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Comparison of Organoleptic and Chemical Characteristics of Some Traditional and Improved Dried Fish Products

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Abstract

This study was investigated to compare the organoleptic and chemical characteristics of four traditional sun dried fish products of Taki (Channa punctatus), Guchi baim (Mastacembelus pancalus), Jat punti (Puntius sophore) and Tengra (Mystus vittatus) with the improved sun dried fish products. The traditional sun dried fishes were collected from local market of Sylhet, Bangladesh and improved sun dried fishes were prepared in the laboratory. Results showed that the color, odor and texture of the improved sun dried fishes were excellent than those of the traditional sun dried fishes. Water reconstitution properties also varied between traditional and improved sun dried fishes where maximum rehydration was observed in the improved sun dried fishes both at 40ºC and 60ºC. Moisture content of the traditional sun dried fishes were varied between 18.32% and 24.63% whereas improved sun dried fishes contained up to 15.99% moisture irrespective of the species. Protein, lipid and ash content of the traditional sun dried fishes were comparatively lower than those of the improved sun dried fishes. Results of this study revealed that quality of the improved sun dried fishes were comparatively better than those of the dried fishes prepared by the traditional method. These results suggest that quality raw materials (fresh fish) as well as hygienic drying method should be practiced to produce quality dried fish products.

Keywords: Dried fish, Organoleptic properties, Water reconstitution and Chemical composition.

Introduction

Drying is considered as one of the most important methods of fish preservation throughout the world. It is regarded as a traditional and primitive preservation method. Dried fish is a low cost dietary protein sources and used as a substitute of fish at the scarcity of fresh fish in Bangladesh[1]. Almost all species of fish can be sun dried and the nutritional quality remains intact after drying the fish. Dried fish retains higher nutritional value compared to raw fish. Moreover, the drying process does not require huge money or highly skilled manpower. It can be performed everywhere from deck of the fishing boat to the roof of the house and the products can be easily transported, marketed and stored in all places of the country. About 20% of the artisanal catch is being dried by traditional sun drying methods and consumed in the domestic market. It is also considered as an important exportable fishery product[2]. The significant amount of dried fishes (approx. 622 mt) were exported from Bangladesh and earned 250.06 million taka as foreign currency[3].

In recent years, Bangladeshi dried fish and fishery products are decreasing trend of export market demand due to the use of low qualities raw fish for the drying purposes, traditional drying practices, improper hygienic and sanitation facilities and indiscriminate use of unauthorized chemical and insecticides at the different stages of handling and processing of dried fish. Moreover, fish drying is usually performed in an open platform or placing the fish on the mats, grass or sands. As a result, the fish is contaminated by dust, dirt or sand and pathogens. It is even a very slow process which makes the products lower quality by contributing the partial destruction of protein and lipid contents through denaturation, oxidation and bacterial or enzymatic degradation. Moreover, available literatures suggest that the quality of the traditional sun dried products found in the local market is not satisfactory for human consumption[4-8]. Therefore, the present study was aimed to compare the organoleptic and chemical characteristics of traditional and improved sun dried fish products.

Materials and Methods

Collection of Traditional Sun Dried Fishes: Four common and available small indigenous dried fish species such as Taki (*Channa punctatus*), Guchi baim (*Mastacembelus pancalus*), Jat Punti (*Puntius sophore*) and Tengra (*Mystus vittatus*) were purchased from local market of Sylhet Sadar Upazilla under Sylhet district during the month of August to September, 2014. Dried fish samples were then packed tightly in a separate polythene bag and brought to the laboratory of the Department of Fisheries Technology and Quality Control, Sylhet

Agricultural University, Sylhet. These samples were stored in a cool and dry place for two months for subsequent quality assessment.

Production of Improved Sun Dried Fishes: The same four species of fishes were also sun dried with proper hygienic and sanitary conditions to obtain improved sun dried products. Fresh fish samples were purchased from Kazir Bazar, Sylhet and transported to the laboratory using an insulated box with fish ice ratio of 1:1. Upon arrival in the laboratory, fishes were washed with tap water to remove the dirt. Then the fishes were gutted and viscera were removed using knives, and washed again with tap water to remove blood, slime and other undesirable substances. The fishes were then treated with turmeric powder for the production of improved sun dried fish products. The washed fishes were exposed under sun for 2 to 3 days until complete drying. The dried fishes were packed in an air tight polythene bag so that moisture cannot be absorbed. Finally, the dried fish products were stored in a clean, cool and dry place for the subsequent analyses.

