ORIGINAL ARTICLE

SEASONAL VARIATIONS ON SERUM GLUCOSE AND LIPID PROFILE IN A MALE POIKILOTHERM VERTEBRATE, *UROMASTYX HARDWICKII*

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Background: *Uromastyx hardwickii*, a local lacertilian species, is widely distributed in the Indo-Pak subcontinent and inhabits mostly the arid regions of the country. This study was carried out to assess the seasonal variations on glucose, cholesterol and triacylglycerol (TAG) levels in a poikilotherm vertebrate species and to develop an experimental model for the study of lipid metabolism in higher vertebrates including mammals. **Methods:** This cross-sectional study was carried out on male *Uromastyx hardwickii*. Sixty animals were bled and sacrificed within 48 hrs of their arrival in the laboratory. Blood samples were collected by anterior abdominal venepuncture from conscious animals using a heparinised syringe. **Results:** Mean serum TAG levels were significantly higher in summer, while no significant changes were seen in cholesterol level during different parts of the year. Mean serum glucose levels were significantly higher in summer. **Conclusion:** Lipid metabolism in *Uromastyx hardwickii* undergoes significant seasonal alteration. There is significant ($p<0.05$) increase in serum triglycerides during summer. Similarly, serum glucose also exhibits seasonal variation.

Keywords: *Uromastyx hardwickii*, animal model, lipid profile, seasonal, triglyceride

INTRODUCTION

Uromastyx hardwickii is terrestrial, found in sandy places and semi-rocky areas. Poikilotherm is a Greek word meaning an animal whose body temperature fluctuates with that of environment. Previous studies indicate that both sexes of this animal carry most of the depot fat in the form of two large abdominal fat pads during winter months and this lipid reserve becomes depleted during summer. During hibernation plasma triglyceride levels have been shown to be increased indicating synthesis in the liver and circulation in the blood to other body parts for production of fat reserve used during hibernation in Captive Balkan Whip snake.[1] In this lizard, plasma testosterone level begins to rise in February and peaks in spring. During summer, testicular testosterone is rising, while the testicular weights are low. In view of these findings, we may conclude that in reptiles, temperature may play a key role.[2] On administration of gonadotrophin releasing hormone, to male C versicolor in non-breeding season increases testicular weight.[3]

In a desert dwelling chelonian species, *Gophersus agassizei*, plasma TAG, phospholipids and cholesterol were measured in both sexes throughout the year. In the male, a negative correlation of cholesterol level with testosterone and spermatogenesis, was observed.[4] Studies in the desert iguana, Dipsosaurus dorsalis, demonstrate that diet composition can affect the lipid composition of tissues, biological membranes and stored fats. This study shows that there is a link between dietary and whole animal physiology. Another factor that influences membrane fluidity is temperature. Cholesterol plays an important role in membrane fluidity.[5] High elevation Mexican lizard, *Sceloporus grammicus microlepidotus*, is reproductively active during the fall months. Courtships, fertilization and onset of embryonic development occur during September and October.[6] In a study on gecko japonicus lizard in Taiwan, there were no visible fat bodies and most lipids are stored in carcass, especially in posterior part of carcass, and around posterior legs and tail. This lizard can also store lipids in the liver. Their fat bodies are utilised for reproduction and maintenance during the hibernation period.[7] Daily and seasonal activity of sleepy lizard, *Tiliqua rugosa*, shows that these lizards are more active in winter and spring seasons. In summer, they are active in early mornings but otherwise they are almost non-active[8].

The present study on *Uromastyx hardwickii* was undertaken with the possibility of defining a convenient experimental model for the study of lipid and glucose metabolism and fat mobilisation in relation to seasonal changes.

MATERIAL AND METHODS

This cross-sectional study was carried out on 60 male *Uromastix hardwicki*. The animals used in this study were collected from the vicinity of Bahawalpur (29ºN, 24ºE) in 4 different seasons through the course of one year and were immediately transported to the Physiology Laboratory, University of Health Sciences, Lahore, under appropriate conditions. To assess the effects of seasonal variations on fats and glucose, animals were divided into 4 groups on the basis of the time of the year of capture and the local ambient temperature during that period. Group I was captured in spring (24 °C), Group II in summer (35 °C), Group

III in autumn (26 °C), and Group IV was captured in winter (11 °C). Males were separated from females on the basis of snout vent length (SVL). Animals with SVL of less than 15 Cm were not used in this study.

In all, 60 animals were bled and sacrificed within 48 hours of their arrival in the laboratory. Two ml blood samples were obtained with a syringe fitted with a 27 gauge needle by the anterior abdominal venepuncture from conscious animals. Samples obtained were immediately centrifuged at 10,000 rpm and serum was stored at -40 ºC until analysed.

Serum glucose was estimated using kit GOD-PAP Method, Randox Laborateries, Crumlin, UK; Serum cholesterol and serum triglycerides using GPO-PAP Method, Human, Weisbaden, Germany.

Data were analysed using SPSS-16.0. Mean±SEM of each parameter was determined. One-way ANOVA was applied to observe group mean difference for more than two groups. Tukey test was applied to analyse mean differences between groups; $p<0.05$ was considered statistically significant.

RESULTS

Mean serum cholesterol level remained unaffected by season and no statistically significant difference was observed during different parts of the year. On the other hand, significant ($p<0.05$) changes were observed in the serum glucose levels, being maximal in summer (170.8±14.09 mg/dl) and autumn (166.7±18.60 mg/dl). Mean serum glucose levels in summer months were significantly higher than those in winter (118.0±3.59 mg/dl) and spring (101.2±14.46 mg/dl). Mean serum triglycerides levels were significantly ($p<0.05$) higher in summer (108.3±5.31 mg/dl) and declined in subsequent months with minimal values in winter (73.6±2.99 mg/dl). Statistically significant increase of serum TAG over the winter months was observed in spring (83.2±2.38 mg/dl) (Table-1).

Table-1: Serum glucose, triglycerides and cholesterol in different seasons of the year

Groups	Glucose	Triglyceride	Cholesterol
Mar-Apr (Spring)	101. 2 ±14.46	83.2 ± 2.38	269.0 ± 45. 04
June (Summer)	170 .8 ± 14. 09	108. 3 ± 5.31	239.6 ± 15.48
Oct (Autumn)	166.7 ± 18.60	92.6 ± 4.39	246.7 ± 26. 03
Jan (Winter)	118. 0 ± 3.59	73.6 ± 2.99	206.7 ± 13.5
p	<0.05	<0.05	>0.05

DISCUSSION

The most important physical factors affecting animal life in the desert are less quantity of food, water and temperature fluctuations. Lipids are very important energy source which the animal can utilise for maintenance and reproduction.[7]

In this study, mean serum cholesterol levels did not show significant changes with change of season. Serum TAG levels were higher in summer and minimal in winter months. In accordance with present findings, decline in TAG levels in winter has been reported in other Reptilian species. The fall in the serum lipid levels during hibernation may point to the increased utilisation of lipids.[9] The clinical biochemical values including blood glucose show biological and analytical variation and vary in different studies on lizards.[10]

CONCLUSION

Serum cholesterol level remains unchanged throughout the year. Serum glucose level shows significant changes during different seasons and in hibernation the glucose level falls due to utilisation. There is a significant increase in serum TAG level during summer as the availability is increased for anticipatory preparation for winter months.

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