

## Effect of different temperatures on sensory attributes of pickle prepared from Thai pangus (*Pangasianodon hypophthalmus*) during storage and consumer's preference to pickle

F.H. SHIKHA\*, M.I. HOSSAIN AND HASNAHENA

Department of Fisheries Technology  
Bangladesh Agricultural University, Mymensingh 2202, Bangladesh

\*Email: shikhafh@bau.edu.bd

**Abstract.** Changes in sensory attributes of fish pickle prepared from Thai pangus were determined under different storage conditions. Survey on consumers' preference was carried out at Kamal-Ranjit Market and Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. It was observed that, the sensory attributes decreased throughout the storage period irrespective of storage temperatures (room temperature, 28°C to 32°C; refrigeration temperature, 5°C to 8°C and frozen temperature, -18°C to -20°C). The product may remain in acceptable condition at low temperatures for more than four months. Study on consumer preference showed that, most of the respondents liked the product and also they showed their interest to buy from shop and shop owners showed interest to sale this product. The average price offered by the consumers for the fish pickle was 10 taka and by the shopkeepers the price was 12 taka for 10g of pickle in each pack; which were much higher than the production cost. In the cost profit analysis, it was found that the margin of profit for the fish pickle was 25%. So, pangas pickle has a high commercial potential.

**Keywords:** Fish Pickle, *Pangasianodon hypophthalmus*, Sensory attributes, Consumer preference

### Introduction

In recent years, Thai pangus (*Pangasianodon hypophthalmus*) has become one of the most popular commercial cultivable species due to its high yield and low production cost. The technology for producing fish pickle is very simple and it requires less complex machinery. Commercial fish farmers can produce this product in homestead kitchen using kitchen utensils for marketing those locally. Successful manufacture and marketing of fish pickle from Thai pangus may create a useful situation for proper utilization of the fish by removing of off-flavor and reducing high level of fat content of the fish and finally raise the price. Production of fish pickle from Thai pangus in household level will generate additional income for commercial fish farmers. The socio-economic implications would be favorable, such as: i) both urban and rural consumers would show interest towards the products; ii) due to less involvement of capital and equipment, the production technology can be spread up to rural levels with lesser risk; iii) successful production will raise the price of raw material so that fishermen will get higher return of the catch; iv) this will improve the livelihood of

poor fishermen v) people will get better nutrition at cheaper price and vi) involvement of the rural women to the income activities.

However, marketing is an essential part of any product and if the product is new in a country, it has to be given special emphasis. The product like fish pickle is new in Bangladesh. It is therefore, very important to go into insight of the peoples preference and marketability of the products. With such consideration the present study was undertaken with product development, shelf life assessment and dissemination of the technology to the field level. It is expected that successful manufacture and marketing of fish pickle from a low priced fish like Thai pangus, will create a useful situation for proper utilization of the fish and raise the price of the harvest.

### Materials and Methods

**Sample Collection and Experimental Condition:** Fresh Thai pangus (*P. hypophthalmus*) fishes were collected from Kamal-Ranjit (KR) Market of Bangladesh Agricultural University, Mymensingh. Total 10 fishes were collected having weight from 1.0 to 1.2 kg. The experiments were carried out in the laboratories of Department of Fisheries Technology, Faculty of Fisheries, BAU for a period of 12 months from November 2015 to May 2016.

**Ingredients for Fish Pickle:** Fish pickle were prepared from the collected fish. Standard recipe for the preparation of pickle and condiment are given in Table I.

**Table I. Standard Recipe for Fish Pickle Preparation**

Ingredient name	Quantity	Ingredient name	Quantity
Fish muscle	500g	Vinegar	50ml
Chili powder	20g	Black pepper	2g
Turmeric powder	2g	<i>Pachforon</i>	5g
Cumin	10g	Sugar	50g
Onion	20g	Salt	30g
Garlic	80g	Tomato sauce	30g
Ginger	10g	Tamarind	20g
Cloves	2g	Sodium benzoate	1g
Mustard oil	150ml		

**Fish Pickle Preparation:** The fish were thoroughly washed with tap water to remove contaminants on the skin, cut into small pieces (approx. 1 cm<sup>3</sup>) using sharp knife and washed with tap water in the laboratory to remove bloods and other contaminants. The pieces were marinated, fried in mustard oil, other ingredients were added and finally heated till vinegar was absorbed. During packing care was taken to see that there was enough oil at the contents of bottles and the polythene packs.

