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Original Article

Production and quality assessment of fish burger from the grass carp, *Ctenopharyngodon idella* (Cuvier and Valenciennes, 1844)

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Abstract

Fish burger was produced from grass carp (*Ctenophygodon idella*) to assess the feasibility of value addition to this low priced fish in Bangladesh. Different food additives (25% mashed potato, 2% NaCl, 2% soybean oil, 2% spices and 0.6% sugar) were used to enhance the consumer's acceptance of the fishery product. Consumers' acceptance of the fish burger was determined by sensory evaluation based on its color, flavor, softness or firmness (S/F), chewy/rubbery (C/R) using 10 point scoring system by a group of 10 untrained judges (20-50 years old). The results were found as follows: color (7.25±1.15), flavor (6.67±1.17), S/F (8.47±1.20) and C/R (7.83±1.23). Evaluation of proximate composition showed that the moisture and protein contents in grass carp mince were 79.15±1.16 % and 18.01±0.44 % respectively which were higher than that of fish burger, 69.46±0.89 % and 16.42±0.57 %, respectively. Lipid (6.64±0.15 %) and ash (2.98±0.09 %) contents in fish burger were also higher than fish mince. The pH of fish mince and fish burger was 6.8±0.11 and 6.6±0.05 respectively. Therefore, from simple cost-profit analysis, it can be assumed that business of fish burger in Bangladesh has a very good prospect and it would be profitable.

Keywords: Production, quality assessment, fish burger, grass carp, *Ctenopharyngodon idella*

INTRODUCTION

Fish flesh has some unique characteristics as having high protein content with balanced profile of amino acids, polyunsaturated and essential fatty acids with ω-3 series of fatty acids and low level of harmful cholesterol and saturated fat (Edwards and Kaewpaitoon 1981). Due to increasing awareness of the consumers on health issues, consumption of fish and fishery products are increasing day by day. Big processing industry like canning or large scale filleting is not yet developed in our country. For effective capacity utilization and potential production of diversified products, processing of the underutilized fish species into *surimi* based value added products will bring immediate benefit to the existing fish processing industries of the country (Nowsad *et al.* 1994). Therefore, it is very important to develop new processing techniques of underutilized protein resources to make them useful and palatable food for human consumption.

One of the important mince based product is fish burger. Fish burger is a very popular and tasty item in fast food industry. In recent years, the preference of the consumers has significantly directed towards the fast food consumption since there has been a rapid urbanization and an increase in working women population. These working people along with new generation students and young people are now more dependent on fast foods. As a result, during the last 5 years, a lot of fast-food shops have been opened in city, suburb and industrial areas of the country. There have been many studies about the production and quality stability of the fishery fast food products including fish cake, fish crackers, fish balls and fish burgers (Sipos *et al.*

1979, Siaw *et al.* 1985, Ihm *et al.* 1992a and 1992b, Lazos 1996). Unfortunately, although burgers prepared from beef and poultry were served to the fast food shops in the market, fish burgers were not produced commercially in Bangladesh.

There are more than 20 main native carp species, contributing about 80 percent of the total freshwater fish production. Grass carp (*Ctenopharyngodon idella*) would serve as an adequate source of raw material for fish burger that may provide a good taste and nutrition to the young and outgoing people in cheaper rate.

Moreover, malnutrition is a serious problem which is caused mainly due to animal protein deficit in the diet (Nuruzzaman 1992). In Bangladesh, it is often argued that mothers and children are generally the first victims of malnutrition. Upon successful marketing of the tasty products, low priced fish species such as grass carp contribute significantly towards protein supplementation in malnourished population. Obviously, in the days to come, these products will share an important business in growing fast food industries. Considering the above facts, the present study was conducted to develop fish burger from grass carp and to investigate on the biochemical composition and consumer acceptance.

METHODOLOGY

Laboratory used for the study: The experiment was conducted in the laboratory of Fisheries and Marine Bioscience Department, Jessore University of Science and Technology, Jessore and Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna.

Selection of fish species: Grass carp, a low-priced fish in the common fish market, would serve as an adequate source of raw material for fish burger that may provide a good taste and nutrition to the young and outgoing people in cheaper price.

Collection of fish: Fish was collected from the Chuadanga Bus Stand Fish Market of Jessore Town. Immediately after collection, the fish was iced properly with crushed ice in an insulated box (Marina cooler for outdoor and indoor cap 35 L, 20 kg capacity) and transported to the laboratory of the Fisheries and Marine Bioscience, Jessore University of Science and Technology. The mean length and weight of the fish were 48±2.50 cm and 1.60±0.35 kg, respectively.

