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QUALITY ASPECTS OF SOME DRIED FISH PRODUCTS COLLECTED FROM DIFFERENT SUPER SHOPS OF DHAKA CITY IN BANGLADESH

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Abstract

An in-depth investigation was carried out on the quality aspects of some dried fish products collected from different super shops of Dhaka city in Bangladesh. The colour of four different dried fish samples namely Parshe (*Mugil cephalus*), Bombay duck (*Harpodon nehereus*), Shark (*Scoliodon shorrakowah*), and Ribbon fish (*Trichiurus haumela*), were brown yellowish to shiny silvery with little difference among the species. Texture of solar tunnel dried fish products was harder and not easily flexible with characteristic odour. No infestation or broken pieces were found around the products. The reconstitution properties of four dried marine fish muscles were assessed at a wide range of temperatures after soaking in water for 15 to 60 minutes. The results shows that as temperature increase (from 20°C to 80°C) reconstitution level was increased and it was in the range of 65.01% to 76.34% in Parshe, 48.26% to 66.16% in Shark, 70.16% to 78.77% in Bombay duck and in Ribbon fish it was found 74.09% to 59.46%. After 15 minutes of soaking time at all the temperature of all the samples were shown similar pattern except Ribbon fish. Bombay duck showed higher constitution rate (74.1%) while lower percentage shown in Shark meat (48.26%). After soaking for 60 minutes at 60°C, the highest level of reconstitution properties was in the range of 59.03% to 78.39% with minimum in Shark and maximum in Bombay duck. Reconstitution capacity of dried fish samples increased considerably with increase in temperature and duration of time. When the samples were allowed soak at 80°C, for a period of 60 min. reconstitution level was in the range of 59.46% to 78.77% with maximum value recorded for Bombay duck and the minimum value for Ribbon fish. Moisture content of Parshe, Shark, Bombay Duck and Ribbon fish were varied between 21.19% to 24.46%. It was found higher in Ribbon fish (24.46%) rather than lower in Parshe (21.19%). Ash, protein, and lipid content of dried fish samples of these species were in the range of 8.1% to 15.02%, 61.25% to 68.09 % and 2.97% to 8.22%, respectively. The pH value of the studied samples varied from 6.2 to 8.13. Parshe and Bombay duck showed higher pH (8.03 and 8.13) while, Shark and Ribbon fish showed lower pH (6.2). The comparative study of microbiological load (cfu gm^{-1}) of four (collected twice) dried fish examined in laboratory for standard plate count (SPC). The microbial load of four dried fish samples collected from different super shops of Dhaka city varied a range of 7.06 ×103 cfu gm^{-1} to 5.58 × 104 cfu gm^{-1}. The results revealed that Shark (S2) and Parshe (S1) carried bacterial load high and it was 5.58 × 104 cfu gm^{-1} and 4.25 × 104 cfu gm^{-1}, respectively. The results of TVB-N of four dried fish in summer varied 48.28 ± 0.87 to 70.73 ± 0.22 mg-N 100 g^{-1}. While, TMA-N of this four dried fish were 43.5± 0.46, 34.14 ± 0.69 mg N 100 g^{-1}, 56.17 ± 0.29 and 44.15 ± 0.96 mg N 100 g^{-1} , respectively. In winter, TVB-N and TMA-N of the four common dried fish varied over a range of 33.31 ± 0.75 to 62.23 ±0.71 mg N 100 g^{-1} and 22.81±0.08 to 51.13±0.45 mg N 100 g^{-1}). All the values of studied samples were much lower than acceptable limit which ranged between 30 – 40 mg-N 100 g^{-1}. The results of the study indicated that dried fish products were acceptable quality in terms of organoleptic and food quality aspects.

Keywords: Dried fish, organoleptic, microbiological, proximate composition and water reconstitution rate.

Introduction

The fisheries sector in Bangladesh plays an important role in the country's socio-cultural and economic life through providing food, nutrition, alleviating poverty, creating employment opportunity and earning foreign exchange. The total fish production of the country in 2009 - 2010 was 486.93 million metric tons and in 2013 - 14 it was 630.24 million metric tons (DoF, 2015). Fisheries sector contributes 3.74% of Gross Domestic Product (GDP) where 23.12% in total agricultural income; 3% of the foreign exchange earnings whereas in 1999 - 2000, total fish

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production was only 16.61 lakh MT (DoF, 2015). Bangladesh earns a significant amount of foreign currency by exporting dried fish and fishery products which ranks third in the export item of fish and fishery products. Bangladesh earned about Taka 3.71 crore as foreign currency by exporting about 272 tons of dried fish and fishery products in 2013-2014 (DoF, 2015).

