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CHANGES IN THE CARBOHYDRATE CONTENT OF DIFFERENT TISSUES OF FRESH WATER FISH *MYSTUS SEENGHALA* IN RELATION TO FEEDING AND OVARIAN CYCLE

Dr. Atul Kumar Tiwari,
Department of Zoology
Govt. Science College Ambikapur,Surguja (C.G.)

ABSTRACT: - Food is the prime need of life hence the study of food and feeding habits becomes highly significant in fishery biology. The food preferences feeding habits, availability of food in the environment and the intensity with which fish feed is an important aspect to study. A proper food supply always leads to a good growth rate which is very important from the view point of commercial fishery. The feeding intensity of the fish varies with the season and is related with maturity, spawning and the availability of food items. The feeding intensity increases after spawning but during the spawning period stomach is either empty or only ¼ th full, which may be due to considerable increase in the size of the gonads. Liver is one of the important organ which reportedly stores glucose, protein or lipid to utilization during ovarian cycle. Glucose level of *M. seenghala* appears to be inversely related in liver and ovary. The highest amount of glucose in the ovary and its lowest amount in the liver can be recorded during May-June month and its highest level in the liver are noted in the November month. Considering these data it appears possible to visualize that the carbohydrate content of the ovary of this fish is perhaps synthesizes from the monomers depleted from the ovary does not include any visible carbohydrate during the resting phase the glucose level of the liver. Such conclusion has also been drawn in other teleosts (Das et al. 1981) this is due to probably exogenous synthesis of carbohydrates yolk of *M. seenghala* in the mature ovary which are abundantly present during May-June month. The occurrence of carbohydrates in the muscles is not constant. Thus a definite relationship between ovary growth and muscle carbohydrate was established.

KEYWORDS: *Mystus seenghala,Glucuse,Liver,Ovary*

INTRODUCTION

The cat fish *M. seenghala* is found is all over the country in rivers, tributaries and irrigation channels. The fish attains a fairly large size and is of a great commercial value. Regarding high nutritive value, easy availability and assimilation in the human body fishes considered as the most potent staple food after food grains. Inland fish resources of India are one of the richest in the world. Fish being a high protein food can go a long way to supplement the nutritional demands of unabatedly growing vast population of India. The fish production of our country has reached 65 lakhs metric tons in 2005-06 from 0.76 million tons during last five decades.

Food is the prime need of life hence the study of food and feeding habits becomes highly significant in fishery biology. The food preferences feeding habits, availability of food in the environment and the intensity with which fish feed is an important aspect to study. A proper food supply always leads to a good growth rate which is very important from the view point of commercial fishery. The term food supply signifies the presence of certain quantity and quality of food that can be utilized by the population for growth and reproduction, the food supply thus governing the mass of a population. The feeding intensity of the fish varies with the season and is related with maturity, spawning and the availability of food items. Several investigators have found that the feeding intensity of the mature fish decreased during the spawning season as compared to the other month of the year.

Breeding is an important aspect through which a living being maintains its race. The attainment of the sexual maturity primarily depends on the food supply during growth. A rapid linear growth leads to earlier sexual maturity, which is closely related to attainment of certain growth rather than a given age.

MATERIAL AND METHODS:

Specimens for this study were collected from the river Beehar at Rewa throughout every month for a complete year. Living specimens of *Mystus seenghala* was collected from Beehar river and other fresh water resources of Rewa Region. The specimens were also procured from fish market during different months of the year for studying the food and feeding habits of this species. Out of these, 86 specimens collected from July to September 2004 were utilized for preliminary studies. The specimens collected from October 2004 to January

