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Biochemical Composition of an Endangered Fish, *Labeo bata* (Hamilton, 1822) from Bangladesh Waters

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ABSTRACT

Fish play an important role in Bangladeshi diet, constituting the main and often irreplaceable animal source food in poor rural households. The study focused on the proximate composition of *Labeo bata* both in moisture and dry matter basis. The established AOAC (Association of Official Agricultural Chemist, USA) methods were followed for nutrient composition of fish. In case of moisture basis the percentage of moisture, protein, lipid, ash and carbohydrate was 72.41±0.81, 18.51±0.31, 3.79±0.25, 4.67±0.18, 0.90±0.03, respectively, while in dry matter basis it was 27.64±0.17, 66.75±0.39, 13.44±0.08, 16.63±0.20, 3.51±0.17, respectively. This result indicates that except moisture all other components are higher in dry matter basis than moisture basis. As the fish contain high level of protein will be helpful to reduce the protein demand of the country.

Key words: Proximate composition, dry matter basis, moisture basis, protein, *Labeo bata*

INTRODUCTION

The annual fish production in Bangladesh was 2,701,370 metric tons and fish contributed about 58% to the nation's animal protein intake (DoF, 2010; Islam *et al.*, 2012; Minar *et al.*, 2012). Fish is an essential and irreplaceable food item in the rural Bangladeshi diet. Fish body composed of mainly water, lipid, ash and protein though small amounts carbohydrates and non-protein compounds are present in a small amount (Cui and Wootton, 1988; Love, 1980; Wootton, 1990; Siddique *et al.*, 2012; Azim *et al.*, 2012). Most of fish usually consists of water (70-80%), protein (20-30%) and 2-12% of lipid (Love, 1980; Ali *et al.*, 2005). But it may change within and between species and also with size, sexual condition, feeding, time of the year and physical activity (Weatherley and Gill, 1987).

About 56 freshwater fish species critically or somewhat endangered in Bangladesh and *Labeo bata*, locally known as *bata*, is one of them (Khan *et al.*, 2000). Being a non migratory fish it remains in one habitat throughout its life (Mathur, 1973; Mathur and Robbins, 1971). Earlier reports stated that the fish was commonly distributed throughout the rivers, haors, baors, beels, jheels, canals and ponds of Bangladesh (Bhuiyan *et al.*, 1992; Rahman, 1989).

A variety of factors such as food, space, temperature, salinity, physical activity influence the growth of fish (Weatherley and Gill, 1987; Ahmed *et al.*, 2012) and the fish body elements may change due to these factors (Kamal *et al.*, 2007). There are a plenty of literatures on the biochemical and nutritional studies of some freshwater fish and some prawn and shrimp species of Bangladesh (Kamaluddin *et al.*, 1977; Gheyasuddin *et al.*, 1979; Rubbi *et al.*, 1987; Naser *et al.*, 2007; Chakrabarty *et al.*, 2003) and in other countries. But no attempt has been found hence forth to determine the body composition of this endangered fish. More over this fish like other fish of the cyprinid can help to reduce the nutrient demand of the people.

Therefore, this study was undertaken to know the nutritional composition of *Labeo bata*.

MATERIALS AND METHODS

Sample collection and processing: The sample of fresh *Labeo bata* were collected from the local market of Mymensingh (Fig. 1) in the early hours of the day and carried to the Fish Nutrition

