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Development of Fish Cracker from Indian Major Carp, *Labeo catla*

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ABSTRACT

Background: The popularity of snack foods among children and younger has attracted the attention of food processor for finding out new avenues of earning profit. Therefore, the aim of this research was to develop crackers from freshwater fish, *catla* and if found successful, become a part of food industry on large scale.

Methods: Fresh fish, *Labeo catla* were procured from local market, available at Nagpur city, Maharashtra. The mince was prepared using meat mincer. The corn flour and seasonings were purchased from local market. The 60:40 ratio of fish mince to corn flour was used for making crackers. The minced meat, corn flour, salt and seasonings were mixed to form smooth dough. Dough was placed in boiling water at 100°C, boiled for 15 minutes and cool down for 15-20 minutes. Dough was cut into 2-3 mm thick slices, sun dried for 2 days and fried in edible oil at 180-200°C for 30 seconds.

Result: The results indicate that crispy, golden brown colored crackers were developed from mince of catla fish with excellent nutritional quality. The developed crackers were rated as 'liked more' among the panelists. This may replace wafers from plant origin in near future to meet the ever-increasing demand of nutritious food to the people.

Key words: Chemical composition, Corn flour, Fish cracker, *Labeo catla*, Sensory qualities.

INTRODUCTION

The consumption of snack and fast foods are growing significantly in India. Nowadays, the snack and fast food industry is deepening their reach in the Indian market and expected compound annual growth rate of 23% till 2025 (Bansal, 2021). The snack and fast foods are prepared and served fast. Burgers, pizzas, fries, hamburgers, patties, nuggets, pakora, samosa, namkeen, chips, chocolate, ice-cream, soft drinks, *etc*. are the favorite snack or fast food. These foods are prepared from both vegetable and animal source and found emerging craze among younger generation. The prepared snack and fast foods are marketed keeping in mind the existing consumer's preference and future demand of the product.

Fish, being an excellent alternative to meat due to its high protein and polyunsaturated fatty acids (PUFA), finds delicacy in everybody's life. Fish accounts for 17% of the global population's intake of animal protein (FAO and WHO, 2020). The freshwater fish is generally consumed in fresh form as fried, boiled or roasted. The development of value-added products from freshwater fish is negligible in India and offers ample scope for development of fish products such as sausages, fish finger, fish crackers, fish patties, etc. to serve Indian as well global consumer. Production of fish cracker from low value fish to increase protein intake through snack foods has the potential to support a small-scale industry in rural areas for malnourished people is a need of the hour.

Fish crackers or "Krupuk" is one of the most favored snack foods in East and Southeast Asian countries, originated in Indonesia. The characteristic of a fish cracker that differs among producers includes size, shape, texture, expansion irregularities and colour and depends on the composition of ingredients in the dough. The good quality fish crackers are thin, dry, puffed, crispy, low moisture and minimum oil absorption (Taewee, 2011). Most of the crackers prepared from marine fish like tuna, seer fish and prawns are already entered into market. Therefore, different freshwater fishes such as catfish (*Pangasius spp.*), tilapia (*Oreochromis mossambicus*), bighead carp (*Hypophthalmichthys nobilis*), dory (*Pangasius hypothalamus*) and catla (*Labeo catla*), rohu (*Labeo rohita*) have potential to be used in the fish cracker industry compatible with marine fish.

The national per capita consumption of fish of 11 kg has been recognized in order to achieve nutritional security of Indian people. Therefore, the role of freshwater fish like Indian major carps (Catla, Rohu, Mrigal) cannot be ignored in the context of Indian food sector. Therefore, the aim of the present study was to investigate the feasibility of Indian major carps (*Labeo catla*) for the development of value-added fish products in the form of fish crackers. The potential consumer of these fish crackers would be children and adolescents.

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MATERIALS AND METHODS

Materials

Freshwater fish, *Labeo catla* with an average length and weight of 42.65 cm and 1317 g respectively, were procured in ice (fish:ice @1:2) from Gittikhadan fish market, Nagpur, Maharashtra during the year 2022 in the Department of Fish Processing Technology of College of Fishery Science, Nagpur. The fish were manually deheaded, gutted, filleted, cleaned with potable water and processed hygienically for the preparation of fish mince. Fish mince was prepared in a meat mincer in the laboratory of Fish Processing Technology, College of Fishery Science, Nagpur. The seasonings including corn flour (Ambuja Gold), salt, sugar, monosodium glutamate, pepper powder, cumin powder, sunflower oil, *etc*. were bought from local market. The mince is used within 1 hr. after preparation.

Preparation of fish cracker

The fish crackers from catla were developed according to the method given by Neiva *et al*., (2011). The procedure for preparation of fish cracker in the present study is given in Fig 1.

