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Changes in sensory attributes of condiment prepared from Thai pangus (*Pangasianodon hypophthalmus*) during storage at different temperatures

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ABSTRACT

For value addition, only developing different products from fish muscle /mince is not enough, as maintenance of proper storage condition to keep the sensory attributes in acceptable range and marketing of the developed products very important. Therefore, the study was carried out to observe the changes in sensory attributes of fish condiment prepared from Thai pangus mince, stored at different temperatures. In the development of product and different analysis standard procedures were followed with some modification in the processes. In this study, a detailed survey on consumers' preference to fish condiment was done at Kamal-Ranjit Market of Bangladesh Agricultural University (BAU), Kewatkhali, Mymensingh town and Faculty of Fisheries (BAU). This study revealed that the sensory attributes of fish condiment decrease 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). At low temperatures, this product may remain in acceptable condition for more than 120 days. The consumers' preference study showed that most of the respondents liked fish condiment and also they showed their interest to buy from shop and shop owners showed interest to sell this product. The average price offered by the consumers for the fish condiment was 18.52 taka and by the shopkeepers, 19.51 taka for 10g of condiment in each pack; which were much higher than the production cost. The cost profit analysis showed that the margin of profit for the fish condiment was 35.14%.

Introduction

Fish is usually consumed after being cooked in a sauce, braised, roasted, fried or cured. Different types of cured fishery products are normally used to prepare the family meal in order to achieve a desirable flavour in the sauce which is eaten with the traditional starchy staples such as cassava, plantain, yam or rice. Fish fermentation is one of methods of fish curing to develop a distinctive flavour in the final product which is usually used as a condiment.

As pangus is a low-cost fatty fish and extensively available in local markets of Bangladesh, so this species of fish also can be used to prepare product like fish condiment. Because of high-fat content and off-flavor many people do not prefer this fish and often the prize of this species goes down thus the fish farmers face financial losses. Therefore, for better utilization of low cost pangus fish, application of proper processing techniques is needed. Like other mince based fish products, fish condiment prepared from pangus fish might bring a new addition to the fishery products in the fisheries sector of Bangladesh. A study carried out by Shikha *et. al* (2019) on the changes in the nutritional composition of fish condiment prepared from Thai Pangus (*Pangasianodon hypophthalmus*) during storage at low temperature for longer period showed that the moisture content (%) decreased at refrigeration and frozen temperature. Lipid content (%) increased up to seven months of storage and then decreased gradually at refrigeration temperature while at the freezing temperature it increased gradually during the whole storage period. Ash content (%) also increased at refrigeration and frozen storage, respectively. Another study of this research group showed that (results are under publication process) - irrespective of storage temperature the TVB-N values and peroxide values increased progressively with the lapse of storage period. The bacterial load (CFU/g) in condiment was found to increase at the room temperatures. However, the growth of bacteria was slower at refrigeration temperature and at frozen temperature bacterial growth found negative.

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Only developing and safe storing of developed product are not sufficient, marketing of the newly developed products also very important for a stable business. Considering these points the study was designed by the same research group to observe the changes in sensory quality attributes of fish condiment at different storage temperatures and to study the consumers' preference to condiment prepared at laboratory condition.

Materials and Methods

Sample collection and experimental condition

Fresh Thai pangus (*Pangasianodon hypophthalmus*) fishes were collected from Kamal- Ranjit (KR) Market of Bangladesh Agricultural University (BAU), Mymensingh. Total 15 fishes were collected having weight from 1.2 to 1.5 kg. The experiments were carried out in the laboratories of the Department of Fisheries Technology, Faculty of Fisheries, Bangladesh Agricultural University (BAU) for a period of 6 months from October 2015 to September 2016.

Sample preparation

Ingredients for fish condiment

The fish condiment was prepared from the collected fish according to the method described below. The standard recipe for the preparation of condiment is given in the following Table 1.