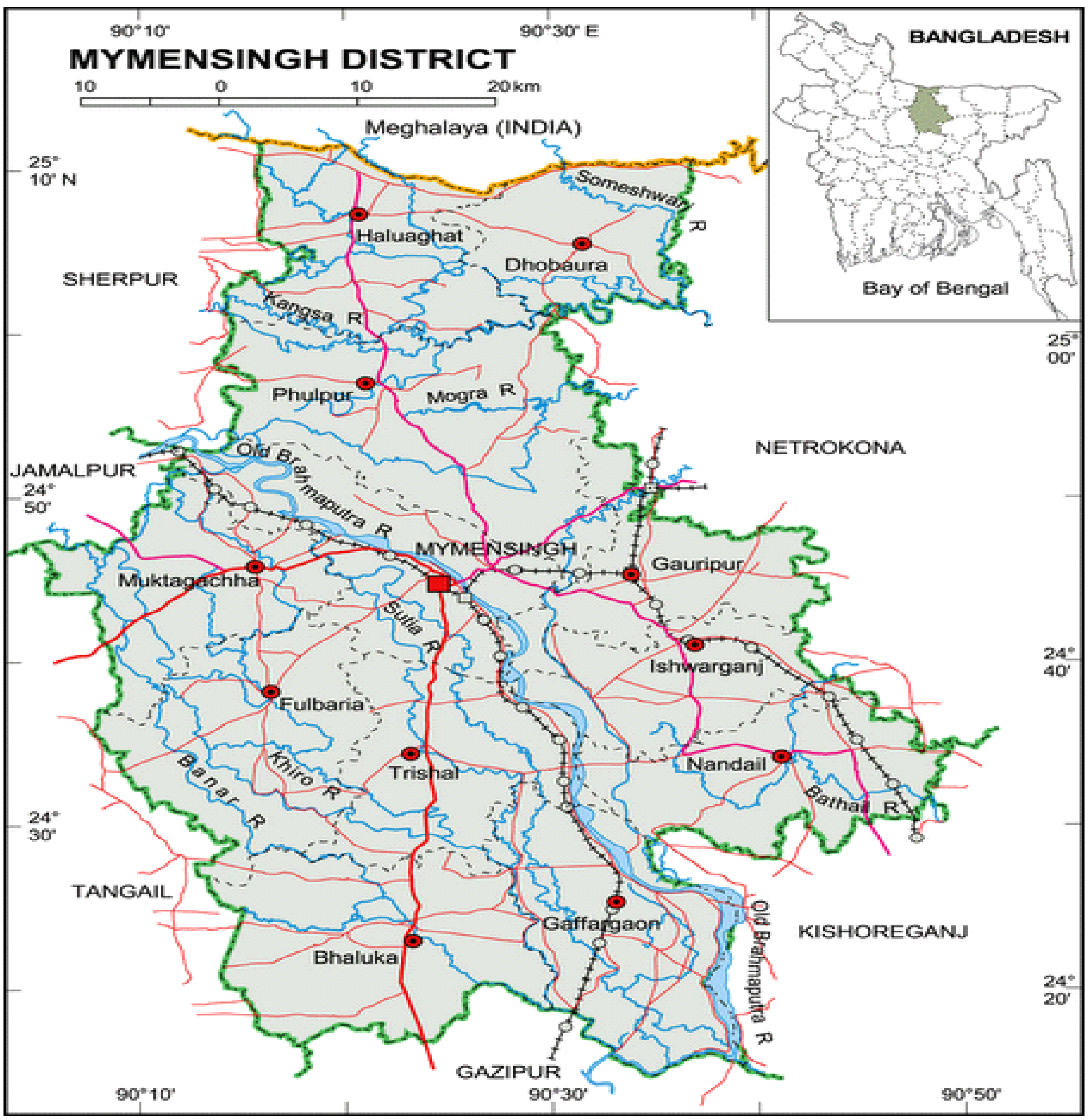

Fig. 1: Sampling stations (Banglapedia, 2006)

Laboratory of Bangladesh Agriculture University. The samples were stored in ice box before laboratory analysis. Then the sample was cut into very small pieces (2/3 g) for nutrient analysis. Ten samples were used for dry mater basis nutrient and ten samples for moisture basis analysis. Established standard methods ere followed for proximate composition analysis.

