



Physicochemical Quality Assessment of Salt-Free Fermented Fish Products of Sylhet Region, Bangladesh

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Abstract- Shidals are popular salt-free fermented fish foodstuffs in Sylhet area of Bangladesh due to its distinctive flavor and taste. In this study, the proximate composition, physicochemical and antioxidative potential had been studied of three kinds of shidals prepared from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*) available in the local markets. The results of investigation suggested that shidals are a good source of protein content ranging from 30.49% to 38.27%. The pH, moisture, crude fat, ash and carbohydrate content ranged from 6.09%-6.74%, 34.46%-35.33%, 17.48%-21.43%, 06.31%-13.05% and 1.20%-1.73% correspondingly. 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity of punti, kangla and bashpata shidals was found 68.13±2.45, 53.95±1.52 and 73.88±1.21, respectively. Total Volatile Base Nitrogen (TVB-N) content ranged from 37.57-57.92 mg.100 g⁻¹. This finding suggested that the fermented fish products is a good source of nutrient for the local peoples.

Indexed Terms- Antioxidant activity, fermented fish, scavenging activity, Shidals.

I. INTRODUCTION

Fermentation of some local fishes is one of the oldest and indigenous techniques for the processing, preservation, and consumption in Bangladesh. Like many other Southeast Asian countries, in the Sylhet region of Bangladesh, the preservation of fish products by fermentation is commonly practiced [1]. Traditionally, fermented fish products are widely consumed because of their characteristic taste and smell as well as rich nutritional profile. Indigenous people in this region use native fermented fish products to provide the basic components of their diet, with various features of nutrition, flavor, palatability and texture [2]. Enhanced flavor, digestibility and therapeutic value have been reported in fermented fish products with improved nutritional and functional properties [3-6]. Consumption of fermented fishes introduces and balances beneficial bacteria into the digestive tract for higher nutrients absorption of the nutrients by regulating enough digestive enzymes [7]. The bioactive peptides are yielded by the breakdown of fish proteins by microbial or indigenous proteases, thus, substantially increasing biological properties of the food [8]. Various biological activities, such as antithrombotic and antioxidative activities, cholesterol-lowering ability, blood-pressure lowering effects and antimicrobial properties have been observed in peptides released from the proteins of fermented fishes. Because of all of these reasons, high priority has been given by the WHO food safety unit for the research in fermented fish products [9]. Shidals are fermented fish products without salts in Eastern Bangladesh and Northeast India. Shidals are generally prepared from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*), three indigenous fishes of Bangladesh [1]. Their distinct strong flavor has made them very popular. The typical strong smell of shidal can be attributed from the conversion of fish proteins and lipids, which produce a variety of peptides, amino acids, fatty acids, indole, skatole, etc. [10]. Their shape remains almost unaltered, but a few cleavages may be observed sometimes around the portions of stomach and tail. Dull white color in shidal indicates

the product of best quality. If they are exposed to air continuously, the color may turn brownish. The old-aged technology of shidal preparation originated in Bangladesh. The month of November to February is the usual time span for shidal production [9]. Dried salt-free punti, kangla or bashpata are generally used and the fermentation occurs in earthen cans (called “matka” in Bengali). These fermented fish products can be produced simply but production of better-quality yields requires expertise [1]. Existence of essential fatty acids has made shidals nutritionally enhanced food product [9]. It has been suggested by some of researchers that salt-free fermented fish like shidals can be considered as a prospective sources of nutrients and natural antioxidants [10, 11]. Various studies have been reported on different fermented fish products throughout the past years. “-Kasef, a traditional salted-fermented fish product of Jazan region, Saudi Arabia have been studied. The identification of dominant microbial communities in hongoe samples provides important information for selection of fermented fish products consisting of strains. Physicochemical properties and bacterial community dynamics of hongoe, a Korean traditional fermented skate product, during fermentation at 10°C have been investigated” [12]. “Microbiological and chemical quality of Hout” [13]. Although some reports are available on the traditional knowledge, handling and processing of shidals, no thoughtful effort has been made to assess the physicochemical qualities of punti, kangla and bashpata shidals to till date to the first-rate of our understanding. Hence, this study has been conducted to study the physiochemical as well as the antioxidant activity of three traditional salt-free fermented fish products of Sylhet are of Bangladesh, known as shidals, made from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*) fishes.

