E-ISSN: 2347-5129
P-ISSN: 2394-0506
(ICV-Poland) Impact Value: 5.62
(GIF) Impact Factor: 0.549
IJFAS 2020; 8(3): 85-87

www.fisheriesjournal.com
Received: 03-03-2020
Accepted: 04-04-2020

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Nutritional compositions in the muscle tissue of some selected local fish species

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Abstract
The biochemical compositions of fishes varies widely by many factors such as biological status in the life cycle, feeding habits and environmental conditions and also in relation to sex, size, stages of maturity and season which have impact on the compositions and quality of aquacultured or wild fish.
The present study is being undertaken to find out the biochemical nutritional compositions in the muscle tissue of three species of fish available in the local aquatic bodies in and around Kalaburagi in the northern part of Karnataka. The three species are *Notopterus notopterus, Tilapia mossambica and Xentodon cancilla*. These three species are available in large numbers in the local aquatic bodies and are consumed by the local people as source of food in their diet. The nutritional biochemical compositions estimated are protein, cholesterol and iron. The amount of protein in fish muscle is usually between 16 and 21%. Proteins are having high biological value as they contain all essential amino acids in the right proportional and specially, lysine as well as sulphur containing amino acids such as methionine and cysteine. The protein content analysed in the fish, *N.notopterus* indicated that 20.2gm/100gm compared to 19.5.gm/100 gm in the fish *Tilapia mossambica* and 17.1gm/100gm in the fish, *Zenentodon cancilla*. The fat content ranges usually from 0.2 to 25%.Fish lipids are known to provide high contents of important components for human diet such as lipid soluble vitamins (A and D) and polyunsaturated fatty acids –PUFA).The cholesterol content of the muscle in three species indicated that the fish, *N.notopterus*, it was 0.6gm/100 gm compared to other two fishes *T.mossambica* and *X.cancilla* as 2.0gm/100gm,1.3gm/100gm of muscle tissue respectively. Fish is good source of almost minerals (sodium, potassium, calcium, magnesium, phosphorous, fluorine and iodine along with iron) and the values range from0.4 to 15%. The iron content estimated in the present study found that 1.7mg/100gm in the fish *N.notopterus*, 1.2gm/100gm in the fish *T. mossambica* and 0.7mg/100gm in the fish, *X, cancilla.* Thus, the results suggest that all the three fishes have proper important nutritional compositions. However, the fish *Notopterus notopterus* stands better compositions of protein, cholesterol and iron compared to other two fishes and this may be because of active feeding habits as it is omnivorous fish.

Keywords: Fish nutritional compositions, protein, cholesterol, iron

1. Introduction
Fishes are one of the major sources of protein nutrition for human beings, therefore,efforts are being made all over the world to exploit both the marine and fresh water bodies for fish production, further, culturable and wild fishes also provide a major bulk of fish protein (Bhogawati and Ratha,1982) [1]. Hence, studies on different sources and nutritive values of wild fishes are necessary. Kalaburagi is in the northern part of Karnataka state and are having number of aquatic bodies including ponds, reservoirs and rivers. Principles of fish nutrition (Gatlin,2010) [3], significance of fish nutrition in aquaculture industry (Prabhu *et al.*, (2017) [10] and fish in human health and nutrition (Mohanty *et al.*, 2019) [9] have reviewed recently considering importance of study related to nutritional compositions of fish and their requirement for fish growth needed for human consumsion. The availability of fish species includes major and minor carps which cultured and wild fishes available naturally and occur in large numbers of about 40-45 species. They both cultured and wild fishes have been serving as food fish for the people of this region. Some reports on biology and ecology have been reported. However, no information is not much available on the nutritional aspects of locally available wild fishes. Hence, the present investigation has been undertaken to study the some macronutrient of protein and cholesterol along with mineral content of iron in the muscle tisuue of three species of locally available fishes such as *Notopterus notopterus, Tilapia mossambica and Xentodon cancilla*

Materials and methods

The three species are *Notopterus notopterus, Tilapia mossambica and Xentodon cancilla.* These three species are available in large numbers in the local aquatic bodies and are consumed by the local people as source of food in their diet. All the three fishes were purchased from the Parkitwar fish market which were just landed from the collection by the fisherman and brought to the laboratory. The sexes could not be distinguished in these fishes because the gonads were not developed and there was no morphological difference.

The muscle tissue was extracted and processed immediately as per requirement for determination of biochemical compositions. The nutritional biochemical compositions estimated are protein, cholesterol and iron.