Proximate composition analysis: Nutrient composition of the raw fish was conducted by AOAC method (AOAC, 1990). For proximate composition of the prepared sample, the percentage of moisture, protein, lipid and ash were determined separately. The crude protein of the fish was determined by Micro-Kjeldahl method (Pearson, 1999). The estimation of fat content of experimental raw fish had been accomplished by Bligh and Dryer method (Bligh and Dyer, 1959). The fresh raw fish sample (2/3 g) were minced, weighed and ignited in the crucible. Then it was transferred in the Muffle Furnace held at dark red at a rate of 550-600°C for 6-8 h until the residue was white. Finally the percentage of moisture, protein, fat and ash content was calculated according to the following formula:

Calculation of moisture:

$$\text{Moisture (\%)} = \frac{\text{Weight loss}}{\text{Original weight of the sample taken}} \times 100$$

Calculation of protein:

$$N_2\text{ (\%)} = \text{(Titration reading-blank reading)} \times \text{strength of acid} \times 100/5 \times 100/\text{weight of the sample}$$

For most routine purpose the % of protein in the sample is the calculated by multiplying the % of N_2 with an empirical factor 6.25 for the fish:

$$\text{Protein (\%)} = \text{\% of total } N_2 \times 6.25$$

Calculation of fat:

$$\text{Fat (\%)} = \frac{\text{Weight of the residus}}{\text{Weight of the samples taken}} \times 100$$

Calculation of ash:

$$\text{Ash (\%)} = \frac{\text{Weight of dry samples}}{\text{Original weight of the samples taken}} \times 100$$

Statistical analysis: The data were collected from the experiment was tabulated and the final result was prepared by using both MS Excel and SPSS 11.5 computer based software.

RESULTS AND DISCUSSION

The proximate composition of the fish as in moisture and dry matter condition are presented in Table 1 and 2, respectively. In moisture basis, the percentage of moisture, protein, lipid, ash and

Table 1: Results of proximate analysis of *Labeo bata* (moisture basis)

	Composition (%)				
Serial No.	Moisture	Crude protein	Lipid (oil)	Crude ash	Carbohydrate
1	72.25	18.45	3.83	4.55	0.92
2	70.92	18.57	3.14	4.90	0.99
3	73.95	17.95	3.95	4.68	0.87
4	71.95	18.90	3.80	4.40	0.89
5	71.85	18.66	3.65	4.58	0.90
6	72.90	18.28	3.92	4.60	0.88
7	72.30	18.69	3.99	4.98	0.91
8	73.05	18.12	3.82	4.62	0.85
9	72.73	18.57	3.79	4.54	0.92
10	72.20	18.89	3.97	4.8	0.93
Mean±SD	72.41 ±0.81	18.51±0.31	3.79±0.25	4.67±0.18	0.90±0.03

Table 2: Results of proximate analysis of *Labeo bata* (dry matter basis)

	Composition (%)				
Serial No.	Moisture	Crude protein	Lipid (oil)	Crude ash	Carbohydrate
1	27.75	66.49	13.80	16.40	3.32
2	27.35	67.75	13.77	16.50	3.54
3	27.80	66.89	13.98	16.37	3.74
4	27.40	66.77	13.85	16.95	3.25
5	27.69	66.57	13.88	16.41	3.64
6	27.63	66.40	13.90	16.84	3.35
7	27.88	66.87	14.01	16.67	3.30
8	27.70	66.52	13.84	16.55	3.52
9	27.65	66.71	13.92	16.82	3.56
10	27.59	66.51	13.79	16.59	3.65
Mean±SD	27.64±0.17	66.75±0.39	13.44±0.08	16.63±0.20	3.51±0.17

carbohydrate was 72.41±0.81, 18.51±0.31, 3.79±0.25, 4.67±0.18, 0.90±0.03, respectively whereas, in dry matter basis it was 27.64±0.17, 66.75±0.39, 13.44±0.08, 16.63±0.20, 3.51±0.17, respectively (Table 1, 2). This result indicates that except moisture all other components are higher in dry matter basis than moisture basis. It indicates that while there was a decline in water content, fat content evidently increased due to heavy feeding during this period which is in good agreement with Huss (1988, 1995).

Moisture variation: It is observed that the moisture percentage in moisture condition ranges from 70.92-73.95 and from 27.35-27.88 and average was 72.41±0.81 and 27.64±0.17 (Fig. 2) which was lower than that reported by Celik (2008) and Osako *et al*. (2002). The present study is more or less coincide with the findings of Ali *et al*. (2005) where he found that the water content of some other fish species namely *Labeo rohita*, *Cyprinus carpio*, *Cirrhinus mrigala* and *Catla catla* was 72.10, 65.60, 65.60, 69.50 and 68.84, respectively. The variation also observed from species to species in both test.

