Univ. j. zool. Rajshahi. Univ. Vol. 34, 2015, pp. 21-24 **ISSN 1023-6104**
http://journals.sfu.ca/bd/index.php/UJZRU

Proximate composition and nutritional value of different life stages of *Lates calcarifer* (Bloch, 1790)

S. Kamruzzaman[1], M.D. Hossain[1], M.A.S. Jewel[1*], D.A. Khanom[1], S. Mustary[2] and M.M. Khatun[3]
[1] Department of Fisheries, University of Rajshahi, Rajshahi-6205, Bangladesh
[2]Department of Zoology, Shaheed Smrity Women's College, Khulna-9250, Bangladesh
[3]Department of Aquaculture, Hajee Danesh Science and Technology University, Bangladesh

Abstract: The biochemical compositions and nutritional value of *Latescalcarifer* (Bhetki) were analyzed using standard analytical techniques. Three different life stages (juvenile, adult and spent) of *L. calcarifer* were considered for this study. The results indicate significant differences among the biochemical compositions of different life stages of this species. Moisture content ranged from 69.633±0.46% in adult male to 72.453±0.55 % in spent female of this fish. The least protein content 16.207±0.34 % was observed in female spent fishes and the highest value recorded as 22.940±0.25% in males adult. The highest fat content was found in female adult 6.370±0.23% and lowest as 3.117±0.44% in female spent fishes. In all the life stages of fish studied, phosphorus content was highest, followed by calcium, magnesium and iron. By evaluating proximate composition and nutritional analysis of *L.calcarifer*, it is revealed that adult stage of this fishes is more nutritionally sound than juvenile and spent stages. The current finding on protein content suggests that *L. calcaifer* (Bhetki) could be recommended as a source of first class protein especially to people suffering from protein energy malnutrition.

Key word: Proximate composition, nutritional value, *Lates calcarifer*.

Introduction

Most of the people in the developing countries like Bangladesh are dependent on fish as a source of animal protein. It has been estimated that about 80% of the animal protein in the diet of the people of Bangladesh are contributed by fish (Hawk &Oser, 1965). Fish is inseparable part of the Bangladesh economy and it plays a vital role in nutritional balance as an important source of protein (Ahmed, 1993). Besides protein, fish is a good source of carbohydrate, fat, vitamin and mineral (Falls, 2012).

Biochemical composition of fish flesh may vary within the same species of fish depending upon the fishing season, age, sex and habitat (Srivastava, 1985), andwithin different region of the body (Jacquot, 1961). In fishes, proximate composition means the composition of fish flesh. Fish flesh contains four basic ingredients in varying proportions major nutrients such as water (70-80%), protein (18-20%), fat (5%) and minerals (5%) and minor nutrients such as vitamin, carbohydrate (Khurseed & Mosharaff, 1998). It has high nutritional value in terms of fats and proteins that are not commonly available in other foods.

L. calcarifer is a fresh water fish commonly known as Asian Seabass and Barramundi, and in Bangladesh, locally known as Bhetki. The fish is a catadromous species of the family Latidae and order Perciformes. The native species is widely distributed in the Indo-West Pacific region from the Persian Gulf, through Southeast Asia to Papua New Guinea and Northern Australia.

L. calcarifer contains polyunsaturated fatty acids (PUFA) enriched of omega-3 fatty acid, which play important roles in cardiovascular system to reduce the risk of heart attack (Islam, 1983). Omega-3 fatty acids are helpful to reduce cholesterol level in blood and helpful in the prevention of hyperlipidemia, secondary cardiovascular disease and high blood pressure (Bradberry & Hilleman, 2013).

The nature and quantity of lipid in fish are dependent on species and habitats. Lipids and fatty acids also play a significant role in membrane biochemistry and have direct effect on the membrane-mediated process in human such as osmoregulation, nutrient assimilation and transport (Ibrahim *et al*., 2004).

Many studies have done on the biochemical and nutritional status of some freshwater fish and marine fishes of Bangladesh viz., Kamal *et al.* (2007), Mahfuj, *et al,* (2012), Pervin *et al.* (2012), Sabina *et al.* (2011). But no attempt has been found to determine the biochemical composition

*Corresponding author: jewelru75@yahoo.com

and nutritional status of different life stages (juvenile, adult and spent) of *L. calcarifer*in Bangladesh. The aim of this study is to determine proximate composition and nutritional value of different life stages of *Latescalcarifer*.

