Evaluation of Quality and Storage Stability of Commercially Produced Dried Fish of Tengra (*Mystus vittatus*) with Laboratory Produced Dried Fish Products

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Abstract

To evaluate the performance and quality of the commercially sun dried fish the present study was designed and conducted by carrying out production of experimentally sun dried fish for a comparative study. It was observed that the experimentally sun dried tengra fish in laboratory contained moisture 15.10-16.90%, protein 58.02-63.21%, fat 8.01-10.50%, and ash 8-10.50%. The commercially sun dried tengra collected from the local market contained moisture 21.05-23.50%, protein 52.10-55.31%, fat 9.02-12%, and ash 12.50-14%. The quality deterioration of the dried fish was studied by observing physical changes such as color, texture, odor and visual appearance by acceptability score technique and change in chemical index of total volatile nitrogen (TVN). The TVN value gradually increased as the quality of the fish products decreased. In case of experimentally sun dried tengra fish the highest TVN value was found 330 mg 100^{-1} g of fish while in the commercially sun dried tengra fish it was 390 mg 100^{-1}g of fish. A direct relationship between moisture and TVN value and an inverse relationship between sensory score and TVN value was observed. The moisture content of the fish product gradually increased as the protein content of the products decreased.

1. Introduction

Fish is one of the most important sources of animal protein available in the tropics and has been widely accepted as a good source of dietary protein and other elements for the maintenance of the healthy body. Dried fish product is used as a means of prolonging shelf life after capture. Sun drying is one of the most important low cost methods of fish preservation and the products provide nutrients to all categories of people throughout the world including Bangladesh.

Doe et al. (1977) observed the spoilage of dried fish and the effect of water activity and temperature on spoilage organisms. He reported that spoilage of dried fish might be due to bacteria, fungi, brining and others, all of which are temperature and water activity dependent. For improving the quality of dried fish several methods of drying have been developed and practiced especially in Bangladesh, and the feasibility of their application was also studied. Doe et al. (1977) worked with the polythene tent drier for getting improved quality of sun dried fish.

Fish production has been increased to 24.40 lmt in 2006-07, which was 23.28 lmt in 2005-06 (DOF, 2008). Dry and dehydrated fish is one of the imported items in Bangladesh. The demand for dried and dehydrated fish as an export item is increasing day-by-day. According to the Fishery Statistical Year Book, in 2005-06, the quantity of exported dry fish and fish product from Bangladesh was 150 t valued at 2.19 crore Bangladeshi Taka, and in 2006-07, it was 77 t valued at 1.34 crore Bangladeshi Taka. On the other hand, in 2005-06, the quantity of exported salted and dehydrated fish was 519 t valued at 19.84 crore Bangladeshi Taka, and in 2006-07, it was 441 t valued at 12.80 crore Bangladeshi Taka (DOF, 2008). The physical and organoleptic qualities of most of the traditional sun dried fish available in the market do not meet the expected standard for human consumption (Kamruzzaman, 1992; Khan, 1992; Saha, 1999).

It is estimated that about 30% (about 3,07,500 mt) of the freshly harvested fish are spoiled every year due to lack of proper preservation facilities. About 40% of the remaining harvested fish are dried which is about 71,750 mt (dry weight). Insects and insecticides contaminated dried fish is about 60% of total dried fish (about 4,30,500 mt) which is not fit for human consumption (Balachandran, 2001).

Considering the fact that the traditional sun drying method

is widely used, especially for commercial drying of fish, the present investigation was undertaken to make a comparative study between commercially produced sun dried fish product and experimentally processed sun dried fish products with a view to get a comprehensive idea regarding the nutritional quality and qualitative changes.

2. Materials and Methods

For open sun drying process tengra fish were selected on the basis of their high protein content, market availability and commercial importance as 'sutki' (dried) fish. All of the fish samples were collected in their highest level of freshness and were taken to the Fish Technology Laboratory, Institute of Food Science and Technology (IFST), Bangladesh Council of Scientific and Industrial Research (BCSIR), Dhanmondi, Dhaka, for processing and evaluating their qualities in fresh raw condition and in finally processed products just in fresh condition, and also evaluating during storage conditions with simultaneous comparison of their qualities with that of dried fish collected from different fish markets in Dhaka city. The duration of study period was April, 2008 to June, 2009.

The following observations were made for assessing the quality of dried tengra (*Mystus vittatus*).

- Physical changes were assessed by the sensory method (Peryan and Pilgrim, 1957).
- Moisture and ash contents of the fish were determined by AOAC method (1975).
- Protein content was determined by Kieldahl method.
- Fat content was determined by Bligh and Dryer method (1959).
- Chemical changes were studied by determining the TVN using Conway modified micro-diffusion technique (Conway and Byrne, 1993).