**Sample Storage:** Fish pickle was packed in plastic bottles and polythene packs. Pickle samples kept in plastic bottles were stored at room temperature (28° to 32°C), refrigeration temperature (5°C to 8°C) and frozen temperature (-18°C to -20°C) in a domestic refrigerator to observe the changes in the sensory attributes. On the other hand the pickle samples packed in polythene packs were kept in different confectionary shops at ambient temperature (around 32°C) to study the consumer's preference.

**Sensory Evaluation:** A panel of nine persons of teachers and students provided the sensory assessments of the products. Sensory evaluation of the fish pickle was conducted according to 9 grades: grade 9= Like extremely, 8= Like very much, 7= Like moderately, 6= Like slightly, 5= Neither like nor dislike, 4= Dislike slightly, 3= Dislike moderately, 2= Dislike very much, 1= Dislike extremely. Chewiness/Rubberiness were defined as the amount of effort the panelist had to exert in chewing to prepare the sample for swallowing. Color and flavor were evaluated organoleptically.

**Statistical Analysis:** The statistical analysis performed and relevant graphs were constructed using Microsoft Office Excel 2007 version.

## Results and Discussion

**Changes in sensory attributes of pickle:** The changes of color, odor, taste and general appearance of fish pickle at room temperature (28°C to 32°C), refrigeration temperature (5°C to 8°C) and frozen temperature (-20°C to -18°C) are shown in Table II. The sensory attributes did not change significantly throughout the storage period ( $p > 0.05$ ). The initial sensory scores of the product gradually decreased with the storage period but none of them was considered as significant. Fresh sweet odor of fish pickle prominent at the primary stage gradually decrease at room temperature with the lapse of time. In case of, refrigeration temperature the product was more stable. The color, taste and general appearance did not change remarkably even after 72 hours ( $p > 0.05$ ) of storage. At the end of the storage period, the sensory quality criteria score remained quite near those of fresh samples.

**Table II. Effects of storage time and temperature on the sensory quality attributes of pickle prepared from *P. hypophthalmus***

Storage temperature (°C)	Storage (Day)	Color	Flavor	Taste	Texture	General acceptability
Room temperature (28° to 32°C)	0	7.66±0.94	7.00±0.81	6.66±1.24	6.00±0.81	6.33±1.24
	3	6.33±2.20	7.33±1.15	6.66±1.15	6.33±1.52	5.00±1.73
	6	7.66±1.52	7.33±0.52	7.33±0.52	8.33±0.57	7.33±0.57
	9	8.00±1.0	6.33±0.57	6.33±0.57	7.66±0.57	7.66±0.57
	12	8.33±0.57	7.66±0.57	7.66±0.57	8.00±1.00	7.33±0.57
	15	8.33±1.15	7.66±0.57	7.33±0.57	8.33±0.57	7.66±0.51

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Refrigeration temperature (5 <sup>o</sup> to 8 <sup>o</sup> C)	0	7.66±0.94	7.00±0.81	6.66±1.24	6.00±0.81	6.33±1.24
	7	8.33±0.57	7.66±0.57	8.33±0.57	8.00±1.00	7.33±0.57
	14	8.00±1.00	7.33±0.57	7.60±0.57	7.33±0.57	6.33±0.57
	27	7.33±1.52	6.33±0.57	7.00±1.00	8.33±0.57	6.00±1.00
	42	8.40±0.55	8.20±0.55	8.40±0.55	8.20±0.45	8.35±0.10
	56	7.33±0.57	7.66±1.15	7.66±1.52	7.00±1.00	7.33±0.57
	73	7.33±0.57	7.33±0.57	8.00±1.00	7.33±0.57	8.00±0.00
Frozen Temperature (-18 <sup>o</sup> to -20 <sup>o</sup> C)	0	7.66±0.94	7.00±0.81	6.66±1.24	6.00±0.81	6.33±1.24
	15	7.33±1.52	7.66±0.57	8.00±1.00	8.00±1.00	7.33±0.57
	30	8.33±0.57	7.33±0.57	7.33±0.57	7.33±0.57	7.66±0.57
	60	8.00±1.00	7.66±0.57	8.66±0.57	7.33±0.57	6.66±0.57
	90	7.33±0.57	7.00±1.00	8.00±1.00	8.00±1.00	7.00±1.00

Here, 8= Like extremely, 7= Like very much, 6= Like moderately, 5= Like slightly, 4= Neither like or not dislike, 3= Dislike slightly, 3= Dislike moderately, 2= Dislike very much, 1= Dislike extremely.