Crude protein variation: The crude protein ranges in both moisture basis and dry matter basis test is from 17.95-18.90 and from 66.40-66.89 where the average was 18.51±0.31 and 66.75±0.39

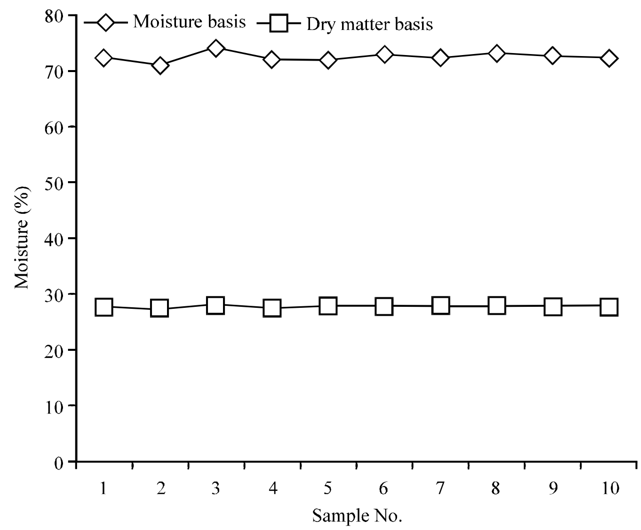

Fig. 2: Variation of moisture between moisture basis test and dry matter basis test

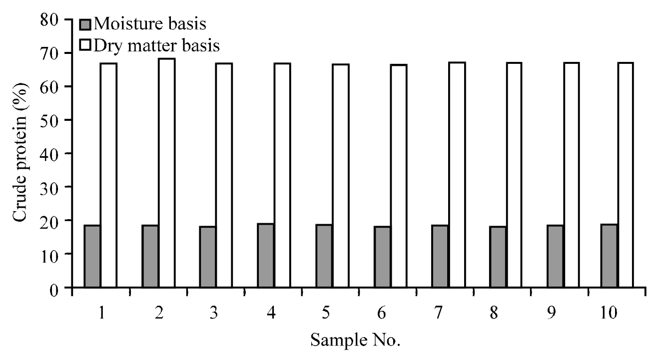

Fig. 3: Variation of crude protein between moisture basis test and dry matter basis test

(Fig. 3), respectively and more or less similar to the findings of with the findings of Nabi and Hossain (1989) in *M. aculeatus* and of Salam *et al.* (1995) in *P. gononiotus* except the dry matter basis.

Lipid variation: From the study it has been found that the range of lipid in moisture and dry matter basis test was from 3.14-3.97 and from 13.77-14.01 and average was 3.79±0.25-13.44±0.08 (Fig. 4). The result is very much higher than some other commercial fish native to Bangladesh like Shoal (*Channa striatus*), Lata (*Ophiocephalus punctatus*) and Shingi (*Heteropneustes fossilis*) whose fat content was estimated as 0.64, 1.08 and 1.23%, respectively estimated by Qudrat-I-Khuda *et al.* (1962).

Ash variation: The ash percentage ranges from 4.40-4.98 and the average was 4.67±0.18 in moisture basis but the range from 16.37-16.95 and average was 16.63±0.20 in dry matter basis test (Fig. 5). Mazumder *et al.* (2008) in *Ailia coila* and in *Amblypharyngodon mola* also find similar ash percentage varied within 1.6-3.2%. The ash content of the fish (*O. rubicundus*) was also more or less similar to that of small indigenous species. Chakwu and Shaba (2009) found higher amount of ash content in *C. gariepinus* (3.06%) than the studied fish while Devadsan *et al.* (1978) in his

