Research Article

SEASONAL VARIATION IN THE PROXIMATE COMPOSITION OF INDIAN MAJOR CARP *LABEO ROHITA* OF DISTRICT SULTANPUR, UTTAR PRADESH, INDIA

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ABSTRACT

Fishes has an excellent nutritive value and is good source of proteins, lipids and various micronutrients essential for the maintenance of good health. The present study was conducted to investigate the seasonal variation (monsoon and post monsoon) in the proximate composition of Indian major carp *Labeo rohita* of district Sultanpur, Uttar Pradesh, India during a period of 6 months from June 2019 to November 2019. In this study we examined 60 fishes (10 per month) and found the seasonal variation in its proximate composition. Protein, lipid, Ash and Moisture contents were 15.95 ± 0.22; 2.77 ± 0.21; 2.19 ± 0.20 and 79.09 ± 0.16 respectively during monsoon season 16.99 ± 0.32; 3.92 ± 0.05; 2.81 ± 0.12 and 76.31 ± 0.43 respectively during post monsoon season. This study showed that the moisture content was higher in monsoon season while the protein, lipid and ash contents were higher in post monsoon season. Present study provides valuable information on seasonal variation in the proximate composition of Indian major carp *L. rohita* that helps the consumers in choosing fish seasonally on nutritional point of view.

Keywords: *Labeo rohita,* Nutritive value, Proximate composition, Seasonal variation.

INTRODUCTION

Fishes are good source of aquatic food. It provides nutrients that give nourishment to the human`s body and promote growth. The chief component of fish includes protein, lipids, ash and water (Mishra, 2020a). The amount of each component within fish body is termed as proximate composition. The people of district Sultanpur, Uttar Pradesh, India have crying need of dietary protein. Fish provides essential nutrients especially Proteins (of high biological values) and Fats, so it is often referred to as rich food for poor people. Protein is the main component that plays an important role in determining the population levels, growth rate and condition of fishes. The knowledge of proximate composition is essential in order to compare its values as food. It is also necessary to have data on the composition of fish in order to make the best use of fish as food and in order to develop the technology of fish processing and fish products (Mishra, 2020b).

Fishes has an excellent nutritive value which provides high quality protein, fats, vitamins and minerals. Fish muscle comprises of moisture, protein and fats as a macronutrients and carbohydrate, vitamins and minerals as micronutrients. Because of presence of both macro and micronutrients in fishes, it is better than other animal foods (Mishra, 2020a). Fish protein is much more important than other protein due to the amino acid composition and protein digestibility (Louka *et al*., 2004). Fish protein comprises of all 10 essential amino acids in desirable quantity for human consumption. Fish protein is very rich in such amino acids as methionine and lysine and low in tryptophan compared to mammalian protein (Nowsad, 2007). Fishes have rich source of essential nutrients required for supplementing both infant and adult dietary requirements (Abdullahi & Abolude, 2001). Thus, the fish muscle contains the entire nutritional component that is necessary for the maintenance of human body.

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The nutritional composition of fish varies greatly from species to species and individual to individual depending on age, feed intake and sex. The sexual changes connected with spawning, environment and season (Silva & Chamul, 2000). The development of reproductive organ, egg size and quality of hormone and enzyme production in fish depends mainly on protein composition. In comparison to land living animals, fishes are rich source of protein (amino acids), which is the building block of tissue and have a high content of Omega-3 long chain poly unsaturated fatty acids. Early before the beginning of civilization, humans consume fish in a variety of ways by making various dishes. Fish has better availability and affordability than other animal protein.

The aim of this study is to provide knowledge of fish composition essential for its maximum utilization. Studies on seasonal variation in the proximate composition are essential for fish and fish products to be utilized efficiently (Mishra, 2020c). Non edible part can be used as a source of raw material in the feed industry. Apart from limited information, there is no published information on the proximate composition of this fish in district Sultanpur, Uttar Pradesh, India. The people of this district like this fish very much, and have much knowledge about the food and feeding habit of *Labeo rohita* (Mishra, 2020a) but they do not know about the seasonal variation in the proximate composition and its nutritional values. The present study can give information about proximate composition and nutritional values of Indian major carp *L. rohita* to the consumers for the selection of fish seasonally.

MATERIAL AND METHODS

Study area, Collection and preparation of sample

The study was conducted utilizing the fishes collected from local fish market of district Sultanpur, Uttar Pradesh, India. Total 60 individuals of fish *L. rohita* were collected from different and different fishermen of the same fish market during the period of 6 month from June 2019 to November collection site and transported to the laboratory of Post Graduate Department of Zoology, Ganpat Sahai Post Graduate College Sultanpur, Uttar Pradesh, India. The fish samples were stored in the freezing temperature until used. Head, scales, fins gills and viscera were removed and washed with tap water. Only fresh muscles from dorsal region without skin and bone were taken as sample. Then the muscles were chopped and grinded by mortar and pestle to make a homogeneous sample.

Analysis of proximate composition

The proximate composition of fish tissue was determined by conventional method of IOAC (1980) with minor modification and triplicate determinations were carried out on each chemical analysis.