Fish is an extremely perishable food commodity. According to local estimate artisanal catch comprises 95% of the total marine catch in the country of which 20% are being sun dried and consumed in the domestic market (Coulter and Disney, 1987). About 20% of the marine artisanal catch is sun dried in Bangladesh and consumed mainly by the rural people (Coulter and Disney 1987). Most of the traditional sun dried products available in the market are poor in quality and not suitable for human consumption (Kamruzzaman, 1992; Khan, 1992; Saha, 1999; Reza *et al.*, 2005). The major quality problems associated with sun dried fish products are insect infestation during drying, improper storage, contaminations, use of insecticides and spoilage. The quantitative losses through spoilage and insect attack on fish being dried fish have been estimated to 10-35% in the marine areas (Doe *et al.*, 1977; Ahmed *et al.*, 1978). In order to improve the quality of traditional dried fish products, a solar tunnel dryer constructed with locally available materials was found very suitable for drying of silver jew fish at temperature of 45 to 52°C for 5 days without showing any infestation, oxidative rancidity, spoilage and contamination (Bala and Hossain, 1998; Bala and Mandal, 2001; Reza, 2002; Reza *et al.*, 2006). However, the present study was undertaken to understand the quality of dried fish produced in a solar drying by determining organoleptic, physical, biochemical and microbiological aspects.

Materials and Methods

Sample collection: Four dried marine fish samples namely Parshe (*Mugil cephalus*), Bombay duck *(Harpodon nehereus)*, Shark (*Scoliodon shorrakowah*), and Ribbon fish *(Trichiurus haumela)* were collected from five super shop of Dhaka city and transported to the quality control laboratory of Department of Fisheries, Khulna in an air tight polythin bag.

Organoleptic quality assessment: The evaluation of organoleptic quality of dried fish is based on the method currently used by Fish Inspection and Quality Control (FIQC) of Department of Fisheries (DoF), Government of Bangladesh with slight modification. Representative whole sample of dried products were taken on a tray to assess the organoleptic characteristics such as colour, odour, texture, broken pieces and insect infestation by a four member panels of experts.

Physical study (Water reconstitution properties): Five gram of dried fish muscle sample put into a nylon net and allowed to soak in one liter of water in water bath at different temperature for a period of maximum of 60 minutes with occasional stirring. When the samples were taken out from the water bath, water was drained off through a coarse nylon net. All the muscle fleshes were then transferred to the strainer and extraneous water was wiped off by a piece of blotting paper. Then the fleshes were weighed again. The gain of moisture for each sample was calculated as percent reconstitution. The reconstitution behavior was measured in water temperature at 20°C, 40°C, 60°C and 80°C. Reconstitution percentage was measured at 15 minutes intervals for each temperature.

Quantification of microbial load: 20.0 gm of pooled sample (dried fish) was weighed and taken into a sterile warring blender jar for blending. The sample was added into a flask containing 180 ml 0.1% sterile peptone water. The mixture was homogenized for two minutes. This provided a dilution of 10^{-1}. 1.0 ml. of this suspension was transferred into McCarty's bottles containing 9 ml of 0.1% peptone water to give a dilution of 10^{-2}. The process was repeated for the preparation of 10^{-3}, 10^{-4} and 10^{-5} dilutions, respectively.

The appropriate dilutions were selected and for every dilution 1.0 ml aliquot were transferred into a sterile petridishes. 20.0 ml portion of molten Plate Count Agar (PCA) was poured into each of this sterile petridishes. The plates were then rotated 5 times clockwise, 5 times anticlockwise, 5 times back and forward. Care was taken not to splash agar on the lid of the dish. Plates were left to solidify. The plates were inverted and incubated at $35^0 \pm 20$°C for 48 h. Plates with 30 - 300 colonies on the surface were only counted.

Proximate composition, pH and Biochemical Analysis: Proximate composition analysis of moisture, ash, lipid and crude protein were carried out according to the standard methods given in AOAC (1980).

Pooled dried muscle was taken from anterior portion (avoiding the red meat portion). Ten gm sample was grinded and mixed well with 100 ml distilled water and grinding for 30 sec. The homogenate was measured in a pH meter with a glass electrode using an expanded scale. TVB-N (Total volatile basic nitrogen) and TMA-N (Tri-methyl Amine basic Nitrogen) were determined according to Conway Micro-diffusion technique (Conway, 1977).

Results and Discussion

Organoleptic characteristics: The results on organoleptic characteristics of dried products obtained from the present study are summarized in the Table 1. The colour of five different dried fish samples namely Parshe (*Mugil cephalus*), Bombay duck *(Harpodon nehereus)*, Shark (*Scoliodon shorrakowah*), and Ribbon fish *(Trichiurus haumela)*, were brown yellowish to shiny silvery with little difference among the species. Texture of solar tunnel dried fish products was harder than those obtained from rotating dryer and not easily flexible with characteristic odour. No infestation or broken pieces were found around the products and the overall quality of all three dried fish products was good. The odour was very natural and the textural characteristics were firm and flexible in all of the samples.