2006 were analyzed quantitatively for elucidating seasonal variations in the food components. This data was also analyzed for various arbitrary size groups in order to see if there is any basic change in dietary habits of the fish at various stages of its growth. Since the number of specimens in similar size groups was considered inadequate, the guts from 312 additional specimens, measuring 18 to 215 mm, were examined from October 2004 to January 2006. However, the observations on the composition of gut contents of various size groups were limited to the period from October to January as all size groups were adequately represented during this period only. The guts were removed from fresh specimens of *Mystus seenghala* and preserved in 5% formalin for subsequent analysis. The contents of the preserved guts were teased in petridishes in order to render their microscopic examination easy. Since the most portion of the alimentary canal of this species is not differentiated into a recognizable stomach, the contents, sampled at random, were examined from various sections of the guts. The gut contents were analyzed by volumetric method, as well as by frequency of their occurrence in the guts. The volume of the gut contents was estimated by a modified point's method, which is described in the following section. In the occurrence method, the number of specimens in which a particular item occurred was given as a percentage of the total number of specimens examined. The occurrence percentage of a particular item was also calculated with reference to the sum of occurrences of all the items.

New technique for volumetric analysis:

The guts of 86 specimens of *M. seenghala* collected from October 2004 to January 2006 were examined, with a view to get familiarized with food organisms encountered in its guts and to evolve a suitable and dependable technique for assessing its food components volumetrically.

The volumetric assessment of planktonic organisms is generally done either by eye estimation or by point's method, in which the bulk of various food organisms is arbitrarily determined. In other methods the organisms are either merely listed or counted. On the basis of preliminary observations on the gut contents of *M. seenghala* a new technique for volumetric food analysis, which is essentially a 'points method' (Swynnerton and Worthington, 1940), was devised for assessing the food composition of this species.

In the point's methods, adopted by Swynnerton and Worthington (1940) and quoted by Hynes (1950), "the food items in each fish stomach were listed as common, frequent, etc. on the basis of rough counts and judgment by eye, due regard being taken of the size of the organisms as well as of their abundance. Each category was the allotted a number of points and all the points gained by each food item were summed and scaled down to percentages to give percentage composition of the food of all the fish examined." One of the criticisms of the point's methods, as pointed out by Hynes (1950), is that 'it is subjective and the investigator may be influenced by prejudice in his allotment of points'. This criticism was largely overcome in the present study by suitably modifying the 'points method' to render the volumetric food analysis objective. The modified method is described below.

Method for biochemical study:

For the biochemical study, attempt has been made to estimate the changes in the quantity of carbohydrates in the muscle, liver and ovaries of *Mystus seenghala* during different seasons. Immediately after collection of fishes were sacrificed after pitching. The ovaries, muscle and liver were taken out and were put into the crushed ice and weighed to the nearest gram. The following methods were employed for carbohydrates estimation.

For the estimation of glucose, Nelson (1944) and Somogyi (1945) method was used.

Reagents:

1. **Somogyi's copper solution –** 56 gm. of anhydrous disodium phosphate was slowly added with stirring to 1400 ml. of water. To it was added 80 gm. of Rochelle salts with stirring. After stirring 200 ml. of 1N NaOH solution was slowly added. Solution of cupric sulphate was prepared by dissolving 16 gm. in 160 ml. of water, and then this solution was added to the phosphate tartarate mixture. Finally 360 gm. of anhydrous sodium sulphate was added slowly with stirring. The mixture was diluted with water to the 2000 ml. This was allowed to stand for two days before filtration.
2. **Nelson's aresenomolybdate solution –** 100 gm of Ammonium Molybdate was dissolved with stirring in 1800 ml of water. 84ml of concentrated H_2SO_4 added slowly with continued agitation and 12gm of sodium arsenate heptahydrate dissolved to it. When the arsenate is dissolved, the solution was diluted to 2000 ml. with water and stored at 37ºC for 48 hrs. After this period, the solution was filtered and stored in a brown bottle.

Procedure:

50 mg of tissue was taken in a Folin-Wu-tube and to it was added two ml. of Somogyi's copper reagent. Tube was placed in boiling water for 20 minutes. Tube was allowed to cool at room temperature and then 2 ml. of Nelson's arsenomolybdate solution was added. The solutions were effectively mixed by moderate vertical agitation with a small knob on the end of a glass rod. The contents of the tube were diluted to the 25 ml. mark with water before shaking to ensure through mixing. The tubes were then allowed to stand for 15 minutes to

permit maximum color development. The solution was read at 660 nm in a photoelectric colorimeter. With each series of unknown samples, tubes containing 2 ml of water of for a blank were treated and 2 ml of standard solution having 0.10 and 0.20 mg of glucose in a similar manner to obtain a standard reference graph.