II. MATERIALS AND METHODS

This research work was carried at the laboratory of Food Engineering and Tea Technology; Chemical Engineering and Polymer Sciences department, Shahjalal University of Science and Technology, Sylhet, Bangladesh.

2.1 Chemicals

Hydrochloric acid (HCl), tris-HCl, sulphuric acid (H₂SO₄), sodium hydroxide (NaOH), potassium ferric cyanide, ferric chloride, trichloroacetic acid (TCA), thio-barbituric acid (TBA), 2,2-diphenyl-1-picrylhydrazyl (DPPH) analytical grade.

2.2 Traditional Shidal Preparation Method

Traditional methods of shidals preparation are shown in figure 1.

2.3 Samples Collection

A total of 3 kg of shidal samples prepared from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*) were procured from three different vendors in local shops of Sylhet, Bangladesh. One kg of samples from each variety of shidals namely punti, kangla and bashpata (figure 2) were wrapped in three separate sterile polybags and taken to the laboratory for physicochemical evaluation.

2.4 Preparation of Sample Extract

Sample extract was prepared by the method followed by Majumder et al. [9]. Five grams of punti, kangla and bashpata shidal samples was separately mixed with 25 ml of distilled water; the mixture was homogenized at the rate of 12,000 rpm/min. Then this shaken at 110 rpm/min on shaker for 40 min at 30°C. Afterwards the samples were centrifuged at 7000 rpm/min for 15 min at 4°C to take away unwanted particles. The accrued supernatant taken into consideration for physicochemical testing.