Table 1. Organoleptic quality assessment of four dried fish collected from different super shops in Dhaka city.

Dried fish sample	Color	Odor	Texture	Infestation	Broken pieces	Overall quality
(Parshe)	Slightly Brown	Characteristic odor	Firm and flexible	Nil	Nil	Excellent
Shark	Silvery	Characteristic odor	Firm and flexible	Nil	Nil	Excellent
(Bombay Duck)	Slight Whitish	Characteristic odor	Firm and flexible	Nil	Nil	Excellent
(Ribbon)	Whitish	Characteristic odor	Firm and flexible	Nil	Nil	Excellent

Water reconstitution properties: The reconstitution properties of four dried marine fish muscles were assessed at a wide range of temperatures after soaking in water for 15 to 60 minutes and the results are presented in Table 2. The results shows that as temperature incase (from 20°C to 80°C) reconstitution level was increased and it was in the range of, 65.01% to 76.34% in Parshe 48.26% to 66.16%, in Shark, 70.16% to 78.77% in Bombay duck, and in Ribbon fish it was 74.09% to 59.46%. After 15 minutes of soaking time at all the temperature of all the samples were shown similar pattern accept Ribbon fish. Bombay duck showed higher constitution rate (74.1%) while lower percentage shown in Shark meat (48.26%). After soaking for 60 minutes at 60°C, the highest level of reconstitution properties was in the range of 59.03% to 78.39% with minimum in Shark and maximum in Bombay duck. Reconstitution capacity of dried fish samples increased considerably with increase in temperature and duration of time. When the samples were allowed soak at 80°C, for a period of 60 min. reconstitution level was in the range of 59.46% to 78.77% with maximum value recorded for Bombay duck and the minimum value for Ribbon fish.

A close relationship was observed between the reconstitution capacity and physical properties of the samples. The quality of the dried fish is also related to final water activity. At low values, water uptake proceeds more quickly. In properly dried fish the water uptake is more is reported to complete in 3-15 minutes (Sikorski *et al.,* 1995). In the present study, solar dried products exhibited slightly less rehydration properties which might be due to the denaturation of protein that took place during drying process and cause some sort of damage to the cellular structure in an irreversible manner. Thus little poor reconstitution in Shark meat compared to other dried fish was due to cemented and compact structure of the muscle with few interfibrillar spaces. With a tough and rubbery tissue, water penetrates mostly to the centre of large pieces by diffusion through the protein of the fiber itself and the process is very slow (Connell, 1957; Sen *et al.,* 1961; Lahiry *et al.,* 1961). Considering the reconstitution ability, it can be stated that dried fish products were off slightly better quality. The studies on the reconstitution rate (%) of the dried products soaked in water at normal room temperature and hot water demonstrated that reconstitution rate was comparatively faster at hot water compared to samples kept at room temperature except for Bombay duck. The dried product, Bombay duck showed an inverse relation with other dried products. The reason could not be assessed.

Biochemical composition: Data of proximate composition analysis of four dried marine products are shown in Table 3. It is evident that a slight variation was observed in moisture, ash, protein and fat content of four dried fish. Moisture content of Parshe, Shark, Bombay duck and Ribbon fish were varied between 21.19% and 24.46%.

Moisture content was found higher in Ribbon fish (24.46%) rather than lower in Parshe (21.19%). Ash, protein, and lipid content of dried fish samples of these species were in the range of 8.1% to 15.02%, 61.25% to 68.09 % and 2.97% to 8.22%, respectively. It may be attributed to the fact that it was processed in winter and investigated immediately as winter was the season of processing.

The result of Hussain, *et al.* (1992) at four fish drying yards on the species used, drying practices and the quality of the dried products support the results of present study. The moisture content of the samples varied over a large range from 12.3% to 54%. They also reported that protein (17.2% to 78%), fat (3.7% to 17.8%) and ash (1.4 to 21.6%) content varied widely in 23 different dried species.

Table 2. Physical, and microbiological quality assessment five dried fish collected from different super shops in Dhaka city.

