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Effect of Starvation on the Biochemical Composition of Freshwater Fish *Channa punctatus*

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Abstract

The present study was carried out to study the changes in Biochemical constituents in different tissues of freshwater fish, *Channa punctatus* studied during starvation. The experiment involved 30 individuals of *Channa punctatus* (species) caught from Godavari river water. At the end of the experimental period, the tissues for biochemical analysis are collected separately from control and starved fishes. Starving resulted in body weight reduction and decrease in biochemical content in fish.

Key Words: Biochemical analysis, *Channa punctatus*, Starvation

Introduction

Under natural conditions numerous fish species endure long periods of starvation associated mainly with seasonal changes in food availability, spawning migrations, preparation for spawning or seasonal changes in water temperature. Starvation is usually the result of poor husbandry and, in many cases, is a squeal to environmental problems. A poorly designed or maintained system is likely to develop water quality problems with related morbidity or mortality among the fish. In an effort to correct the water quality problems aquarists may cut back on feed to the point where the animals (fishes) are in a negative caloric balance and being to lose weight, if the problem becomes chronic, starvation can result. Starvation is experienced in most species of fish during certain periods of every year largely due to environmental conditions and it affects different organs in different ways.

The problem concerns how the great nutrients viz. Protein and Glycogen, are metabolized transferred to storage depots and converted to energy. Starvation also affects the physiology and other constituents of fish [1,2,3,4,5]. Reduced energy requirements due to low metabolic rates have also been demonstrated by starvation experiments with *Trematomus eulepidotus* [6]. Prolonged starvation effects on red and white muscles of two freshwater fishes have been studied [7] The study of biochemical and haematological response to starvation in *H.fossilis* [8]. They reported the decrease in the activity of lactate dehydrogenase in both liver and muscles as a function of starvation. The amount of protein and glycogen also decreased as the period of starvation increased . The size dependent effect on starvation and mass loss in yellow perch larvae and juveniles [9]. There is increasing evidence that starvation may be a major cause of mortality in both immature and adult fishes[10]. Fasting also affects metabolic enzymes, RNA/DNA and proteins in fish. It has a great impact on fish growth.

Material and Methods

The freshwater fish *Channa puctatus* weight 40 gms to 60 gms were collected from Godavari river at Nanded (M.S). They were acclimatized to laboratory conditions for 2 weeks. Thirty individuals were placed in aquarium for 60 days, from end of November 2010 to end of January 2011. The aquarium having 40 liters of Tap water which was dechlorinated (pH 7.0-7.9) at least for two days prior to experimentation. They were fed alternate days, regularly during acclimatization period. After acclimatization for two weeks, healthy specimens of *Channa puctatus* were divided into control and fasting groups. Each group contained 10 individuals. Control was fed on chopped earthworms or small pieces of earthworms. However, the food was withheld from the fasting group. Water in the aquaria was removed daily up to experimental period during which control fishes were deprived of food. The tissues i.e. Liver , Muscle, Gill were immediately dissected out, weighed on an electrical pan balance sensitive up to 00.030 mg, and their known weights processed separately for the estimation of protein and glycogen. The data was compared with the values of biochemical constituents in the tissues of the specimen of the starved fish.

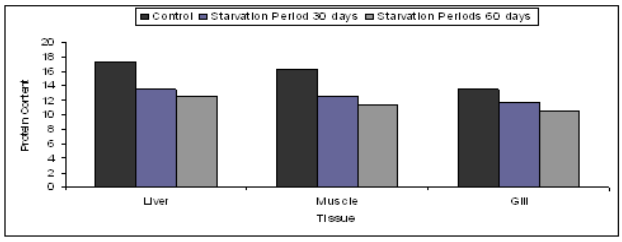
The Concentration of Protein was estimated standrad method [11] using Folin-Cioalteau reagent and its concentration calculated with the help of a calibration curve prepared by relating the optical density to micrograms of bovine serum albumin. This technique has also been followed [12]. The Glycogen content was estimated calorimetrically by the method[13]). The values of result were represented by means ± the standard deviations of the means.