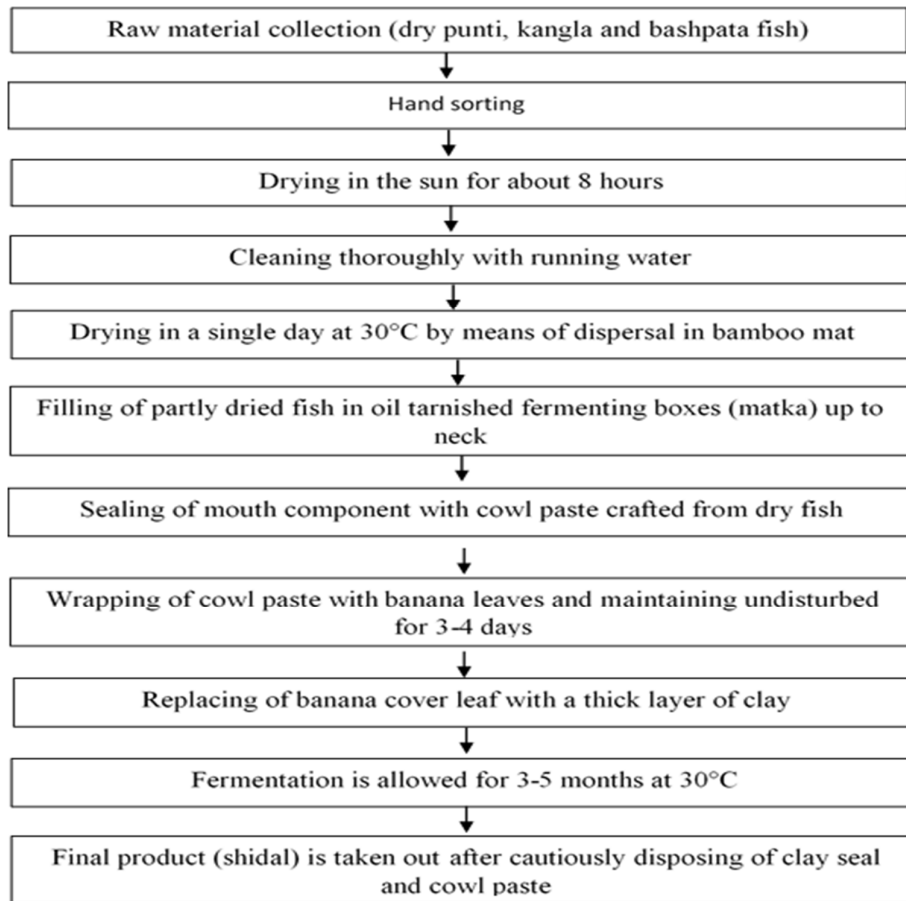


Figure 1: Traditional methods of shidals preparation



(a) Punti (*Puntius sophore*) shidal

(b) Kangla (*Notopterus notopterus*) shidal

(c) Bashpata (*Setipinna phasa*) shidal

Figure 2: Salt-free fermented fish product ‘shidal’ made from (a) punti (*Puntius sophore*), (b) kangla (*Notopterus notopterus*) and (c) bashpata (*Setipinna phasa*), after collecting from local market.

2.5 Physicochemical Analysis

2.5.1 Proximate Analysis

Moisture, crude fat, protein, ash and carbohydrate content material of the shidals had been estimated in keeping with the methods of AOAC [14]. The moisture content was determined from the sample's weight loss (5.0 g) after being oven-dried for 2 hours at 105 °C before normal weight was reached. Via an extraction technique using petroleum ether and protein analyzed using the Kjeldahl process, fat content was measured. The conversion content of nitrogen to crude protein was based on factor 6.25. Ash content material was decided from the load of the pattern burned at 550°C for 4 h. Carbohydrate content was assessed from the following equation (Equation 1).

$$\text{Percentage of Carbohydrate} = (100 \% - \text{Protein} - \text{Fat} - \text{Moisture} - \text{Ash}) \quad (1)$$

2.5.2 Determination of pH, total volatile base nitrogen (TVB-N) and DPPH radical-scavenging activity

The pH was determined by Digital pH meter (JENWAY-3015 pH meter). 15.0 g of sample had been blended in 150 ml DW for two min on high speed in a warring blender. The pH of the suspension was measured. The TVB-N content was measured by slightly modified method described by Gassem [13]. 10 g of sample was blended in 50 ml DW; the blender was washed with 250 ml DW into the distillation flask and 1.0 to 2.0 g of MgO become delivered to the mixture. TVB-N turned into launched by means of boiling the aggregate with MgO, which averted volatile acids from distilling over into the boric acid. The distillate of unstable nitrogen changed into acquired in 25 ml of boric acid 2.0% then titrated by using 0.1 N sulfuric acid. The results were calculated using the following equation (Equation 2):

$$\text{TVN-N (mg N/100g)} = \text{Titration (ml of 0.1 N acid)} \times 1 \quad (2)$$

Antioxidant activity of the punti, kangla and bashpata shidals were determined with modification [9]. One gram of sample was mixed in 9.0 ml of 100 mM Tris-HCl buffer (pH 7.4). Then this solution was nicely mixed, centrifuged at 7000 rpm/min for 10 min at 30°C. A regarded quantity of supernatant was taken and delivered with same quantity of DPPH solution (0.5 mM in ethanol). The combination turned into left to settle for 30 min at dark condition. Absorbance was measured at 517 nm using a UV-spectrophotometer (Shimadzu Corporation, Japan).

2.6 Statistical Analysis

Experiments were performed twice, and all measurements have been executed in triplicate. Values had been expressed as mean \pm standard deviation (SD) and analyzed using one-way analysis of variance. Mean contrast changed into carried out using Duncan's more than one variety test and sizable difference became described at $p < 0.05$.

III. RESULTS AND DISCUSSIONS

3.1 Proximate composition

The mean values of proximate composition of fermented fish products made from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*) are given in table 1. The highest moisture content 35.33 ± 1.29 % was found in kangla shidal and lowest 34.46 ± 0.35 % was found in punti shidal. There is no significant different in moisture content among three samples. These findings is supported with the report of Kakati and Goswami, who found that punti and bashpata shidal contained 33.44% and 37.52% respectively [11]. The higher moisture content in those shidals may be because of the possible absorption of moisture from the environment at storage, considering that in maximum locations shidal is stored in earthen pots or in plastic bottles during supply chain [2]. The highest crude fat content was found to be 21.43 ± 0.68 % in punti shidal and lowest was found to be 17.48 ± 0.48 % in kangla shidal.