Table 1. Standard recipe for fish condiment preparation

Ingredient	Amount (g)	Ingredient	Amount (g)
Fish muscle	500 g	Vinegar	50 ml
Chili powder	30 g	Black pepper	2 g
Turmeric powder	5 g	Panch phoron*	5 g
Cumin	10 g	Sugar	50 g
Onion	30 g	Salt	30 g
Garlic	20 g	Tomato sauce	30 g
Ginger	10 g	Tamarind	30 g
Cloves	2 g	Sodium benzoate	1 g
Mustard oil	80 ml		

* Mixture of five spices such as cumin, brown mustard, fenugreek, nigella and fennel

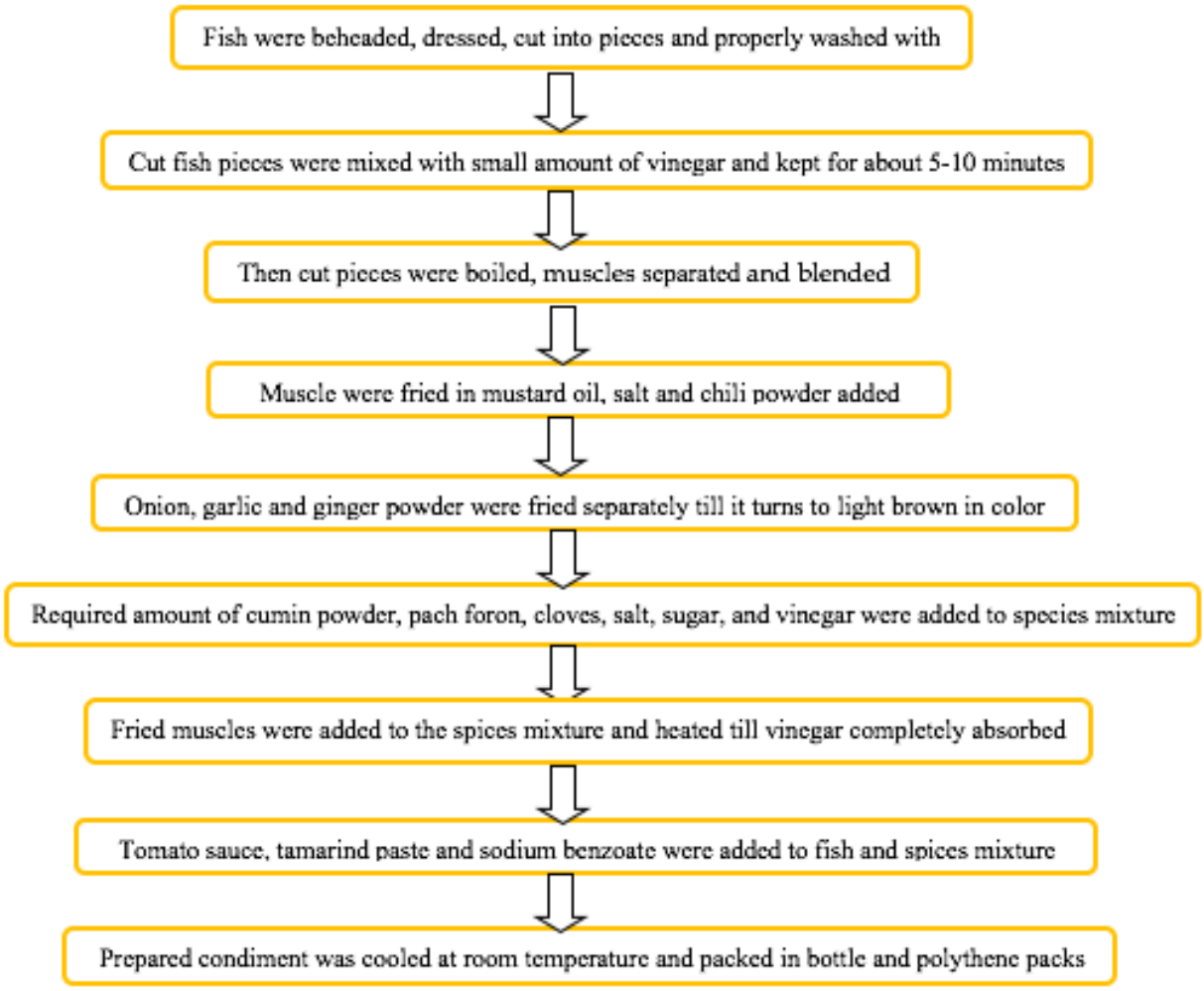

Fig. 1 Flow diagram of fish condiment preparation

Changes in sensory attributes of fish condiment

Fish condiment preparation procedure:

