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COMPARATIVE STUDY ON NUTRITIONAL COMPOSITION OF SEVEN AIR-BREATHING FRESHWATER FISHES FROM ASSAM, INDIA

Dorothi Katyayan[1], Manmi Kalita[2*] and Pradip Kumar Sarma[3]

[1]Post Graduate Student, Department of Zoology, Bhattadev University, Bajali, Assam, India
[2]Research Scholar, Department of Zoology, Bhattadev University, Bajali, Assam, India
[3]Associate Professor, Department of Zoology, Bhattadev University, Bajali, Assam, India

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ABSTRACT

This study was carried out to compare the nutritional values of seven freshwater, air-breathing fish species commonly found in Assam, India. The fish included *Channa punctata, Channa striata, Channa gachua, Channa marulius, Heteropneustes fossilis, Anabas testudineus*, and *Clarias magur*. Samples were collected from the Kamrup district, and their protein, fat, moisture, ash, and carbohydrate contents were analyzed. The results showed that *Channa marulius* had the highest protein content at 24.94%, while *Clarias magur* had the lowest at 14.3%. Interestingly, *Clarias magur* contained the most fat (8.14%), and *Heteropneustes fossilis* had the least (1.52%). Moisture levels were high in all species, while ash and carbohydrate contents were quite low. These findings could be helpful for researchers, nutritionists, fish farmers, and consumers in choosing fish based on their nutritional benefits and for future studies.

INTRODUCTION

Freshwater fish species hold important commercial value due to their nutritive benefits. Fish is considered as an excellent source of protein and essential nutrients required for maintaining a healthy body (Adeniyi *et al*., 2012). The fishery sector plays a vital role in providing protein-rich food and generating valuable foreign exchange (Varadharajan *et al*., 2013). In India, the nutritional composition of fish has mainly been studied to measure their nutritional value. Fish protein is known for its high digestibility and is regarded as having significant biological and growth-promoting properties (Shekkar *et al*., 2004), containing all ten essential amino acids in adequate amounts for human consumption (Bhilave *et al*., 2013). Considerate the nutritional composition is vital for estimating the nutritional value of various species, not only fish but also for quality assessment and optimal utilization of these natural resources (Rodriguez-Gonzalez *et al*., 2006). Nowadays, consumers are increasingly interested in understanding the nutritional value of the products they consume. Generally, the biochemical composition of the entire fish body reflects its quality. Consequently, the proximate biochemical composition of a species is helpful in determining its nutritional and edible value in terms of energy elements when compared to other species (Arunachalam *et al*., 2017). Thus, the current study was conducted to compare the nutritional composition of seven air-breathing freshwater fish species (i.e., *Channa punctata, Channa striata, Channa gachua, Channa marulius, Heteropneustes fossilis, Anabas testudineus,* and *Clarias magur*) from Kamrup district of Assam, India.

*Corresponding author: **Manmi Kalita**

Research Scholar, Department of Zoology, Bhattadev University, Bajali, Assam, India

MATERIALS AND METHODS

Study areas, sample collection and preservation

The fish sample used for the experiment was air-breathing freshwater fish and they were collected from the local fish market of Kamrup district, Assam, India. The collected freshwater fish samples were taken to the fish biology and fishery sciences laboratory, Department of Zoology, Bhattadev University in air tight polythene bags and stored at 4°c for further nutritional study. The whole experiment was conducted during the month of April, 2024 to May, 2025.

Method for Biochemical Analysis

1. Protein content

Protein content was determined by Lowry's method with slight modification (Lowry *et al*., 1951). To a 10 mg of sample 1 ml of 1N NaOH was added for protein extraction in water bath for 30 minutes. Thereafter, it was cooled at room temperature and neutralized with 1 ml of 1N HCL. The extracted sample was centrifuged at 2000 rpm for 10 minutes, and an aliquot of the sample (1 ml) was further diluted with distilled water (1/9 v/v). From the diluted sample, 1 ml was taken and treated with 2.5 ml of mixed reagent (carbonate – tartarate – copper) and 0.5 ml of 1N Folin's reagent. After 30 minutes, sample absorbency was read at 750 nm using UV-visible spectrophotometer (EVOLUTION 201, Thermo Scientific) and results were expressed in percentage.

2. Lipid content

3 gm of dried sample was extracted with petroleum ether in a soxhlet apparatus for about 8 hours. After that the petroleum ether was removed by fractional distillation. The flask was dried at room temperature and the amount of lipid in the flask was calculated.