Preparation of the product: The preparation of the fish burger was divided into two steps. First, preparation of mince from the raw fish and then preparation of fish burger from the prepared mince. The steps are described as follows:

Preparation of the mince: The fishes were weighed and then washed with clean tap water, beheaded, eviscerated, skinned and washed. The skinned fishes were filleted and deboned manually in iced condition. Then mince was prepared by a mechanical mincer (National Meat Grinder, MK-G3NS, Matsushita Electric Industrial. Co. Ltd., Osaka, Japan) through one mm orifice diameter; so that all bones and connective tissues were removed from the muscles.

All the utensils used in the experiment were cleaned with adequate washing and kept cool (5^0C). Mince recovery from each fish was recorded. Huge amount of crushed ice was made available through an ice maker (Lab Tech Ice Macker, Series L cm-200m, R4044A, UK) to maintain adequate temperature throughout the product preparation. After mincing, the mince was kept in a small bowl that is fixed in a big plastic bowl around which huge amount of ice was kept.

Preparation of the fish burger from the mince: The mince obtained from the Grass carp fish muscle was ground with 2% NaCl, 2% oil, 0.6% sugar, 2% spices (onion, garlic, ginger, green chili paste and hot spices) and 25 % potato. The whole dough was stuffed into a steel frame. The size of each burger patty was (6.5x6x0.5 cm). The steel frame was set on a wooden plate. Another wooden plate was fixed on the frame and held tightly with nuts and bolts to compress the material kept in the steel frame in between the two wooden plates. After freezing at -4^0C for 20 minutes, the patties were separated from the steel frame and dipped in a batter formulation. Then it was fried in dip- soybean oil and was ready to eat. After cooling, the burger patty was packaged in air tight polyethylene bag for different biochemical analyses.

Ingredients used for burger preparation: In case of ingredients selection, emphasis was given to Bangladeshi known taste so that the products could attract local consumer's acceptance. The list of the ingredients used for burger and batter preparation and their percentages are shown in table 1, 2 and figure 1.

Table 1: Ingredients and their percentages used for the preparation of burger

Spices	***Percentage (%) of ingredients***
Fish mince	68.4
Smashed potato	25
Table salt	2
Vegetable oil	2
Table sugar	0.6
Spices	2

Table 2: Ingredients and their percentage used for batter preparation

Spices	*Percentage (%)*
Wheat flour	34
Table salt	1
Monosodium Glutamate (MSG)	1
Spices	1
Chicken egg	19
Water	44

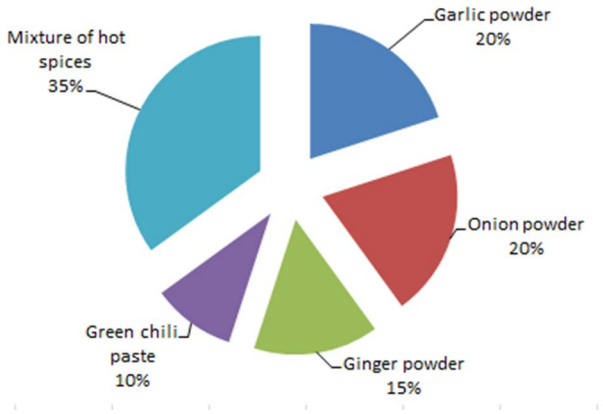

Figure 1: Spices and their percentages used for the preparation of burger (out of 2% of all spices)

Quality analysis: The quality of the burger was analyzed by sensory and proximate composition analysis. For the determination of sensory quality of the fish burgers scoring test was used according to Paulus *et al.* (1979).

Sensory evaluation: Sensory evaluation is an easy, quick and efficient method for getting idea about the quality of the product. A large number of schemes have been proposed for sensory evaluation of fish burger produced from Grass carp meat. Sensory methods were used to assess the degree of freshness based on organoleptic characteristics such as color, odor and texture of the product. The evaluation methods used in this study were based on one that is currently in use in various institution of the world. All burgers were served to 10 panelists to evaluate the sensory attributes (color, odor, taste, texture, general acceptability) of the samples by using 10-points descriptive scale.

