ENERGY STATUS VIS-A-VIS CARBOHYDRATE ENZYME REGULATORS IN NON-DESCRIPT SHEEP FROM ARID TRACTS DURING EXTREME HOT ENVIORNMENTAL TEMPERATURE PERIOD[#]

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ABSTRACT

An endeavour was carried to find out the body energy status vis-à-vis carbohydrate metabolism enzymes regulators of non-descript sheep from arid tracts during extreme hot environmental temperature period (ETP). Blood samples were taken to yield serum from non-descript male and female sheep of 4-13 months of age groups, owned by private slaughter houses during month of October to November (moderate) and May to June (extreme hot). For this purpose glucose-6-phosphatase and aldolase as a enzyme regulators of carbohydrate metabolism was selected. The moderate mean overall values of serum glucose-6-phosphtase (UL^{-1}) and aldolase (UL^{-1}) were 8.87±0.66 and 12.00±0.87, respectively. The mean values of serum enzymes regulators were observed to be significantly ($p \leq 0.05$) higher during extreme hot temperature period as compared to respective moderate value. Age effect showed a significant ($p \leq 0.05$) increase in the mean values in both the temperature being highest in the lambs of 10-13 months of age and lowest in sheep of 4-7 months of age for both the indicators studied in the present endeavour. Prototype of variations of data implicit the line of strategy in physiological stratagem by sheep during the periods when possible development of oxidative stress was there.

Key words: Enzyme regulators, serum, non-descript sheep, glucose-6-phosphatase, aldolase

Introduction

Gluconeogenesis is an important metabolic process in ruminants to make continue supply of glucose. Blood glucose level in ruminants does not depend largely on the feeding status as does in non-ruminants. It becomes imperative to monitor the level of regulating enzymes with glucose as a fuel molecule to find out the energy flow in the body. Strapping relation of glucose-6-phosphatase with the oxidative stress is instituted upon the truth that lipid peroxidation can inactivate the glucose-6-phosphatase (Koster *et al.,* 1986). This thermal distress sometimes goes to the scope that indecent illustration of genetic potential is experienced. Aldolase is also named as fructose-bisphosphate aldolase (EC 4.1.2.13) and catalyses a reversible reaction that divides the fructose 1,6-bisphosphate into the triose phosphates dihydroxyacetone phosphate and glyceraldehydes-3-phosphate. Changeable environmental temperatures are unreliable factors producing threat to animal lives. The present study was carried out in respect to enzyme regulators of carbohydrate metabolism in non-descript breed of sheep raised under natural ambience.

Materials and Methods

To study the body energy status vis-à-vis carbohydrate enzymes regulators of non-descript sheep from arid tracts during extreme hot ETP, blood samples were collected to yield the serum. For this purpose, 240 non-descript male and female sheep of 4-13 months of age groups were selected from private slaughter houses. Blood samples were obtained during slaughtering from the private slaughter houses under the permission of Institutional Animal Ethics Committee (IAEC), College of Veterinary and Animal Science, Bikaner, RAJUVAS, Rajasthan. ETPs, during which the collection of blood samples were made, comprised of the months of October and November (moderate) as control and the months of May and June (extreme hot ETP). Blood was obtained without any added anticoagulant. In each ETP, 120 blood samples were obtained (60 males and 60 females). In each ETP, sheep were grouped as 4-7 months (20 male and 20 female); 7-10 months (20 male and 20 female) and 10-13 months (20 male and 20 female) of age groups. Enzyme regulators Glucose-6-phosphatase (G-6-Pase) was determined by method of King (1965) was opted with modifications (Anonymous, 2010) and aldolase by method of Sibley and Lehninger with modifications (Anonymous, 2010) as described by Kour (2010). Significance of the effects of ambiences, sex and age groups was tested (Kaps and Lamberson, 2004). The variations in the means were measured by Duncan's new multiple range test (Duncan, 1955).

Results and Discussion

The present investigation was launched to determine body energy status vis-à-vis carbohydrate enzymes regulators of non-descript sheep from arid tracts during extreme hot environmental temperature period.

Glucose-6-phosphatase (G-6-Pase)

A significant ($p \leq 0.05$) increase was found in the mean value at the time of extreme hot ETP when matched up to moderate ETP i.e. 8.87± 0.66 UL^{-1} illustrated in (Table 1). Mean values substantiated the earlier research regarding G-6-Pase enzyme (Kataria *et al*., 2010) in sheep and Bhartendu (2017). Ambient stress intervened rise in glucocorticoid level perhaps potentiated the level of G-6-Pase (Srivastava, 2018). The activity of G-6-Pase can be linked with the serum glucose contents in the present exploration revealing depressed gluconeogenesis during extreme hot ETP. In extreme hot ETP the per cent change

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in the serum G-6-Pase mean value was evaluated to be 35.28 (Table 1). However, per cent decrease was less. Mean values of G-6-Pase were recorded to be significantly ($p \leq 0.05$) higher in male sheep as compared to female sheep in both the ETPs. Therefore, magnitude of per cent lowering due to extreme hot ETP was more in male sheep than female sheep.