Pickle stored at frozen temperature, also scored as quite near to fresh fish sample for sensory attributes. Tokur *et al.* (2004) investigated the changes in quality of tilapia during frozen storage at -18°C for over 8 months. They found that the sensory quality attributes decreased gradually throughout the storage period but none of the sensory quality attributes were considered as unacceptable. Farid *et al.* (2014) carried out a study on the comparative study of the sensory scores, quality and shelf life study of dry and pickle salted shoal (*C. striatus*) at room temperature (27-31°C). They reported, according to the panel's evaluation, the sensory properties of dry salted (DS) and pickle salted (PS) shoal fish products were in acceptable condition throughout the storage period though, statistically there was significant difference ( $p < 0.05$ ) in the sensory evaluation during storage period based on the panel's score. The initial score of the sensory evaluation of DS and PS shoal was 9. But during storage period this score rapidly decreased and at the end of the storage period, the score was 5 in case of DS (165 days) and PS (150 days) Shoal. This hedonic rating-scale was applied to evaluate the acceptability of the sun dried fishes by their external morphology and quality changes (Yu 1985). This hedonic rating scale was also applied by using 9- points for the sensory evaluation of the dried and dehydrated fish (Morshed 2005). Saritha *et al.* (2014) carried out a study on the physico-chemical and sensorial characteristics of commercial seafood pickles of Tuticor in super markets. In their study, the sensory attributes like appearance, colour, texture and saltiness, sourness, flavour of pickles from Tamil Nadu and Kerala were organoleptically assessed. The panel scores for all the organoleptic characteristics remained within the acceptable limit for all the pickles. The seafood pickles of Kerala had maximum organoleptic scores and the scores showed a decreasing trend with the seafood pickle of Tamil Nadu. The saltiness and sourness of the pickle received low scores for Tamil Nadu pickle. The texture of the seafood pickle of Kerala got good scores since it contains many pieces. An appearance was very good for all types of seafood pickle, but Kerala pickle had good flavor. According to the opinion of the taste panel, the pickles from Kerala had good taste similar to that of Tamil Nadu pickle. The findings of these studies more or less coincide with the findings of the present study.

**Consumer's acceptance to fish pickle:** The survey work was continued for two months (July-August) in the year 2016. The data was collected from Kamal-Ranjit Market, Kewatkhali and Mymensingh town by preparing a questionnaire. The acceptability study was carried out on the people from different level of the society. The categories and distribution of the selected characteristic of consumer's response in the study are shown in Table III. About 70% of the respondent in the study belongs to the middle age (31 to 50 years). The educational status of maximum percentage of respondent (60%) was graduate level. Most of the respondent's (55%) occupation was service and the income level was medium that is 10000 to 15000 Tk/month. People of Faculty of Fisheries, K.R. market, Kewatkhali and Mymensingh city liked the product individually.

Consumers' responses were divided into five categories, such as very good, good, average, bad and very bad. Most of the respondents scored the product as very good in taste (63.22%), and good in color (60%) and flavor (60%). Overall taste (41.33%) also scored as very good. In case of texture 43.33% scored as good and 23.33% scored as average (Table IV). No respondents scored very bad or bad in respect of any parameter with exception of flavor. Among the respondents 5% scored bad in case of flavor parameter and the mean value of flavor was low (4.26%) among the other sensory parameters. Lekshmi Bhai *et al.* (2017) conducted a study on consumer behavior at Eastern Condiments Pvt. Ltd., which is one of the pioneers in Condiment industry and the market leader in variety of packaged curry powders and pickles in South India. They reported that majority of the customers think that Eastern was a good brand. As the factors like price, promotion, packaging, availability etc. has a great impact on the consumers buying behavior, Eastern can generate marketing strategies based on that. Boughanmi *et al.* (2007) estimated consumer preferences for value-added Fish products in Oman. They reported that competition in both local and international markets for the food business requires the development of differentiated products in order to meet the demand of more quality-stringent, health-conscious, and attribute-oriented consumers.

**Table III. Categories and distribution of the selected characteristics of consumers' response in the study**

Variable	Observed range	Possible range	Categories	Response	
				No.	(%)
Age	16-55	Year	Young age (15-30)	20	60
			Adult age (31-50)	35	70
			Old age (> 50)	10	40
			Illiterate	0	0.5
Education	5-18	Year of schooling	Primary (1-5)	4	10
			Secondary (6-10)	10	23
			Higher secondary	12	55
			Service holder	35	60

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Occupation	1-4	Type of occupation	Service	32	55
			Businessman	10	16
			Teacher	25	27
			Day labor	3	6
Annual income	7000-23000	Thousand	Low (5000-10000)	14	25
			Medium (10000- 15000)	30	60
			High (15000-25000)	16	27

**Table IV. Consumers' response (%) towards pickle prepared from *P. hypophthalmus* respect of color, flavor, taste, texture and overall taste**

Product characters	Score No.	Respondent No.	Respondent (%)	Mean $\pm$ SD
Color	1	1	0	4.40 $\pm$ 0.75
	2	1	0	
	3	5	8.30	
	4	35	60	
	5	25	41.60	
Flavour	1	2	0	4.26 $\pm$ 0.63
	2	3	5	
	3	10	25	
	4	35	60	
	5	10	16.68	
Taste	1	1	0	4.00 $\pm$ 0.52
	2	0	0	
	3	1	1.68	
	4	20	35.10	
	5	30	63.22	
Texture	1	0	0	4.00 $\pm$ 0.52
	2	1	0.5	
	3	14	23.30	
	4	25	43.35	
	5	20	33.30	
Overall taste	1	1	0	4.32 $\pm$ 0.69
	2	2	0	
	3	10	12.99	
	4	35	50	
	5	20	41.33	

\*Score 5 = Very good; 4 = Good; 3 = Average; 2 = Moderate average and 1 = Reject

Results of the conjoint analysis by Boughanmi *et al.* (2007) showed that the most important attribute in the purchasing decision of the average consumer was the cooking method, which contributed 79.21% to the average overall preference, whereas the least important attribute was the price, contributing only 0.34% to overall preference. Segmentation of the fish value-added market according to nationality showed that there was no significant difference between Omani and non-Omani preference structure. Hu *et al.* (2014) carried out an online survey on current seafood consumption patterns and trends involving 1038 students from 10 universities. They reported that the domestic

demand for aquatic products in China had increased greatly, from consumption of 4.5 kg per person in 1970 to 31 kg per person in 2009. The study showed that 49.9% of respondents' families bought fish once a week. Fish markets (47.2%) and supermarkets (21.8%) were the main sources of purchase due to good freshness (48.6%) and shopping convenience (45.8%). More than half of all respondents (55.8%) preferred fish over meat. The study provided preliminary information of Chinese consumption patterns on aquatic products for understanding current and future consumption trends of China's aquatic market, and may be used as a reference for aquatic product processing industry. These studies on consumer preferences towards different food products support the way of consumer preference study as did in the present study for fish pickle.

**Marketing feasibility of fish pickle:** The marketing feasibility of pangus fish pickle was thoroughly analyzed. People were asked whether they would buy it from the market if available at reasonable and affordable prices. Maximum interviewee (85%) responded positively (Table V). On the other hand, the shopkeepers were first familiarized with the product. Then, they were asked, whether they want to sale this product. All the respondents (100%) replied positively (Table V).

**Table V. Consumers' and shopkeepers' response (%) in market preference to fish pickle**

Panel Characters	Score No.	Consumers' Response			Shopkeepers' Response		
		Respondent No.	Respondent (%)	Mean $\pm$ SD	Respondent No.	Respondent (%)	Mean $\pm$ SD
Yes	1	45	75	1.88 $\pm$	25	80	3.70
No	2	8	25	0.46	2	20	$\pm 0.10$

Finally, the consumers were requested to set prices for each product what they can afford and think reasonable (Table VI). Most (41.67%) people thought the price should be 15 taka. 38.33% people opined that the price should be 20 taka. Only 3.33% and 13.33% people thought that the price should be 10 and 25 taka, respectively. Further, the shopkeepers were also asked to set price for the product in respect to their business aspect (Table VI). About 50% of the shop keepers thought the price should be 20 taka. About 30% shopkeepers set the price of the product at 15 taka and 20% shopkeepers set this price at 25 taka. Noonari *et al.* (2015) studied the performance of pickle production processing and marketing in Sindh, Pakistan. They reported that the pickle products were packed in polythene bags then were placed in the Glass bottles or bucket. The gross income of pickle production unit was Rs. 2350,000 and total expenditure was Rs.1575,700 with an input output ratio of 1:1.49.

**Table VI. Price preference to pangus fish pickle by the consumers and shopkeepers**

Price (Tk.)	Consumers' price preference			Shopkeepers' price preference		
	Respondent No.	Respondent (%)	Mean $\pm$ SD	Respondent No.	Respondent (%)	Mean $\pm$ SD
5-10	3	5	20.00 $\pm$ 4.17	1	4	20.00 $\pm$ 3.60
11-15	20	34		4	17	
16-20	24	42		15	66	
21-25	7	12		3	13	
26-30	4	7		0	0	

The industrial infrastructure is the web of personal, economic, social and legal relationships that support the production of pickle commodities. It included, most visibly, input suppliers and output processors. However, it also included the formal and informal business relationships between individual farms. Their survey also revealed that pickle consumption is very popular in Sindh Pakistan and with the exception of one respondent, all the respondents consume some or the other type of pickle. They also found that in spite of availability of readymade pickles the popularity of homemade pickles has not decreased. Thus there is large market for pickle producing units which goes untapped because people go for homemade pickles. Like vegetable pickles, fish pickle has also gained popularity in the recent past in India (Anonymous 2003). The demand for these types of ready-to serve fishery products is increasing day by day among the non-vegetarian population in India. The result of these studies are in support of the findings of the present study in the marketing festivity of pickle prepared from fish.

**Cost- profit analysis of pickle preparation:** A simple cost and profit analysis (Table VII) was performed on the basis of market survey. It was done for 50 pack (10 g/pack) pickle for an example. About 400g fish mince was required for the production of 50 pack pickle from 1250g fish. The production cost of pickle was 10 taka. The maximum retail price for the product was set as 12 taka. In the market survey, most of the consumers and the confectionary owners set this price for the pickle. A net profit of 117 taka was obtained from the product in the analysis. The margin of profit was about 25%. The margin of profit of the pangus fish pickle was very high and most of the consumers (75%) and shop owners (80%) responded positively in respect of market preference.



**Table VII. Cost and profit analysis of pangus fish pickle business**

Cost			Profit					
Item	Unit cost (Tk.)	Amount	Total cost (Tk.)	Amount	Unit price (Tk.)	Total price (Tk.)	Net profit (Tk.)	% Profit
Fish (pangus)	50/Kg	1.25 Kg	62.5					
Fish mince	-	400g	-	50	12			24.92%
Ingredients and others	-	-	150	pack.	And 6	330	117	≈25%
Total			212.5≈213					

Shodhganga (2003) stated that profit depends on many factors, such as investment, turnover, product, installed fish processing capacity, availability of raw-material, raw-material price, value added products, quality standards, packaging, managerial skill, degree of competition, having fishing boats, exchange rate, cost of production and price received. Value added product is a source of reaching higher profits. However, firms face problems in the development of value added product. It is considered as a risky activity, with non-availability of skilled labor and lack of finances. Packaging can improve profits. Hence, a majority of the fish processing units wish to improve the packing designs of their products. But the cost of packaging machineries is high and unaffordable. This statement indicates clearly the economics related to business of fish product and support the approach of cost-profit analysis done in the present study.

The sensory attributes of pickle did not change significantly irrespective of temperature. Pickle may remain in acceptable condition at low temperatures for more than four months. On the other hand, as most of the respondents liked the product and also they showed their interest to buy from shop and shop owners showed interest to sale this product and the cost profit analysis showed the margin of profit for the fish pickle 25%, therefore, it can be assumed that- business with fish pickle in Bangladesh has a very good prospect and it would bring economic benefit to the producers.

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