Assessment of Organoleptic Properties: The organoleptic properties of traditional and improved sun dried fishes were determined according to the method described by Howgate[9]. For this purpose, firstly the color, odor, texture, insect infestation and presence of broken pieces were assessed by five panel members of the Department of Fisheries Technology and Quality Control, Sylhet Agricultural University, Sylhet and consensus was made on the overall quality of each product based on these characteristics.

Determination of Water Reconstitution Behavior: About 8-10 g of sample from individual fish species was taken and weighted by analytical balance and then immerged into water at 40 ºC and 60 ºC. The dried fish sample was soaked into water for 45 minutes. Any loose muscle that attached to sample was removed before dipping into water. The dried fish sample was removed from the water at every 15 minutes interval and the surface water was removed with blotting paper and reweighted each sample by analytical balance. The percentage of water uptake in rehydrated fish sample was calculated using the following formula:

$$\text{Water reconstitution (\%)} = \frac{W_r - W_i}{W_i} \times 100$$

Where: W_i = Initial weight of the dry fish, W_r = Weight of the dry fish after water absorption.

Analysis of Chemical Composition: Chemical composition such as moisture, crude protein, lipid and ash were determined based on the AOAC methods[10].

Statistical Analysis: For each measurement, analyses were repeated 3 to 5 times, data were pooled, and the mean and standard deviation were determined. Statistical analysis was performed using Microsoft Office Excel 2007. The student's t-test was carried out to determine significant differences between traditional and improved sun dried fish products. Trends were considered significant when the means of compared sets differed at $P < 0.05$.

Results and Discussion

Organoleptic Properties of Dried Fish Products: The results of the organoleptic properties of traditional and improved sun dried fish products are presented in Table-1. It was found that the color of all the traditional sun dried fishes differed from silvery to whitish depending on the species. In some cases, slightly sour or sour odor was observed in some of the products. Infestations by flies and insects were also observed in the dried fish products. The eggs and larvae of the insects were seen on the different parts of the dried fishes. The fungal growth was also observed in some of the dried fishes. Although the broken pieces were not commonly found in all the species but observe in some of the products. On the other hand, the improved sun dried fishes were noticed whitish to yellowish color with slight variation. Texture was firm and flexible in all of these species. Insect infestation or broken pieces was not seen in these products during the storage period under laboratory conditions. However, improved sun dried fishes showed better quality when compared with those of the dried fishes obtained from the local market. It has been reported that the traditional sun dried fish products showed objectionable color, odor and texture whereas the dried fish produced by solar tunnel drier gave comparatively better quality in all aspects[11]. It has also been reported that no discoloration was observed in the traditional and improved sun dried fish products but some sort of insect infestation was noticed in the traditional sun dried products during the study period[12].

Water Reconstitution Behavior of Dried Fish Products: Water reconstitution behavior of traditional and improved sun dried fish products are summarized in Table-2. It was observed that the traditional sun dried fish, *Channa punctatus* absorbed 20.43% moisture within 15 minutes of initial soaking at 40ºC. The rehydration values in all the dried fishes were higher when kept for a longer period of time. The values were increased from 28.52% to 36.01% after soaking for 30 and 45 minutes, respectively. The water reconstitution rate was also increased with the increasing of temperature. The traditional sun dried *Channa punctatus* was found to be absorbed 20.67% moisture within 15 minutes which was increased up to 39.23% while soaked into water at 60ºC for 45 minutes. A similar trend in water rehydration properties was also observed for other traditional sun dried fish products both at 40ºC and 60ºC, although no significant difference was observed among these products at both the temperatures. In contrast, all the improved sun dried fishes showed higher rehydration capacity at both the temperature of 40ºC and 60ºC. It was also observed that the rehydration values of all the improved sun dried fishes were significantly higher than those of traditional sun dried fishes when water reconstitution behavior was compared between the test samples.

