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Research Article

BLOOD BIOCHEMICAL PROFILE OF ASIAN ELEPHANT (*ELEPHAS MAXIMUS*) IN CAPTIVE STATE

AYUSH RANJAN*, KOMAL[1], ANIL GATTANI[2] and AJEET KUMAR
Department of Veterinary Biochemistry, Bihar Veterinary College, Bihar Animal Sciences University, Patna-800014, Bihar
[1]Division of Animal Biochemistry, IVRI, Izatnagar, Bareilly-243 122, U.P.
[2]Department of Veterinary Physiology and Biochemistry,
College of Veterinary Science and Animal Husbandry, Jabalpur- 482 001, M.P.

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ABSTRACT

The elephant has an important place in Indian mythology and culture, though the number of elephants has been reduced and has become an endangered species. Despite of the wilderness of the animal, it is considered a social animal and can be reared under captivity. The captive animals are primarily used for tourism and for sacred processions. For such captive animals' proper veterinary care are highly required. Blood biochemical evaluation is important as by assessing the blood-biochemical alteration, a veterinarian can diagnose and rationalize the treatment of the disease. A total of fifteen adult captive elephant blood samples were evaluated for blood biochemical profile among which five were in musth. All the samples were analyzed for Alkaline phosphatase, Aspartate aminotransferesae, Alanine transaminase, total bilirubin, total protein, albumin, alibumin/globulin ratio, glucose, blood urea nitrogen, creatinine, sodium, potassium and chloride. The levels of Alkaline phosphatase and creatinine in blood were found to be higher in five musth animals. The elevated activity of ALP in elephants should be interpreted carefully, especially if samples were received from male elephants near or in musth.

Keywords: Biochemical, Captive, Elephant, Musth

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One of the largest land mammals, Asian elephants (*Elephas maximus*) are commonly seen in zoological parks, safari parks, and national wildlife sanctuaries. Asian elephant populations in Thailand, Sri Lanka, India, Laos, Vietnam, Malaysia, Indonesia, and other Southeast Asian nations are estimated to be around 50,000 (Takehana *et al.*, 2018). Asian elephant populations have decreased recently due to reduced habitat brought on by the growth of agricultural areas, deforestation, and/or excessive ivory hunting. On the IUCN Red List of threatened species, the Asian elephant is currently classified as "endangered." Despite of the wilderness of the animal, it is considered as a social animal and can be reared under captivity. The captive animals are primarily used for tourism and for sacred processions. Further, Musth phenomenon experienced by male elephants and is a behavioral and physiological change in animals for smooth copulation between the sexes (Duer *et al.*, 2016). Both wild and captive elephants show aggression, act of dominancy and increased sexual desire during musth state, which make difficult to feed and manage them during that period and under certain circumstances human safety and animal welfare is also of concern (Glaeser *et al.*, 2022). This behavior activated by a surge in plasma testosterone (Chave *et al.*, 2019) and physiological changes indicate that it is metabolic challenge (LaDue *et al.*, 2022). Social, environmental and psychological factors also influence physiology and metabolism of elephant in captive conditions and may lead to a range of health issues that could contribute to significant morbidity and mortality in elephants (Klinhom *et al.*, 2017). Very scanty reports are available related to biochemical changes during musth behavior among Asian elephant in Indian condition. Therefore, the present study was envisaged with an aim to improve the understanding regarding biochemical changes for liver and kidney associated with musth in the elephants.

MATERIAL AND METHODS

The study was carried out on fifteen Asiatic male elephants which were maintained in captivity at biological parks in Bihar. Among the selected animals five were in Musth state. The presented investigation was conducted in January, 2020. During the course of the study, samples from elephants were taken only once. All the animals involved in the study were apparently healthy. A 23-G butterfly needle was used to draw blood from the auricular vein using a 5-ml disposable syringe. The blood was then transferred into a blood collection tube. The serum samples from the centrifuged blood were then frozen at -20°C until analysis. Then, the serum samples were subjected to monitor liver function and kidney function tests, *i.e.*, Aspartate amino transferase (AST), Alanine amino transferase (ALT), Alkaline phosphatase (ALP), blood glucose (Glu), Total protein (TP), Total bilirubin (TBIL) Serum Creatinine (CRE) and Blood urea nitrogen (BUN). All the assays were performed by following the kinetic as well as end point chemistry protocols using commercially available kits (Coral diagnostics). Statistical analysis of data was carried out by independent sample 't'

*Corresponding author: ayush13ranjan@gmail.com

Table 1. Different parameters result of liver function and kidney function tests in Non-Musth and Musth elephants

