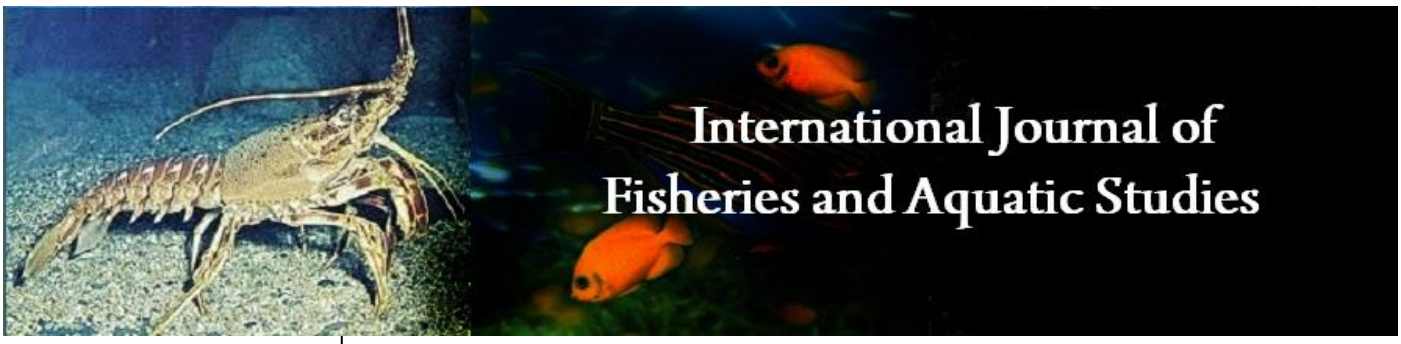

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Nutritional quality assessment of dried baim fishes in Sylhet Sadar Upazila

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Abstract
The present work was conducted to assess the nutritional quality of dried baim fish (locally called baim shutki). Dried baim fish samples were collected from three different sources (market, drying yard and control) for this study where samples were made available and analyzed on monthly basis. Proximate analysis was conducted for nutritional quality. The study was conducted over a period of five months from November 2017 to March 2018. The value of moisture, lipid, crude protein, ash, crude fiber and NFE were found in the range of 15.61±.27 to 21.97±.08%, 4.30±.26 to 10.26±.05%, 63.43±.13 to 54.37±.42%, 7.01±.07 to 20.47±.34%, 1.11±.27 to 2.06±.16% and 1.11±.10 to 2.86±.16% during the five months investigation in control, drying yard and market sample respectively. Besides, the mean (±SD) moisture content of the study of control, drying yard and market sample were 16.62±.78, 17.91±.11 and 19.84±1.6%; lipid content were 8.87±.79, 7.72±.93 and 5.6±1.1%; protein content were 61.99±.93, 60.82±.65 and 56.34±1.81%; ash content were 8.85±1.71, 10.78±1.43 and 16.08±2.71%; crude fiber content were 1.07±.16, 0.9±.05 and 0.74±.10% and NFE content were 2.61±.22, 1.87±.23 and 1.41±.28%, respectively. The study showed that lipid, protein, crude fiber and NFE content (%) was higher in control sample and lower in market sample. Moisture and ash content was found higher in market sample and lower in control sample. This present study can be concluded that nutritional quality of control sample was comparatively good than the commercially produced dried baim fish products.

Keywords: Baim shutki, proximate composition, NFE

1. Introduction
Dry fish is a very favorite food item among the people of South-east Asian countries and has a good market demand besides fish and seafood products. It is a low-cost dietary protein source and used as a substitute of fish at the scarcity of fresh fish in Bangladesh [15] and many other countries. In Bangladesh, dried fish is very demanding foodstuff due to its high protein content and nutritional value. People all over the world like to take dried fish products for its low cost and availability throughout the year as it can be kept for longer time without any conservation. In the dried fish markets of Bangladesh, all the shops- big or small have at least 10 to 15 types of dried fish or shutki almost all the year round. But the physical and organoleptic qualities of most of the traditional sun-dried fish available in the markets do not meet the expected standard for human consumption [14, 16, 26]. At present, people are more aware of health and nutritional issues [4, 10] and they concern about the nutritional value of the food items when they buy food items for their household. With the increase of education level of the people, consumers are now more concern about the nutritional value of the food items. And it is said that the composition of the nutrient elements is an important aspect of food quality as it influences the keeping quality of the products. Therefore, information on the nutritive value can be considered important regarding the proper utilization of the products. A good number of works on biochemical composition of fishes in Bangladesh has already been done by many researchers [6, 12, 25]. But, very few researches are found on specific dried fish products. As nutritional composition varies in large scale in different dried fish products, nutritional quality of specific dried fish products should be assessed in order to make better utilization of the specific products.
Baim *(Mastacembelus sp.)* is one of the most important eel fish in Bangladesh with great demand as good table fish. It is one of the most common species of fishes of Mastacembelidae family. Though it has been declared as critically endangered in Bangladesh it is found in a