Table 1: Proximate composition of fermented fish products made from punti (*Puntius sophore*), kangla (*Notopterus notopterus*) and bashpata (*Setipinna phasa*).

Parameters	Punti	Kangla	Bashpata
Moisture (%)	34.46 ± 0.35	35.33 ± 1.29	35.31 ± 0.94
Crude fat (%)	21.43 ± 0.68	17.48 ± 0.48	18.38 ± 0.55
Protein (%)	30.49 ± 1.33	33.28 ± 0.99	38.27 ± 0.59
Ash (%)	12.12 ± 0.63	13.05 ± 0.76	6.31 ± 0.58
Carbohydrate (%)	1.49 ± 0.47	1.20 ± 0.65	1.73 ± 0.74

Note: Data given are mean ± standard deviation for three different value of each sample. Values denoted with the different letter within the same rows are significantly ($p \leq 0.05$) different.

The difference of the fat contents among the three shidal samples might be contributed to the lipid content of the raw fish. Similar fat content was reported by some researchers for fermented fish products [11]. Protein contents of the shidal ranged from $30.49 \pm 1.33\%$ to $38.27 \pm 0.59\%$. The highest protein content was found to be $38.27 \pm 0.59\%$ in bashpata shidal and lowest protein content was found to be $30.49 \pm 1.33\%$ in punti shidal. There is a significant different of protein content among three samples. Increasing the protein, fat content material of the product may be attributed to the reduction of moisture contents. From this result, it is revealed that fermented fish products are good sources of protein and fat. Similar findings were reported by another researcher for fermented fish products [11]. Ash contents of the shidals were within the range of $6.31 \pm 0.58\%$ to $13.05 \pm 0.76\%$. The highest ash content was found to be $12.12 \pm 0.63\%$ in punti shidal while lowest ash content was found to be $6.31 \pm 0.58\%$ in bashpata shidal. Very small amount of carbohydrates within the range of $1.20 \pm 0.65\%$ to $1.73 \pm 0.74\%$ was observed in the fermented fish products. The highest carbohydrate content was found to be $1.73 \pm 0.74\%$ in bashpata shidal while the lowest carbohydrate content was observed to be $1.20 \pm 0.65\%$ in kangla shidal. An overall comparison of proximate composition among different fermented fish product is shown in Figure 3.

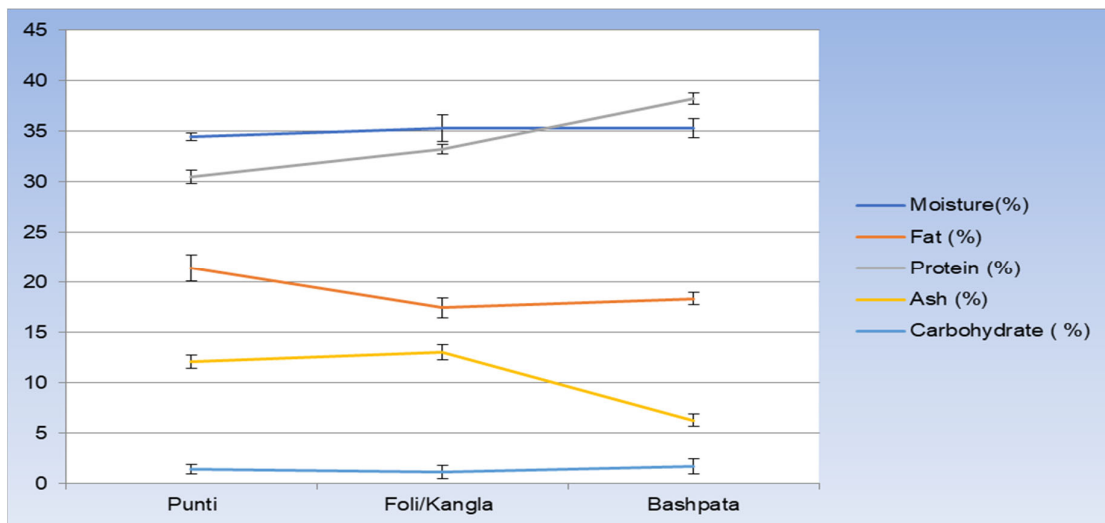


Figure 3: Comparison in proximate composition among different fermented fish.