RESULTS

Changes in the carbohydrate content of different tissues were as follows:-

1. Ovary:

Highest level of glucose was recorded in 6.55 ± mg/g in ovary in the month of July, which gradually reduces, and lowest recorded in January (2.32 ± mg/g). Considering these data it appears that carbohydrate content of ovary is perhaps synthesized from the monomer depleted from the ovary dose not include any visible carbohydrate content during the resting phase. This conclusion is also been drawn in other teleosts (Change and Idle, 1960 Verma et al, 1985). This is due to probably the exogenous synthesis of carbohydrates yolk of *Mystus seenghala* in mature oocytes, which are abundantly present in the spawning period.

2. Liver:

In liver the glucose content was found to vary considerably from season to season. Highest level of glucose (30.16 ±mg/g) was recorded in the month of January, which gradually reduces, and lowest recorded in June (4.85 ±mg/g) and then again increases to (27.88 ± mg/g) in the month of December.

3. Muscles:

Muscular tissue constitutes about 40% of the body weight and it is therefore the largest single tissue component of the body, which can suddenly change its metabolism manifold depending on its state of activity. The activity of muscles is major determinant of metabolic requirements of the body and all the circulatory and other adjustment related to this. The occurrence of carbohydrates in the muscles is not constant. The highest amount of glucose in the in the ovary (6.55 mg/g) and its lowest level in liver (0.85 mg/g) can be rerecorded during the spawning phase. The lowest glucose level in the ovary (2.32 mg/g) and its highest level in the liver (30.62 mg/g) are noted in the resting /spent phase. Glycogen quantity changes with maturation cycle of the ovary. The lowest quantity of glycogen was observed in stage II and in the following state. Glycogen content reaches to its maximum in stage IV.

Table-1: Seasonal fluctuation of the Carbohydrates content in the liver, Muscles and Ovary of *M. seenghala*.

Months	Liver	Muscles	Ovary
January	46.15±3.89	10.25±0.2	4.26±0.35
February	38.34±3.45	15.32±1.0	4.88±0.32
March	33.26±2.69	8.02±1.04	7.10±0.23
April	29.24±3.0	9.02±0.59	10.85±0.88
May	25.38±4.25	10.54±0.25	13.17±1.0
June	24.58±3.54	13.2±0.65	15.68±1.87
July	23.89±2.89	12.23±1.69	15.02±2.33
August	24.25±2.48	10.36±2.0	13.86±2.80
September	30.02±5.0	11.25±0.89	5.10±0.97
October	29.03±5.03	14.04±0.	234.39±0.77
November	40.16±6.06	15.3±2.14	4.10±0.45
December	41.25±5.07	15.2±1.56	4.22±0.12

DISCUSSION:

Carbohydrate cycle in various tissues in relation to feeding and ovarian cycle:

Liver is one of the important organ which reportedly stores glucose, protein or lipid to utilization during ovarian cycle. Glucose level of *M. seenghala* appears to be inversely related in liver and ovary. The highest amount of glucose in the ovary and its lowest amount in the liver can be recorded during spawning phase and its highest level in the liver are noted in the resting or spent phase. Considering these data it appears possible to visualize that the carbohydrate content of the ovary of this fish is perhaps synthesizes from the monomers depleted from the ovary does not include any visible carbohydrate during the resting phase the glucose level of the liver. Such conclusion has also been drawn in other teleosts (Das et al. 1981) this is due to probably exogenous synthesis of carbohydrates yolk of *M. seenghala* in the mature ovary which are abundantly present during spawning phase. The occurrence of

carbohydrates in the muscles is not constant. The lowest quantity of glycogen in the muscles was observed during stage II and in the following stage glycogen constituent reaches to its peak in stage IV. Thus a definite relationship between ovary growth and muscle carbohydrate was established.

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