Table showing Changes in the biochemical components during starvation

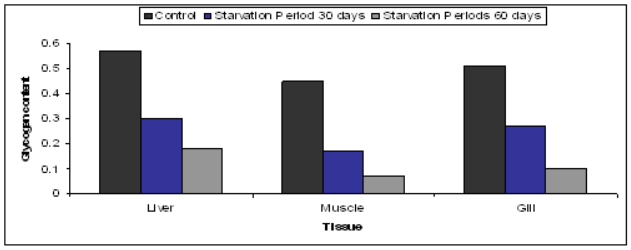
BIOCHEMICAL CONSTITUENTS	TISSUE	CONTROL X ± S.D	STARVATION PERIOD 30 Days (X ± S.D)	STARVATION PERIOD 60 Days (X ± S.D)
PROTEIN	Liver	17.35 ± 0.80	13.52 ± 0.63	12.55 ± 0.55
	Muscle	16.32 ± 0.68	12.55 ± 0.55	11.43 ± 0.70
	Gill	13.52 ± 0.63	11.75 ± 0.63	10.55 ± 0.54
GLYCOGEN	Liver	0.57 ± 0.06	0.30 ± 0.01	0.18 ± 0.01
	Muscle	0.45 ± 0.01	0.17 ± 0.01	0.07 ± 0.01
	Gill	0.51 ± 0.02	0.27 ± 0.02	0.10 ± 0.01

Result and Disscussion

It is evident from the starvation studies that the fasting decreases significantly the activity of fish. Starvation resulted in changes in body weight and chemical composition. Muscle rich in proteins, forms mechanical tissue intended for mobility and do not participate in metabolism. Liver being the centre for various metabolisms is also rich in proteins. Protein contents of different tissues of *Channa puctatus* are given in the table along with control. The protein of control group of *Channa puctatus* in liver was 17.35 ± 0.80 , muscle 16.32 ± 0.68 and gill 13.52 ± 0.63. The Control values showed little fluctuation due to change in the environmental factors. The experimental group after 30 days in liver 13.52 ± 0.63, muscle 12.55 ± 0.55 and gill 11.75 ± 0.63 were as after 60 days the decrease in each parameter in liver 12.55 ± 0.55 and , muscle 11.43 ± 0.70 and gill 10.55 ± 0.54.



Graph 1: Graph showing Protein Content of different tissue during starvation



Graph 2: Graph showing Glycogen Content of different tissue during starvation

Whereas, the glycogen level are found to be highest in liver, as it is the chief organ of carbohydrate metabolism in animals, followed by muscle. Liver glycogen is concerned with storage and export of hexose units for maintenance of blood glucose and that of muscle glycogen is to act as a readily available source of hexose units for glycolysis within the muscle itself. A fall in the glycogen level clearly indicates its rapid utilization to meet the enhanced energy demands in fish. Glycogen content in control group consist, liver 0.57 ± 0.06, muscle 0.45 ± 0.01 and gill 0.51 ± 0.02 . The results are compared with the starved group i.e. 30 days group shows, liver 0.30 ± 0.01, muscle 0.17 ± 0.01 and gill 0.27 ± 0.02. After 60 days, in liver 0.18 ± 0.01, muscle 0.07 ± 0.01 and 0.10 ± 0.01. The study of hepatosomatic index and liver protein concentration fell rapidly during the initial 33 days but were maintained constant thereafter [14]. Liver glycogen was depleted but muscle glycogen was unaffected. It is suggested that in the snakehead, protein catabolism is reduced with the onset of starvation. The serum protein level in which 4.50 mg/dl in control and for 60 days starvation the result were 3.74 mg/dl are observed [15]. The protein and glycogen was significantly lower in starved group than in control group are studied [16]. The progressive decrease in protein content after 30 and 60 days was observed. The absence of mortality and the good condition of the fish indicate that *Channa puctatus* can survive long periods of food shortage.

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