Softness/firmness (S/F) was defined as the amount of force required to bite through the sample with incisors and chewiness/rubberiness (C/R) was defined as the amount of effort the panelist had to exert in chewing to prepare the sample for swallowing. The quality was evaluated by the numerical scores up to 10. The sensory evaluation of the prepared grass carp fish burger is shown in Table 3.

Table 3: The sensory evaluation of the prepared grass carp fish burger

Characters	*Scoring characters*	*Score*
Softness/ Firmness	Extremely farm	1 to <4
	Moderately soft	4 to <8
	Very soft	8 to 10
Chewy/ Rubbery	Extremely chewy/rubbery	1 to <4
	Moderately chewy/ rubbery	4 to <8
	Not chewy/ rubbery	8 to 10
Color	Content considerably colored (Dark gray)	1 to <4
	Content moderately colored (Brown/ Light gray)	4 to <8
	Contents finally colored (Bright brown)	8 to 10
Flavor	Contents have strong abnormal odor and a markedly poor flavor.	1 to <4
	Contents have slightly raw or scored odor or flavor; seasoning seems to be somewhat inadequate.	4 to <8
	Contents have no abnormal flavor and have a good characteristics flavor and seasoning.	8 to 10

Chemical evaluation:

pH: pH was determined for the homogeneous mixtures of sample and distillated water (1:10, w/v) using a digital Mettler Toledo pH meter and its pH was measured at room temperature. Analyses were made in three parallels.

Proximate composition: Proximate composition analysis of moisture, crude protein, lipid and ash were carried out according to the methods given in AOAC (1990). For each analysis of proximate composition, triplicate sample were used.

Cost-profit analysis: A simple cost and profit analysis was done on the basis of market survey. Total cost and net profit of 50 burgers were calculated to identify the marketing feasibility of the product.

RESULTS AND DISCUSSION

Proximate composition analyses and pH measurement: The proximate composition analyses and pH measurement of the fish burger are presented in Table 5. The moisture content in fish mince was 79.15±1.16% and in fish burger was 69.46±0.89% Moisture content reduction in fish burger might be due to release of water from fish burger during cooking. Protein content of fish mince was 18.01±0.44% and in fish burger was

16.42±0.57%. The reduction of protein content in fish burger might be due to excessive heat generated during cooking that denaturized the protein and burned into ash. Another reason may be addition of potato starch in fish burger. Ihm *et al.* (1992a) determined that the protein and moisture rates of sardine burgers were lower than the rates of sardine as the raw material but increase in fat and ash contents was found in sardine burgers. Taskaya *et al.* (2003) reported moisture and protein 71.92% and 21.67%, respectively for fresh rainbow trout, but in fish burger moisture content found 63.61% and crude protein 17.50%. These results are in good agreement with the results of present study.

Table 5: Proximate composition and pH value of fish mince and fish burger.

Product types	Proximate composition				pH
	Protein	Lipid	Ash	Moisture	
Mince	18.01±0.44	4.89±0.13	2.01±0.19	79.15±1.16	6.80±0.11
Burger	16.42±0.57	6.64±0.15	2.98±0.09	69.46±0.89	6.60±0.05

Lipid content in fish mince was 4.89±0.13% and in fish burger was 6.64±0.15%. Lipid content increase in fish burger due to ingest vegetable oil during frying. The reason of increase in fat rates in the study of Ihm *et al.* (1992a) was thought to be used high amount of fat in the production of sardine burgers. Ejaz (2008) found the lipid content of Pangus fish mince was 4.89±0.13 and fish burger was 6.82±0.15. The values of the present study showed good relationship with the reference values of Pangus burger.

Ash content in fish mince was 2.01±0.19% and ash content in fish burger was 2.98±0.09%. Ash content also increased due to addition of spices and other ingredients (*i.e.* NaCl, potato etc.) and some ash might be produced during frying. Ihm *et al.* (1992a) found the incretion of fat and ash content in sardine burgers compared to raw fish. Azad (2001) also found that the protein and moisture content of fish burger was decreased and lipid and ash content was increased, which is very similar with the present study. Ejaz (2008) found the incretion of ash content of burger (2.98±0.09) have higher value than Pungas fish mince (2.01±0.19). These results of Pangus burgers are in good agreement with the results of present study.

The pH of mince was 6.8±0.11 (about to neutral) because of pre-rigor prime quality fresh fish were used in the experiment. The pH of fish burger was found 6.60 ± 0.05. The pH is a determining factor in the mince for higher gel forming ability. From the mince with around neutral pH a very good quality product can be produced. A good quality product can be prepared from the mince with around neutral pH (Azad 2001).

