the sex ageing 0 to 3 years were used in the present investigation. The feeding management was of semi-intensive type where animals used to consume *Ziziphus numularia* leaves and loopings of *Prosopis cineraria* trees.

Blood samples were collected from jugular vein by using EDTA containing vials and serum was processed on same day. Liver tissues were collected from the animals immediately after slaughter. All the analyses were carried out at the same day of collection on fresh samples. Modified method of Cornelius *et al.* (1959) was used to determine the liver enzymes. Standard methods were used to determine the both serum enzymes, viz. AST and ALT by using the Reitman and Frankel's (1957) method of kit.

RESULTS AND DISCUSSION

Overall mean values of liver AST and ALT were 579.65 ± 11.33 and 402.09 ± 21.34 , respectively. The overall mean values of liver AST and ALT obtained in our study were more or less similar to those obtained by Fakhruddin (2003) in goats.

AST and ALT are useful indicators to show the integrity of hepatocytes (Tennants 1999). As per Coles (1986) liver biopsy can provide valuable information to a clinician along with serum determination. ALT is much more abundant in

liver than other tissues (Oser 1976). As per Ghoshal and Kataria (1995) the GPT rises sooner faster and higher than GOT. During extreme climatic conditions mean values of ALT increased significantly ($P \leq 0.05$). Per cent decrement of AST was 3.25 and increment of ALT was 35.31, respectively. The effect of climate was observed only on liver ALT values. The values were higher in extreme hot. Similar trends were observed for serum transaminases.

Mean values of liver AST were lower, while ALT values were higher in both sexes during extreme climatic condition when compared to moderate one. We observed that mean liver AST and ALT were low in female goats in comparison to males in both the climatic conditions. However, the difference were significant ($P \leq 0.05$) only for ALT. Mean values of liver AST and ALT were low in the animals of above 1 year age groups than 0–1 year in both the climatic conditions except for ALT mean value which was higher above 1 year age group during extreme climatic condition. However the differences were significant ($P \leq 0.05$) only for ALT during moderate condition.

Mean \pm SEM values of serum enzymes, viz. AST and ALT during moderate and extreme climatic conditions, sex and age groups in Marwari goats are presented in Table 2. Overall mean values of serum AST and ALT were 186.76 ± 7.87 IU/l and 57.54 ± 1.24 IU/l, respectively, (Table 1). In the present investigation ALT activity was predominated over the AST activity during extreme hot condition probably due to stress. Smith and Hoijer (1962) also reported similar findings in goats and the increment in ALT was 35.31. However, Kataria *et al.* (1993)

Table 1. Mean \pm SEM values of serum AST and ALT during moderate and extreme climatic conditions, age groups and sex in Marwari goats

Main effects	AST (IU/l)	ALT (IU/l)
Overall (300)	186.76 ± 7.87	57.54 ± 1.24
Climatic condition		
Moderate (150)	189.85 ± 6.27^a	57.41 ± 1.75^a
Extreme (150)	183.68 ± 14.47^a	77.68 ± 1.75^b
Sex		
Moderate		
Male (100)	235.16 ± 14.88^c	54.92 ± 1.50^c
Female (50)	180.36 ± 7.07^d	60.17 ± 2.00^c
Extreme		
Male (100)	256.16 ± 11.52^c	55.80 ± 1.50^c
Female (50)	154.10 ± 4.30^d	59.28 ± 2.00^c
Age group		
Moderate		
0–1 year (100)	225.40 ± 15.47^e	56.68 ± 2.07^e
Above 1 year (50)	190.15 ± 9.48^e	58.13 ± 2.77^e
Extreme		
0–1 year (100)	170.70 ± 8.22^e	73.15 ± 2.07^e
Above 1 year (50)	164.46 ± 9.25^e	82.21 ± 2.77^f

- (i) Figures in the parentheses are number of animals; (ii) for the main effects in each parameter means comparison have been made. Mean of moderate and extreme condition for each parameters have been compared with the same conditions. Superscript b. on the mean of extreme condition indicates that mean change is significant ($P \leq 0.05$); (iii) effect of sex and age have been determined within each climatic condition. Superscript d on the mean value of female and on the mean value of above 1 years age group animals for each parameters indicates that mean changes are significant ($P \leq 0.05$); (iv) similar superscripts show nonsignificant ($P > 0.05$) differences.

