ABSTRACT
Aquatic food is an important source of nutrients in the human diet. Fish and shell fishes are a good source of amino acids, proteins, fat, minerals, vitamins, moisture, ash and other nutrients. Aquaculture emerged worldwide in the last two decades. Fish and shell fishes have very low saturated fats, which is the fat that raises cholesterol levels in the body. Minerals are essential in fish and shell fishes nutrition. Its biochemical composition may be different by several factors such as species, environmental factors, size, age, natural diet and feed composition and it changes seasonally. There are changes in the proximate chemical composition, fresh mass, water content, ash content, organic constituent, lipid and protein content and energy levels of fish and shell fishes. There are many inorganic elements in the body of fish and shell fishes associated with the skeletal structure and biochemical’s, involved in vital physiological functions. The knowledge of the biochemical composition of any edible organism is extremely important as the nutritive value is reflected in the biochemical contents. The present investigation was undertaken to analyze the comparative study about biochemical composition of different fishes and shell fishes, commonly available in India.

To estimate and compare the biochemical composition of five fish species (*Catla catla*, *Labeo rohita*, *Cyprinus carpio*, *Channa maculata*, *Aquilla aquilla*) and five shell fishes (*P. paludosa*, *P. canaliculata*, *P. lineata*, *P. cumigni* and *Pila globosa*) were collected and subjected to composition through moisture, protein, ash and fat determination. Considerable variations were observed in the proximate composition of different fish and shell fish species.

KEYWORDS: Fish, Shell Fishes, Nutrients, Biochemical Composition

INTRODUCTION
Biochemical studies on fishes and shell fishes have drawn the attention of several researchers because their tissues are a major source of protein, carbohydrate and lipid and have high calorific value [1]. The importance of chemical analysis in marine fishes and prawns is to express the food value in terms of energy units [2]. In India, various studies have been carried out on the biochemical constituents in relation to reproductive cycle of fishes and
prawns [3] but very little information is available on the nutritive and calorific value. Fishes and shell fishes are a key stone of an aquatic ecosystem. Snails are trading is one of domain business because of molluscs farms [4]. The largest freshwater apple snail, *Pila globosa* is an edible snail having an increasing demand throughout the world [5] mentioned that shell fisheries is a solution to the world food problem because it is an available source of low cost animal protein for poor people. Proximate composition generally means percentage composition of basic constituents such as water, protein, lipids, carbohydrate and minerals. The energy yielding nutrients like protein, lipid and carbohydrate are considered as macronutrients are present in high level where as non energy yielding nutrients like vitamins and minerals are micronutrients and are present in small quantities [6]. Fish and shell fishes are long been recognized as a valuable source of high quality protein in the human diet. In recent years, fish and shell fish lipids have also assumed great nutritional significance owing to their protective role against the development of cardiovascular disease and rheumatoid arthritis.

Fish and shell fishes are the most important animal protein and other vital nutrients sources that are widely consumed by all races and classes of people. Fish and shell fish meat contains significantly low lipids and high water compared to that of beef or chicken and is favored over other white or red meats[7]. Lipids from fish are well known as a rich source of long-chain n-3 polyunsaturated fatty acids (LC n-3 PUFA) such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which cannot be synthesized by humans and commonly obtained from the diet [8]. Polyunsaturated fatty acids from fish and shell fish have been reported to have preventive and/or curative effects for several diseases including arterial hypertension cancers and inflammatory diseases [9]. It may also aid in lowering the risk of Dementia, Alzheimer’s diseases [10], and prevent the cardiovascular diseases [11]. Proximate composition is a good indicator of physiology which is needed for routine analysis of fisheries [12]. However, fish of various species do not provide the same nutrient profile to their consumers. These differences in the nutritional compositions of different species may be attributed to food composition, food and feeding habit, feeding rate, habitats, sex, age, size, genetic traits and season/migration. Besides being used as food, fish and shell fishes are also increasingly demanded for use as feed. However, information concerning the chemical composition of freshwater fishes and snails in general is valuable to nutritionists concerned with readily available sources of low-fat, high-protein foods such as most freshwater fishes and shell fishes and to the food scientist who is interested in developing them into high-
protein foods, while ensuring the finest quality flavor, color, odor, texture, and safety obtainable with maximum nutritive value [13].

In the present communication, an attempt is made to work out and compare the biochemical composition in different species of selected fishes (five) and shellfishes (five) available in India.

MATERIAL AND METHODS:

Preparation of sample:

The sample of the five fish species (*Catla catla, Labeo rohita, Cyprinus carpio, Channa maculata, Anquilla anquilla*) and five shell fishes (*P. paludosa, P. canaliculata, P. lineata, P. cumingi, Pila globosa*) were collected from Waddepally lake and brought immediately to the laboratory for further studies. The animals were kept in the glass trough in tap water for 24 hours, for emptying and cleaning the gutters. The shell was removed and the entire body tissue was dried at 55°C (constant temperature), for 24 hours in the hot air oven and fishes also same process. Then the dried meat was powdered and the required quantity of powder was taken for the estimation of total carbohydrate, protein, lipid, moisture, calorific content.