a considerable amount in Sylhet region. Dried products made from baim have a good local, national market and export value. And considering all these facts this research has been undertaken to assess the nutritional quality of dried Baim *(Mastacembelus* sp.*)* fish collected from different sources.

2. Materials and Methods

2.1 Study area and study sample

Dried fish products from baim fish are produced mid-October to April in Sylhet area. It has a good demand in the local markets of Sylhet region as it is very much popular to the local community of Sylhet region and found in the markets almost all the year round. In this study, dried baim fish is selected for the assessment of nutritional quality due to its high palatable taste, market demand, as well as commercial importance as sutki and Sylhet region is selected for the availability of the fresh baim fish.

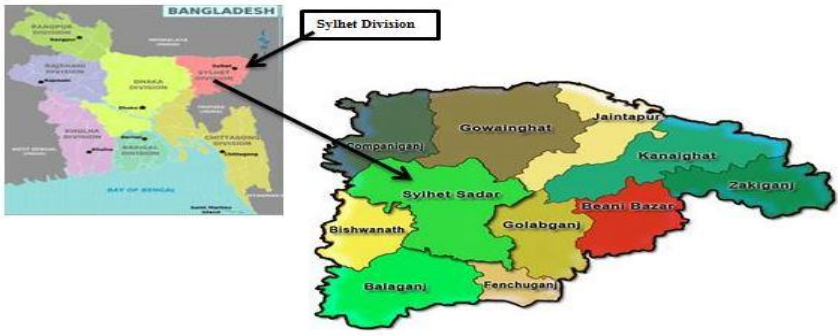

Fig 1: Map showing the study area.

2.2 Collection and preparation of samples

In this study, 3 different types of dried baim fish (sutki) samples (Drying yard sample, market sample and control sample) were used. Drying yard and market samples were collected from drying yard and local markets of Sylhet Sadar and control samples were made with proper hygienic condition. Samples were collected as monthly basis from November 2017 to March 2018 in total 5 months.

Preparation of control sample

For the preparation of the control sample, at first baim fishes were collected in their highest level of freshness. Then they were carried to the experimental site in a clean, good quality polythene bag with ice in order to keep the fish fresh. After that, the fishes were carefully washed with clean water to remove blood, slime, unnecessary adherents and other things. Then they were kept on a clean polythene sheet wrapped wooden basket in the sun. They were kept in sun regularly during the day time for 4 to 5 days as sometimes the sky was cloudy until the required drying period was over. During the sun-drying period, they were kept covered by a small meshed mosquito net to avoid external contamination and to prevent the sample from bird attack and fly infestation.

Control Drying Yard Market

Fig 2: Samples collected from different sources

2.3 Experimental site

Lab experiments were conducted in the Fish Nutrition Laboratory of Bangladesh Agricultural University, Mymensingh, Bangladesh.

2.4 Proximate composition analysis

Proximate composition analysis was carried out according to the methods of Association of Analytical Chemists with certain modification [2].

2.5 Statistical analysis

Statistical analysis was done by performing one way ANOVA (Post Hoc, Duncan) and SPSS (IBM 2010 and Version 20) at 5% confidence level. Univariate and multivariate analysis of General Linear Model (GLM) was used to determine significant ($p<0.05$) difference between estimated data.