% lipid= (weight of lipid/ weight of sample) x 100.

3. Moisture content

5g of dried fish sample was taken and kept at 105° C in the hot air oven until a constant weight is obtained. The difference in weight can be calculated and expressed as % moisture content of the sample. Percentage can be calculated by the following formula:

Moisture % = (weight of tissue – dry weight of tissue/ weight of tissue) x100

4. Ash content

About 3-5g prepared sample was taken in pre-weighed porcelain crucible and was placed in muffle furnace at 550°C for 6 hours. Then the crucibles were a cooled in desiccators. After recording the weight of ash, the ash content of the sample can be computed as below;

% Ash content = (Weight of ash /weight of sample) × 100

5. Carbohydrate content

Carbohydrate content was calculated based on difference calculation [carbohydrate = 100% - (% of moisture+% of ash+ % of protein+ % of lipid)].

RESULT AND DISCUSSION

During the present study, the protein content was recorded at 15.6%, 19.38%, 24.92%, 24.94%, 18.28%, 16.66%, and 14.3% for *C. punctata, C. striata, C. gachua, C. marulius, H. fossilis, A. testudineus,* and *C. magur*, respectively. The lipid content for these species was recorded as 5.04%, 2.34%, 2.24%, 1.66%, 1.52%, 3.96%, and 8.14%. The moisture content was found to be 76.42%, 75.36%, 69.7%, 69.22%, 78.5%, 75.2%, and 72.24% for *C. punctata, C. striata, C. gachua, C. marulius, H. fossilis, A. testudineus,* and *C. magur*, respectively. The ash content was determined to be 2.4%, 2.3%, 1.8%, 3.0%, 1.32%, 2.42%, and 3.46% for *C. punctata, C. striata, C. gachua, C. marulius, H. fossilis, A. testudineus,* and *C. magur,* respectively. The carbohydrate content for *C. punctata, C. striata, C. gachua, C. marulius, H. fossilis, A. testudineus,* and *C. magur* was found as 0.76%, 0.6%, 1.2%, 1.44%, 0.38%, 1.74%, and 1.76% in each. The protein content of the fresh fish samples ranged from 14.3% to 24.94%, with the highest value at 23.94% in *C. marulius* and the lowest value at 14.3% in *C. magur*. The lipid content varied from 1.52% to 8.14%, with the maximum value in *C. magur* and the minimum value in *H. fossilis*. The moisture content ranged from 69.22% to 78.5%, highest value at 78.5% in *H. fossilis* and lowest value to 69.22% in *C. marulius*. The ash content varied from 1.32% to 3.46%, with the highest in *C. magur* and the lowest in *H. fossilis.* Lastly, the carbohydrate content ranged from 0.38% to 1.76%, with the highest in *C. magur* and the lowest in *H. fossilis*.

According to Bijaylakshmi, *et al*.,(2014)*C. striata* contains high moisture content i.e. 80.11% and low lipid content i.e. 1.66%. *T. fasciatus* contained high lipid content (5.93%). The lipid value and moisture value of *C. striata* was found to be 1.47% lipid and 82.66% moisture reported by Ahmed *et al*., 2012. According to Sarma *et al*.,2019, protein and crude fat in all six fish ranged from 15.65 (*S. phasa*) to 20.88% (*C. garua)* and 2.91 (*C. garua*) to 13.23% (*S. phasa*), respectively.Protein was estimated in *A. mola* (18.46%), *G. chapra* (15.23%), *P. chola* (14.08%), *C. nama* (18.26%), *P. atherinoides* (15.84%) and in *A. coila* (16.99%) respectively. Fat content was recorded as 4.10%, 5.41%, 3.05%, 1.53%, 2.24% and 3.53% respectively in the six species of fish (Mazumdar *et al*.,2008).

Jahan *et al*. (2017) recorded that the protein, lipid, moisture and ash content of five samples ranged from 54.31 (*P. sophore*) to 68.90% (small prawns), 13.33 (*P. sophore*) to 19.33% (*L.* rohita), 11.55 (*L. rohita*) to 13.95% (*H. molitrix*) and 0.16 (small prawns) to 0.44% (*C. mrigala*), respectively. The highest value of carbohydrate was 19.23% (*P. sophore*) and the lowest was 1.75% (*C. mrigala*).