Determination of moisture content

For the determination of total moisture content of the whole body of fish, the viscera, fins and tail were removed from the body of the fish and then the edible portions of the fish was divided in to several parts for making three-four uniform samples from all the parts of fish. The wet samples were put in the weighed again. The petridish with wet samples were kept in digital hot air oven for drying at 105°C for about 24 hours or until the constant weight was obtained. Then dry samples were taken out from oven and put in desiccators, after 30 minutes the weight was taken, the difference in weight (wet and dry sample) was calculated and expressed as percentage moisture. The percentage moisture content was calculated by using the following formula.

$$\text{Moisture (\%)} = \frac{\text{Wet sample weight (g)} - \text{Dry sample weight (g)}}{\text{Wet sample weight (g)}} \times 100$$

Determination of ash contents

The inorganic components of fish, often collectively called ash because of the method of measuring them, are seldom of direct technological interest. Measurement of ash is sometimes a useful indicator of the amount of leaching of soluble constituents of fish resulting from contact with water or melting ice. The moisture free dried fish samples were grinded and finely powdered with the help of mortar and pestle for converting samples in to fine powder which was used for the analysis of other parameters such as ash contents. The fine powdered moisture free samples were taken in clean pre-weighted silica crucible and weighed again along with samples. The crucible containing samples was then placed in a muffle furnace at a temperature of 550-600°C for 6 hours till the residue became completely white. The samples were then allowed to cool in desiccator for about 20-30 minutes, reweighed and the amount of ash was calculated as the difference in weight. The percentage of ash content was obtained by using the following formula.

$$\text{Ash content (\%)} = \frac{\text{Weight of Ash}}{\text{Weight of samples}} \times 100.$$

Determination of crude protein content

Protein is usually determined by measuring nitrogen, the characteristic element in protein, rather than protein itself; estimation of protein directly is a more time-consuming procedure. Not all substances containing nitrogen, however, are proteins, so the quantity estimated from measurement of nitrogen is usually called crude protein, which in addition to true protein includes free amino acids, tri-methylamine oxide and its decomposition products and other substances. Kjeldahl method was used to determine protein content of fish samples. Approximately 1g of each sample was taken in a clean Kjeldahl flask and 4g digestion mixture was added along with 25 ml of concentrated H_2SO_4 by swirling the flask. Then the Kjeldahl flask was

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placed in an inclined position on heating device of digestion chamber and carefully heated at more than 100°C for about 1-1.5 hours. The end point of digestion was indicated by a completely clear and light blue color solution. Then the content of flask was cooled at room temperature. Distilled water (100 ml) and Na2S2O2 (25 ml) were continuously added in each flask, and were mixed and cooled. A few glass beds were added in each flask to prevent bumping. Then 100-120 ml of 40% NaOH was added in each flask to make solution sufficiently alkaline. The flask was immediately connected to distilling bulb on condenser against Kjeldahl flask to collect the distillate. After completion of distillation (about 100 ml distillate) the collected distillates were titrated with standard HCl (0.1). The end point was indicated by light pinkish color. Total crude protein was calculated by using the following formula.

$$N\ (\%) = \frac{0.14 \times (\text{Titration fina} - \text{blank}) \text{ reading} \times \text{Strength of HCl } (0.01)}{\text{Weight of sample (g)}} \times 100.$$

Crude protein is an estimate for total protein. A crude protein contains nitrogen from not only protein but non-protein sources as well. Crude protein is used for energy and helps build tissue. Crude Protein is based on a laboratory nitrogen analysis, from which the total protein content in a feedstuff can be calculated by multiplying the nitrogen figure by 100/16 or 6.25. This is from the assumption that nitrogen is derived from protein containing 16% nitrogen (AOAC, 1984). So the nitrogen content of a sample of fish is conventionally converted to crude protein by multiplying with 6.25.

Crude Protein (%) = Total Nitrogen (%) × 6.25.

Determination of fat contents

Most methods of measuring fat content depend on extracting the fat by dissolving it in a suitable solvent. In the method given below the fat is recovered from the solution by evaporating the solvent and is then weighed. Accurately weighted 5g sample was taken in the thimble paper and placed in to the hollow spaces of Soxhlet apparatus. Then 200-300 ml acetone was poured in to ground round join bottom flask of Soxhlet apparatus, and the flask was carefully heated at 70-90°C for about 2-3 hours as acetone evaporated at this temperature. Then acetone was slowly accumulated in the hollow spaces of Soxhlet apparatus and siphoning to the ground round join

bottom flask. Then acetone was taken in to pre-weighted beaker and transmitted to hot air oven at 70°C for about 45-50 minutes to evaporate acetone. The lipid containing beaker was kept in desiccator for cooling and the weight was measured after cooling. The lipid content was estimated by using following formula.

$$\text{Fat } (\%) = \frac{\text{Weight of lipid (beaker containing lipid} - \text{empty beaker) in (g)}}{\text{Weight of sample in (g)}} \times 100.$$