3. Results and discussion

3.1 Moisture content

Moisture content of baim shutki varied from 15.61±.27 to 21.97±.08%, with higher values recorded from market sample and lower values from control sample [Table 1]. In each month, significantly ($p<0.05$) higher moisture content was observed in the market samples and significantly lower moisture content was observed in the control samples. Variation in sample value might be due to differences in temperature and humidity of the air in different months.

The average moisture content (%) of baim shutki collected from control, drying yard and market during the periods (five months) of investigation was 16.62±.78, 17.91±.11 and 19.a84±1.6%, respectively [Table 7]. Average moisture content was higher in market sample and lower in control sample. The present finding is supported by Ahmed *et al.* 2013, Khanum *et al.* 2001 and Nayeem *et al.* 2010 [1, 17, 22]. They observed significantly higher moisture content in the samples collected from retailer and lower from producer in case of semi-fermented fish products.

Haque (2004) stated that normally the sun dried fishes contain an average of 10 to 20% moisture [8]. Nahid *et al.* (2016) found moisture content in smoke-dried chapila, kaika and baim fish 12.36%, 11.69% and 8.22%, respectively which are lower than the present study [21]. Begum *et al.* (2011) reported that the experimentally sun dried tengra fish in laboratory contained moisture 15.10-16.90% and on the other hand the commercially sun dried tengra collected from the local market contained moisture 21.05-23.50% which are also in agreement with the present study [3].

3.2 Lipid content

The variation of lipid content among the studied dried baim fish samples from three different sources ranged within 4.30±.26 to 10.26±.05% [Table 2]. The highest value was found in control sample in the month of February and the lowest value in market sample in the month of March. Significantly ($p<0.05$) higher lipid content was observed in control samples than the lipid content of drying yard and market samples.

The average lipid content (%) of baim shutki collected from control, drying yard and market samples were 8.87±.79, 7.72±.93, 5.6±1.1%, respectively [Table 7]. From the observed results, it is evident that lipid content (%) was comparatively higher in samples obtained from control than from drying yard and market.

Nahid *et al.* (2016**)** found fat content in smoke-dried kaika and baim fish 5.25% and 10.78%, respectively [21]. Majumdar (2017) reported lipid content ranged from 5.15 to 9.21% in dried taki (*Channa punctatus*), puti (*Puntius sophore*) and chapila (*Gudusia chapra*) [18]. Ullah *et al.* (2016) analyzed 10 (ten) dried fish samples traditionally prepared in the North East India and reported that lipid content was ranged from 11.47% to 18.45%. These findings are more or less similar to the present study [27].

3.3 Protein

Protein content varied from 63.43±.13 to 54.37±.42%. The highest value was found in control sample in the month of January and lowest value was found in market sample in the month of March [Table 3].

The average value of protein content of baim shutki from control, drying yard and market samples during the periods (five months) of investigation were 61.99±.93, 60.82±.65 and 56.34±1.81%, respectively [Table 7]. It is evident that protein content (%) was comparatively higher in control samples than from the samples of drying yard and market. Ahmed *et al.* (2013) reported higher values of protein in the samples obtained from control as compared to samples from producer [1]. Lower level of protein content in the products obtained from retailers could be probably due to the loss of quality at different stages of marketing chain.

These findings are supported by Haque (2004) who reported that normally the sun dried fishes contain 60 to 80% protein [8]. Besides, Nahid *et al.* (2016) found protein content 70.82% in smoke-dried baim fish which is higher than the present findings [21]. Islam *et al.* (2013) reported protein content in the range of 32.02 to 41.38% with the highest value in *Channa punctatus* (taki) and the lowest in *Amblypharyngodon mola* (mola) [13]. Ullah *et al.* (2016) analyzed 10 (ten) dried fish samples traditionally prepared in the North East India where the range of protein content were 27.46% to 56.84% [27].

3.4 Ash content

The data regarding ash content are shown in Table 4. Ash content varied from 7.01±.07 to 20.47±.34%. The highest value observed in market sample in the month of March and the lowest value in control sample in the month of January. Ash content of market sample was significantly ($P<0.05$) higher and ash content of control sample was significantly lower.

The average ash content (%) of baim shutki collected from three different sources (control, drying yard and market) during the five months investigation were 8.85±1.71, 10.78±1.43 and 16.08±2.71%, respectively [Table 7].

