



Serum Enzyme Changes in Heat Stressed Buffaloes of Nagpur Origin

Shalini J. Chahande*, J. M. Chahande

Seth Kesarimal Porwal College, Kamptee, District: Nagpur-441002, Maharashtra(INDIA).

sdshalini89@gmail.com, Phone No (M)-9890364933

ABSTRACT

One of the greatest challenges facing producers and livestock around the world is heat stress. Heat stress strongly affects animal bioenergetics, with adverse effects on the performance and well being of livestock. Animals are affected directly or indirectly due to changes in environmental factors such as ambient temperature, solar radiation, and humidity. Therefore, a study was conducted to correlate between altered enzyme in relation to the physiological responses. 80 buffaloes of Nagpuri breed were selected in the present study. Buffaloes were under observation from Feb. to Jun. months. Fortnightly observations on blood parameters were undertaken. Buffaloes were secured well with least disturbances. Serum samples were used for measuring serum activities of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), alkaline phosphatase (ALP), Using commercial kits. The activities of aspartate amino transferase and alanine amino transferase were higher in heat stress conditions than in cold ($p = /<0.05$). The increase in the activities of AST, ALT and ALP in plasma is mainly due to the leakage of these enzymes from the liver cytosol into the blood stream, which reflects liver damage and disruption of normal liver function.

Key words: Environmental heat, buffalo, AST, ALT, ALP.

Introduction

Under the present date climatic change scenario, it is expected to elevate atmospheric temperature. The summer in India is already scorching and the added effect of climate change may aggravate the situation. Moreover, the rains also do not follow the normal rhythm, as seen from the spread of monsoon in India. This leads to small but significant spells of elevated humidity. It is already documented that the animal body respond to elevated heat as well as humidity, however during the process to cope up with the changed situation certain biological functions in the animal's body bound to get affected. To conserve the body reserves of energy certain changes in behaviour observes in buffaloes as reduction in feed intake, its effective utilization in body, disturbances in water metabolism occurs. in addition to that the blood metabolites, hormones, enzymes, minerals everything changes drastically. The bioenergetics of the buffaloes is challenged due to heat stress which in turn adversely affect the production and reproduction performance of the buffaloes. The effect of heat stress is aggravated when environment heat stress accompanied by high ambient humidity [1], [2]. The factors such as ambient temperature, solar radiation and associated humidity in the environment directly or indirectly affect the animals.

Maharashtra state is bestowed with buffaloes of Nagpuri breed having its home tract in eastern Vidarbha. The tribe named as Gaoli rear these buffaloes for milk production. The big herds are reared traditionally. The improved systems of management have not been used and hence the data on many aspects is very scanty. The animals did not get much protection from the scorching heat prevails in this region. The cooling in addition to the existing structures may improve the productivity of the animals.

Few farmers at some places are using certain cooling management practices. However, the data regarding health status of the buffaloes in gross and in this region particularly is scarce, with respect to response to cooling treatments. Productivity of the animals is related to the health status of the animals as ascertained by function of liver. Hence it finds imperative to study the enzymes related to liver functions, as influenced by the environmental heat stressed condition.

Material and Methods

Present study was undertaken to estimate the effect of different cooling systems on the well being of buffaloes in the form of health most notably on Serum enzymes. The buffalo herds located in heavily populated area were under observations. The data thus generated was analyzed using RBD statistical design. Present study included 80 buffaloes of Nagpuri breed. Buffaloes were under observation from Feb. to Jun. months. Fortnightly observations on blood parameters were undertaken.

A. *Topographical and climatic situation of the Place of work:*

Nagpur is located on the latitude of 21⁰ 30' North and longitude of 79⁰ 03' East with a height of 310 Meters above mean sea level. Nagpur comes under the dry hot climatic zone of the tropical region. During summer season the maximum environmental temperature rises to 48 °C and humidity range from 14 to 16 %. The weather is hot during day time and warm but pleasant during night hours. The average rainfall is 950 to 1250 mm in 59 rainy days. Mean max and min temperatures are 32 to 37 °C and 15 to 24 °C. The mean humidity is 35 to 73 %.

Buffalo farming system is traditional in the region. Productivity of animals varies greatly. Grazing and feeding of dry grasses, straws, with little supplementation of concentrates is in vague.

B. *Housing environment:*

All buffaloes were housed under shed. They were provided with identical diet. The diet included green and dry roughage as well as concentrate. The incorporation of concentrate and greens in the diet was limited and fixed. Rest of the dietary requirement was fulfilled by dry roughage. Ad libitum water was supplied to the animals.

C. *Treatments:*

One group each of buffaloes was treated with physical measures of environmental heat stress management viz. splashing water(T1), covering body with wet gunny bags(T2), using water sprinklers(T3), and using foggers(T4).

D. *Experimental control:*

One group of buffalo was kept under shed only(T0).