The fishes were thoroughly washed, cut into large pieces (2-3 pieces/fish) using sharp knife and repeatedly washed with tap water in the laboratory to remove bloods and contaminants. The pieces were marinated in a small amount of vinegar for 5-10 minutes. Then boiled and bones, skin were separated from the muscles. The muscles were blended and fried in mustard oil. The ingredients were fried and then mixed with the fried muscles. The mixture of fried fish muscle and ingredients were heated till vinegar was absorbed. The detail procedure is shown in following flow diagram.

Sample storage

Fish condiment was packed in plastic bottles and polythene packs. Condiment 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 condiment samples packed in polythene packs were kept in different confectionary shops Kamal-Ranjit Market, Kewatkhali and Mymensingh city at ambient temperature (around 32°C) to study the consumers' preference for fish condiment.

Sensory evaluation

A panel of nine persons of teachers and students of the Department of Fisheries Technology 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 was 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

Data from different biochemical measurements were subjected to statistical analysis. The statistical analysis and relevant tables were prepared using Microsoft Office Excel 2007 version.

Results

Changes in sensory attributes of fish condiment

Table 2 is showing the changes in color, odor, taste and general appearance of fish condiment at room temperature (28°C to 32^{0}C), refrigeration temperature (5^{0}C to 8^{0}C) and frozen temperature (-20^{0}C to -18^{0}C). Throughout the storage period the sensory attributes did not change significantly ($p>0.05$). With the lapse of storage period, the initial sensory scores of fish condiment decreased but none of them were considered as significant. The fresh-sweet odor of fish condiment prominent at the beginning of storage gradually decreases at room temperature with the progress of time. At the refrigeration temperature the fish condiment was more stable. Even after 90 days of storage, the color, taste and general appearance did not change remarkably ($p>0.05$).

At the end of the storage period, the sensory quality attributes remained quite near those of fresh samples. The fish condiment stored at frozen temperature for 120 days, also scored quite near to fresh sample for sensory attributes. A study on the effect of ambient storage on the quality characteristics of aerobically packaged fish curls (using fish meat of Catla) incorporated with different flours was done by Raja *et. al.* (2014). The curls were aerobically packaged in LDPE (low density polyethylene) pouches and evaluated for various physicochemical, microbiological and sensory parameters. The mean scores of sensory parameters i.e. appearance and color, flavor, crispiness, texture and overall acceptability for control as well as treatment samples showed significantly ($p < 0.05$) decreasing trend with storage period. The decrease was significantly ($p < 0.05$) highest on 21st and 28th day of storage. The mean values for all the quality and storage parameters up to the day 21 of the storage were within the acceptable limits. Another study was carried out by Mahanta and Muzaddadi (2012) on post-fermentation preservation of Shidal- a Fermented fish product of North-East India to develop a low cost packing and preservation method for shidal outside mutka (earthern vat) using different concentrations of salt in glass bottles. Shidal was packed in glass bottles after sprinkling with salt (2% and 5%) and stored at ambient temperature (18-34°C) for 120 days. Parameters related to microbial, biochemical and sensory changes were analyzed at 15 day intervals and the quality was compared with the control (without salting) to see the periodic quality loss. The sensory scores indicated longer shelf life of 90 days for T1 and T2 while the control had shelf life of 60 days in glass bottles. 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. The obtained results from above mentioned studies more or less coincide with the findings of the present study.

