STUDIES ON THE SEASONAL VARIATIONS IN PROXIMATE COMPOSITION OF LABEO BOGA

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Abstract:
Studies were conducted on seasonal variations in the proximate composition of Labeo boga ranging from 15±1.5 cm L and 110±15 g W, collected from River Tawi. During pre monsoon period i.e from Mar-May, the protein, lipid and ash contents were observed to be maximum i.e 17.5±0.31 for protein; 3.26±0.43 for lipid and 1.23±0.02 for ash; whereas during monsoon period (June-Aug), these energy reserves shows significant (p<0.05) decline as compared to pre monsoon season, with protein, lipid and ash content observed to be 16.46±0.64, 1.95±0.46 and 1.03±0.01 respectively. Further, the values of these energy reserves showed an increasing trend during the post monsoon season i.e from Sep-Nov; and thus protein, lipid and ash contents observed to be 17.21±0.17, 2.96±0.06 and 1.17±0.03 respectively. However, moisture content was observed to be higher in winter season (83.11±0.6) and least during pre monsoon season (77.22±1.98) owing to the higher temperature during pre monsoon season i.e from March-May, and hence more water loss from the fish body. The data thus revealed that nutritional quality of fish varies according to the season and thus results are of immense importance for human dietary.

Key Words: Season, Protein, Muscle, Lipid, Proximate, Summer & Monsoon

Introduction:
Fish plays a very prominent role in human nutrition and health. Fish provides a good source of readily digested high quality animal protein, fat, minerals and vitamins especially Vit. A, D, E. Principal composition of fish is 16-21% protein, 0.2-2.5% fat, 1.2-1.5% carbohydrate and 66-81% water (Love, 1970). Fish is one of the main food constituents in our diet as it includes essential fatty acids, amino acids and some of principal vitamins and minerals in sufficient amounts for healthy living (Borgstrom, 1961). People now are increasingly become aware of quality of food and it’s implication on their health. In many regions of the world, the food security is provided by fish, thus providing healthy and valuable supplement for diversified and nutritious diets. The proximate composition of fish is used as an indicator of quality of fish. Proximate composition involves the estimation of protein, lipid, moisture and ash contents of fresh fish body. Body composition can give idea about the nutritional importance of fish.

The biochemical composition in fishes vary widely from specie to specie, from fish to fish and even among different body parts. At any given time, the biochemical composition of an individual fish is the result of complex interactions between physical and biological characteristics like size, temperature, food availability, reproductive/spawning period etc (Basade et al 2000). Protein occur in the body in the form of amino acids and other metabolites, which serve as a building block of body. Hence, protein content can be used as an important tool to evaluate physiological standards (Pilla et al 2014). Lipids are the best energy producers next to carbohydrates (Chezian et al 2010). Protein, fat and water content of fish is important to consumers, scientists and manufacturers from many aspects including nutritional values, seasonal variations and considerations regarding processing (Murray and Burt, 2001). The seasonal changes occur in the biochemical contents of fresh water fishes indicates that biochemical constituents in any organism vary with the variation of environmental changes (Ganeshwade et al 2016). Number of workers have studied the depletive effects of maturation and spawning in the chemical composition of fish (Pandey et al. 1976; Kiran and Puttaiah, 2005). Also, seasonal variation in the biochemical composition of fresh water fish has been studied by Venkatesan et al 2013, Jan et al 2012 and many others. Proximate composition of fish is directly affected by reproductive activity and this must be considered when assessing the biochemical indices of growth (Ashwini et al. 2016). In general, the proximate composition of fish are subject to marked seasonal changes. Knowledge of proximate composition of fish is of paramount importance to evaluate it in regard to nutritive value and physiological condition (Love, 1970; Brown and Murphy, 1991).

Material and Methods:
During the present course of investigation, the live samples of Labeo boga were collected from the River Tawi. The average length and weight of fish were in the range of 15±1.5 cm L and 110±15 g W respectively. Muscle samples were collected and then subjected to biochemical analysis by using the following methods, each parameter was estimated in triplicate and mean value was calculated for protein, lipid, ash and moisture.
Proximate Composition Analysis:

- **Protein:** The protein content was determined by Lowry’s method (1951). The amount of protein /g was calculated by obtaining standard curve prepared in Bovine Serum Albumin (BSA) protein (0-100mg) and finally calculating in percent basis.