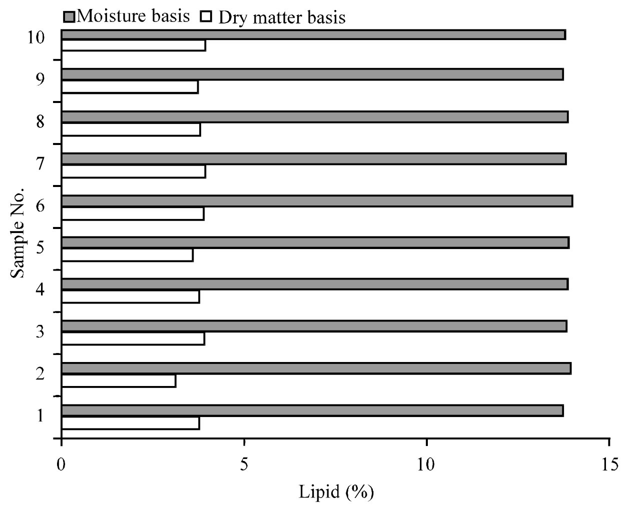

Fig. 4: Variation of lipid between moisture basis test and dry matter basis test

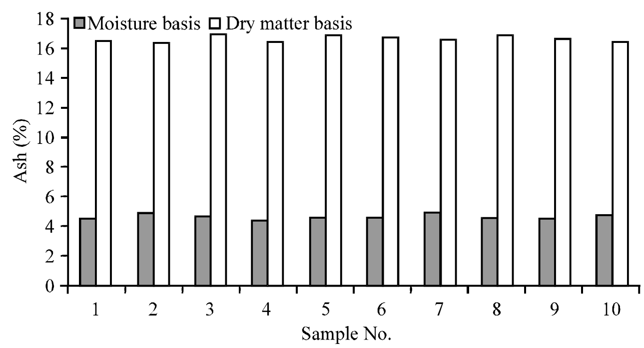

Fig. 5: Variation of ash between moisture basis test and dry matter basis test

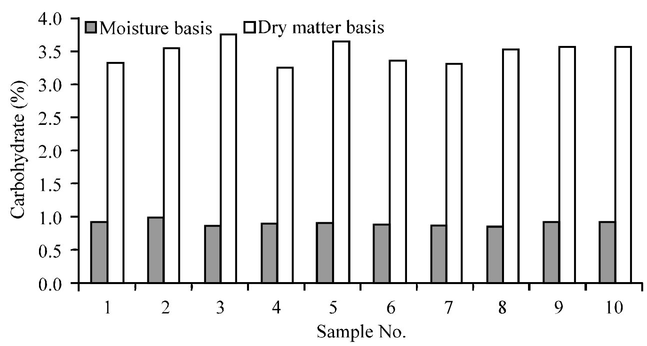

Fig. 6: Variation of carbohydrate between moisture basis test and dry matter basis test

experiment found lower amount of ash content in six freshwater fishes *L. rohita* (1.31%), *Catla catla* (0.93%), *Cirrhinus cirrhosus* (1.40%), *L. calabasu* (1.02%), *Mystus seenghala* (0.91%) and *Wallago attu* (0.72%).

Carbohydrate variation: The ash percentage ranges from 0.89-0.99 and the average was 0.90±0.03 in moisture basis but the range from 3.25-3.74 and average was 3.51±0.17 in dry matter basis test (Fig. 6).

According to Stansby (1954) and Salam *et al.* (1995), variation in proximate composition of fish flesh may vary with species variation, season, age and feeding habit of the fish (Islam and Joadder, 2005). Generally moisture content shows inverse relationship with lipid content. The inverse relationship has also been reported in marine fishes such as *Mugil cephalus* (Das, 1978).

CONCLUSION

The present findings describe the major nutritional composition of *Labeo bata*. The fish contains comparatively high amount of protein. Excepting moisture, all other nutrients were higher in dry matter samples. Increasing production of the species can reduce the animal protein requirements of Bangladesh. This study only looked at the major nutritional composition of the species so further study should be carried to know the mineral, vitamins and essential fatty acid compounds of the species. As the fish contain high amount of protein, necessary steps should be taken to increase the production of the species by aquafarming and proper management of natural habitat of the species. Artificial breeding of the species can increase the supply of fry for culture.

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