Mean values of serum G-6-Pase were observed to be highest in sheep of 10-13 months age group and lowest in 4-7 months of age group in both the ETPs. All the alterations were found to be significant ($p \leq 0.05$). Age group of 10-13 months in the investigation revealed highest per cent alteration during extreme hot ETP and 7-10 months group exhibited minimum per cent alteration during extreme hot ETP. It can be opined that glucose-6-phosphatase is significant for evaluation of energy status. Findings of increase in serum glucose-6-phosphatase level of both sexes and all age groups of non-descript sheep distinctly demanded speeding up of energy status to fight against higher strength of free radicals produced during hot ETP.

Aldolase (ALD)

The mean value 11.00 ± 0.10 UL^{-1} of serum aldolase attained during moderate ETP was reckoned as control value (Table 2). Influence of extreme hot ETP was recorded to be significant ($p \leq 0.05$) on serum aldolase value when matched up to control value. A significant ($p \leq 0.05$) increase was found in the mean value at the time of extreme hot ETP when matched up to moderate ETP mean value. Per cent change in the serum aldolase mean value was evaluated to be 36.36 (Table 2), when ETP was extreme hot as compared to the condition when ETP was moderate. Earlier workers have also associated energy and stress relation (Kataria, 2000 and Bhartendu, 2017). Mean values of aldolase were recorded to be significantly ($p \leq 0.05$) higher in male sheep as compared to female sheep in both the ETPs. Mean values of serum aldolase were observed to be highest in sheep of 10-13 months age group and lowest in 4-7 months in both the ETPs. Age group of 10-13 months in the investigation revealed lowest per cent alteration during extreme hot ETP and 4-7 months group exhibited maximum per cent alteration during extreme hot ETP. The alterations due to sex and age were also reported by Kour and Kataria (2011) in goats. However, female sheep and youngest age group was more affected. Investigated heat stress stimulated variations in metabolic controllers of animals from arid tracts and found that serum aldolase increased significantly during hot ambience when compared to moderate ambience.

This opined that stimulation of gluconeogenesis assisted the animals to fight the heat stress. In the present investigation, alteration in the level of energy status vis-à-vis carbohydrate metabolism enzyme regulators indicated towards stress and modulation of energy metabolism in non-descript sheep. Thus, animals should be prevented from harse environmental stress to avoid bad effect on health status so that all the bodily functions play peacefully. Consequently, it can be suggested that ration of animals must be enriched with proper quantity of antibiotics to fulfill the requirement of antioxidants in the animal's body.

Table 1: Mean ± SEM values and per cent alterations of serum glucose-6-phosphatase (G-6-Pase, UL^{-1}) in the non-descript sheep during moderate and extreme hot environmental temperature periods (ETPs)

Effects	Moderate ETP Mean ± SEM (120)	Extreme Hot ETP Mean±SEM (120)	Per cent Alterations in Extreme Hot ETP
Environmental Temperature Periods ETP (120)	$8.87^{b} \pm 0.66$	$12.00^{b} \pm 0.87$	35.28
Male (60)	$9.98^{bd} \pm 0.32$	$14.00^{bd} \pm 0.87$	40.28
Female (60)	$7.66^{bd} \pm 0.33$	$10.00^{bd} \pm 0.86$	30.54
4-7 Month (40)	$7.35^{bf} \pm 0.11$	$9.50^{bf} \pm 0.13$	29.25
7-10 Months (40)	$8.97^{bf} \pm 0.12$	$11.50^{bf} \pm 0.14$	28.20
10-13 Month (40)	$10.19^{bf} \pm 0.10$	$15.00^{bf} \pm 0.13$	47.20

i.Figures in the parenthesis indicate number of non-descript sheep
ii.'b' marks significant ($p \leq 0.05$) differences between moderate and hot ETPs for a row; iii 'd' marks significant ($p \leq 0.05$) differences between male and female mean values within an ETP; iv 'f' marks significant ($p \leq 0.05$) differences among mean values of the age groups within an ETP

Table 2: Mean ± SEM values and per cent alterations of serum aldolase (ALD, UL^{-1}) in the non-descript sheep during moderate and extreme hot environmental temperature periods (ETPs)

Effects	Moderate ETP Mean ± SEM (120)	Extreme Hot ETP Mean±SEM (120)	Per cent Alterations in Extreme Hot ETP
Environmental Temperature Periods ETP (120)	$11.00^{b} \pm 0.10$	$15.00^{b} \pm 0.10$	36.36
Male (60)	$13.00^{bd} \pm 0.06$	$18.00^{bd} \pm 0.05$	38.46
Female (60)	$9.00^{bd} \pm 0.06$	$12.00^{bd} \pm 0.05$	33.33
4-7 Month(40)	$8.20^{bf} \pm 0.04$	$11.60^{bf} \pm 0.03$	41.46
7-10 Months (40)	$11.30^{bf} \pm 0.05$	$15.30^{bf} \pm 0.04$	35.39
10-13 Months (40)	$13.50^{bf} \pm 0.03$	$18.10^{bf} \pm 0.03$	34.07

i. Figures in the parenthesis indicate number of non-descript sheep.
ii. 'b' marks significant ($p \leq 0.05$) differences between moderate and hot ETPs for a row; iii. 'd' marks significant ($p \leq 0.05$) differences between male and female mean values within an ETP; iv. 'f' marks significant ($p \leq 0.05$) differences among mean values of the age groups within an ETP.

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