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Research Article **Zoology**

BIOCHEMICAL AND ELEMENTAL ANALYSIS OF *Catla catla* AND *Oreochromis niloticus*

R. Mahalakshmi and Dr. S. Sivasuriyan

ABSTRACT

The current examination on the nutritional profile of *Oreochromis niloticus* and *Catla catla* bringing to our attention the richness of healthy nutrients present in the eatable portion such as muscle. The protein and amino acid content was higher in *Catla catla* as compared to *Oreochromis niloticus.*The carbohydrate content was lower in *Oreochromis niloticus* as compared to fresh water fish *Catla catla*. The lipid content was lower in *Catla catla* as compared to fresh water fish *Oreochromis niloticus*. Among the two fishes, *Catla catla* has rich nutrients as compared with fresh water fish *Oreochromis niloticus*. In *Oreochromis niloticus* and *Catla catla* shows the presence of calcium, magnesium, potassium, sulphate, iron and chloride were presented. Vitamin C and E were present *Oreochromis niloticus* and *Catla catla*. Over all, the study concludes that locally obtainable *Catla catla* fish has rich nutrition which may be use growth and development and can be a substantial aid in redressing the problems of malnutrition, diabetic and cardiovascular patients in our country.

Keywords: *Nutritional analysis, Oreochromis niloticus and Catla catla*

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INTRODUCTION

India is the third largest producer of fish in the world next only to China and Peru and it ranks second in the production of Inland fishes. Fish production has increased from 0.75 million tons in 1950 to 6.90 million tons in 2006-2007, registering a compound growth rate of 4.53% per annum which has been the fastest growing one in respect of any item in the food sector. The fisheries sector contributes Rs. 19,555 cores to national income which is 1.4% of the GDP and 4.7% of the agricultural GDP. Out of total Indian exports, the share of export is 3.32%. The distribution however is that it is the 3rd largest contributor to the net foreign exchange earned by the country. This sector accounts for 13.95% of total exports of the Indian economy. Fishery sector, besides contributing towards nutritional security component of the food basket of India, is recognised for providing livelihood and employment to millions of people.

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MATERIALS AND METHODS

Collection of samples

The fish **(***Oreochromis niloticus* and *Catla catla*) were collected in 2019 from Gandarvakottai market

Oreochromis niloticus

Catla catla

Fig.1: Collection of Samples

Preparation of homogenate

The *Catla catla* and *Oreochromis niloticus* were sacrificed and flesh was dissected out, washed with ice-cold physiological saline. The 1g tissues was weighed and homogenized using a Teflon homogenizer. Tissue homogenate was prepared in 0.1 M Tris Hcl buffer (pH 7.4) and used for the estimation of various biochemical parameters.

Table 1: Shows the following biochemical parameters analyzed.

Fish	PARAMETERS
Catla catla and Oreochromis niloticus	**Biochemical Markers** Protein, Carbohydrate, Lipids Amino acids, Inorganic elements and Vitamins

Biochemical estimations

Protein was estimated by the method of Lowry *et al* . (1951). Total lipids in tissues were estimated by the method of Folch *et al* (1957). To estimate the amount of carbohydrate present in the given sample by using Anthrone method. Amino acid in tissues were estimated by the method of Rosen (1957).

RESULTS

The present study was carried out to analyze the various biochemical parameters in *Catla catla and Oreochromis niloticus*. The observations made on different fishes were compared as follows. Table I - Shows the levels of Carbohydrate in *Catla catla and Oreochromis niloticus*. Carbohydrate was decreased in *Oreochromis niloticus* when compared to *Catla catla* . Protein, amino acid and lipids content in was decreased in *Oreochromis niloticus* when compared to *Catla catla*

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Table 1 shows crbohydrate, protein, lipids and amino acid content in *Catla catla and Oreochromis niloticus*

Fish	Carbohydrate (mg/gm)	Protein (mg/gm)	Lipids (mg/gm)	Amino acids (mg/gm)
Catla catla	71.42	104.83	10.23	57.14
Oreochromis niloticus	60.71	95.66	70.40	28.57

Values were expressed as mean ± SD.

