Original Article

Effect of Seasonal Variations on Organ Weights (Fat, Liver and Gonads) In a Male Poikilotherm Vertebrate, Uromastyx Hardwickii

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Objective: Uromastyx hardwickii, a local lacertilian species, is widely distributed in the Indo-Pakistan subcontinent and inhabits mostly the arid regions of the country. This study has been carried out to assess the seasonal variations on fat, liver and gonads in a poikilotherm vertebrate species and to develop an experimental model for the study of lipid metabolism in higher vertebrates including mammals.

Material and Methods: This cross-sectional study was carried out on male Uromastyx hardwickii (n=60). On sacrificing the animals, abdominal fat pads, liver and gonads were quickly removed, cleaned and weighed.

Results: Maximal increase in fat pad weight was observed in autumn. Liver weight was significantly maximal in autumn and less in summer while testicular weights showed marked seasonality in weight and maximum increase in spring and decrease in summer.

Conclusion: Lipid metabolism in Uromastyx hardwickii undergoes significant alteration in relation to season. There is significant ($P < 0.05$) increase in liver weight, fat pad and testicular weight during different parts of the year.

Key words: Seasonal variation, organ weights, uromastyx hardwickii.

Introduction

Uromastyx hardwickii: Animals of this genus are terrestrial, preferably found in sandy places and semi-rocky areas. Poikilotherm is a Greek word meaning an animal whose body temperature fluctuates with that of environment. During colder months of the year (Nov- March), these animals become sluggish and metabolic activity declines. Abdominal fat pads enlarge before
they go into hibernation and animals maintain them throughout the hibernating period.[1] Monthly changes in plasma and testicular androgen concentration of spiny tailed lizard, Uromastix hardwickii are correlated with changes in testicular weights and spermatogenic cycle in this species.[2] It has previously been shown that in cold acclimatized hamsters approximately 50% lipids from brown fat tissue are depleted during arousal .It is surmised that heat produced by the combustion of the lipid during arousal process could be the major factor for the heat needed to re-warm the animal following hibernation.[3]

In the oviparous lizard, Phrynocephalus przewalski, liver and muscle of these lizards are principal sites of lipid storage. Triacylglycerol mainly deposited in liver, while phospholipids are stored in the muscle and brain.[4]

Abdominal fat bodies and total body fat level exhibit a seasonal cycle in many temperate and tropical lizards. Lipids stored in fat bodies are used for gonadal recrudescence and in females for ovarian development during the winter months.[5] In study on gecko japonicus lizard in Taiwan, has no visible fat bodies and most lipids are stored in carcass, specially in posterior part of carcass and around posterior legs and tail. This lizard can also store lipids in the liver. Their fat bodies are utilized for reproduction and semantic maintenance during hibernation period.[6] Hamsters when kept at increased ambient temperature increase their preference for saturated fats and this suggests that temperature dependent fatty acid choice in wide range of animals.[7] The present study on Uromastix hardwickii was undertaken with the possibility of defining a convenient model for the study of lipid metabolism and fat mobilization specially in relation to seasonal and environmental changes.

Materials 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 four 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 organ weights (fat pad, liver and gonads), animals were divided into four groups on the basis of the time of the year of collection and the local ambient temperature during that period **(Table: 1).** 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.

Sample Collection:

In all, 60 animals were sacrificed within 48 hrs of their arrival in the laboratory. On killing the animals fat pads, liver and gonads were quickly removed, cleaned and weighed.

Statistical Analysis:

The data was entered and analyzed 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 observe which group mean differs. p value < 0.05 was considered statistically significant.

Table-1: Ambient temperatures and seasons at the time catches were made in the field.

Group	Seasons	Average ambient Temperature (°C)
I	Spring	24
II	Summper	35
III	Autumn	26
IV	Winter	11

Table-2: Show fat pad weight, liver weight and testicular weight in different seasons of the year.

Groups	Fat Pad Weight(g)	Liver Weight(g)	Testicular Weight(g)
Mar-Apr. (Spring)	4.6±0.84	4.6±0.66	2.0±0.41
June (Summer)	20.±0.40	3.0±0.27	0.1±0.01
Oct. (Autumn)	8.4±0.30	5.7±0.16	0.4±0.06
Jan (Winter)	5.1±0.31	4.4±0.32	0.5±0.04
Significance	P<0.05	P<0.05	P<0.05

Results

Seasonal variations: **Table-2** show fat pad weight, liver weight and testicular weight in different seasons of the year. Maximal increase in fat pad weight was observed in autumn (8.4 ± 0.30 g) and decline trend were seen in winter (5.1 ± 0.31g) spring (4.6 ± 0. 84g) and summer (2.0 ± 0. 40 g). Liver weight was significantly maximal (5.7 ± 0. 16 g) in autumn and less in summer (3.0 ± 0. 27 g). Testicular weights showed marked seasonality in weight. Maximum testicular weight was observed in spring (2.0 ± 0. 41 g) and lowest in summer (0.1 ± 0. 01 g).

Discussion

At low temperatures, the strategy of metabolism in tissues of hibernators is to provide adequate nutritional ensure stores and availability of chemical energy.[8] There were significant ($p < 0.05$) changes seen in fat pads during different parts of the year. This means that fat bodies were well formed in autumn, before the animals get into winter hibernation. During winter, fat pad weight showed a significant decline which continued during spring and summer when it became minimal. It has been reported in Uromastix hardwickii, soon after these animals came out of hibernation, their fat reserves decrease in weight[9] Mean liver weight was maximum in autumn and then showed significant decline till he summer season. These changes are in agreement with Xiang and Peichao who showed that lipid stored at this site can be used for semantic maintenance during hibernation period and partially for the demands of reproduction.[10] In another study no change in weight of liver along with kidneys and heart has been observed in hibernating and non-hibernating animals.[11] In spring, mean testicular weight was highest as testes were full of sperms and then weights began to decrease in summer indicating that testis in this species undergo sudden regression and this state continues till autumn. In winter, testicular weight has been observed to steadily increase and become maximum in spring as both spermatids and sperms are present and testes along with epididymus are full of mature sperms.[12] However
another study reveals that growth is low, but not arrested in *C. versicolor* lizard during winter.[13]

Conclusion

There is significant increase ($p < 0.05$) in liver, fat pad and testicular weight during different parts of the year. There is steady increase in the weights of different organs including liver, fat pad and gonads from spring to autumn because lipids and fats are used for survival during hibernation and reproduction.

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