Estimation of protein:

Folin-Ciocalteu phenol method of Lowry et al. was adopted for the estimation of total proteins in the tissue [14]. The dry tissue sample weighing 10 mg was thoroughly homogenized with 1 mL of deproteinizing agent (10% TCA) by keeping the tubes in ice. All samples were centrifuged for 20 min at 3 000 r/min. The precipitate obtained was used for protein estimation. The precipitate was dissolved in 2 mL 1 mol/L NaOH and to 1 mL of this solution, freshly prepared 5 mL alkaline reagent was added. This was kept at room temperature for 10 min, after which 0.5 mL of 1 mol/L Folin- Ciocalteu reagent was added and mixed rapidly. A standard stock solution was prepared using bovine serum albumin crystals at a concentration of 25 mg/5 mL NaOH. Different dilutions in the range of 0.25 to 2.50 mg/mL were prepared from this stock solution, the alkaline reagent and Folin-Phenol reagent was added as in the case of tissue samples. A blank was prepared with 1 mL 1 mol/L NaOH and treated the same way as earlier mentioned. All the test tubes were kept for 30 min at room temperature, the blue colour developed, and the optical density (OD) was evaluated against the blank at 660 nm:
% Composition of protein = \( \frac{\text{Standard value} \times \text{OD of sample}}{\text{Weight of tissue}} \times 100 \)

**Estimation of carbohydrate:**

For the estimation of total carbohydrate content, the procedure of Dubois et al. using phenol-sulphuric acid was followed [15]. About 5 mg of oven-dried tissue was taken for carbohydrate analysis. The tissue was taken in a test tube and 1 mL of phenol (5%) and 5 mL concentrate H\textsubscript{2}SO\textsubscript{4} were added in quick succession. The tubes were kept for 30 min at 30 °C and the OD of the colour developed was measured at 490 nm against the blank. D-glucose was used as a standard and it had an OD value of 0.1 carbohydrates as calculated by using the formula:

\[
% \text{Composition of carbohydrate} = \frac{\text{Standard value} \times \text{OD of sample}}{\text{Weight of tissue}} \times 100
\]

**Estimation of lipid**

The chloroform-methanol extraction procedure of Floch et al. was used for extracting lipid from the various body parts [16]. The lipid content was estimated gravimetrically by following method. The lipid was extracted from 500 mg of powdered oven-dried tissue with 5 mL of chloroform: methanol (2:1) mixture added. The mixture was filtered by a micro filter. This extract was taken in a pre-weighed beaker and oven dried. Beaker was reweighed with lipid. The difference in weight was taken as total lipid content and the percentage was calculated as follows:

\[
% \text{Composition of lipid} = \frac{\text{Weight of lipid}}{\text{Weight of tissue}} \times 100
\]

**Estimation of calcium:**

To the 5 g of wet tissue samples, mixture of hydrochloric acid, nitric acid and perchloric acid (HCl, HNO\textsubscript{3}-HClO\textsubscript{4}) at a ratio of 10:5:1 was added for digestion at 300 °C. The digests were filtered suitably and aspirated in digital flame photometer. The obtained values were expressed in mg/100 g. The level of calcium was estimated by following the method of Guzman and Jimenez [17].

**Estimation of phosphorus and iron:**

The tissue samples collected were stored in pre-cleaned polythene contains and were later aspirated in an inductively coupled plasma spectrophotometer (ICP) after calibrating the instrument with appropriate blank and series of known standards for the minerals.
(phosphorus and iron). The phosphorus and iron levels were estimated by following the method of Topping [18].

**Calorific content estimation:**

The calorific content was calculated from the biochemical composition by using the calorific equivalents of 5.65 kcal/g for protein, 4.45 kcal/g for lipid and 4.10 kcal/g for carbohydrate as suggested by Brett and Groves and expressed in dry weight basis [19].

**Estimation of moisture:**

A known quantity of the wet tissue was dried in a hot air oven at a constant temperature of 60 °C until the wet tissue was dried completely. The moisture content was estimated by subtracting the dry weight of the sample from the total weight. The percentage of moisture was calculated [20].

**RESULT AND DISCUSSION:**

Bio-chemical compositions of both snail and fish species are given in tables and figure 1 and 2. Higher levels of carbohydrate, protein and lipids were found in tissues of fish species.

