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ASPHYXIATION INDUCED ALTERATIONS IN THE GLYCOGEN CONTENT OF SNAKE HEADED FISH, *CHANNA PUNCTATUS* (BLOCH, 1972), GODAVARI RIVER, NANDED

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ABSTRACT

Temperature is the dominant ecological factor on all animal lives. The aquatic animals are highly sensitive to the temperature fluctuations. In present work, snake headed fish *Channa punctatus* was exposed for 24, 48, 72 and 96 hours under stress conditions of temperature. The notable changes in glycogen content were observed and compared with control set. It showed that sudden asphyxia developed in animals facing stress conditions and their normal activities were affected. As a result, the glycogen content was significantly decreased than that of the control.

Key words : Glycogen, Temperature Stress, *Channa punctatus*.

INTRODUCTION

Temperature in environment affects the metabolism. Metabolism is the rate at which energy and material resources are taken up from the environment, transformed within an organism, which help to maintain growth and reproduction in animals. The metabolism is a fundamental physiological trait found in plants as well as animals. The changes in biochemical parameters in animals helps to understand the organisms respond to environmental changes (Dahlhoff, 2004). Carbohydrates are considered to be the first among the organic nutrients to be utilized to generate required energy (Heath, 1987). They serve as precursors for the dispensable amino acids and some nutrients, which are metabolic intermediates necessary for growth (NRC, 1993).

The frequency of changes in the composition of biochemical constituents of any organism varies with the fluctuations of the environmental changes. Biochemical studies are good parameters which help to see the effect of temperature on biochemical composition of vital tissue of fish. Hence attempt has been made to find out biochemical changes in tissues like Liver and Muscle of freshwater fish, *Channa punctatus.*

MATERIALS AND METHODS

The freshwater fish, *Channa punctatus* was collected from the Godavari River, Nanded (Maharashtra) with the help of local fisherman. They were brought to the laboratory, kept in glass aquarium with continuously aerated tap water and acclimated 8-10 days prior to experimentation. The estimation of Glycogen concentration was done by the method of Anthrone (Seifer et. al., 1950) using glucose powder as the standard. The values were calculated from standard graph of glucose. The total polysaccharides (glycogen) expressed as mg/gm wet wt. of tissue.