E. *Blood sampling:*

Buffaloes were secured well with least disturbances. Blood samples were collected aseptically from the jugular vein puncture before initiation of treatment and at the end of experimental period, in plain vaccutainer tubes. Serum was separated by centrifugation at 3000 rpm for 15 min and stored in aliquots at -20⁰c until analysed for biochemical parameters.

F. *Enzyme assays:*

Serum samples were used for measuring serum activities of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), and alkaline phosphatase

(ALP), Using commercial kits supplied by span diagnostics, India and by means of Digital VIS/Ultraviolet Spectrophotometer (Systronics, India).

Results

A. Aspartate aminotransferase

Significant variation among treatment groups have been observed, as seen from the table. The values of AST being highest in control group. Variation in AST values in T4 group being the lowest (66.68 ± 1.99) followed by T3 (67.39 ± 1.97), T1 (68.77 ± 1.74) and T2. (69.48 ± 1.53).

B. Alanine aminotransferase

ALT values also differ significantly due to treatments. Higher values of ALT have been represented by control group. Variation in ALT values in T4 group (29.53 ± 1.48) being lowest followed by T3 (29.85 ± 1.86), T1 (30.27 ± 1.52) and T2 (30.65 ± 1.64).

C. Alkaline phosphatase

Significantly higher values for ALP has been noted in control group as compared to treatment groups. T4 group exhibited the numerically lowest value (41.56 ± 1.24) followed by T3 (42.19 ± 1.23), T1 (42.60 ± 1.28) and T2 (43.21 ± 1.20).

Analysis of variance suggests that the AST, ALT and ALP differ highly significantly within treatment groups over year and farms as well as in pooled data. Significant variation in AST, ALT and ALP due to week of observation was also observed.

Table: Mean \pm SE of AST, ALT and ALP activity in serum of buffaloes within treatment groups

Treatment	T0	T1	T2	T3	T4	Pooled	CD
AST	77.14 $\pm 2.54^a$	68.77 $\pm 1.74^{bc}$	69.48 $\pm 1.53^b$	67.39 $\pm 1.97^{bc}$	66.68 $\pm 1.99^c$	69.89 ± 1.67	2.77
ALT	37.68 $\pm 1.64^a$	30.27 $\pm 1.52^b$	30.65 $\pm 1.64^b$	29.85 $\pm 1.86^b$	29.53 $\pm 1.48^b$	31.60 ± 1.53	2.28
ALP	46.44 $\pm 1.30^a$	42.60 $\pm 1.28^b$	43.21 $\pm 1.20^b$	42.19 $\pm 1.23^b$	41.56 $\pm 1.24^b$	43.20 ± 1.15	1.75

Discussion

The activities of AST and ALT were higher in heat stressed conditions than in cold ($p \leq 0.05$). The increase in activities of AST, ALT and ALP mainly due to the leakage of these enzymes from the liver cytosol into the blood stream, which reflects liver damage and disruption to normal liver function. It is known that the activity of amino transferase in the blood is important in acting as a catalyst in connecting the metabolism of amino acids and carbohydrates. Changes in amino acid transferase in blood can be a consequence of their activities in liver cells and a cell structure damage. Some studies show that the overall mean serum GOT, GPT values were higher in summer than in winter in Barki and Rahmani ewes [3]. Decrease in AST have been reported by [4] during heat stress in sheep. Increased activity of some enzymes with rising temperature may be due to the fact that reactions are simply accelerated at higher temperature [5] observed that high ambient temperature enhanced significantly AST activities. [6], [7] in cattle, [8] and [9] in camel, [10] in Avikalin sheep than in Malpura sheep may be attributed to thermal stress [11] attributed increased activity of serum AST, ALT in the heat stressed animals to the increased stimulation of gluconeogenesis by corticoids. Stress, diseases of body tissue and injuries affect the ALT activities, [5]. GPT levels were significantly higher in summer in Chlos and crosses with Ossimi lambs, [12] and in rams [1]. The variation of plasma ALP activity in both cooled and non-cooled cows were within normal value, [13]. It does not confirm the hypothesis that a reduction of plasma ALP activities would coincide with a reduction in liver activity on cows exposed to high temperature, [14]. Enzyme activity of ALP has been indicated to be a quick and reliable blood marker of heat stress, [14]. Due to thermal stress glucocorticoid concentration was increased in control group which resulted in an increased ALP, [15]. Increase in ALP activities due to heat stress, may be due to alkalosis caused by increased alveolar ventilation. ALP is involved in maintaining homeostasis and energy generation in animal body, [16] and [17], which seems to be the region of higher activity in the present investigation.

Conclusion

Serum aminotransferase concentration was lower in buffaloes subjected to heat stress this indicated that the activity changes with altered environment serum transferase concentration was higher in control buffaloes, indicated altered transferase activities in environmentally stressed buffaloes. In order to stabilize / improve the enzyme activities of

the buffaloes which is in question it is necessary to provide proper environmental conditions for the sustained living of the buffaloes.

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