Consumers' acceptance to fish Condiment

In this study a survey work was carried out for two months (July-August) in the year 2016. The data was collected from Kamal-Ranjit Market, Kewatkhali and Mymensingh city using a questionnaire. The acceptability study was carried out on the people from different level of the society.

Table 2. Changes in sensory quality attributes of fish condiment prepared from Thai pangus during storage

Storage temperature (°C)	Storage period (day)	Color	Flavor	Taste	Texture	General acceptability*
Room temperature (28° to 32^{0}C)	0	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00
	3	8.80±0.45	8.80±0.45	8.78±0.45	8.78±0.55	8.80±0.01
	6	8.60±0.55	8.67±0.50	8.80±0.55	8.60±0.55	8.67±0.09
	9	8.60±0.55	8.80±0.45	8.40±0.55	8.80±0.55	8.65±0.19
	12	8.56±0.55	8.40±0.55	8.40±0.55	8.60±0.55	8.49±0.11
	15	8.40±0.55	8.40±0.55	8.40±0.55	8.40±0.55	8.40±0.55
Refrigeration temperature (5^0 to 8^{0}C)	0	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00
	7	8.80±0.45	8.60±0.55	8.60±0.55	8.60±0.55	8.60±0.16
	15	8.60±0.55	8.60±0.55	8.40±0.55	8.40±0.55	8.50±0.12
	30	8.40±0.55	8.40±0.55	8.20±0.45	8.60±0.55	8.35±0.10
	45	8.40±0.55	8.20±0.55	8.40±0.55	8.20±0.45	8.35±0.10
	60	8.20±0.84	8.40±0.45	7.80±0.45	7.80±0.45	8.00±0.23
	75	8.40±0.55	8.00±0.70	8.00±0.00	8.20±0.45	8.10±0.12
	90	7.80±0.84	7.80±0.84	7.60±0.55	7.60±0.55	7.70±0.12
Frozen temperature (-18^0 to -20^{0}C)	0	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00	9.00±0.00
	15	9.00±0.00	8.60±0.55	8.40±0.55	8.60±0.55	8.65±0.25
	30	8.80±0.45	8.60±0.55	8.40±0.55	8.60±0.55	8.60±0.16
	60	8.60±0.55	8.20±0.84	8.20±0.45	7.80±0.84	8.20±0.33
	90	8.20±0.84	7.80±0.84	8.00±0.71	8.00±0.71	8.00±0.16
	120	7.60±0.55	8.00±1.00	7.60±0.55	7.60±0.55	7.70±0.20

*9=excellent, and 1=dislike extremely

Table 3. The categories and distribution of the selected characteristics of consumers' response in the study

Variable	Observed range	Possible range	Categories	Response	
				No.	Percent (%)
Age	16-55	Year	Young age (15-30)	25.00	41.67
			Middle age (31-50)	30.00	50.00
			Old age (>50)	5.00	8.33
Education	5-18	Year of schooling	Illiterate	0.00	0.00
			Primary (1-5)	4.00	6.67
			Secondary (6-10)	12.00	20.00
			Higher secondary	14.00	23.37
			Graduate	30.00	50.00
Occupation	1-4	Type of occupation	Service	32.00	53.33
			Businessman	10.00	16.67
			Student	15.00	25.00
			Day labour	3.00	5.00
Annual income	7000-23000	Thousand	Low (5000-10000)	14.00	23.33
			Medium (10000-15000)	30.00	50.00
			High (15000-25000)	16.00	26.67

Table 3 shows the categories and distribution of the selected characteristic of consumers' response in this study. About 50% of the respondent in the study belonged to the middle age (31 to 50 years) and about 42% of young age (15 to 30 years) group. The educational status of maximum percentage of respondents (50%) was graduate level. Most of the respondents' (about 53%) occupation was employee of govt. and non-government organizations 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 condiment. Table 4 showing the consumers' responses which 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 for taste

(63.33%), color (41.67%) and as good for flavor (58.33%).