The protein content in the muscle tissue was measured by Lowry's method (Lowry *et al.*, 1951) [2] using Folin-Ciocalteau reagent with bovine serum albumin as standard. This method is a sensitive to low concentrations of protein. The major disadvantage of the Lowry's method is the narrow pH range within which it is accurate. However, since we used small volumes of sample, which have little or no effect on the pH of the reaction mixture.

The cholesterol was determined by Liebermann Burchard method. The tissue homogenised in 5 ml. of 3.1 alcohol ether mixture and centrifuged for 10 minites and the supernatant in a test tube was kept in a water bath for drying, then added 5ml of chloroform and 2ml of acetic anhydride mixture to the test tube. The mixture was kept in dark for about 30 minutes for colour development. Measurement of optical density at 660nm in a spectrophotometer was carried out by using blank. The blank was prepared by adding 5 ml of chloroform directly proportional to acetic anhydride mixture.

The iron concentration in the muscle tissue was determined byTthiocynate method by preparing ash of the muscle tissue, adding 10 ml of 2.0 N HCL and 10 ml of distilled water, the mixture was filtered and the filtrate added with 2.5 ml of 0.1 N KSCN, mixed thoroughly and the absorbance measured by using spectrophotometer at a wave length of 458nm**.**

Statistical analysis of the data: In all the cases six observations were made and the results are expressed as arithmetic mean with their standard deviation, standard error and student "t" test.

Results

The concentrations of two macronutrients and iron studied have been expressed in mg/g wet weight of muscle tissue of three species of fish *N.notopterus, Tilapia mossambica and Zenentdon cancella*

The concentration of protein, cholesterol and iron have been shown in theTtable-1. The protein content analysed in the fish, *N.notopterus* indicated that 20.2gm/100gm compared to 19.5.gm/100 gm in the fish *Tilapia mossambica* and 17.1gm/100gm in the fish, *Zenentodon cancilla*.The fat content ranges usually from 0.2 to 25%.Fish lipids are known to provide high contents of important components for human diet such as lipid soluble vitamins (A and D) and essential fatty acids (omega-3 polyunsaturated fatty acids –PUFA).The cholesterol content of the muscle in three species indicated that the fish, *N.notopterus*,it was 0.6gm/100 gm compared to other two fishes *T.mossambica* and *X.cancilla* as 2.0gm/100gm,1.3gm/100gm of muscle tissue respectively. Fish is good source of almost minerals (sodium, potassium, calcium. magnesium, phosphorous, fluorine and iodine along with iron) and the values range from0.4 to 15%. The iron content estimated in the present study found that 1.7mg/100gm in the fish *N.notopterus*, 1.2gm/100gm in the fish *T.mossambica* and 0.7mg/100gm in the fish, *X,cancilla.*

Thus the results suggest that all the three fishes have proper important nutritional compositions. However, the fish *Notopterus notopterus* has better nutritional compositions in the muscle tissue of protein, cholesterol and iron compared to other two fishes and this may be because of active feeding habits as it is omnivorous fish. The feeding of this fish includes insects, small fishes, crustaceans, young roots of aquatic plants and is a active feeder compared to other fishes. This fish can be considered as carni-ominivorous preferring aquatic insects. Kiran and Waghary, (1998) [8] have studied the food and feeding habits of this fish at Saroongar lake (Hyderabad) and found that the fish *N. notopterus* is carni-ominivorous euryphagic and bottom feeder. Feeding intensity is maximum in summer and minimum in the winter which is related to maturity. This fish is capable of adjusting and widening its food spectrum, when preferred items becomes scare. They appear to thrive on other food easily and readily available in the area. The muscle tissue distribution of protein, cholesterol and iron was in the order *N.notopterus> T.mossambic>Z. cancilla.*

Table 1: Showing nutrient content in the muscle tissue of three fishes (gm/100gm & mg/g wet wt.) values are expressed mean ± standard deviation.