- **Lipid:** The lipid content was determined by Folch’s method. 5g of muscle was taken and then left in the dark overnight to extract lipid in 50 ml of chloroform /methanol (2:1). After about 18 hrs the mixture was filtered using Whatman paper 1. The filtrate was then given washing with 0.9% saline solution to remove the non-lipid contaminants and allowed to separate, using separating funnel. The lower phase was then taken and dried, and then weight was taken.

$$\text{Lipid} = \frac{\text{Weight of residue (mg) } \times 100}{\text{Weight of sample taken (mg)}}$$

- **Moisture:** Moisture content was estimated by the method of AOAC (1995). The moisture content was determined by drying 5g of sample in oven for 18hrs at 105±1ºC. Then sample was cooled and again weighed to take dry weight of sample.

$$\text{Moisture} = \frac{\text{Weight Loss (mg) } \times 100}{\text{Original weight of sample taken (mg)}}$$

- **Ash:** The ash content was determined by the method of AOAC (1995). 2g of muscle was taken in crucible and then burnt out by placing the sample in hot plate. The crucibles were kept in muffle furnace raising the temperature to 600ºC. Sample then ignited for 4 hrs at 600ºC and then transferred to dessicator for cooling and then was weighed.

$$\text{Ash} = \frac{\text{Weight of residue (mg) } \times 100}{\text{Weight of sample taken (mg)}}$$

- **Statistical Analysis:** The results so obtained were then statistically analysed using t-test. Level of significance was set to alpha level of 0.05.

Results and Discussion:

The results of present findings are given in Table 1-2 and Fig. 1-2 which clearly reveal the seasonal variation of proximate composition in *Labeo boga*.

<table>
<thead>
<tr>
<th>Months</th>
<th>Protein%</th>
<th>Lipid%</th>
<th>Moisture%</th>
<th>Ash%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep</td>
<td>17.32±0.02</td>
<td>2.89±0.02</td>
<td>80.25±0.02</td>
<td>1.14±0.01</td>
</tr>
<tr>
<td>Oct</td>
<td>17.29±0.01</td>
<td>3.01±0.01</td>
<td>81.82±0.01</td>
<td>1.20±0.02</td>
</tr>
<tr>
<td>Nov</td>
<td>17.01±0.01</td>
<td>2.98±0.012</td>
<td>82.14±0.03</td>
<td>1.18±0.02</td>
</tr>
<tr>
<td>Dec</td>
<td>16.92±0.02</td>
<td>2.21±0.02</td>
<td>82.40±0.03</td>
<td>1.00±0.04</td>
</tr>
<tr>
<td>Jan</td>
<td>15.98±0.03</td>
<td>2.35±0.01</td>
<td>83.82±0.04</td>
<td>1.09±0.02</td>
</tr>
<tr>
<td>Feb</td>
<td>16.33±0.02</td>
<td>2.45±0.04</td>
<td>83.12±0.01</td>
<td>1.11±0.01</td>
</tr>
<tr>
<td>Mar</td>
<td>17.21±0.01</td>
<td>2.84±0.02</td>
<td>79.52±0.02</td>
<td>1.22±0.03</td>
</tr>
<tr>
<td>Apr</td>
<td>17.45±0.02</td>
<td>3.25±0.03</td>
<td>76.14±0.04</td>
<td>1.25±0.03</td>
</tr>
<tr>
<td>May</td>
<td>17.84±0.03</td>
<td>3.70±0.01</td>
<td>76.02±0.03</td>
<td>1.24±0.03</td>
</tr>
<tr>
<td>Jun</td>
<td>17.18±0.03</td>
<td>2.45±0.01</td>
<td>77.84±0.01</td>
<td>1.04±0.01</td>
</tr>
<tr>
<td>Jul</td>
<td>15.94±0.02</td>
<td>1.52±0.01</td>
<td>78.62±0.02</td>
<td>1.02±0.02</td>
</tr>
<tr>
<td>Aug</td>
<td>16.28±0.01</td>
<td>1.88±0.02</td>
<td>79.41±0.01</td>
<td>1.04±0.01</td>
</tr>
</tbody>
</table>

Table 1: showing the monthly percental variation (Mean±S.D) in proximate composition of *Labeo boga*.