Preliminary determination of quality of dried tengra was done by trained panel of six judges following 9-point hedonic scale (table 1). The average score of 5 was considered to be the borderline of acceptability by Peryan and Pilgrim (1957).

The chemical methods of assessing the quality of fish and fish products are based on estimating the product of spoilage either as individuals or as groups. According to Pearson and Muslemuddin (1970), TVN has been widely used as an index for freshness of fish. Modified Conway micro-diffusion technique was originally devised by Conway and Byrne (1993) for determination of ammonia in blood. Pearson (1999) simplified the method using boric acid solution instead of standard acid in the central compartment of the Conway dish which was titrated against N/70 H_2SO_4.

Data were analyzed using SPSS for windows-12 statistical program with 1% level of significance.

Table 1: Overall acceptability score (9-point hedonic scale)

Scores	Description
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like or dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

3. Results and Discussion

The result of biochemical composition of tengra fish in its fresh and highly acceptable condition, commercially sun dried and experimentally sun dried condition is presented in the table 2 and figure 1. The result reflects the clear variation between experimentally processed and commercially produced fish products.

Experimentally sun dried fish samples contained maximum level of protein (60.45%) whereas the fresh fish sample of the

Table 2: Differences in biochemical composition of tengra fish in different conditions

Sample condition	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Raw	75.37	15.35	4.74	2.27
Commercially sun dried	22.41	53.63	10.33	13.23
Experimentally sun dried	16.01	60.45	9.25	9.33

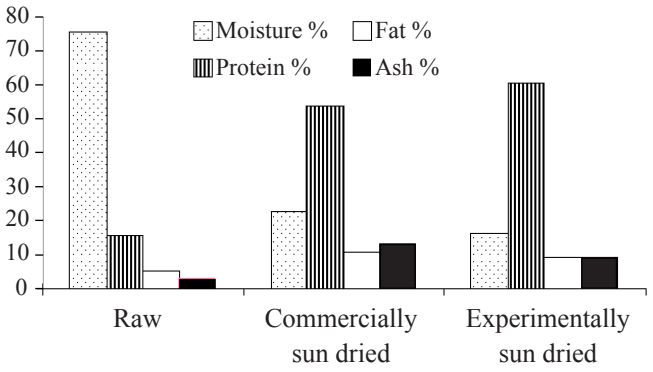

Figure 1: Biochemical composition of tengra fish in different conditions

same species was found to contain 15.35% protein, and the commercially sun dried fish contained protein in between two (53.63%). The moisture content in fresh raw condition of our experiment resembles with the findings of Clucas (1996) who observed that the moisture content of fresh water fish ranged from 70-80%. The results showing variation in biochemical composition of experimentally sun dried tengra fish in fresh acceptable condition was found to have more or less similarities with the findings of Gopalan et al. (1974) in their report of nutritive value of Indian foods.

A direct relationship between moisture and protein content; and an inverse relationship between moisture and fat content, and fat and protein content of the experimental fish in fresh and highly acceptable condition was observed. Whereas an inverse relationship between moisture and protein content, and moisture and fat content; and a direct relationship between protein and fat content in experimentally and commercially sun dried fish samples was observed. In case of experimentally sun dried tengra, the highest TVN value was 330 mg 100^{-1} g of fish while in the commercially sun dried tengra fish it was 390 mg 100^{-1} g of fish. A direct relationship between moisture and TVN value, and inverse relationship between sensory score and TVN value was observed (figure 2, 3, 4 and 5). The moisture content of fish product gradually increased as the protein content of the products decreased.

Different quality parameters of sun dried tengra samples stored in plastic container at ambient temperature are shown in table 3. Experimentally sun dried fish was found to be of superior quality than that of commercially sun dried fish. Experimentally sun dried fish contained higher level of protein, obtained high acceptability score, and had no dirty particles and insect larval infestations. Whereas commercially sun dried fish was found to be of inferior quality in their appearance, with higher level of TVN, moulds, and presence of other dirty infestations. Besides, experimentally sun dried fish had much longer shelf life than that of commercially sun dried fish.

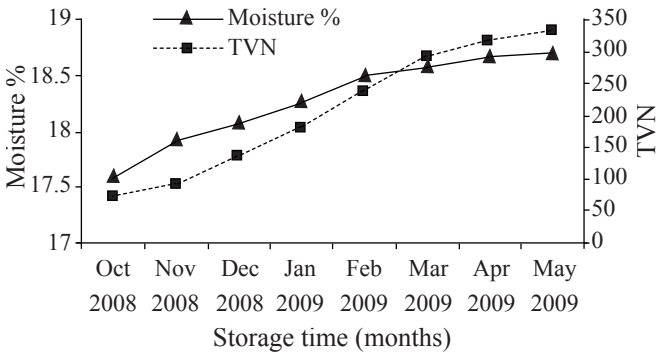

Figure 2: Direct relationship between moisture content and TVN value of experimentally sun dried tengra fish during storage in plastic container at ambient temperature

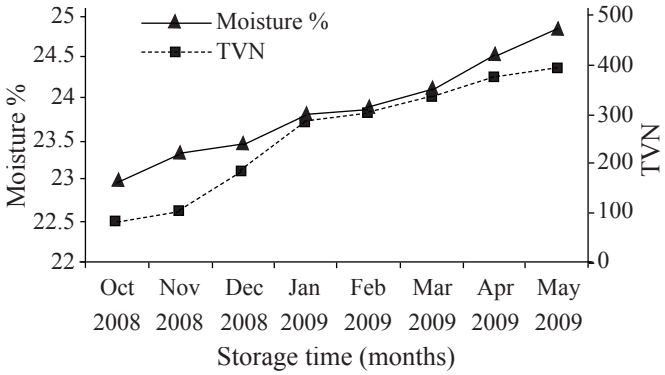

Figure 3: Direct relationship between moisture content and TVN value of commercially sun dried tengra fish during storage in plastic container at ambient temperature

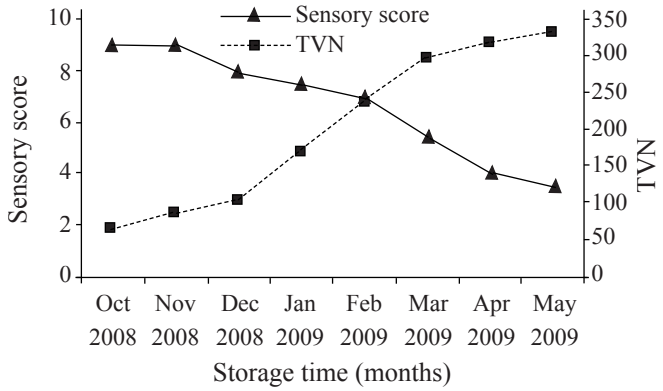

Figure 4: Inverse relationship between sensory score and TVN value of experimentally sun dried tengra fish during storage in plastic container at ambient temperature

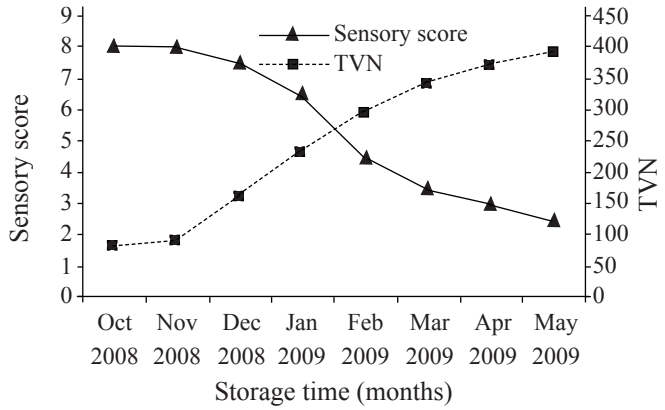

Figure 5: Inverse relationship between sensory score and TVN value of commercially sun dried tengra fish during storage in plastic container at ambient temperature

Table 3: Different quality parameters of sun dried tengra samples stored in plastic container at ambient temperature

1	2	3	4	5	6	7
Experimentally sun dried tengra fish	Oct, 2008	17.60	58.51	9	64	a
	Nov, 2008	17.92	58.37	9	82	a
	Dec, 2008	18.09	58.29	8	100	a
	Jan, 2009	18.27	58.17	7.5	165	a
	Feb, 2009	18.49	58.02	7	235	a
	Mar, 2009	18.59	57.79	5.5	295	a
	Apr, 2009	18.68	57.57	4.0	315	b
	May, 2009	18.70	57.36	3.5	330	b
	Oct, 2008	23.00	52.67	8	80	a
Commercially sun dried tengra fish	Nov, 2008	23.35	52.46	8	88	a
	Dec, 2008	23.46	52.57	7.5	165	a
	Jan, 2009	23.78	52.69	6.5	280	a
	Feb, 2009	23.90	51.75	4.5	298	b
	Mar, 2009	24.12	51.58	3.5	330	b
	Apr, 2009	24.54	51.40	3.0	370	b
	May, 2009	24.85	51.10	2.5	390	b

1: Name of samples; 2: Month; 3: Moisture (%); 4: Protein (%); 5: Sensory score; 6: TVN (mg 100^{-1} g of fish); 7: Visual observation; a: Nil; b: Fungus

4. Conclusion

It may be concluded that the quality of sun dried products was much better than commercial products. Thus by following the stated methods and by maintaining the laboratory conditions we can get the improved quality of dried products where the protein content is higher than that of commercial products. Therefore, the improved techniques should be recommended for commercial use.

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