Qualitative elements analysis in *Catla catla and Oreochromis niloticus*

The following elements were found in *Catla catla and Oreochromis niloticus*. In *Catla catla* shows the presence of calcium, phosphate, sodium, magnesium, potassium, sulphate, nitrate, iron and chloride were presented. In *Oreochromis niloticus* shows the presence of calcium, phosphate, sodium, magnesium, potassium, sulphate, nitrate, iron and chloride were presented. (Table 2).

Table 2: Qualitative analysis of inorganic elements in *Catla catla and Oreochromis niloticus*

S.No	Elements	*Catla catla*	*Oreochromis niloticus*
1.	Calcium	+	+
2.	Magnesium	+	+
3.	Sodium	+	+
4.	Potassium	+	+
5.	Iron	+	+
6.	Sulphate	+	+
7.	Phosphate	++	+
8.	Chloride	+	+
9.	Nitrate	+	+

Note: (-) Absence (+) Presence

Vitamins

The vitamin analysis in *Catla catla* and *Oreochromis niloticus* investigated. Vitamin C and E were present *Oreochromis niloticus* and *Catla catla*. The table 3 and Fig 3 following carried results.

Table.3: Qualitative analysis of Vitamins in in *Catla catla* and *Oreochromis niloticus*

S. No	Vitamins	*Catla catla*	*Oreochromis niloticus*
1	Vitamin-A	-	-
2	Vitamin-C	+	+
3	Vitamin-D	-	-
4	Vitamin-E	+	+

(- Absent, + present)

Qualitative analysis of Inorganic elements

Fish (500mg) was prepared and treated with HNO_3 and HCl (3:1 v/v) for 1 hour. After the filtration, the filtrate was used to perform the following tests (Khandelwal 2006). Qualitative analysis of vitamins (Pearson, 1976; Patel, 2005).

DISCUSSION

Biochemical studies are very important from the nutritional point of view. Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all nutrients as a component of the human body (Sudhakar *et al* ., 2011). In various fish species, proteins are of important as structural compounds, biocatalysts and hormones for control of growth and differentiations (Amal and Naheb, 2012). Protein in fish is a main component constituent of tissue and organs. They are precursors of other nitrogen compounds (enzymes, hormones, slurry, neurotransmitters, cofactors, etc) and constitute an important energy source. The effect of dietary lipid levels on fish growth performance varies considerably within species, size, age, diet and composition, range of lipids level tested and rearing conditions (Arredondo, 2012). Inadequate protein levels in the diets result in a reduction of growth and loss of weight. However, when an excess of protein is supplied in the diet, only part of it is used for protein synthesis (growth) and the remaining is transformed into energy (Arredondo *et al* ., 2013). Each body cell is composed mainly of protein. Protein makes up the membrane surrounding the cell and also occurs within the cell. During growth period, adolescence and pregnancy, the number of cell increases and more protein is required for cell growth. In all stages of life tissue protein is constantly being broken down and must be replaced by dietary protein. Protein plays a vital role in the formation of enzymes, antibodies and hormones and other substances that regulate the body process.

Protein and Amino acid

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 inproteins (Agusa *et al* ., 2007). Fish and shellfish are important source of protein and income for people in Southeastern Asia They are also increasingly marketed for the health benefits to consumers (Schmidt *et al* ., 2006). The requirement of nitrogen and sulphur is regulated by dietary protein. The protein immunoglobins act as prime defense against bacterial and viral infections. Proteins by means of exerting osmotic pressure help in maintenance of electrolyte and water balance in human system. Several studies show that protein derived from fish, balances many body regulatory factors. It is well known that protein is the most important and expensive item that should be supplied in adequate amounts to support good growth with minimal cost (Wec *et al* ., 1982: Zehra *et al* ., 2011; Nurnadia *et al* ., 2011) determined the proximate composition and energetic values of selected marine fish and shellfish from West Coast of Penisular Malaysia. This study has included Catla catla and Chenna striata. The study revealed that Catla catla contained high protein content. Long-tailed butterfly ray contained the highest protein According to the work done by Anbuchezhian *et al* . (2011) in Catfish it is clear that antimicrobial proteins and peptides play key role in innate immunity and they had been observed from a wide variety of organisms in last few years. Hence, the fishes rich in protein will produce more innate immunity. *Catla catla* would be more useful in developing innate immunity.