Table-1
Organoleptic properties of traditional and improved sun dried fish products

Species	Drying method	Color	Odor	Texture	Infestation	Broken pieces	Overall quality
Channa punctatus	Traditional	Off white and clear	Characteristic odor	Firm and Flexible	No infestation	Nil	Good
	Improved	Whitish	Characteristic odor	Firm and flexible	No infestation	Nil	Excellent
Mastacembelus pancalus	Traditional	Off white and clear	Natural	Firm and Flexible	Slightly infestation by flies	Nil	Good
	Improved	Whitish	Characteristic odor	Firm and Flexible	No infestation	Nil	Excellent
Puntius sophore	Traditional	Whitish	Natural	Firm	No Infestation	Nil	Good
	Improved	Whitish	Characteristic odor	Firm and flexible	No infestation	Nil	Excellent
Mystus vittatus	Traditional	Whitish	Slightly sour	Soft	No Infestation	Slightly Broken	Good
	Improved	Whitish	Characteristic odor	Firm and flexible	No infestation	Nil	Excellent

In the present study, the improved sun dried fishes were rehydrated more rapidly than those of the traditional sun dried fishes, although the rehydration ability in all fish samples was higher when soaked in elevated temperature and longer period of time. In this study, the overall trend of the rehydration was nearly identical with the values which was reported earlier, although those studies were carried out in a variety of temperature, time and species[13,14]. It has been reported that increasing of water temperature also increases the rate of rehydration. This might be due to the fact that increased temperature of water opens the structure of fish products which maximize the scope of rapid rehydration. It has been reported that there was a positive relationship between rehydration ability and physical properties of the dried fish products[7]. Moreover, rehydration of food products depends mainly on the internal structure of the dried fish muscle[13,15].

Chemical Composition of Dried Fish Products: The chemical composition such as moisture, protein, lipid and ash content of traditional and improved sun dried fish products are presented in Table-3. The moisture content of the traditional sun dried fishes was varied from 18.32% to 24.63%. On the contrary, the moisture content in the improved sun dried fishes varied from 13.24% to 15.99% in which the highest value (15.99%) was found in *Channa punctatus* and the lowest value (13.24%) was observed in *Puntius sophore*. Results also showed that the traditional sun dried fishes contain significantly higher moisture content than those of the dried fishes prepared by the improved method. It is known that the dried fish products contain less amount of moisture which indicates the better quality of the products. It is known that dried fish with 15% or less moisture content is well enough to inhibit microbial growth[16]. It has been reported that the moisture content of four sun dried small indigenous fish products (control) were within the acceptable limit (<25%), whereas the moisture content of traditional sun dried products were comparatively higher than the recommended value[8].

The protein content of traditional sun dried products were ranged between 42.08% and 56.46%, in which the highest protein content (56.46%) was found in *Mystus vittatus* and the lowest (42.08%) was observed in *Mastacembelus pancalus*. On the other hand, the protein content of the improved sun dried products was observed within the range of 62.01% to 65.02% where the highest value (65.02%) was obtained in *Mystus vittatus* and the lowest value (62.01%) was found in *Mastacembelus pancalus*. Overall the protein content of improved sun dried products showed comparatively higher amount than those of traditional sun dried fish products. Similar results also reported by Ahmed *et al.*[17]. They reported that traditional sun dried fish products contain less amount of protein than control sun dried products.

Table-2
Water reconstitution behavior of traditional and improved sun dried fish products[1]

Species	Soaking Temperature	Soaking time (minutes)	Water Reconstitution (%)	
			Traditional	Improved
Channa punctatus	40°	15	20.43 ± 0.82[a]	30.03 ± 0.82[b]
		30	28.52 ± 0.26[a]	40.01 ± 0.32[b]
		45	36.01 ± 0.07[a]	52.60 ± 0.70[b]
	60°	15	20.67 ± 0.19[a]	31.85 ± 0.31[b]
		30	29.63 ± 0.27[a]	43.44 ± 0.29[b]
		45	39.23 ± 0.56[a]	55.55 ± 0.66[b]
Mastacembelus pancalus	40°	15	21.19 ± 0.57[a]	31.25 ± 0.27[b]
		30	31.37 ± 0.47[a]	41.56 ± 0.71[b]
		45	37.97 ± 0.14[a]	53.26 ± 0.27[b]
	60°	15	22.77 ± 0.22[a]	32.52 ± 0.26[b]
		30	33.37 ± 0.16[a]	44.60 ± 0.22[b]
		45	39.97 ± 0.32[a]	55.92 ± 0.13[b]
Puntius sophore	40°	15	18.65 ± 0.28[a]	28.30 ± 0.19[b]
		30	27.26 ± 0.23[a]	37.63 ± 0.59[b]
		45	35.60 ± 0.08[a]	50.54 ± 0.11[b]
	60°	15	20.43 ± 0.07[a]	29.26 ± 0.10[b]
		30	28.74 ± 0.20[a]	40.19 ± 0.03[b]
		45	37.36 ± 0.56[a]	52.51 ± 0.23[b]
Mystus vittatus	40°	15	19.54 ± 0.17[a]	29.60 ± 0.37[b]
		30	28.63 ± 0.10[a]	39.52 ± 0.14[b]
		45	37.12 ± 0.39[a]	52.49 ± 0.18[b]
	60°	15	20.78 ± 0.38[a]	31.52 ± 0.16[b]
		30	29.94 ± 0.25[a]	43.68 ± 0.05[b]
		45	38.44 ± 0.13[a]	54.59 ± 0.25[b]