**Table 1: Proximate composition of the tissues of Five Fish species**

<table>
<thead>
<tr>
<th>S no</th>
<th>Fish species</th>
<th>Carbohydrate (%)</th>
<th>Protein (%)</th>
<th>Lipid (%)</th>
<th>Moisture (%)</th>
<th>Ca (mg/100g)</th>
<th>P (mg/100g)</th>
<th>Fe (mg/100g)</th>
<th>Calorific value (kcal/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Catla catla</em></td>
<td>6.23±0.02</td>
<td>22.10±0.02</td>
<td>1.32±0.03</td>
<td>70.01±0.02</td>
<td>277.02±0.02</td>
<td>216.06±0.02</td>
<td>4.54±0.02</td>
<td>67.48±0.02</td>
</tr>
<tr>
<td>2</td>
<td><em>Laebio rohita</em></td>
<td>7.23±0.02</td>
<td>20.10±0.02</td>
<td>1.30±0.03</td>
<td>75.01±0.02</td>
<td>276.02±0.02</td>
<td>213.04±0.03</td>
<td>4.56±0.02</td>
<td>68.44±0.02</td>
</tr>
<tr>
<td>3</td>
<td><em>Cyprinus carpio</em></td>
<td>6.20±0.02</td>
<td>21.10±0.02</td>
<td>2.30±0.03</td>
<td>75.01±0.03</td>
<td>260.02±0.02</td>
<td>212.06±0.03</td>
<td>5.56±0.02</td>
<td>66.42±0.02</td>
</tr>
<tr>
<td>4</td>
<td><em>Channa maculata</em></td>
<td>8.23±0.02</td>
<td>23.10±0.02</td>
<td>3.30±0.03</td>
<td>60.01±0.02</td>
<td>265.02±0.02</td>
<td>214.06±0.03</td>
<td>4.54±0.02</td>
<td>64.42±0.02</td>
</tr>
<tr>
<td>5</td>
<td><em>Aquilla aquilla</em></td>
<td>5.23±0.02</td>
<td>20.11±0.02</td>
<td>1.29±0.03</td>
<td>60.02±0.02</td>
<td>264.03±0.03</td>
<td>215.06±0.03</td>
<td>6.52±0.02</td>
<td>63.44±0.02</td>
</tr>
</tbody>
</table>
The estimated Carbohydrate content (%) in fishes *Catla catla*, *Laebio rohita*, *Cyprinus carpio*, *Channa maculata*, *Aquila aquilla* is 6.23, 7.23, 6.20, 8.23, 5.23 respectively. The variation of carbohydrate content is more or less similar to one another and in snails viz: *P.paludosa*, *P.canaliculata*, *P.lineata*, *P.cumingi* and *Pila globosa* is 5.23, 4.20, 3.20, 4.23, and 7.20 respectively. The carbohydrate content is higher levels in fishes compare to shell fishes.

The estimated protein content (%) in fishes *Catla catla*, *Laebio rohita*, *Cyprinus carpio*, *Channa maculata*, *Aquila aquilla* is 22.10, 20.10, 21.10, 23.10 and 20.11 respectively. The variation of protein content also more or less similar to one another and in snails viz: *P.paludosa*, *P.canaliculata*, *P.lineata*, *P.cumingi* and *Pila globosa* is 20.63, 20.53, 19.53, 18.53 and 22.40 respectively. The protein content is higher levels in fishes compare to shell fishes.
fishes. The estimated lipid content (%) in fishes *Catla catla, Laebio rohita, Cyprinus carpio, Channa maculata, Aquilla aquilla* is 1.32, 1.30, 2.30, 3.30 and 1.29 respectively and in snails species viz: *P.paludosa, P.canaliculata, P.lineata, P.cumingi* and *Pila globosa* is 1.03, 1.06, 1.30, 1.04, and 2.08 respectively. The variation of lipid content more or less similar in both snails and fishes.

Moisture is the major component in the tissues fishes and shell fishes. The estimated content (%) for *Catla catla, Laebio rohita, Cyprinus carpio, Channa maculata, Aquilla aquilla* is 70.04, 75.01, 75.02, 60.01 and 60.02 respectively. Therefore table 1&2 indicates that similar variation in the moisture contents of the experimented fish and shell fishes. Mineral also constitute important components of hormones, enzymes and enzyme activators in human nutrition [21]. Mineral deficiencies can cause biochemical, structural and functional pathologies which depend on several factors, including the duration and degree of mineral deprivation. The main aim of the present study was to ascertain the levels of nutritionally significant minerals and their variations in fishes and shell fishes. The estimated mineral content (%) for *Catla catla, Laebio rohita, Cyprinus carpio, Channa maculata and Aquilla aquilla* among the species calcium attained the highest level was obtained from *Catla catla* (277.02±0.02 mg/100g) and the lowest level was obtained from *Aquilla aquilla* (264.03±0.03) and in shell fish species calcium attained the highest level was *Pila globosa* (270.03±0.02) and lowest level was obtained from *P.paludosa* (250.02±0.02). The calcium content is higher levels in fishes compare to shell fishes.

**CONCLUSION**

In general, aquatic food is one of the most nutritionally balanced foods. The aquatic food diet helps to control weight and goes a long way towards preventing heart diseases. Studies on mineral analysis, carbohydrate, protein, lipid composition of commercial aquatic food in India are limited. This might be due to lack of awareness on the benefits of these nutrients particularly from molluscan meat. The nutritional values of fishes and shell fishes do not bring the limelight so far, so consumption of these nutrient rich molluscs and fishes has not attracted attention. The results of the present study provide information about the protein, lipid composition and also suggest the consumption of this fishes and shell fishes. Therefore the balanced and healthy diet is a prerequisite for good health.
ACKNOWLEDGEMENTS:

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