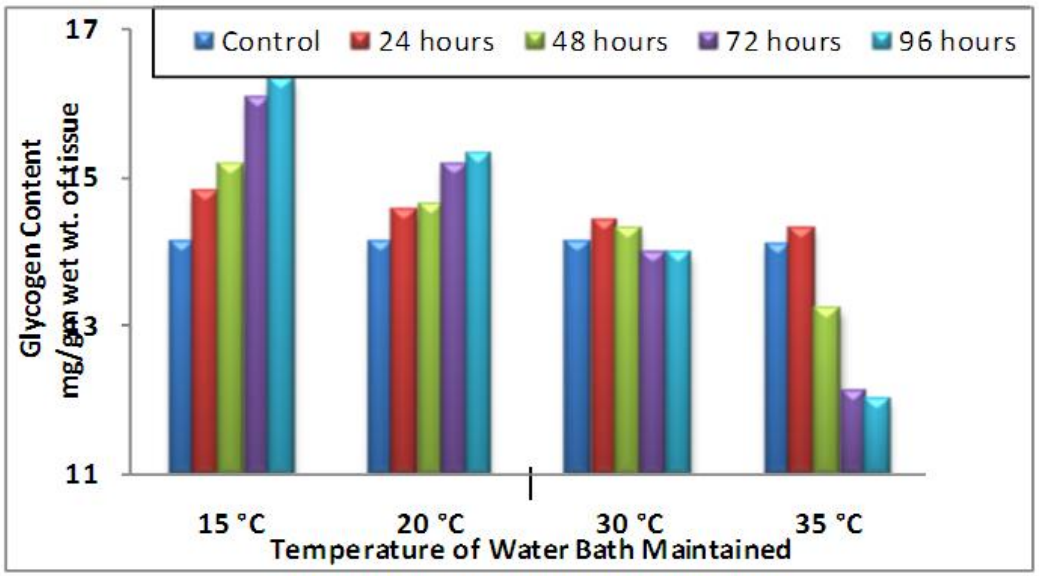
RESULT AND DISCUSSION

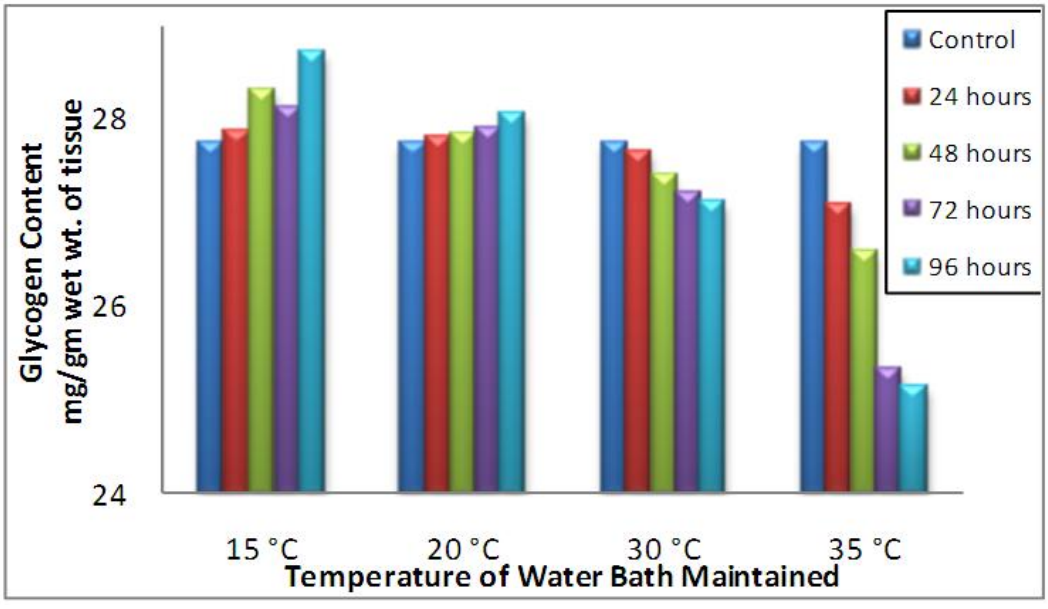
The results of glycogen content in vital tissues viz., muscle and liver of snake headed freshwater fish *Channa punctatus* in relation to thermal stress (acclimation at cold and warm conditions) have been represented in the graphs plotted in a & b along with control; the values were expressed in mg/gm wet wt. of tissue.

Effect of Temperature on Muscle Glycogen Content (Graph-A)

The fish when exposed to cold temperature stress (15 ± 1° C) showed suddenly increased trend up to 96 hrs period of exposure i.e. 14.84, 15.20, 16.08 and 16.34 mg/gm wet wt. of tissue respectively as compared to control set. The slowly increase in glycogen content was found at

Figure 1: Graph 4.3 a Effect of Temperature on Glycogen Content in Muscle (A) and Liver (B) of Fresh Water Fish, *Channa punctatus* at cold and warm stress (Graph-A &B)





20 ± 1° C up to 96 hrs the values were found to be 14.56, 14.66, 15.18 and 15.32 mg/gm wet wt. of tissue respectively. As compared to 15 ± 1° C, increase in temperature results the slowly increase in glycogen in muscle of *Channa punctatus*. The fish showed decrease in glycogen content at 30 °C temperature. The values for 24, 48, 72 and 96 hrs were 14.42, 14.34, 14.00 and 13.98 mg/gm wet wt. of tissue respectively. At 35 ± 1° C fish showed remarkable changes of glycogen content. Decreasing glycogen contents were observed up to 96 hrs. The values were 14.32, 13.24, 12.12 and 12.02 mg/gm wet wt. of tissue respectively. The total glycogen content in control set at 15 °C, 20 °C, 30 °C, 35 °C in muscle of *Channa punctatus* found to be 14.14, 14.16, 14.14, 14.14 mg/gm wet wt. of tissue respectively.