[1]Each value is expressed as mean ± SD (n = 3). Means with different superscript letters (a and b) within a row are significantly different ($P < 0.05$).

Table-3
Chemical composition (% fresh matter basis) of traditional and improved sun dried fish products[1]

Species	Drying method	Moisture	Protein	Lipid	Ash
Channa punctatus	Traditional	21.43 ± 0.89^{b}	54.65 ± 0.65^{a}	6.01 ± 0.12^{a}	15.76 ± 0.30^{b}
	Improved	15.99 ± 0.35^{a}	63.68 ± 0.18^{b}	7.73 ± 0.40^{b}	11.43 ± 0.45^{a}
Mastacembelus pancalus	Traditional	23.52 ± 0.32^{b}	42.08 ± 0.33^{a}	7.86 ± 0.10^{a}	23.25 ± 0.35^{b}
	Improved	13.55 ± 0.54^{a}	62.01 ± 0.32^{b}	8.57 ± 0.19^{b}	13.01 ± 0.36^{a}
Puntius sophore	Traditional	18.32 ± 0.30^{b}	42.40 ± 0.25^{a}	5.15 ± 0.22^{a}	24.17 ± 0.95^{b}
	Improved	13.24 ± 0.83^{a}	63.55 ± 0.25^{b}	6.90 ± 0.06^{b}	13.17 ± 0.33^{a}
Mystus vittatus	Traditional	24.63 ± 0.54^{b}	56.46 ± 0.62^{a}	6.17 ± 0.18^{a}	18.64 ± 0.28^{b}
	Improved	13.81 ± 0.70^{a}	65.02 ± 0.13^{b}	7.41 ± 0.23^{b}	12.48 ± 0.29^{a}

[1]Each value is expressed as mean ± SD (n = 3). Means with different superscript letters (a and b) of each species within a column are significantly different ($P < 0.05$).

The lipid content in the traditional sun dried products varied from 5.15% to 7.86%, whereas the highest lipid content (7.86%) was found in *Mastacembelus pancalus* and the lowest value (5.15%) was observed in *Puntius sophore*. Similarly, the highest lipid content (8.57%) was observed in *Mastacembelus pancalus* and the lowest value (6.90%) was found in *Puntius sophore* when fish were dried by improved method. However, improved sun dried products resulted in higher amount of lipid content compared to the products dried by the traditional method. The lipid content was varied between of 3.21% and 14.03% with the highest lipid content found in *Amblypharyngodon mola* and the lowest in *Channa punctatus*[18]. On the other hand, some scientists obtained 3.7-17.8% fat in 23 sun-dried fish species[19], which is more or less similar to the present study.

The ash content of traditional sun dried products ranged from 15.76% to 24.17%, where the highest value (24.17%) was observed in *Puntius sophore* and the lowest value (15.76%) was found in *Channa punctatus*. On the other hand, the ash content of improved sun dried products varied from 11.43% to 13.17%, which were significantly lower than those of the traditional sun dried products. The ash content varied over a larger range of 1.4-21.6% in 23 different small indigenous fish species[19]. It has also been reported that a wide range of ash content from 5.08 to 12.14% found in fourteen dried fishes[20].

Conclusion

In the traditional sun drying method in Bangladesh, drying is mostly carried out in an unhygienic condition. Results of this study demonstrated that the dried fish produced by the improved method showed better quality compared to the product prepared by the traditional method. Therefore, it is necessary to maintain proper hygienic and scientific methods to produce quality dried fish products. Moreover, the quality and safety of the dried fish product is highly desirable for the health conscious people in the country and to achieve this scientific and improved drying method should be practiced throughout the country.

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