<table>
<thead>
<tr>
<th>Season</th>
<th>Protein % Mean ± S.D</th>
<th>Lipid % Mean ± S.D</th>
<th>Moisture % Mean ± S.D</th>
<th>Ash % Mean ± S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Monsoon</td>
<td>17.21±0.17&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.96±0.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>81.40±1.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.17±0.03&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Winter</td>
<td>16.41±0.47&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.23±0.12&lt;sup&gt;b&lt;/sup&gt;</td>
<td>83.11±0.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.06±0.05&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pre Monsoon</td>
<td>17.54±0.31&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.26±0.43&lt;sup&gt;c&lt;/sup&gt;</td>
<td>77.22±1.98&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.23±0.02&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Monsoon</td>
<td>16.46±0.64&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.95±0.46&lt;sup&gt;d&lt;/sup&gt;</td>
<td>78.62±0.78&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.03±0.01&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Table 2: showing the mean percental proximate variation in different seasons in muscle tissue of *Labeo boga* (Values are Mean ± SD) Within columns, Values with different letters as superscript represent significant variation (p<0.05)
Seasonal variation in proximate composition of *Labeo boga* has been examined. The average percental protein content observed during post monsoon, winter, pre monsoon and during monsoon season were 17.21±0.17, 16.41±0.47, 17.54±0.31 and 16.46±0.64 respectively. The protein content observed to be highest during the pre monsoon season (17.54±0.31) which corresponds to the preparatory phase of fish, while the low values were observed in the monsoon season (16.46±0.64). Such results with increased protein content during pre monsoon (preparatory phase) and decreased protein content during the monsoon (spawning) period were in conformity with the findings of Ganeshwade *et al.* (2016) in *Mystus Cavasius*. Similar results obtained by Bruce (1924) in the muscles of Herrings. Any seasonal change in the body composition is associated with the growth. During the period of heavy feeding, the protein content of muscle tissue increases slightly; also fish may have starvation periods for natural or physiological reasons (spawning or migration) or because of external factors such as shortage of food as was observed by Ashwini *et al.* (2016). During the post spawning season, rise in the protein content observed which indicates the voracious feeding by the fishes after spawning (1983) in *Garra mully* (Sykes) and Geetha *et al.* (1991) in *Heteropnuestes fossilis* (Bloch). Mahdi *et al.* (2006) and Jan *et al.* (2012) studied seasonal variation in the protein content in the muscles of *Shizothorax esocinus* and recorded highest value of protein content during the pre monsoon season and lowest in monsoon season. The contradictory results for the maximum values for the protein during the monsoon and minimum during the post monsoon were reported by Pillai *et al.* 2014 in the muscle of *Lutjanus Johnii*, a commercially important fish. Parulekar (1969) also reported increased protein content during spawning and minimum during early maturation phases; such
observation contradicted the present findings. Statistical analysis confirmed the differences in protein composition in fish muscle between different seasons were significant at p<0.05 level.

The average per cental lipid content observed during post monsoon were 2.96±0.06; during winter 2.33±0.12; during pre monsoon 3.26±0.43 and monsoon were 1.95±0.46. The lipid content observed to be maximum in the months of May and April (pre spawning period) while significant decline (p<0.05) in the lipid content in fish muscle was observed during the monsoon season than the pre monsoon season which could be due to possible utilization of lipid as an energy source and it’s possible mobilization from the muscle into gonad during spawning. Reduction in the lipid content during the spawning season has also been recorded in Bragmaceros melellandi by Parulekar and Bal, (1969); in Mugil cephalus by Das and in Ambassis commersoni by Bumb,( 1972). Also, high values of lipid content were observed during the post monsoon period (Sep-Nov) and pre monsoon (Mar-May) period which might be due availability of food; as lipid values depend upon the food availability, feeding factor as well as feeding condition of fish. Similar observations were reported by Ganeshwade et al. (2016) and Huss; 1988, 1995. Piggott and Tucker (1990) observed the differences in these values could be due to many factors as fat content in fish may vary according to the seasons, specie and geographical variations. Also, differences in the total lipid content could be due to the age variation and maturity within same specie as also suggested by Ashwini et al (2016). Such a seasonal trend of variation in the lipid content shows that fishes like other animals store lipid in the muscle for the supply of energy during starvation, reproductive phases and infestation period. Statistical analysis confirmed the differences in lipid composition in muscle tissue of fish between different seasons were significant at p<0.05 level.

The average per cental moisture content observed in the undertaken study during post monsoon, winter, pre monsoon and monsoon were 81.40±1.01, 83.11±0.6, 77.22±1.98 and 16.4±0.64 respectively. The results revealed that moisture content observed to be lowest in the pre monsoon season i.e Mar- May (77.22±1.98) and increases significantly through the spawning to the post spawning season and thus showing maximum value in winter season (83.11±0.6). This is an accreditation to the findings of various authors (Basade et al 2000; Dygert, 1990). Also, the moisture content of the fish muscle shows an inverse relationship with lipid and proteins as has also been observed by Lone and Matty, (1980); winfre and Stickney, 1981. Ash content represents the total inorganic matter as mineral constituents in the tissue. The average per cental ash content observed during the post monsoon, winter, pre monsoon and monsoon were 1.17±0.03, 1.06±0.05, 1.23±0.02 and 1.03±0.01 respectively. The ash content in fish showed slight changes only with respect to seasons. The Ash content decreases during the monsoon/spawning period while higher values observed in the pre monsoon and post monsoon season. Such findings are in line with the findings of Basade et al, 2000. Muscle ash content is known to be influenced by season, sex, food as has been reported by Vinograov, (1953); Nataranjan and Srinivasan (1961). During the pre monsoon season and post monsoon period, ash content observed to be higher which indicates greater mineral requirements during the growth phase i.e pre monsoon and post monsoon period. Similar observation reported by Khwaja, (1966).

Conclusion:

Such studies on the nutritional composition of fish reveals the nutritional status of fish under study also provide information on the health condition of fish. The proximate composition values obtained for Labeo boga would be useful to the consumers in choosing the fish based on it’s nutritional importance.

References: