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Gita Bezbaruah
Department of Zoology, Tihu College, Tihu, Nalbari, Assam, India

Dipali D Deka
Department of Zoology, Tihu College, Tihu, Nalbari, Assam, India

Corresponding Author:
Gita Bezbaruah
Department of Zoology, Tihu College, Tihu, Nalbari, Assam, India

Variation of moisture and protein content in the muscle of three catfishes: A comparative study

Gita Bezbaruah and Dipali D Deka

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Abstract
Three species of Catfishes (*Mystus vitattus*, *Clarius batrachus* and *Heteropneustus fossilis*) were analyzed for proximate composition i.e. Moisture and Protein content to evaluate their nutritional value. The Moisture content of the fish species ranged between 71.2 ± 0.07% to 79.45±0.04%. The muscle protein content of the fishes were ranged between 14.49±0.96% to 18.14±0.07%.The mean values of moisture and Protein content were found statistically significant (P<0.05) among all three species. The moisture content in *Mystus vittatus* was higher than the other samples at highly significant (p<0.001) level. The amount of moisture content in *Clarius batrachus* is higher than *Heteropneustus fossilis* but lower than *Mystus vittatus* at highly significant level (p<0.001). There was a non significant (p>0.05) difference between moisture content in *Mystus vittatus* and *Clarius batrachus*. The Protein content in *Heteropneustus fossilis* is higher than that of the other fish samples at highly significant (p<0.001) level. The protein content in *Clarius batrachus* is higher than *Mystus vittatus* but lower than *Heteropneustus fossilis* at highly significant level (p<0.001). The protein content in *Mystus* vittatus and *Clarius* batrachus is none significantly (p>0.05) different. Variation of protein content of different fishes helps nutritionists and researchers who are striving to improve the nutritive value, Processing and marketing of those fish species and in fishing industry. The experiment were conducted during a time period of June 2019 to February 2020. Fish samples were collected from Tihu local market and were brought to the Biotech Hub laboratory of Tihu College, Tihu, Nalbari, Assam.

Keywords: Catfish, protein, Assam

1. Introduction
The great resource of our rivers, oceans and lakes not only provide recreational activities to rejuvenate the soul, they have also been providing important sustenance in the form of fish for thousands of years. Freshwater fishes play a vital role for animal proteins in the world [1]. Approximately 16 percent of animal proteins consumed by the world's population are derived from fishes, and over one billion people depend on fish as their main source of animal proteins [2]. Fishes are easily digestible nature of proteins and are important source of essential minerals. Biochemical composition of fish shows very wide variation from one species to another, within the same species in different portions of the body, from season to season, according to age, size, growth etc [3]. Fish is recommended as a part of a healthy diet and it is considered to be a key component of a cardio-protective diet. Furthermore, fish is an important source of various nutrients, such as protein, n-3 fatty acids, vitamin D, iodine, and selenium, which may contribute to a healthier metabolic profile [4, 5]. Fish is a major source of food for mankind, providing with a significant amount of the animal protein diet, excellent dietary sources of highly unsaturated fatty acid (HUFA) and polyunsat- urated fatty acid (PUFA), especially the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) [6].
Mystus vittatus is a small indigenous fish species is rich in protein, micronutrients, vitamins and minerals not commonly available in other foods [7]. It is also an economically important species for the aquarium industry in Bangladesh [8].Catfishes are good source of omega-3 fatty acid than the frozen fishes. Many studies have shown that the omega-3 fatty acid is important for brain development. Many experts of several countries explain the importance of omega-3 fatty acid and conclude that it must be consumed in adequate quantity The fishes belonging to

the genus *Clarias* has been traveled to many continents, adapting itself successfully into extreme environmental conditions. *Clarias batrachus* in some parts of India, particularly in [9]. West Bengal & Tripura is considered as a medicinal fish & traditionally remained as a tremendous source of nutrition for the pregnant & lactating mothers, the elderly & children. Many a times consumption of "Magur" (Local name of *Clarius batrachus*) is prescribed prophylactically to the anemic & malnourished individuals as well as for the convalescent of the patients due to the nutritional superiority. Intensive *Clarius batrachus* culture in several Indian states as in rural Bengal & Tripura have much potential towards livelihood development, employment generation & ensuring nutritional enrichment in the regular diet among of the people [10]. Heteropneustes fossilis is an important tropical food fish. It has very high iron content and fairly high content of calcium compared to many other freshwater fishes [11]. Knowledge of the proximate composition of different fishes can be used to estimate the food value and to plan the most appropriate industrial and commercial processing [12].