RESULTS AND DISCUSSION

In most fish samples the proximate composition of protein, fat, ash and moisture are between 15.74% - 16.18% ; 2.54% - 2.92% ; 2.04% - 2.42% and 78.92% - 79.24% respectively during monsoon season (Table 1) and 16.70% - 17.32% ; 3.86% - 3.96% ; 2.68% - 2.92% and 75.90% - 76.76% respectively during post-monsoon season (Table 2). In general, the proximate composition of the fish body indicates the fish quality. Therefore, proximate composition of a fish helps to assess its nutritional value in terms of energy units. Variation of proximate composition of fish flesh may also occur within same species depending upon the fishing ground, fishing season, age, sex and reproductive status of the fish. The variation in chemical composition of fish is closely related to feed intake, migratory, swimming and sexual changes in connection with spawning. The variation in proximate composition of fish flesh may vary with species variation, season, age and feeding habit of the fish (Salam *et al.,* 1995). Biochemical composition, nutritive values and seasonal variation in the chemical composition of fish tissue associated with reproductive cycle (Al-Dubaikel, 1996).

In the present study the average percentage of protein content of *L. rohita* was 15.95 ± 0.22 in monsoon season (Table 1) and 16.99 ± 0.32 in post-monsoon season (Table 2). The gradual increase in protein contents in post-monsoon season in fishes suggests a recovery of the fish from the strenuous act of spawning (Bano, 1977). The protein level of *L. rohita* were more during pre-spawning period and its level decreases during spawning period (Ganeshwade, 2015). The high value of muscle protein was observed in *Wallago attu* with ripe gonads (Jafri, 1969) During spawning muscle protein started declining gradually due to its transfer in to gonads to meet energy

Table 1. Proximate composition of the Indian major carp *L. rohita* during monsoon season (June 2019 - August 2019).

Month	Protein	Lipid	Ash	Moisture
Jun. 2019	15.74	2.92	2.42	78.92
Jul. 2019	15.92	2.86	2.12	79.10
Aug. 2019	16.18	2.54	2.04	79.24
Mean ± S.D.	15.95 ± 0.22	2.77 ± 0.21	2.19 ± 0.20	79.09 ± 0.16

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Table 2. Proximate composition of the Indian major carp *L. rohita* during post-monsoon season (September 2019 - November 2019).

Month	Protein	Lipid	Ash	Moisture
Sep. 2019	16.70	3.96	2.68	76.76
Oct. 2019	16.94	3.94	2.84	76.28
Nov. 2019	17.32	3.86	2.92	75.90
Mean ± S.D.	16.99 ± 0.32	3.92 ± 0.05	2.81 ± 0.12	76.31 ± 0.43

equirement of fish. (Hickling & Rutenberg, 1936) reported that protein synthesized and accumulated in the somatic tissues during pre-maturation period and would be utilized for gamete formation in addition to the growth of fish.

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In the present study the average percentage of lipid content of *L. rohita* was 2.77 ± 0.21 in monsoon season (Table 1) and 3.92 ± 0.05 in post-monsoon season (Table 2). The high lipid content in post-monsoon season might be due to active feeding of fish and decreased value of lipid content are found in pre-spawning period which indicates that lipid content is utilized during maturation. There was also decline in the lipid content during spawning period and this is possible due to mobilization of lipid as an energy source to meet the high energy demand during the act of ovulation and spawning, and due to low feeding intensity and low availability of food items (Ganeshwade, 2015). Reduction in the amount of lipid content in the muscles for the development and maturation of gonads has been well discussed by Raina (1999) and Samyal *et al*. (2011). In the present study, the average percentage of ash content of *L. rohita* was 2.19 ± 0.20 in monsoon season (Table 1) and 2.81 ± 0.12 in post-monsoon season (Table 2). The increase in ash content in the fish indicates higher mineral metabolism during this season (Bano, 1977). It is presumed that the amount of food and concentration of minerals after the water recedes in the post-monsoon season increased considerably. The percentages of ash content in both the seasons were more or less similar (Mishra, 2020a). In the present study, the average percentage of moisture content of *L. rohita* was 79.09 ± 0.16 in monsoon season (Table 1) and 76.31 ± 0.43 in post-monsoon season (Table 2). The changes in moisture and fat content indicate that while fat

content evidently increased, there was a decline in water content due to heavy feeding during this season, which is in good agreement with previously reported results by Huss *et al*. (1998). The moisture content found in the present study agreed with the research findings of other workers.

CONCLUSION

Present research work provides information about proximate composition of Indian major carp *L. rohita*. Seasonal variation was also found in the proximate composition of fish *L. rohita*. The moisture content was higher in monsoon season while protein, lipid and ash content were higher in post-monsoon season. The result of present study suggests that the proximate composition of fish varies from season to season. This might be due to physiological changes in environmental condition i.e. spawning, heavy feeding or starvation. This study provides valuable information on seasonal variation in proximate composition of the fish *L. rohita* in order to take necessary precaution to distinguish their nutritional value that would be useful to help the consumers in choosing fish seasonally on nutritional point of view.

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