Paul *et al*.,2013 recorded the protein content of *C. striatus* and *C. marulius* that ranged 18.24% and 20.5% respectively. Chakraborty and Brahma (2017) recorded the protein content of *C. punctata* to be 17.84%. Borah, 2020 recorded the lipid content of *Clarias magur* to be 7.90 ± 0.63. Ghosh and Majumdar,2020 recorded the lipid content of *Heteropneustes fossilis* and Anabas t*estudineus* to be 1.4% and 4.4% respectively. Paul *et al*.,2023 recorded the moisture content of *C. striatus* and *C. marulius* that ranged 70.80% and 69.5% respectively. Pegu *et al*.,2023 recorded the moisture percentage of *C. punctatus* to be 70.55%. Borah, 2020 recorded the ash content of *Clarias magur* to be 3.74 ± 0.28. Pegu*et al*.,2023 recorded the ash content of *C. punctatus* per 100 gm to be 6.81±0.94. Paul*et al*.,2023 recorded the ash content of *C. striatus* and *C. marulius* that ranged 1.97% and 2.20% respectively. Paul *et al*.,2023 recorded the carbohydrate content of *C. striatus* and *C. marulius* that ranged 1.10 ± 0.31 and 0.84 ± 0.10 respectively. The present study supported comparatively with other findings.

Table 1. Comparative analysis of the biochemical constituents ofthe selected freshwater fish species

Sl .No	Name of species	Protein (%)	Lipid (%)	Moisture (%)	Ash (%)	Carbohydrate (%)
1	*Channa punctata* (Bloch, 1793)	15.6 ± 1.10	5.04 ± 0.65	76.42 ± 0.38	2.4 ± 0.21	0.76 ± 0.31
2	*Channa striata* (Bloch, 1793)	19.38 ± 2.33	2.34 ± 0.50	75.36 ± 2.24	2.3 ± 0.22	0.6 ± 0.38
3	*Channa gachua* (Hamilton, 1822)	24.92 ± 1.26	2.24 ± 0.19	69.7 ± 1.02	1.8 ± 0.20	1.2 ± 0.44
4	*Channa marulius* (Hamilton, 1822)	24.94 ± 1.25	1.66 ± 0.30	69.22 ± 1.28	3.0 ± 0.18	1.14 ± 0.51
5	*Heteropneustes fossilis* (Bloch, 1794)	18.28 ± 0.43	1.52 ± 0.25	78.5 ± 0.41	1.32 ± 0.28	0.38 ± 0.14
6	*Anabas testudineus* (Bloch, 1792)	16.66 ± 0.35	3.96 ± 0.20	75.2 ± 0.33	2.42 ± 0.23	1.74 ± 0.27
7	*Clarias magur* (Linneaeus, 1758)	14.3 ± 0.33	8.14 ± 0.27	72.24 ± 0.28	3.46 ± 0.25	1.76 ± 0.23

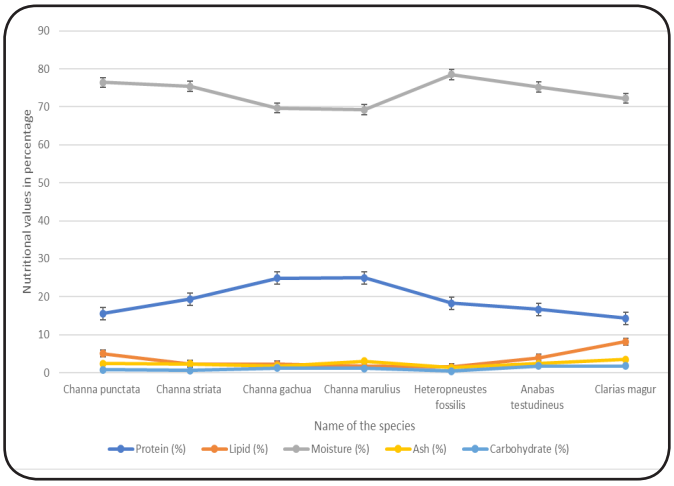

Fig.1. Comparation between nutritional composition of seven air breathing freshwater fishes.

CONCLUSION

The present study concludes that the studied fish species are nutritionally enriched and can play an excellent role in the fishery science and these locally obtainable fishes are highly recommended for regular consumption. Moreover, it can also serve as a good source of income for the rural people of the area as there is a high market value.

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