Dried fish sample	Soaking Temp.	Reconstitution rate (%) at different Soaking time (mins)				Microbial Load (cfu gm^{-1})
		15	30	45	60	
S1 (Parshe)	Room temp. (20°C)	65.01	66.67	68.08	70.47	4.25×10^4
	40°C	66.86	66.98	67.14	68	
	60°C	66.01	67.71	68.84	72.26	
	80°C Room	69.32	72.48	74.14	76.34	
S_2 Shark	Room temp. (20°C)	48.26	48.92	49.74	52.94	5.58×10^4
	40°C	50.06	51.17	51.88	53.77	
	60°C	55.02	56.27	58.17	59.03	
	80°C Room	59.67	60.91	63.79	66.16	
S_3 (Bombay Duck)	Room temp. (20°C)	70.16	71.14	71..73	71.93	7.06×10^3
	40°C	73.35	74.23	74.86	75.26	
	60°C	73.84	74.37	75.74	78.39	
	80°C Room	74.1	74.16	75.26	78.77	
S_4 (Ribbon fish)	Room temp. (20°C)	74.09	73.55	73.01	72.27	8.11×10^3
	40°C	70.18	70.07	68.31	68.18	
	60°C	65.26	65.56	64.79	64.62	
	80°C Room	60.99	59.63	59.82	59.46	

Table 3. Proximate composition of four dried fish collected from different super shops in Dhaka city.

Dried fish sample	**Moisture (%)**	**Ash (%)**	**Protein (%)**	**Fat (%)**	**pH**	**TVB-N (mg N 100 g^{-1})**	**TMA-N (mg N 100 g^{-1})**
S1 (Parshe)	21.19	10.35	68.09	8.22	8.03	57.82 ± 0.69	43.5 ± 0.46
S_2 (Shark)	23.81	8.1	64.06	2.97	6.2	48.28 ± 0.87	34.14 ± 0.69
S_3 (Bombay Duck)	21.26	15.02	61.25	3.5	8.13	70.73 ± 0.22	56.17 ± 0.29
S_4 (Ribbon)	24.46	9.51	62.36	3.67	6.2	59.86 ± 0.61	44.15 ± 0.96

Table 3 showed the pH content of the studied samples and it was varied from 6.2 to 8.13. Parshe and Bombay duck showed higher pH (8.03 and 8.13) while, Shark and Ribbon fish showed lower pH (6.2).

Table 3 also illustrates the biochemical changes in four dried fish. TVB-N values varied between 48.28±0.87 to 70.73±0.22 mg N $100g^{-1}$. However, Shark indicated a much lower content of TVB-N (48.28±0.87 mg N $100g^{-1}$) in comparison to the other three samples where the values were higher than 55.0 mg 100 g^{-1}. The value of TVB-N value, Shark showed a much reduced amount of TMA-N (34.14 m 0.69 mg N 100 g^{-1}). While Parshe, Bombay duck and Ribon fish had TMA-N content of 43.5 m 0.46, 56.17 m 0.29 and 44.15 m 0.96 mg N 100 g^{-1}, respectively.

According to Connell (1976) TAM-N is used as spoilage indicator of marine fish. Total Volatile Basic Nitrogen (TMA-N) is a quality index of freshness of fish. According to Tsai, *et al.* (1989) the standard limit of TVB-N and TMA-N content of dried fish is <138 mg N 100 g^{-1} and <18 mg N 100 g^{-1}. The TVB-N content of present investigation is much lower than that of standard limit of acceptability.

Microbiological activity: Table 2 shows the comparative study of microbiological load (cfu gm^{-1}) of four (collected twice) dried fish examined in laboratory for standard plate count (SPC). The standard plate count (SPC) of different samples indicated an acceptable microbial load. Four dried fish samples collected different super shops of Dhaka city varied between a range of 7.06×10^3cfu gm^{-1} to 5.58×10^4cfu gm^{-1}. The results revealed that Shark (S_2) and Parshe(S_1) carried bacterial load high and it was 5.58×10^4cfu gm^{-1} and 4.25×10^4cfu gm^{-1}, respectively. Cho *et al.* (1988) reported the viable bacterial counts ranged from 10^3 to 10^7cfu gm^{-1} in dried fish. Ito *et al.* (1984) observed that the viable bacterial count of dried Sardine was 4.9×10^4cfu gm^{-1} and dried Jel fish 1.0×10^7cfu $gm^{-}1$, respectively. The present investigation also indicated that SPC of four dried fish varied widely. Although the present level of moisture content were quite unsuitable for the growth of bacteria, yet in the tropical region like Bangladesh, without proper packaging, it was almost impossible enough to prevent uptake of water, and some degree of spoilage was almost inevitable during storage. Kamruzzaman (1992) reported that dried fish products even with low moisture content stored under no protection against high humidity might be vehicle for bacteria responsible for food spoilage.

The results of the present study indicated that dried fish collected from five super shops of Dhaka city were acceptable quality in terms of organoleptic, biochemical as well as microbiological and food quality aspects.

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