3.2 pH, total volatile base nitrogen (TVB-N) content and DPPH radical scavenging activity (%)

The pH, total volatile basic nitrogen (TVB-N) content and DPPH radical scavenging activity (%) of fermented fish product are given in Table 2.

Table 2: pH, total volatile basic nitrogen (TVB-N) content and DPPH radical scavenging activity (%) of fermented fish made from Punti (*Puntius sophore*), Kangla (*Notopterus notopterus*) and Bashpata (*Setipinna phasa*).

Parameters	Punti	Kangla	Bashpata
pH	6.74 ± 0.02	6.09 ± 0.15	6.12 ± .02
TVB-N (mg/100g)	45.61 ± 0.67	37.57 ± 0.51	57.92 ± 0.59
DPPH radical scavenging activity (%)	68.13 ± 2.45	53.95 ± 1.52	73.88 ± 1.21

Data given are mean ± standard deviation for three different value of each sample. Values denoted with the different letter within the same row are significantly ($p \leq 0.05$) different.

The pH value of shidal samples ranged from 6.09 ± 0.15 to 6.74 ± 0.02 . The pH of punti shidal appeared to be a little higher with respect to other shidals, but this may be owing to the higher amount of volatile nitrogenous compound production during fermentation that accumulated in punti shidal. Similar results were observed by other scientist Kakati and Goswami, who reported that the pH values of punti and bashpata shidal were 6.10 and 6.20 respectively [11]. The content of TVB-N of the product is the signs of excessive fermentation [13]. The TVB-N values of the shidals ranged from 37.57 ± 0.51 mg/100g to 57.92 ± 0.59 mg/100g, indicating the degradation of tissue protein responsible to produce the typical flavor and aroma of shidals. The TVB-N content was found to be 45.61 ± 0.67 mg/100g, 37.57 ± 0.51 mg/100g and 57.92 ± 0.59 mg/100g in punti, kangla and bashpata shidals, respectively. These results are consistent with the reports made by some authors [11, 15]. Similar TVB-N values were reported by Sarojnalini and Suchitra in ngari, a local fermented fish found in the Manipur State of India [16]. TVB-N in fermented fish product do not contribute to the formation of any ammonia-like odor in fermented fish products indicating that the punti, kangla and bashpata shidals investigated in this study were supported by Majumdar et al. [2]. DPPH radical scavenging activity of punti kangla and bashpata shidal was determined as $68.13 \pm 2.45\%$, $53.95 \pm 1.52\%$ and $73.88 \pm 1.21\%$ respectively (table 2). The highest DPPH radical scavenging activity was found to be $73.88 \pm 1.21\%$ in bashpata shidal while the lowest DPPH radical scavenging activity was observed at $53.95 \pm 1.52\%$ in kangla shidal. Higher DPPH radical scavenging activity reveals the high contents of antioxidants in the fermented fish products. These results are supported with the reports made by some others researchers [5, 13]. It is well recognized that the bioactive agents from our diet can inhibit the effects caused by oxidative stress [17]. Therefore, punti, kangla and bashpata shidals may be considered as health-food from the observed protein, fat content and DPPH radical scavenging activity.

IV. CONCLUSION

The present study revealed that punti, kangla and bashpata shidals (fermented fish products) possess a high nutritive value and antioxidative properties. Therefore, it can be concluded that punti, kangla and bashpata shidals, three salt-free fermented fish products of Sylhet region of Bangladesh are potential sources of nutrients and natural antioxidants.

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Conflicts of Interest

The authors confirmed no conflicts of interest among them.

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