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Seasonal Variations in the Blood Glucose and Urea Levels of Freshwater Fish, *Cirrhinus mrigala* (Ham.)*

M N RAIZADA and C P SINGH
Zoology Department, Agra College, Agra 282002

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Seasonal variation in the normal glucose and urea levels of *Cirrhinus mrigala* has been studied. Highest values in blood glucose (87.75mg% in male and 98.97mg% in female) were obtained during winter and lowest (73.60mg% in male and 77.02mg% in female) during summer. Blood urea showed highest values (27.12mg% in male and 29.53mg% in female) during monsoon and lowest values (25.22mg% in male and 27.88mg% in female) during summer. Females showed higher values than males in both glucose and urea level.

Key Words: Seasonal variations, Glucose, Urea, *Cirrhinus mrigala*

Introduction

The perusal of the available literature shows that few workers have reported the seasonal variations in the blood glucose and urea levels. However, Khanna and Singh (1971) reported the seasonal variations in the blood glucose levels in *Channa punctatus* (Bloch). The seasonal fluctuations and normal levels in the blood glucose in both fresh water and marine fishes have been also studied by Nace and Schub (1961), Schub and Nace (1961) and Tandon and Joshi (1974). In urea levels, a detailed account of urea retention and ion regulation in Coelacanth, *Latimeria chalumnae* has been reported by Pickford and Grant (1967). Srivastava and Pickford (1972) also studied the effect of hypophysectomy on blood glucose and urea in male, *Fundulus heteroclitus*.

The present observations are on changes in blood glucose and blood urea levels of the freshwater fish, *C. mrigala*, during different seasons in both sexes.

Material and Methods

For the present study, the fishes were collected from the Laramada fish farm and Sikandra Nursery at Agra during different seasons of the year 1977–78. Healthy fishes were used for the blood sampling. The blood was collected directly from the heart into the urea vials, containing anti-coagulant (potassium oxalate).

The method of Folin and Wu (1920) as described by Hawk et al. (1954) was used for the estimation of blood glucose. For the estimation of urea, urease nesslerization method described by King and Wootton (1951) was adopted.

Observations

In male fish, the glucose content varies from 73.60mg/100ml to 87.75mg/100ml of blood while in female it varies from 77.02

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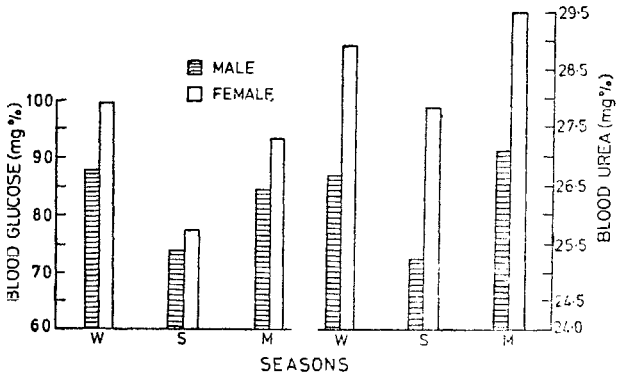

Figures 1 & 2 Seasonal variations in blood glucose and urea levels of *C. mrigaal* (Ham.)

mg/100ml to 98.97mg/100ml of blood. Thus higher values are observed in females than males (figure 1). The maximum amount of blood glucose (87.75mg/100ml in male and 98.97mg/100ml in female) is recorded during the winter, while minimum values (73.60mg/100ml in male and 77.02mg/100ml in female) are obtained during summer (table 1).

The highest values in bood urea (27.12 mg% in males and 29.53mg% in females are recorded during monsoon while minimum values (25.22mg% in males and 27.88mg% in females) are obtained during summer (figure 2). Urea content during different seasons ranges from 25.22mg% to 27.12mg% in males and 27.88mg% to 29.53mg% in females. Females show the higher values than the males (table 2).