The present study was undertaken with the objectives to analyze the proximate composition (Moisture Content, Protein content) of three Catfish species i.e *Mystus vittatus*,*Clarius batrachus* and *Heteropneustus fossilis* that harvested from pond and open water stock and evaluate their nutritional quality.

2. Materials and Methods

2.1. Collection of samples

Three species of Catfishes *Mystus vittatus*,*Clarius batrachus* and *Heteropneustes fossilis* were collected from Tihu local market. Collected samples were brought to the Biotech –Hub Laboratory of Tihu College, Tihu. The samples were taken to the laboratory, stored in air tight polythene bags at 4°C until biochemical investigations were done.

2.2. Biochemical analysis

Proximate composition (moisture, protein) of the samples was analyzed. The sample is heated under specified conditions, and the loss of weight is used to calculate the moisture content of the sample [13]. The estimation of protein was done by Lowry method [14]. The experiment was conducted during a period from June 2019 to February 2020.

2.3. Statistical Analysis

The results for three freshwater fishes *Clarius batrachus*, *Mystus vittatus* and *Heteropneustus fossilis* are presented as mean ± standard deviation acquired from the statistical analysis. Statistical analysis was carried out using SPSS (Statistical Package for Social Science. Version16.0). The significant differences between means were calculated by one way Analysis of Variance (ANOVA) followed by Tukey range test.

3. Results

Moisture content in the fish samples during this study varied greatly. According to the following results the moisture content was in range of 71.20% to 79.41%. In *Mystus vittatus* 79.41%, in *Clarius batrachus* 78.58%, in *Heteropneustus fossilis* 71.20% (Table1). The moisture content in *Mystus vittatus* was higher than the other samples at highly significant (p<0.001) level. The moisture content in *Clarius batrachus* is higher than *Heteropneustus fossilis* but lower than M.vittatus at highly significant level (p<0.001). There was a non significant (p>0.05) difference between moisture content in *Mystus vittatus* and *Clarius batrachus*. (Table 1)

Table 1: Moisture content in the muscle of three Catfishes (% fresh matter basis)

Sl. No	Fish sample	Min	Max	Mean	SD(±)
1	*Mystus vittatus*	79.38	79.44	79.41	0.03
2	*Clarius batrachus*	78.24	79.44	78.58	0.74
3	*Heteropneustus fossilis*	71.12	71.26	71.20	0.07

*****Min= Minimum, Max=Maximum, SD=Standard Deviation

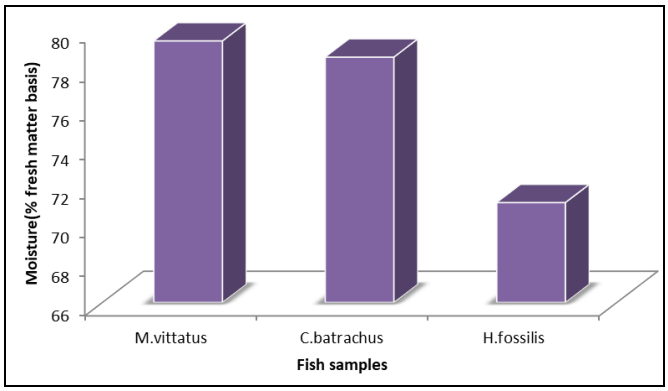

Fig 1: Histogram showing moisture content in the muscle of three catfishes (% fresh matter basis)

Protein content in the fish samples were found different from each other. According to the following results the protein content lies in between 14.49% to 18.14%. In *Mystus vittatus* 14.49%, in *Clarius batrachus* 15.70%, in *Heteropneustus fossilis* 18.14%. The Protein content in *Heteropneustus fossilis* is higher than that of the other fish samples at highly significant (p<0.001) level. The protein content in *Clarius batrachus* is higher than *Mystus vittatus* but lower than *Heteropneustus fossilis* at highly significant level (p<0.001). The protein content in *Mystus vittatus* and *Clarius batrachus* is non significantly (p>0.05) different. (Table 2)

Table 2: Protein content in the muscle of three Catfishes (% fresh matter basis)

Sl. No	Fish sample	Min	Max	Mean	SD(±)
1	*Mystus vittatus*	15.35	15.67	14.49	0.96
2	*Clarius batrachus*	15.67	15.72	15.70	0.02
3	*Heteropneustus fossilis*	18.08	18.23	18.14	0.07