	Non-Musth	Musth
Total Protein (g/dL)	6.53 ±0.23	7.56±0.29
Albumin (g/dL)	3.27±0.15	3.51±0.15
Globulin (g/dL)	3.26±0.13	4.05±0.18
Cholesterol (mg/dL)	22.55±0.88	24.37±1.05
Calcium (mg/dL)	9.87±0.75	11.05±0.67
Phosphorus (mg/dL)	4.14±0.21	4.95±0.25
AST (U/L)	14.82±0.69	17.05±0.72
ALT (U/L)	13.23±0.58	11.65±0.62
BUN (U/L)	16.46±0.57	18.35±0.69
Creatinine (mg/dL)	1.27±0.05	3.43±0.09*
Sodium (mmol/L)	123.3±6.18	124.2±6.05
Potassium (mmol/L)	5.80±0.25	5.55±0.27
Chloride (mmol/L)	111.7±3.63	112.3±4.12
ALP (U/L)	47.79±1.39	140.5±3.82*
Billirubin (mg/dL)	0.59±0.01	0.54±0.01
Direct Billirubin (mg/dL)	0.18±0.01	0.19±0.01
Indirect Billirubin (mg/dL)	0.40±0.01	0.35±0.01
Testosterone (ng/dL)	3.96±0.28	50.5±1.46*

* Significant ($p<0.05$)

test with level of significance of $p < 0.05$ using the statistical package SPSS 17.0 version.

RESULTS AND DISCUSSION

Musth is a period of heightened aggression and sexual activity in male elephants that is characterized by a range of biochemical changes. One of the key biochemical changes that occurs during musth is an increase in androgenic steroids, such as testosterone and dihydrotestosterone (DHT), which is thought to be responsible for many of the physiological changes that occur. In addition, a number of other biochemical changes occur during musth, including changes in the levels of enzyme activity and proteins in the blood.

The results of different parameters related to liver and kidney function tests of the present study are depicted in table 1. In brief, Creatinine, Alkaline phosphatase and Testosterone levels were found to be significantly ($p<0.05$) higher in the captive elephant under musth condition as compare to non musth in present study. However, there was non-significant difference observed among other biochemical parameters. The majority of the blood biochemistry results in the present study were consistent with other Asian elephant reports (Santos *et al.*, 2020; Steyrer, 2021). The observed difference could be due to the inclusion of samples from different locations and management conditions. Elephants, whether in the wild or captivity, eat a lot and frequently spend 12 to 18 hours per day for eating (Eltringham, 1991). An elephant's digestive tract can process food for up to 24 hours, and they defecate about 13 times per day (Eltringham, 1991; Ratnasooriya, *et al.*, 1994). In male elephants, testosterone levels vary throughout their life cycle, with the highest levels observed during musth. Our result corroborates that musth is linked with high serum testosterone level. Similar types of observation also have been reported by Brown *et al.* (2007), Chave *et al.* (2019) and LaDue *et al.* (2022). The amount of creatinine produced is a function of skeletal muscle mass and a non-protein nitrogenous substance that is produced during the metabolism of muscle creatin and phosphocreatin. This gives the estimation of creatinine an advantage over that of BUN because less non-renal factors affect creatinine than do those for BUN. The higher level of muscle activity during musth causes a rise in blood creatinine levels (Schulte and Rasmussen, 1999). Our results are in accordance with the report of Niemuller *et al.* (1990). The seasonal variation in the creatinine concentration was reported by Brown *et al.* (1978) in African elephant.

In the Asian elephant, differences between the sexes appear to be more pronounced than in the African elephant, particularly for serum ALP and GGT activities, which are significantly higher during musth times (Santos *et al.*, 2020; Steyrer, 2021). The increased osteoblast activity in young elephants, results in greater ALP levels (Niemuller *et al.*, 1990). In our study also ALP activity were found to be increased in musth animals. The observed mineral and electrolytes concentration in the present study is well within the range earlier reported (Niemuller *et al.*, 1990, Brown and White, 1977) in African elephant. It was also reported that blood protein and mineral concentrations are influenced by season and location. These data may be utilised in captivity to assess nutritional needs and helpful to manage against mineral imbalances that can affect bone health.

CONCLUSION

Environmental, physiological and biological factors all influence health. Depending on the animal species, these factors change. The physiology of the body may be reflected by haematology, serum biochemistry and urinalysis parameters, therefore these measurements may be used to examine the health of the animals. Musth is a complex phenomenon that is influenced by a range of factors, including age, social status, and environmental conditions. While much is still unknown about the biochemical changes that occur during musth, studies have provided important insights into the physiology of this period of heightened sexual activity and aggression in male elephants. The serum biochemical values obtained in the study came from elephants that are under captivity with balanced diet plan, therefore they serve as a baseline

reference that can be utilised to diagnose a variety of illnesses by using serum values as prognostic markers.

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