Discussion

The results of the present study indicate that blood glucose and urea of *C. mrigala* changes seasonally and this is probably connected with the temperature, gonadal cycle, metabolic activities, feeding intensity etc. Nace and Schub (1961), Robertson et al. (1961) Dean and Goodnight (1964) and Nace et al. (1964) show that seasonal variations in blood glucose level are mainly due to thermal variations and gonadal cycle. Silver and Shenk (1968) observed experimentally that lowering of temperature causes hyperglycemia in *Opsanus tau*. They recorded that serum glucose level increased with the fall of temperature. Similar results were also noted by Tandon and Joshi (1974) in *Clarias batrachus*. They observed the highest blood glucose level during winter and lowest during summer and correlated it with the lowering of temperature and gonadal development. Experimentally they observed that the fish showed a considerable rise in its blood glucose level when transferred from water at 35°C to water at 5°C. The present study also revealed that the fish, *C. mrigala* has highest blood glucose level during winter. Thus, the authors agree with the views of the above authors. The high values during winter may also be suggested due to continuous feeding activity, showing that the low temperature does not affect the feeding rhythm of the fish.

The lowest values in blood glucose level during summer (prespawning period) can be correlated with the rise in temperature and gonadal development. During this period fish shows law metabolic activities and less intake of food due to high temperature. The lowest values during this period are also due to its utilization in the enhanced fat synthesis which accompanies maturation of gonads. Mackay and Beatty (1968) reported that hormonal stimulation of lipid synthesis and gonadal growth are responsible for changes in the plasma glucose of male white sucker. The high level in monsoon coincides with the favourable temperature of the environment, which occurs mainly due to heavy rain in this region. During this period fish also showed high metabolic activities and more intake of food which results in high level of blood glucose.

In urea, during metabolism some waste products (creatine, creatinine, uric acid etc.)

Table 1 *Blood glucose*

	Male			Female		
	Range (mg%)	Mean (mg%)	S.E.M.	Range (mg%)	Mean (mg%)	S.E.M.
Winter	76.0–100.0 (30)	87.75	± 3.271	60.0–124.0 (30)	98.97	± 2.200
Summer	50.0–100.0 (40)	73.60	± 3.902	32.0–102.0 (40)	77.02	± 2.510
Monsoon	64.0–100.0 (30)	81.40	± 2.902	66.0–109.0 (30)	93.00	± 5.542

Table 2 *Blood urea*

	Male			Female		
	Range (mg%)	Mean (mg%)	S.E.M.	Range (mg%)	Mean (mg%)	S.E.M.
Winter	20.0–37.0 (30)	26.66	± 1.358	22.0–28.0 (30)	28.90	± 1.352
Summer	21.0–32.0 (40)	25.22	± 1.230	20.0–36.0 (40)	27.88	± 2.135
Monson	20.0–34.0 (30)	27.12	± 0.960	23.0–38.0 (30)	29.53	± 1.237

SEM = Standard error of mean, Number of fish in parenthesis

are released. The retention of these substances often is harmful to the body and they are to be removed. Human blood normally contains 18 to 38mg% of urea in blood, values about 40mg% indicate uremia in man. The marine species retain a concentration of 2.0 to 2.5 mg% of urea in blood while fresh water species retain 1% of urea, by the high concentration which maintain themselves hyperosmotic to their medium (Baldwin 1958). Smith (1929a, 1936) noted that both urea and trimethyllamine oxide (TMAO) were present in the urine even at a lower concentration than in plasma. The uremia persisted even when the fish was in a state of ananition. He suggested that urea and TMAO were actively reabsorbed from the glomerular filter.

Clarke (1935) and Burger (1965) reported that when *Squalus acanthies* exposed to dilute sea water, a progressive increase in urine flow started which lead to decreased concentration of urea, sodium and chloride in plasma. Mackay and Beatty (1968) reported that urine flow of *Catostomus commersonii* increased with rising the temperature.

The low values in the blood urea (table 2) in both the sexes were obtained during summer, may be correlated with the increase of temperature lead to the increase of urine flow, which lead to the low values of urea in the blood. In monsoon and winter the high values of blood urea are due to the decrease of temperature which shows the decrease of urine flow and increased urea level (figure 2).

Besides this, an increase in the level of urea during monsoon and winter may also be explained on the basis that during these periods the fish remain active and have normal intake of food. On the other hand, a reverse condition appears to be true during

summer, when the temperature was quite high. During this period fish also consume less amount of food and the metabolic activities in them are considerably reduced, resulting into low level of urea in the blood.

Thus, from the above picture it may be concluded that temperature, gonadal development, metabolic activities and feeding intensity etc., play an important role in the regulation of blood glucose and urea levels.

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