In case of texture 33.34% scored as good and 43.33% scored as average. 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 (4.62%) among the other sensory parameters. A study was carried out by Nwabueze and Nwabueze (2010) on consumer attitude to fermented fish (*Heterotis niloticus*) in Ndokwa -East, Delta State, Nigeria. Partial fermentation of the fish samples was allowed for overnight in a bowl with a simple cover and thereafter cooked for about 48 minutes with little salt and pepper to taste. This process had significant effects ($p < 0.05$) on sensory ratings for flavor and overall acceptance of fermented *H. niloticus* though the process did not have any significant ($p > 0.05$) effects on the texture and color of the fish samples. Fermented *H. niloticus* had a better flavor and overall acceptance than unfermented *H. niloticus*. It was recommended that fish species which are not very tasty such as *H. niloticus* can be properly fermented to enhance the flavor and used as fish food or as condiments by people who ordinarily do not relish the flavor of unfermented *H. niloticus*. Lekshmi Bhai *et al.* (2017) conducted a study on consumers' behaviors at Eastern Condiments Pvt. Ltd., which is one of the pioneer 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.

A review paper written by Charles (2018) on the psychology of condiments states that- condiments and sauces constitute a ubiquitous presence on dinner tables the world over. Yet, that said, they have received surprisingly little serious scientific attention from researchers interested in gastronomy and food science. The psychology behind choosing of condiments, both when selecting what to purchase on the supermarket shelf, and when deciding which condiment(s) will best compliment a particular dish. Not only do condiments enhance the taste/flavor of a dish (e.g., they often contain flavor-enhancing elements such as salt and umami), but they may also be used to add some color/textural interest to whatever is being consumed. This review also states that- the actual taste experience (of the condiment/sauce) is often determined as much by the packaging/branding as by the product itself. The findings of the present study are more or less similar to the findings of other researchers.

Marketing feasibility of fish condiment

The marketing feasibility of pangus fish condiment was thoroughly analyzed. People were asked whether they would buy condiment from the market if the product is available at reasonable and affordable prices. Most of the interviewee (85%) responded positively (Table 5). On the other hand, the shopkeeper's were first familiarized with fish condiment and then they were asked, whether they want to sale this product. All the respondents of shopkeeper' group (100%) replied very positively (Table 5). Finally, the people of Faculty of Fisheries, K. R. market, Kewatkhali and Mymensingh city were requested to set the prices for each pack of fish condiment (containing 10g) what they can afford and think reasonable (Table 6). Most (41.67%) consumers thought the price should be 15 taka, 38.33% people opined that the price should be 20 taka. Only 3.33% and 13.33% consumers thought that the price should be 10 and 25 taka, respectively. On the hand while shopkeepers were asked to set the price for each pack of fish condiment (containing 10 g) in respect to their business aspect, 50% of the shop keepers thought the price should be 20 taka, 30% shopkeepers set the price of the product at 15 taka and 20% shopkeepers set this price at 25 taka.

Lee *et al* (2011) carried out a study on marketing strategies of fishery products for supermarkets and farmers' markets in Taiwan. They reported that considerations of the marketing characteristics for two types of market in Taiwan, this research drew up marketing strategies based on the 40 Principles of Invention according to the theory of inventive problem solving. Consumer behaviors in the different markets were analyzed in order to form alternatives of marketing for fishery products. Recommendations for supermarkets are (1) to understand consumers' needs through surveys; (2) selling supplementary products at the same location; (3) collecting and responding consumers' feedback. Three marketing strategies for farmers' market are suggested as: (1) implementing a reform of the products; (2) chatting with consumers; (3) providing information about the products. Garc´ıa-Casal *et al* (2016) reported that spices and condiments are an important part of human history and nutrition and have played an important role in the development of most cultures around the world. The condiments market has been growing continuously over the last few years, with the quantity of products sold under the category of sauces, dressings, and condiments during the period 2008–2013 increasing from 31,749,000 to 35,795,000 metric tons. The main buyers of fish sauce are Vietnam and Thailand, with purchases of 333,000 and 284,000 metric tons in 2013, respectively. The sauces and condiments category is dynamic, with large differences in consumption in habits and practices among countries. These studies indicate the relevancy of marketing feasibility study of prepared products like fish condiment as done in the present study.