Table 2. Mean \pm SEM values of liver AST and ALT during moderate and extreme climatic conditions, age groups and sex in Marwari goats

Main effects	AST (IU/l)	ALT (IU/l)
Overall (300)	579.65 ± 11.33	402.09 ± 21.34
Climatic condition		
Moderate (150)	579.98 ± 19.54^a	362.88 ± 30.18^a
Extreme (150)	579.33 ± 11.57^a	441.31 ± 30.18^b
Sex		
Moderate		
Male (100)	602.16 ± 47.27^c	380.31 ± 47.86^c
Female (50)	584.07 ± 32.04^c	345.48 ± 35.87^d
Extreme		
Male (100)	579.33 ± 11.57^c	511.36 ± 35.87^c
Female (50)	565.30 ± 22.75^c	371.25 ± 27.85^d
Age group		
Moderate		
0–1 year (100)	631.15 ± 41.00^e	412.54 ± 35.87^e
Above 1 year (50)	570.00 ± 27.45^e	313.22 ± 47.85^f
Extreme		
0–1 year (100)	584.75 ± 21.41^e	439.15 ± 35.87^e
Above 1 year (50)	555.60 ± 37.15^e	443.47 ± 47.85^e

See footnote of Table 1 for details.

reported that higher activity of AST during summer in goats. In present study serum ALT was significantly ($P \leq 0.05$) higher during extreme hot condition. Highman and Atland (1960) theorized that stress predisposed to gluconeogenesis with associated rise in circulatory transaminases. Latif *et al.* (1997) reported seasonal variation in transaminases activities of sheep. Baumgartner and Pernthaner (1994) recorded the effect of season and age on transaminases activities in sheep. This could be a probable cause of changes in transaminases activities due to temperature variation.

The mean values of serum AST and ALT were higher in male than in female while the values of serum AST was lower and ALT higher in both age groups in extreme climatic condition than moderate one.

Mean values of serum AST were significantly ($P \leq 0.05$) lower and the ALT higher ($P < 0.05$) significantly in females than males in moderate climatic condition. Mean values of serum AST were significantly ($P \leq 0.05$) lower and serum ALT ($P < 0.05$) higher in female goats than male in extreme climatic condition. In present study, the sex effect was significant ($P \leq 0.05$) only for ALT. The changes in serum transaminases due to sex are probably because of sex hormones (Chatterjee *et al.* 1979).

Mean value of serum AST was lower in the animals of above 1 year age group, than zero to 1 year age group in extreme climatic condition except serum ALT mean value that was higher in above 1 year age group. However, the difference was significant ($P \leq 0.05$) for serum ALT.

REFERENCES

- Baumgartner W and Pernthaner A. 1994. Influence of age, season and pregnancy upon blood parameters in Australian Karakul sheep. *Small Ruminant Research* **13**(2): 147–51.
- Chatterjee M, Ghosh S P, Chokroborty A K, Desarkar M K and Chatterjee S. 1979. A note on the effect of starvation and sex hormones on blood glucose and gluconeogenesis in male and female goats. *Indian Journal of Animal Sciences* **49**(8): 677–79.
- Coles E H. 1986. Haemostasis and coagulation of blood. *Veterinary Clinical Pathology*. 4th edn. Pp. 98–113. W B Saunders company, Philadelphia.
- Cornelius L E, Bishop J A, Switzer J and Rhocle E A. 1959. Serum and tissue transaminases activity in domestic animals. *Cornell Veterinarian* **49**: 116–26.
- Fakhruddin. 2003. 'Biochemical changes in aqueous and vitreous humour enzymatic and histopathological changes in liver and heart in relation to time since death in slaughtered goats.' Ph D. Thesis submitted to Rajasthan Agricultural University, Bikaner, Rajasthan.
- Gahlot N. 1988. 'Studies on serum enzymes in camel.' M.V.Sc. Thesis submitted to Rajasthan Agricultural University, Bikaner, Rajasthan.
- Ghoshal A K and Kataria N. 1995. *Some hematological and biochemical parameters as an aid in clinical diagnosis of animals diseases*, pp 5–15. Directorate of Research, Veterinary and Animal Science, Rajasthan Agricultural University, Bikaner.
- Highman B and Atland P D. 1960. Serum enzymes rise after hypoxia and effect of autonomic blockade. *American Journal of Physiology* **199**(6): 981–86.
- Latif H A E, Ismail E, Salem M H and Hassan G A. 1997. Effect of dehydration on some biochemical constituents of blood of karki, Suffolk and their crossbred sheep. *Indian Journal of Animal Sciences* **67**: 786–91.
- Oser B L. 1976. Blood analysis. *Hawk's Physiological Chemistry*. 14th edn. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Reitman S and Frankle S. 1957. A colorimetric method for the determination of serum GOT and GPT. *American Journal of Clinical Pathology* **28**: 56–63.
- Rai B, Tiwari S and Khan B U. 2000. Production and management system of Jakhrana goats under village conditions. *Livestock International* **4**: 4–8.
- Smith R E and Hoijer D J. 1962. Metabolism and cellular function in cold acclimation. *Physiological Review* **42** (1): 60–142.
- Tennat B C. 1999. Hepatic function. *Clinical Biochemistry of Domestic Animals*. pp 327–52. (Eds.) Kaneko J J, Harvey J W and Bruss M L.
- Young B A. 1988. Cold stress as it affects animal's production. *Journal of Animal Science* **52** (1): 154–63.