Materials and Methods

Sample Collection: *Latescalcarifer* (Bhetki) was collected from Shibsa river estuary of Khulna district, Bangladesh for a period of 12 months (July 2014 to June 2015). 12 fish samples (6 male and 6 female) were collected in each month. A total of 144 fishes were used for the present study. Ten fish samples of each stage were considered for biochemical and mineral composition study. About 150-200g of fishes was collected as juvenile fish sample, 1200-1500g of fish as adult sample and 3000-3500g of fish as spent sample from the fishermen. The specimens were collected during early hours of the day and carried to the laboratory of the BCSIR of Rajshahi in ice box.

Sample preparation and analysis: The frozen fish samples were removed from the ice box and allowed to thaw. The head, tail, fins, viscera and skin of each fish were removed. The fillet was scrapped with a knife and mashed with a mortar until a uniform mixture was produced. The mixture was stored in refrigerator. Fishes were selected randomly regardless of sex.

Proximate composition analysis: Moisture, protein, fat and ash contents of the sample were determined by the AOAC methods (AOAC, 1990). The experiments were performed in triplicate and values are expressed as mean±standard deviation.

Mineral Analysis: Mineral analysis of fish sample were done according to the AOAC method (AOAC, 1990), using Atomic Absorption Spectrophotometer.

Statistical Analysis: Statistical analysis was performed by using the SPSS (Statistical Package for Social Science, evaluation version 16). Significance was assigned at the 0.05% level. The mean values also compared to see the significant difference through DMRT (Duncan Multiple Range Test).

Results and Discussion

Moisture: The moisture content varied among different life stages as well as in case of sexes in *L. calcarifer*. The highest moisture content was found in juvenile female fishes (73.45±0.32%)and lowest in male fishes of adult stage (68.05±0.96%) (Table 1). Pervin *et al*. (2012) reported that moisture content of *L. calcarifer* about 70%, and similar findings was also reported by Hui (2001). The percentage of water is a good indicator of relative contents of energy, proteins and lipids in fish. The lower the percentage of water, the greater the protein and lipid contents and higher the energy density of fish (Dempson *et al*., 2004).

Protein: Protein is the major nutrient in fish, and the levels help to define their nutritional status of the fish. The highest protein content was found in adult male fishes (22.94±0.255%) and lowest in female fishes of spent stage (17.70±0.23%) (Table 1). According to the Pervin *et al*. (2012) protein content of *L. calcarifer* was 23.5% which was slightly higher than the findings of the present study. In the present study, protein content of *L. calcarifer* found to vary from 17.70% to 22.94% which is nearly similar to the protein of Ilisha (*Tenulosailisha*) (22.56%) as reported by Begum & Minar (2012). Significant differences ($P<0.05$) of protein content were found in case of adult fishes than in juvenile and spent fishes of *L. calcarifer* (Table 1). The estimated values of protein, fat, moisture and carbohydrate may vary considerably within and between species, and also with size, sexual condition, feeding, time of the year and physical activity (Ali *et al*., 2005).

Fat: The mean percentage of fat in *L. calcarifer* varied from 3.25±0.14 to 5.30±0.52 % in juvenile and adult females respectively (Table 1). Pervin *et al.* (2012) reported the fat value of this fish as (5.7±0.3%). The fat value as recorded in *L. calcarifer* is similar to that of Chapila (*G. Chapra*, 4.55%) as reported by Begum and Minar (2012). According to Ackman, (1967), *L. calcarifer* is a medium fat content fish (4-8%) and Siva *et al*. (2013) found the fat content of this species as 4.41%. Significant differences ($P<0.05$) of fat content were found in case of spent fishes than in juvenile and adult fishes of *L. calcarifer* (Table 1)..The protein and lipid cycle appears to be having a strong correlation with feeding and spawning of female fishes reported in a number of fish species (Chakraborty *et al*., 1985).

Ash: In the present study the fluctuation of ash content made difficult to show any relationship with different life stages and sexes in *L. calcarifer*. The mean percentage of ash content among different life stages varied from 3.25±0.16 to 4.80±0.17% (Table 1) which was similar to the findings of Pervin*et al.* (2012) who reported that ash content of *L. calcarifer* was 5%.Siva *et al*.

(2013) reported that the percentage of average ash content of *L. calcarifer*was 2.70% which was lower than the fat content of the present study.

Mineral composition: Among the mineral elements investigated, concentration of phosphorus (P) in *L. calcarifer* was appreciably higherthan calcium, magnesium and iron. The minerals (phosphorus, calcium, magnesium and iron) studied in the current research are among the major mineral elements contributing to the proper functioning of the human body, hence they are considered important dietary elements (Pye, 1986).