Cost- profit analysis of condiment preparation

A simple cost and profit analysis (Table 7) of fish condiment was performed on the basis of the market survey. It was done for 40 pack (10 g/pack) of condiment for an example.

Table 4. Consumers' response (%) towards fish condiment prepared from pangus in respect of color, flavor, taste, texture and overall taste

Product characters	Score no.*	Respondent no.	Respondent (%)	Mean ± SD
Color	5	25	41.67	4.34±0.63
	4	30	50	
	3	5	8.33	
	2	0	0.00	
	1	0	0.00	
Flavor	5	10	16.67	3.87±0.75
	4	35	58.33	
	3	12	20.00	
	2	3	5.00	
	1	0	0.00	
Taste	5	38	63.33	4.62±0.52
	4	21	35.00	
	3	1	1.67	
	2	0	0.00	
	1	0	0.00	
Texture	5	20	33.34	4.10±0.75
	4	26	43.33	
	3	14	23.33	
	2	0	0.00	
	1	0	0.00	
Overall taste	5	20	33.33	4.17±0.69
	4	30	50.00	
	3	10	16.67	
	2	0	0.00	
	1	0	0.00	

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

Table 5. The consumers' and shopkeepers' response (%) in market preference to pangus fish condiment

Panel characters	Score	Consumers' response			Shopkeepers' response		
		Respondent no.	respondent (%)	Mean ± SD	Respondent no.	respondent (%)	mean ± SD
Yes	1	51	85	1.15 ± 0.40	20	100	1.00 ± 0.00
No	2	9	15		0	0	

Table 6. Price preference to pangus fish condiment by the consumers' and shopkeepers'

Price (Tk.)	Consumers' price preferences			Shopkeepers' price preference		
	Respondent no.	Respondent (%)	Mean ± SD	Respondent no.	Respondent (%)	Mean ± SD
5-10	2	3.33	18.52 ± 4.17	0	0	19.51 ± 3.60
11-15	25	41.67		6	30	
16-20	23	38.33		10	50	
21-25	8	13.33		4	20	
26-30	2	3.33		0	0	

Table 7. Cost and profit analysis of pangus fish condiment business

	Cost			Profit				
Item	Unit cost (Tk.)	Amount	Total cost (Tk.)	Amount	Unit price (Tk.)	Total price (Tk.)	Net profit (Tk.)	% Profit
Fish (pangas)	120 /kg	1.20 kg	144	40 pack.	15	600	156	35.14
Fish mince	-	395 g	-					
Ingredients and others	-	-	300					
Total			444					

About 400g fish mince was required for the production of 40 packs condiment from 1250g of fish. The production cost of condiment was 11.10 taka. The maximum retail price for the product was set as 15 taka. A net profit of 106 taka was obtained from the product in the analysis. The margin of profit was about 35.14% (Table 7). The margin of profit of the pangus fish condiment was good which indicated a sustainable business could be run with this product.

From the view point of economics of fish processing, Shodhganga (2003) stated that, profit is necessary for the survival and growth of every business. It is also a very broad indicator of efficiency. Also, profits are a natural concomitant of growth and development of a business over time. He also reported 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. Similarly, adoption of quality standards can improve profit level. Report based on Shodhganga's study clearly indicates the economics related to business of fish products and support the approach of cost-profit analysis done in the present study for fish condiment.

Conclusion

Irrespective of storage temperatures the sensory attributes of fish condiment did not change significantly. At low temperatures fish condiment might remain in acceptable condition for more than 120 days. In market feasibility study, most of the consumers liked fish condiment and they showed their interest to buy from shop and the shop owners also showed interest to sale the product. The cost profit analysis study showed that, the margin of profit for the small scale business of the fish condiment was about 35%. Therefore, it can be assumed that- business with value added products like fish condiment in Bangladesh has a very good prospect and it would bring economic benefit to the producers as well as to the fish farmers.

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