***** Min=minimum, Max=maximum, SD=Standard deviation

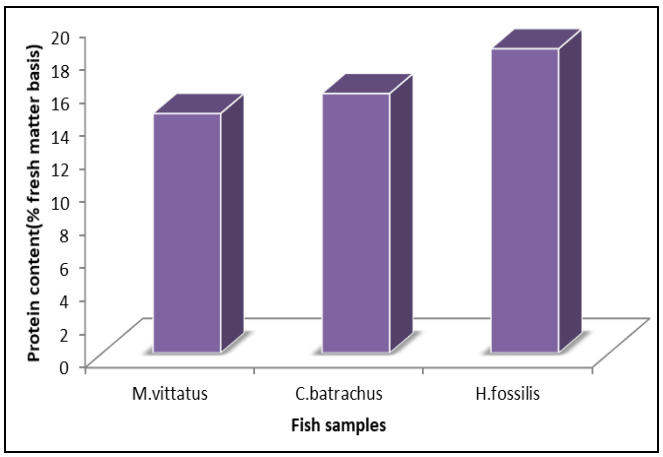

Fig 2: Histogram showing Protein content in the muscle of three Catfishes (% fresh matter basis)

4. Discussion

4.1. Moisture content

It has been evident from the earlier research work that the moisture content found in *Mystus vittatus* is 79.45% [8]. The moisture content in *Clarius batrachus* was found 78.25g/100g [3]. The moisture content in *Heteropneustus fossilis* ranged from 54.5% to 62.4% [15]. The results obtained during this experiment were quite similar as reported by these workers. The moisture content of five freshwater fish species viz., *Mystus vittatus*, *Ompok bimaculatus*, *Channa striata*, *Wallago attu* and *Pangasianodon hypophthalmus* were studied [16]. The composition of fishes also largely depends upon the water temperature [11]. The ration levels (fish feed) had significant effects on growth and conversion efficiencies in fingerling H. fossilis [17]. The variation in nutrients of this species often appears to vary from season to season; probably the basic causes of change in composition are usually variation in amount and quality of food that the fish eats and the amount of movement it makes as well as physiological activities [18].

4.2. Protein content

The total protein content in various tissues in fishes were investigated by various authors and correlated their results with different factors like seasons, habitat differences, processing methods, sex differences, breeding seasons and non-breeding seasons, size and age differences etc. There are so many works have been performed by different workers regarding the protein content in the muscles of Catfishes which are summarized as below.

It was observed that protein content found in *Mystus vittatus* was 17.59% [8]. The protein content found in *Clarius batrachus* was 15.05 g/100g [3]. The Protein content in *Mystus vittatus* was found 14.94% [16]. Protein content in *Heteropneustus fossilis* ranged from 17.90% to20.5% [15]. The values of protein content found during this study were similar in case of both *Clarius batrachus* and *Heteropneustus fossilis* but the reduced value of protein found in *Mystus vittatus* during this study might be due to feeding habit as the proximate composition may vary due to supply of higher protein and lipid concentrated artificial feed in the pond whereas open water sources are not limited [19]. The composition of a particular species often appears to vary from one fishing ground to another, and from season to season as the protein and ash contents were also greatly influenced by seasons. In general protein and ash values were low during winter and high during summer or monsoon months. The seasonal cycles of various biochemical constituents in the two tissues of the fish seemed to be governed partly by feeding and partly by the cycle of maturation and depletion of gonad [20].

5. Conclusion

The tested parameters like moisture and protein content are found different in each fish sample. The moisture content *Mystus vittatus* was found higher than *Clarius batrachus* and *Heteropneustus fossilis*. On the other hand the protein content in *Heteropneustus fosssilis* was found higher as compared to other fish samples. The high moisture content in fish increases the deterioration level when it is stored for longer period of time. This is because micro- organisms are highly active with high moisture content. From the nutritional point of view of protein requirement in the diet *Heteropneustes fossilis* (Singhi) is more efficient than the *Mystus.vittatus* (Tengara) and *Clarius batrachus* (Magur).

This study will provides required information regarding on variation in protein content of the following fish species. Biochemical analysis of fish tissue are of great importance in order to estimate the nutritional values of fishes and also necessary to ensure their original market values. It is also important to determine the composition of fish in relation to make the best use of it as a food. This type of study will surely help to develop convenient technology of processing fish and fish products.

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