Phosphorus (P): In the present study, phosphorus content of *L. calcarifer* was found to vary from 172.5±3.55 to 198.3±2.22 mg/100g in spent male and adult female respectively (Table 2). It is found that phosphorus content was relatively higher in female fishes than male fishes of *L. calcarifer*. Obodai *et al.* (2009) found that phosphorus content of a marine fish, *Chloroscombuschrysurus* was 283.50 mg/100g.

Table 1: Proximate composition in different life stages of *Lates calcarifer* (Bhetki).

Life stages	Sexes	Biochemical composition			
		Moisture	Protein	Fat	Ash
Juvenile	Male	71.23±0.49^{bc}	21.54±0.37^{b}	3.98±0.06^{c}	3.25±0.16^{c}
	Female	73.45±0.32^{a}	20.45±0.38^{c}	3.25±0.14^{c}	4.20±0.42^{ab}
Adult	Male	68.05±0.96^{d}	22.94±0.15^{a}	5.10±0.26^{a}	3.45±0.26^{bc}
	Female	68.35±1.01^{d}	21.46±0.30^{b}	5.30±0.52^{a}	3.55±0.14^{bc}
Spent	Male	69.63±0.27^{cd}	18.32±0.18^{d}	4.65±0.61^{b}	4.80±0.17^{a}
	Female	72.85±0.50^{ab}	17.70±0.23^{d}	4.20±0.23^{b}	4.55±0.28^{a}

Figures bearing common letter(s) in a column as superscript do not differ significantly (P <0.05)

Table 2: Mineral contents (mg/100 g) in body composition of *Lates calcarifer*.

Parameters	Juvenile		Adult		Spent	
	Male	Female	Male	Female	Male	Female
Phosphorus	180.2±1.25	186.2±1.98	190.2±1.43	198.3±2.22	172.5±3.55	176.4±2.54
Calcium	141.2±1.13	143.2±3.53	143.9±3.54	151.1±2.13	135.3±2.24	136.9±4.24
Magnesium	120.3±2.34	121.1±0.56	123.2±0.33	125.3±1.12	119.4±2.23	120.6±1.32
Iron	14.34±1.23	15.35±1.22	12.55±0.56	13.20±0.74	09.11±0.45	10.15±1.25

*Values are expressed as the mean ± standard deviation.

Calcium (Ca): *L. calcarifer* can be a good source of calcium for the human body, considering the suggested daily calcium intake amount of 800 mg/day (Whithney and Rolfes, 2008). The highest calcium content was recorded in male adult (151.1±2.13 mg/100g) and the lowest value of calcium content was found in spent male fishes (135.3±2.24 mg/100g) (Table 2). In the present study, mean calcium content of *L. calcarifer* was slightly higher than that of the findings of Pervin *et al.* (2012), who reported that calcium content of *L. calcarifer* as 140 mg/100g. According to Obodai *et al.* (2009) calcium content of a marine fish, *Scomber japonicas* was 381.5 mg/100g which was higher than that of *L. calcarifer* in the present study.

Magnesium (Mg): Magnesium content was found to vary from 119.4±2.23 to 125.3±1.12 mg/100g (Table 2). Magnesium content was relatively higher in adult stage of both sexes than in juvenile and spent stages. It was also found that female fishes contained higher magnesium content than male fishes in all stages of *L. calcarifer*. According to Pervin*et al.* (2012) magnesium content of *L. calcarifer* was 120 mg/100g which was similar to the findings of the present study. An adequate intake of magnesium has some useful roles in human body as it regulates enzyme systems, helps to maintain bone health, provides required energy for metabolism, and acts as a part of the protein-making machinery in all cells of soft tissues (Whithney and Rolfes, 2008).

Iron (Fe): The highest iron content was found in juvenile fishes (14.34±1.23 to 15.35±1.22 mg/100g) and lowest value was recorded in spent fishes (09.11±0.45 to 10.15±1.25 mg/100g) (Table 2). In the present study iron content of *L. calcaifer* was found higher than the values obtained by Parvin *et al.* (2012) who found iron content of *L. calcaifer* as 9 mg/100g. Some other fishes like cod, salmon, and halibut are good sources of iron, containing 9.4, 8.6 and 9.5 mg/100gm respectively (Gehring *et al*., 2011).

Conclusion

The current findings of protein content suggests that *L. calcaifer* (Bhetki) could be recommended as a source of first class protein especially to people suffering from protein malnutrition. It may be concluded that moderate and unsaturated fat contents coupled with the high mineral contents of the *L. calcaifer*, make the fish highly nutrient, which could be recommended for human consumption for protein security. By evaluating proximate composition and nutritional analysis of *L. calcarifer*, it is revealed that the adult fishes are more nutritionally sound than juvenile and spent stages.

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Manuscript accepted on 26.07.2015