Quality of fish burger

Sensory evaluation: A final sensory evaluation was made by a group of 10 untrained judges (22-46 years old students and teachers) who were invited to evaluate the product on the basis of hedonic ratings. The physical and organoleptic qualities of fish burger were evaluated on the basis of the color, odor, texture and overall other quality aspects and the results are presented in Table 6. Fish burger of bright brown color is considered best to the consumers The experimented fish burger obtained points is 7.25±1.15, which indicates brown/ light grey color and described as moderately good color. The loss of excellent bright brown color may be due to overheating during frying in oil or presence of a small part of hidden dark muscle in the fish mince. Composition of spices may also be responsible for this color. Ejaz (2008) reported the color point 6.49±0.08, 7.10±0.10, 8.37±0.2, 8.28±0.02, and 8.41±0.03 in Pangus burger produced adding 0, 10, 15, 20 and 25% mashed potato respectively. The present study of fish burger agrees with the color test of the above report. The prominent fresh sweet seasoning odor of fish burger is preferred by the consumers and considered excellent flavor. The experimentally produced fish burger obtained point 6.67±1.17 for flavor, which is considered moderately good flavor. Ejaz (2008) reported the flavor point 4.48±0.07, 6.51±0.08, 7.03±0.15, 8.15±0.05 and 8.87±0.15 % in Pangus burger produced adding 0, 10, 15, 20 and 25% mashed potato respectively. The present study of fish burger agrees with the flavor test of the above report.

Table 6: Different quality parameters and acceptable level

Parameters	Obtained points
Color test	7.25±1.15
Flavor test	6.67±1.17
Softness/ Firmness	8.47±1.20
Chewy/ Rubbery	7.83±1.23
General appearance	8.47±1.25

The experimented fish burger obtained point 8.47±1.20 for softness, which is considered as very soft and desirable by the consumer. This excellent texture may be due to addition of potato starch with fish mince. Ejaz (2008) reported the softness point 3.58±0.27, 5.37±0.21, 6.22±0.12, 7.46±0.04 and 8.35±0.05 % in Pangus burger produced adding 0, 10, 15, 20 and 25% mashed potato respectively. The present study of fish burger agrees with the softness test of the above report. The less the chewy/ rubbery the burger product, the best. The obtained fish

burger got point 7.83±1.23 for chewy/ rubbery of the product which indicates moderate chewiness. Ejaz (2008) reported the chewy/ rubbery point 3.07±0.15, 5.87±0.15, 6.13±0.06, 7.13±0.05 and 8.17±0.38 % in Pangus burger produced adding 0, 10, 15, 20 and 25% mashed potato respectively. The present study of fish burger agrees with the chewy/ rubbery of the above report. The experimentally produced fish burger got point 8.47±1.25 in general taste which is considered excellent by the consumer.

Cost- profit analysis: A simple cost and profit analysis was done on the basis of market survey Table 6. It was done for 50 burgers in this experiment. About 1000 g fish mince was obtained from approximately 3.5 kg fish for the production of 50 burger. The production cost/burger was BDT 13.54. The maximum retail price for the product was set as BDT 25. In the market survey, most of the consumers and the fast food shop owners set this price for the burger. A net profit of BDT 573 was obtained from the product in the analysis. The margin of profit was about 84.63%.

Table 6: Cost-profit analysis of grass carp fish burger

Item	*Cost*			*Profit*				
	Unit cost (BDT/kg)	*Amount (g)*	*Total cost (BDT)*	*Amount (Pcs.)*	*Unit price (BDT)*	*Total price (BDT)*	*Net profit (BDT)*	*Profit (%)*
Raw fish	135	3500	472	50	25	1250	573	84.63%
Fish mince	-	1000	-					
Ingredients and bread	-	-	205					
Total			677					

CONCLUSION

Production of fish burger from Grass carp in household level will generate additional income for commercial fisherman. The socio-economic implications would be favorable as both urban and rural consumers would show interest towards the products. Due to less involvement of capital and equipment, the production technology can be spread up to rural levels with lesser risk. Successful production will raise the price of raw material so that fishermen will get higher return of the catch. This will improve the livelihood of poor fishermen and people will get better nutrition at cheaper price. Therefore, it can be assumed that business with value added products like grass carp fish burger in Bangladesh has a very good prospect and it would bring economic benefit to the producer.

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