Effect of Temperature on Liver Glycogen Content (Graph-B)

The fish, *Channa punctatus* exposed to cold temperature (15 ± 1° C) showed enhancing rate of glycogen content up to 96 hrs period of exposure. The obtained values were for 24, 48, 72 and 96 hrs period of exposure 28.88, 28.30, 28.14 and 28.72 mg/gm wet wt. of tissue respectively. The fish acclimated to 20 ± 1° C showed increasing gradually level of glycogen content to that of control set. The amount of glycogen content in liver of fish up to 96 hrs period of exposure were 27.82, 27.86, 27.92 and 28.06 mg/gm wet wt. of liver respectively. At warm acclimated temperature (30 ± 1° C) the fish showed declining rate of glycogen content up to 96 hrs. The obtained values up to 96 hrs period of exposure were 27.66, 27.42, 27.22 and 27.12 mg/gm wet wt. of liver respectively. The fresh water fish *Channa punctatus* at 35° C temperature stress showed reduction in glycogen content up to 96 hrs period of exposure. The recorded glycogen content up to 96 hrs period of exposure were found to be 27.10, 26.60, 25.34 and 25.16 mg/gm wet wt. of tissue respectively. The total glycogen content in control set at 15 °C, 20 °C, 30 °C, 35 °C in liver of *Channa punctatus* found to be 27.64, 27.66, 27.62, 27.54 mg/gm wet wt. of tissue respectively. Carbohydrates are regarded to be first from organic nutrients to be utilized to generate required energy. The amino acids in carbohydrates are act as precursors among which some nutrients act as intermediates necessary for growth. They are present in free state as well as binding state with the protein molecules and glycogen. The amount of carbohydrates content in animals is variable with the sex, as well as of the same sex at different location (Heath, 1987).

The primary goal of this work is to find out effect of low & high temperature stress on glycogen content in the freshwater fish, *Channa puncatus*. Stress is a generalized response attributed to the fact that fish commonly have a complex of adaptive reactions to cope with stressors (Bonga. 1997). In fishes, temperature is important factor to determine the muscle performance. The poikilotherms show compensation in metabolic rate under acclimation to different environmental temperatures. Modifications in metabolism have all been reported following temperature acclimation. A common investigation is that the capacity of muscle for aerobic metabolism increases with cold adaptation (Hazel et. al., 1974). The glycogen content found to be decreased when temperature exceeded the tolerance limit while the glycogen content increased parallel to slowing metabolism when temperature decreased below the tolerance limit (Turkmen et al., 2000; Bayir et al., 2007; Das et al., 2009).

A significant depletion in glycogen content in the tissues of fish, *Channa punctatus* under warm temperature stress was observed in present investigation. Glucose is an important substrate in energy yielding process, where carbohydrates perform important in the energetic of thermal stress and adaptation. As temperature increases the glycogen content was decreased. The hypoxic fish, *Channa punctatus* was under stress condition which requires more oxygen causes sticking changes in the physiological functioning. The natural environments of fish causes stress condition one of which temperature causes the disturbances in the normal physiological activities of fishes. In stress fish showed increased opercular movements leads to

rise of oxygen depletion water. The more oxygen consumption rate causes hyper excitability in which considerable amount of energy was required therefore makes great demand of oxygen. The hypoxia leads to the anaerobic glycolysis due to breakdown of glycogen present in tissues. This causes depletion of stored glycogen in tissues. The increased opercular activity leads to increased muscular activity.

According to Coban et. al., (2011) the dissolved oxygen concentration affects the glycogen content in tissues. Energy reserves-glycogen was low during summer when dissolved oxygen low and while the glycogen content high during spring when dissolved oxygen was high. It may happen due to that glucose transportation increased when oxygen was low due to anaerobic ATP production, that liver glycogen decreased. In low temperatures, energy consumption decreased as nutrition, reproduction and swimming activities slowed down or completely stopped. Therefore, at low temperatures fish have more tolerance against hypoxia and at low temperatures hypoxic conditions, liver glycogen level decreases less (Nilsson, 2004).

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