Lipids

Cholesterol is undoubtedly the most publicized lipid in nature, because of the strong correlation between high levels of cholesterol in the blood and the incidence of disease of the cardiovascular system in humans. Usually, the cholesterol content will be more in fish liver oils but in the present investigation the consumable part of fish, muscle and brain were found to contain cholesterol. It is the essential constituent of cells. It aids in the permeability of the cells. It controls the red cells from being easily homolyzed. It functions as the defensive action and transports fat to liver in the form of cholesterol ester for oxidation. It assists the formation of bile acids and bile salts, 7-dehydrocholestrol and vitamin D3, corticosteroid hormone, androgens, estrogens and progesterone.

Cholesterol helps the granulation of cell division and acts as an antagonist to phospholipids. High Density Lipoprotein (HDL) transports cholesterol and its esters from peripheral tissues to the liver for its catabolism (scavenging action). Very Low Density Lipoprotein (VLDL) transports mainly endogenous triglycerides synthesized in hepatic cells from the liver to the extra-hepatic tissue including adipose tissue for storage. Low Density Lipoprotein (LDL) regulates cholesterol synthesis in extra-hepatic tissue. The triglycerides are the most abundant of all lipids. They constitute about 98% of total dietary lipids, the remaining 2% consists of phospholipids and cholesterol and its ester. They are major components of storage or depot fats in animal cells but not normally found in membranes. Triglycerides can be stored in quantities, sufficient to supply the energy needs of the body for many months as in the case of obese person. They are not only stored for longer duration but also yield over twice as much energy as carbohydrates. Lipids and fatty acids play a significant role in membrane and have a direct impact on membrane mediated process such as osmoregulation, nutrient assimilation and transport. On the other hand, the nature and quantity of these lipids in fish vary according to species and

habit.(Kumaran *et al* ., 2012). Previous studies correlate with our present investigation pertaining to lipid observations.

Carbohydrate

Components like carbohydrate play a vital role as energy precursors for fish under stress conditions (Umminger, 1970). Glucose is a carbohydrate that has a major role in the bioenergetics of animals, being transformed to chemical energy (ATP), which in turn can be expressed as mechanical energy (Lucas, 1996). Changes in carbohydrate metabolism measured as plasma glucose (energy substrate whose production is thought to metabolically assist the animal to cope with an increased energy demand caused by stress) used as general stress indicators in fish (Teles *et al* ., 2007). Glucose (or glucose 6-phosphate) is released through the degradation of glycogen by glycogen phosphorylase (GP) (Roach *et al*., 1998), and energy is mainly supplied by the oxidation of glucose and lactate as a result of carbohydrate metabolism (Morgan *et al* ., 1997). The glucose concentration was proposed to be mediated by endocrine release such as cortisol (Hontela *et al* ., 1996). Silbergeld (1974) stated that assay of this important blood parameter can serve as an indicator of environmental stress. In the present study decreased the carbohydrate content in *Oreochromis niloticus* as compared to *Catla catla* .

Elements in *Catla catla and Oreochromis niloticus* fish

The elements are separate entities from the other essential nutrients like proteins, fats, carbohydrates, and vitamins. Animal husbandry had demonstrated the need for minerals in the diet (Hegsted *et al* ., 1976). In this century, biological assay methods clarified the significance and importance of mineral elements for human and animal nutrition and modern analytical techniques led to the detection of trace elements as essential nutrients and this is still an active area of current research. Micronutrient deficiencies are a major public health problem in many developing countries, with infants and pregnant women especially at risk (Batra and Seth, 2002). Infants deserve extra concern because they need adequate micronutrients to maintain normal growth and development (Rush, 2000). The micronutrient deficiencies which are of greatest public health significance are iron deficiency, causing varying degrees of impairment in cognitive performance, lowered work capacity, lowered immunity to infections, pregnancy complications e.g. babies with low birth weight, poor learning capacity and reduced psychomotor skills (Batra and Seth, 2002). In the present study all the elements present in *Catla catla*as compared to fresh water fish.