The minced meat (600 g) of fish blended with corn flour (300 g) in the ratio 60:40 and rest of the flour (100 g) was used to form the smooth dough. Thereafter, seasoning like salt (1.5%), monosodium glutamate (1.5%), black pepper powder (1%) and cumin powder (1%), 20% water were incorporated to the mixture and kneaded well. The formed dough made into cylindrical shaped rolls (Logs) (Fig 2) in cellulose casing of approximately 5 cm diameter. The resultant logs were cooked with a direct steam at 100°C for 15 minutes. Cooked logs were cooled at once. Cooled logs were sliced into the pieces of 2-3 mm thickness. The prepared sliced were dried under sun for about 2 days. The dried slices of fish crackers were deep fried at 180-190°C for 30 seconds in sunflower oil before serving.

Fish mince + corn flour + seasoning
↓
Steaming or boiling at 100°C for 15 min.
↓
Cool the dough for 15-20 min.
↓
Formation of gel like dough
↓
Drying in sunlight for 2 days.
↓
Dried- non-expanded fish cracker
↓
Deep frying in oil at 180-200°C for 30 seconds
↓
Expanded fish crackers

Fig 1: Procedure for preparation of fish cracker from *Labeo catla*.

Chemical composition

The moisture, protein, fat and ash content were estimated as per AOAC (2005). The samples are dried in an oven at 105°C for 12 hours for estimation of moisture content. The protein and fat content were determined using micro kjeldahl and Soxhlet method. The ash content was estimated using incineration of sample in muffle furnace at 550±600°C for 6 hours. The carbohydrate content was estimated by subtracting moisture, protein, fat and ash content from 100.

Sensory evaluation

Sensory analysis of dried and fried fish crackers was carried out on appearance, colour, odour, taste, crispiness and overall acceptability using 10 trained panelists in the laboratory. The dried and fried fish cracker samples were presented on white plates randomly and between each test, panelists were given drinking water to wash palate to avoid sensory fatigue. The panelists evaluated fish crackers on 9-point hedonic scale (Mailgaad *et al*., 1999). Panel members were provided with sensory sheets having characteristics and were asked to assign scores based on the following scale 1, dislike extremely; 2, dislike very much; 3, dislike moderately; 4, dislike slightly; 5, neither like nor dislike; 6, like slightly; 7, like moderately; 8, like very much; 9, like extremely.

Statistical analysis

The data of dried and fried fish crackers obtained in triplicate were calculated and presented as mean±SD (Standard Deviation). One-way analysis of variance (ANOVA) was carried out using SPSS (IBM SPSS version 16). Duncan's multiple range test was used to compare means and statistical significant difference is expressed as $P<0.05$.

RESULTS AND DISCUSSION

Chemical composition

The chemical composition of fresh fish, dried and fried fish cracker obtained from catla is presented in Table 1. From the results, it can be seen that significantly different ($P<0.05$) values were observed for proximate composition of fresh fish, dried and fried fish cracker, which may be attributed to different processing methods employed for product preparation before consumption. The chemical composition obtained in the present study for fresh fish is well correlated with results of Memon *et al*. (2011) for catla. The low fat content and higher moisture content in fresh fish represents use of white muscle fish (Osman *et al*., 2001) in the present study for preparation of fish crackers. The dried fish crackers showed appreciable moisture content in commensurate with dried fish products and well below the recommended level of 16% by FSSAI (FSSAI, 2010). The lowest moisture content (0.68%) was noticed in fried fish crackers as available water in dried fish cracker was lost during drying under sun and deep frying of fish crackers in oil (Baishak *et al*., 2020). The large surface area was observed for wet fish crackers than dried fish crackers in the present study.

The fresh catla contains protein content of 18.29%, which is in line with report of Mehta *et al*. (2014) for carps. The protein content in dried crackers was above 12%, therefore, crackers prepared in the present study can be graded a class I grade as per codex (Codex Standard for Honey, 2001). The higher protein content was observed for dried fish crackers may be attributed to increment in dry mass due to loss of moisture content. The seasoning and ratio of fish to corn flour/starch affects the protein content of crackers (Zzaman *et al*., 2017). The good quality protein and its appropriate content is very essential for growth of child.

As expected, fried fish crackers showed higher fat content in the product than fresh fish and dried fish crackers due to absorption of oil during frying process. The fresh fish contains fat content of 2.43%. Nowsad *et al*. (1999) observed fat content in the range of 1.8-2.4% in Indian major carps.

Though significant (P<0.05), but not much variation was seen in ash content of fresh fish, dried and fried fish crackers. The probable reason for increase in ash contents of dried and fried fish crackers are salt, seasonings, carbohydrate and oil products, *etc*. Compared to the results of Nowsad *et al*. (1999) for Indian major carps, higher ash content was recorded in the present study in fresh fish, may be due to processing conditions.