This agrees well with the findings of Nahid *et al*. (2016) who reported that the ash content in smoke-dried chapila, kaika and baim fish was 10.83%, 8.31% and 10.74%, respectively [21]. The present findings are also in agreement with some earlier findings [7, 9]. In this study Average ash content (%) was found comparatively higher in market samples than from drying yard and control. Begum *et al.* (2011) also found higher ash content (12.50-14%) in the commercially sun dried tengra collected from the local market than in the experimentally sun dried tengra fish (8-10.50%) in laboratory [3]. This may be due to contamination of the market samples. Ahmed *et al*. (2013) mentioned that the higher ash content noticed in the products sampled from retailers are probably associated with contamination with filth, sand, dust etc. which might occur during handling, transportation and preservation in the marketing chain [1].

3.5 Fiber content

Fiber content of dried baim fish collected from different sources are shown in table 5. It is observed that fiber content varied from 1.11±.27 to 2.06±.16% with the highest value obtained from control sample and the lowest value from market sample.

The average fiber content (%) of dried baim fish collected from control, drying yard and market samples during the periods (five months) of investigation were 1.07±.16, 0.9±.05 and 0.74±.10%, respectively [Table 7]. From the observed results, it is evident that fiber content (%) was comparatively higher in control samples than from drying yard and market samples.

Okereke *et al.* (2014), found ash content ranged from 0.25-0.60% in smoked *Clarias gariepinus* which is lower regarding to the present study [23]. Mustapha *et al.* (2014) assessed ash content as <1.00% in both *C. gariepinus* and *O. nicotilus* where one was dried with solar driers and the other one was with other common methods of drying [19]. Oladipo and Bankole (2013) estimated 4.79% crude fiber in dried O. *niloticus* [24]. Chukwu and Shaba (2009) reported 0.98±0.01% crude fiber in catfish (*Clarias gariepinus*) dried by using electric oven [5]. These findings are more or less similar to the present findings.

3.6 Nitrogen free extract

The data on Nitrogen Free Extract (NFE) are presented in table 6. It is clear that Nitrogen Free Extract (NFE) which composed mainly of digestible carbohydrates, vitamins and other non-nitrogen soluble organic compounds content varied from 1.11±.10 to 2.86±.16%, with highest value observed in control sample and lowest value in market sample.

Table 7 shows that the average value of NFE content (%) of baim shutki collected from control, drying yard and market sample were 2.61±.22, 1.87±.23 and 1.41±.28%, respectively. NFE content (%) was comparatively higher in control samples than from drying yard and market. It is said that Nitrogen Free Extracts (NFE) reduced with the time of storage in case of dried and fermented products. The lower NFE content noticed in market samples are probably associated with reduced carbohydrate content during long time handling, transportation and preservation.

Iheanacho *et al.* (2017) found 18.30% NFE in African catfish (*Clarias gariepinus*) processed by solar drying methods which is comparatively higher than the present study [11]. Nahar *et al.* (2017) reported NFE in the range of 0.83±0.04 to 1.08±0.02% in chepa shutki (a semi-fermented product) collected from retailer, control and producer which is lower than the present findings [20].

Table 1: Moisture content (%) of dried baim fish samples obtained from different sources in different months

Sources of sample	Months				
	November17	December17	January18	February18	March18
Control	16.18^{c}±.11	16.63^{c}±.28	17.63^{c}±.44	17.07^{c}±.12	15.61^{c}±.27
Drying Yard	17.36^{b}±.19	18.00^{b}±.10	18.73^{b}±.28	19.08^{b}±.13	16.36^{b}±.10
Market	18.55^{a}±.38	19.27^{a}±.23	21.97^{a}±.08	20.93^{a}±.16	18.45^{a}±.29

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

Table 2: Lipid content (%) of dried baim fish samples obtained from different sources in different months

Sources of sample	Months				
	November 17	December17	January18	February18	March18
Control	8.55^{a}±.28	8.35^{b}±.13	8.52^{a}±.68	10.26^{a}±.05	8.68^{a}±.38
Drying Yard	8.45^{a}±.22	8.87^{a}±.05	7.13^{b}±.24	6.62^{b}±.08	7.53^{b}±.29
Market	6.40^{b}±.40	6.04^{c}±.15	6.67^{b}±.43	4.58^{c}±.44	4.30^{c}±.26