Nutrient content	***Notoptrus notopterus***	***Tilapia mossambica***	***Xenedon cancilla***
Protein	20.2±0.59 gm/100gm	19.5±0.59gm/100gm	17.10±0.58gm/100gm
Cholesterol	0.6±0.12gm/100gm	2.0±0.40gm/100gm	1,30±0.23gm/100gm
Iron	1.7±0.78mg/100gm	1,2±0.72mg/100gm	0.7±0.21mg/100gm

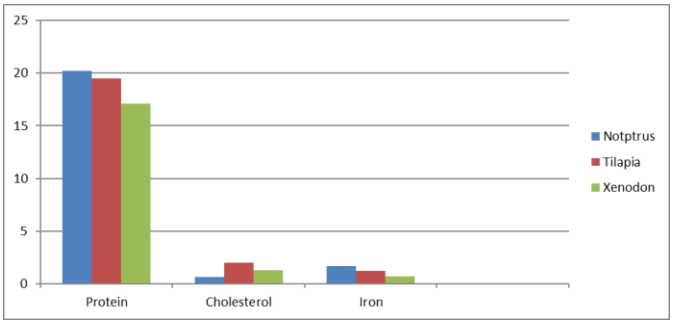

Fig 1: Showing biochemical compositions in three fishes

Discussion

The three species of collected in wild from the local aquatic body by the fisherman and are being extensively used for consumption by the local rural people in Kalaburagi may provide major sources of cheap nutrition particularly rural populations. The nutritional value of different fishes depends on their biochemical compositions like protein, fat, vitamins, mineral contents etc. Fish are regarded as an excellent source of high-quality protein particularly the essential amino acids lysine and methionine. In addition to the high nutritional value, fish proteins also have good functional properties such as water-holing capacity, gelling, emulsification and textural

properties for the products such as fish mince and surimi, the water holding capacity and the gelling properties which determine the textural attributes of the products are important quality parameters. Fish muscle is usually between 16 and 21% but vascular than 16% or as high as 28% are occasionally found in some species of fish. Proteins are important for growth and development of the body, maintenance and repairing of worn out tissues. The amount of protein content of fish depends on species, nutritional condition and type of muscle. Protein plays an important role in biological process in enzymatic catalysis in transport or mechanical support, for control of growth and differentiation. The depletion in protein levels indicates rapid utilization of energy stores to meet the energy demands warranted by the environment and the degradation of protein content may be due to enhanced proteolytic activity (Gita and Yeragi, 1998) [5]. or by alteration of membrane permeability. Decrease in content has been observed in *Heteropneustes fossils* and *Anabas testudineus (Geeta* Bhaskar, 1997) [4] after various pollutant treatments. Fish proteins are having high biological value as they contain all amino acids in the right proportional and specially lysine as well as sulphur containing amino acid such as methionine and cysteine which are absent in plant protein. The type of protein distribution amongst the three fishes in the present study indicates in the order *N.notopterus> T.mossambic>Z. cancilla.* Thus, in spite of their relatively smaller sizes, these wild species of fishes have served the local people of this region as good source of protein nutrition and could be exploited commercially.

The lipid content of fish varies depending on the species as well as season. However, fish have less fat than red meats. The lipids are the economical usual form used by fishes to stock energy and can be stored in many organs (Guijarrow *et al.*, 2003) [6]. The major content of fat is having cholesterol and ranges usually from 0.2 to 255 as the fat content rises, so water content falls and vice versa. It is notable that the decrease of cholesterol from liver and leads to increase of cholesterol in gonads through circulation depends on spawning phase (Joshi, 1988) [7]. Fish lipids are known to provide high contents of important components for the human diet, such as nutritional lipids- soluble vitamins (A and D) and essential fatty acids omega-3 polyunsaturated fatty acids (PUFA) that have shown a positive role in preventing certain human diseases, including cardiovascular ones. All the three species of studied in the present study shows less quantity of cholesterol, the order is as follows *T. mossambica> X. cancilla> N.notopterus* indicating that they are not fatty fishes as such fatty fishes classification has been made for some fishes (Mohanty *et al.*, 2019) [9].

The fish can absorb a number of minerals directly from the water including iron the natural waters are low in iron and feed is considered the major source of iron and iron is necessary for the formation of heme compounds, these compounds carry oxygen, iron deficiency causes a form of anemia. At high-level, iron can be toxic and cause reduced growth, diarrhea, liver damage and death (Prabhu *et al;* 2017) [10]. The total iron content in the muscle tissue was less and almost similar in the fishes studied in the present investigation, the order of iron concentration was *N.notopterus> T.mossambic>Z. cancilla.* This may be due to their similar feeding pattern and absorption of iron from the aquatic medium.

Conclusions

Taking into consideration the observed higher level of protein, moderate content of cholesterol (fat) and lesser concentration of iron in general in the three fresh water fishes in the present study, it may be suggested that the three species of fish have higher metabolic rate and they could be developed as a source of protein nutrition for the people of this region.

Acknowledgement

The authors are thankful to Gulbarga University, Kalaburagi for providing facility and RSK is grateful to Indian Science Congress Association, Kolkata for awarding Sir Asutosh Mookherjee fellowship.

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