The significantly (P<0.05) higher percentage of carbohydrate content was observed in fried fish crackers which was contributed by corn flour only (Zzaman *et al*., 2017). The decrease in protein content in fried fish crackers increased carbohydrate content of resultant products as compared to dried crackers (Chudasama *et al*., 2019). The usual range of carbohydrate content in commercial fish crackers is 65-80% (Muthia *et al*., 2010).

Sensory evaluation

The perception of younger generation towards purchase of snack foods lies in attractive appearance and crispiness it offers in dried and fried products. The non-vegetarian consumers tend to like taste of the products of animal origin

Table 1: Chemical composition of fresh fish, dried and fried fish cracker.

	Fresh fish	Dried fish cracker	Fried fish cracker
Moisture (%)	76.68^{a}±0.28	13.53^{b}±1.53	0.68^{c}±0.09
Protein (%)	18.29^{a}±0.26	31.27^{b}±1.21	10.86^{c}±0.44
Fat (%)	2.43^{a}±0.16	5.75^{b}±1.01	27.43^{c}±1.35
Ash (%)	2.40^{a}±0.11	3.64^{b}±0.47	3.85^{b}±0.10
Carbohydrate (%)	0.19^{a}±0.19	45.81^{b}±0.75	57.18^{c}±1.67

Data are mean±standard deviation (n=3). The different superscripts in the row denote significant differences (p<0.05).



Fig 2: Cylindrical logs before and after boiling.



Fig 3: Wet and dry crackers developed from *Labeo catla* fish.

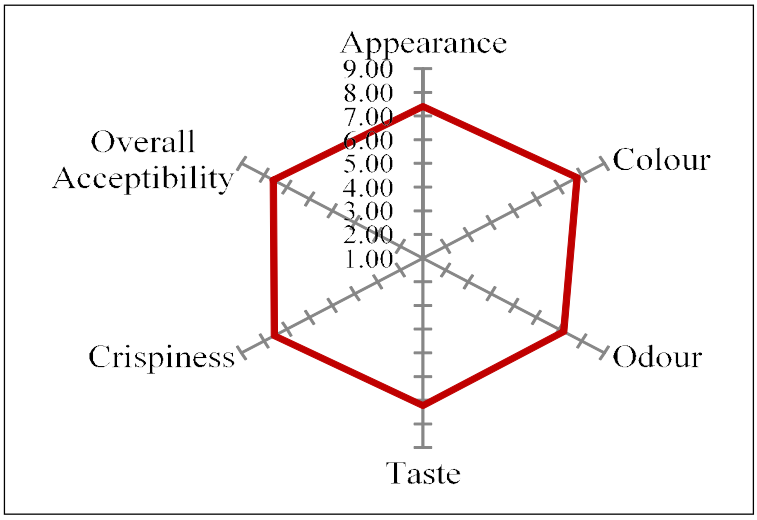

Fig 4: Radar diagram showing scores for sensory characteristics of fried fish cracker developed from catla.

rather than its composition. Therefore, acceptability of the products made from aquatic origin is the most important aspect of snack foods. The prepared dried fish crackers were off-white in colour due to use of corn flour and hard to touch. The dried fish crackers were irregular and elongated in shape. The improper cooking style and uneven drying in sun causes irregular shape in dried fish crackers (Yu, 1991). In the present study, 40% corn flour was mixed with fish mince for the development of fish crackers. The availability of limited water in mince to absorb and swell starch granules in corn flour might contributed to hard texture to the fish crackers.

The off-white colour of dried fish cracker was changed to golden yellow to golden red after frying in edible oil (Fig 3). After frying process, the fried crackers were little bit expanded in thickness. The lack of proper gelatinization of starch granules resulted in insufficient expansion of fish crackers (Yu, 1991). Panelist perceived fried fish crackers as crispy, slight fishy odor, rough and hard in texture along with slight saltiness. The high content of fish in crackers increased hardness of crackers (Nurul *et al*., 2009). The corn starch was ascribed to be responsible for hardness of the product (Park *et al*., 1993). The scores of sensory characteristics of fried fish crackers are graphically represented in Fig 4. Based on the sensory data, it can be seen that fish crackers developed from mince of catla added with corn flour showed good crispiness after frying, the major criteria for purchase behavior of consumer. The scores of colour, appearance and overall acceptability showed panelists 'liked more' these fried fish crackers made out of fresh water fish.

CONCLUSION

The nutritious and healthy value-added fish crackers were successfully developed from freshwater fish, catla. The developed crackers were found crunchy and delicious after frying in oil without traces and taste of corn flour when used at the ratio of 60:40 (mince:corn flour). The presence of fat content in fish crackers is major concern from consumer health point of view in the development fried fish crackers. However, the prospect for development of fish crackers from catla seems to be too high on commercial scale. Therefore, considerable research is needed to ensure shelf-life stability of fish crackers using effective packaging at room temperature.

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