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

Table 3: Protein content (%) of baim shutki samples obtained from different sources in different months

Sources of sample	Months				
	November 17	December 17	January 18	February 18	March 18
Control	61.44^{a}±.42	62.19^{a}±.71	63.43^{a}±.13	61.95^{a}±.10	60.95^{a}±.57
Drying Yard	60.37^{b}±.23	60.98^{b}±.13	61.59^{b}±.41	61.20^{b}±.19	59.98^{b}±.10
Market	57.45^{c}±.24	56.56^{c}±.35	54.68^{c}±.34	58.63^{c}±.17	54.37^{c}±.42

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

Table 4: Ash content (%) of baim shutki samples obtained from different sources in different months

Sources of sample	Months				
	November17	December17	January18	February18	March18
Control	10.01^{c}±.29	9.25^{c}±.16	7.01^{c}±.07	7.16^{c}±.15	10.84^{c}±.24
Drying Yard	10.92^{b}±.24	9.60^{b}±.03	9.71^{b}±.11	10.53^{b}±.07	13.15^{b}±.11
Market	15.78^{a}±.38	16.36^{a}±.21	14.34^{a}±.21	13.43^{a}±.13	20.47^{a}±.34

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

Table 5: Fiber content (%) of baim shutki samples obtained from different sources in different months

Sources of sample	Months				
	November 17	December 17	January18	February 18	March 18
Control	1.05^{a}±.21	1.30^{a}±.15	1.12^{a}±.18	0.91^{a}±.07	0.94^{a}±.04
Drying Yard	0.84^{b}±.06	0.93^{b}±.04	0.97^{a}±.07	0.90^{a}±.07	0.85^{ab}±.07
Market	0.71^{b}±.12	0.67^{c}±.09	0.68^{b}±.12	0.91^{a}±.04	0.76^{b}±.10

*Values are mean ± SD (n=5). Within a column, means sharing a common superscript letters are not significantly different at (p>0.05).

Table 6: Nitrogen free extract (NFE) content (%) of baim shutki samples obtained from different sources in different months

Sources of sample	Months				
	November 17	December 17	January 18	February 18	March 18
Control	2.76^{a}±.15	2.50^{a}±.39	2.29^{a}±.25	2.66^{a}±.09	2.86^{a}±.16
Drying Yard	2.07^{b}±.37	1.62^{b}±.18	1.87^{b}±.27	1.68^{b}±.30	2.13^{b}±.15
Market	1.11^{c}±.10	1.11^{c}±.12	1.65^{b}±.20	1.52^{b}±.17	1.66^{c}±.20

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

Table 7: Proximate composition (mean value) of baim shutki samples obtained from different sources during the study periods (five months)

Sources of the sample	Parameters					
	Moisture (%)	Crude Protein (%)	Lipid (%)	Ash (%)	Crude Fiber (%)	NFE (%)
Control	16.62^{c}±.78	61.99^{a}±.93	8.87^{a}±.79	8.85^{c}±1.71	1.07^{a}±.16	2.61^{a}±.22
Drying Yard	17.91^{b}±.11	60.82^{b}±.65	7.72^{b}±.93	10.78^{b}±1.43	0.9^{b}±.05	1.87^{b}±.23
Market	19.84^{a}±1.6	56.34^{c}±1.81	5.6^{c}±1.1	16.08^{a}±2.71	0.74^{c}±.10	1.41^{c}±.28

*Values are mean ± SD (n=5). Within a column, means not sharing a common superscript letters are significantly different at (p<0.05).

4. Conclusion

The present study showed that dried baim or shutki of baim is a source of high-quality protein and can play an important role to solve the malnutrition problem of Bangladesh. Baim shutki collected from market was found inferior quality than the others for nutritional aspects. This indicates loss of considerable amount of traditional fishery products due to lack of adequate knowledge about the quality aspect, lack of packaging system, lack of sanitation and poor marketing channel. Government and other agencies should take necessary steps to disseminate adequate knowledge about the quality aspects and improve the marketing channel for safe and steady supply of different traditional fishery products to the common people of Bangladesh.

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