Minerals are inorganic substances, present in all body tissues and fluids and their presence is necessary for the maintenance of certain physicochemical processes which are essential to life. Minerals are chemical constituents used by the body in many ways. Although they yield no energy, they have important roles to play in many activities in the body (Eruvbetine, 2003). Every form of living matter requires these inorganic elements or minerals for their normal life processes (Ozcan, 2003). Minerals may be broadly classified as macro (major) or micro (trace) elements. The third category is the ultra trace elements. The macro-minerals include calcium, phosphorus, sodium and chloride, while the micro-elements include iron, copper, cobalt, potassium, magnesium, iodine, zinc, manganese, molybdenum, fluoride, chromium, selenium and sulfur (Eruvbetine, 2003). The macro-minerals are required in amounts greater than 100 mg/dl and the micro-minerals are required in amounts less than 100 mg/dl (Murray *et al* ., 2000). The ultra trace elements include boron, silicon, arsenic and nickel which have been found in animals and are believed to be essential for these animals. Evidence for requirements and essentialness of others like cadmium, lead, tin, lithium and vanadium is weak (Albion Research Notes, 1996).

Vitamins

Vitamins are organic substances that are essential in tiny amounts for growth and activity of the body. They are obtained naturally from plant and animal foods. Organic in this definition refers to the chemistry and molecules of vitamins. The word organic means that the molecules of the substance contain the element carbon. The term also means that vitamins can be destroyed and become unable to perform their functions in our bodies. Too much heat, certain kinds of light and even oxygen can destroy some vitamins. Vitamins work with other substances in the body like enzymes and minerals. Together they perform such functions as strengthening bones, healing wounds, keeping the skin healthy, building cells, and helping to resist infections. The amounts of vitamins ingested from food are measured in micrograms or milligrams (Okwu, 2004).

Vitamins are separated into two groups, fat soluble and water soluble. The fat soluble vitamins are A, D, E, and K, and can dissolve in dietary fats and are stored in the liver and body fat. The body stores them for a longer amount of time, so they are not needed every day. Too much of these vitamins can become toxic and cause health problems. The water soluble vitamins are made up of 8 B vitamins and vitamin C. Water soluble vitamins dissolve in

water, and are not stored in the body. Rather they travel through the bloodstream and need to be replenished every day. These vitamins are easily destroyed during food preparation and storage.

Vitamin E remains the most mysterious of vitamins. The body needs it but its lack does not lead to any known disease. Vitamin E is the most exploited vitamin in that it is sold as a cure-all and even as an anti-aging potion. Vitamin E, vitamin C, and beta carotene are antioxidants. Some studies suggest that the trio might help to strengthen the body's immune system and play a role in cancer prevention (Okwu, 2004).

Vitamin C, or ascorbic acid, is one vitamin humans cannot make; they have to get it from food. Vitamin C helps hold the cells together, heal wounds, and build bones and teeth. The best sources for vitamin C are citrus fruits, strawberries, melons, and leafy green vegetables. Vitamin C also helps to absorb and use Iron. It is important to protect the vitamins in fruits and vegetables from being destroyed; simple ways of doing this include refrigeration, washing them before cutting them, storing them in airtight containers, and avoiding high temperatures and long cooking times (Okwu, 2003).

CONCLUSION

Over all, the study concludes that locally obtainable *Catla catla* fish has rich nutrition which may be use growth and development and can be a substantial aid in redressing the problems of malnutrition, diabetic and cardiovascular patients in our country.

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