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Optimization of technique for developing ready to cook fish fillets using spice mix as preservative from fresh water fish (*Catla catla*)

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Abstract
The method of preparation of the restructured fish fillets were standardized by adopting two methods of cooking (microwave and conventional oven) separately to standardize the best time temperature combinations for visualizing the doneness of the product prepared. The descriptive scale was followed to rate the doneness of the fish fillets after sensory evaluation by three panel members. Laboratory prepared spice mix (LPSM) was taken in three concentrations (1, 2 and 3%) to standardize the best level of spice mix in terms of color and over all acceptability of the product cooked in conventional and microwave oven. The fillets were standardized by judging through sensory evaluation (9 point hedonic rating scale) done by semi trained panelists. The best time-temperature selected for preparation of fish fillets in conventional oven was standardized at 140˚C for 20 min. after assessing the level of cooking by judging the doneness of the products to get the optimum desired after taste effect. The fish fillets preferred 2 min. of cooking in microwave oven as rated highest by sensory evaluation. Laboratory prepared spice mix (LPSM) with 2% concentration level proved to be the most accepted one in producing color and overall acceptability.

Keywords: *Catla catla*, sensory evaluation, standardization, conventional oven, microwave

Introduction
Fish and fishery products contain high quality protein and other necessary nutrients; they are low in saturated fatty acids and contain high content of unsaturated fatty acids[3].The cultured fresh water fish contains omega 3 and 6 polyunsaturated fatty acids of n-3 type which have beneficial effect on human health[5]. There is a growing demand for ready-to-eat and ready-to-cook convenience products due to social and cultural changes in recent years. One of the most important foods in this group is battered products[6]. During recent years, fish processing, product development and value-addition have received wider attention because of increased urbanization, more and more women having jobs and domestic help becoming expensive [2]. Processing of carps into value added battered products enhance their acceptability and market value as revealed by sensory evaluation of the product [7]. Indian major carps being the high protein food form a major component of Indian aquaculture but carps have limited consumer acceptability because of presence of intramuscular bones. On the same lines, an attempt has been made to develop ready to eat fish balls by conventional and microwave oven baking which were quick refrigerated (4±1°C) after preparation [1]. Processing of *Catla catla* into fish fillet is one of the step to enhance their acceptability and market value. In the present study attempts were made to standardize a value added non-battered and non-breaded product "fish fillet" from fresh water fish catla.

Materials and Methods
Catla (*Catla catla*), a fresh water species was purchased from the local fish market, Hisar. LDPE bags, aluminium foil, other ingredients and containers were purchased from local market, Hisar.
Clove, Cinnamon, Mace, Black pepper, Red pepper, Cardamom, Cumin seed, Ginger dried, Indian bay leaf (Tejpatta), Nutmeg, Pipali, Onion powder, Garlic, Sugar, Salt, Phosphates.
Laboratory prepared spice mix was obtained by well mixing of suitably dried and grounded whole spices.

Method of preparation of fish fillets
Four types of fillets (P0S0M0, P0S1M0, P0S0M1, P0S1M1) on the basis of method of cooking i.e. conventional and microwave oven cooking along with spice mix concentration i.e. with spices and without spices were prepared. The details of the recipe used in spice mix are given in Table 1
Fresh fish (catla) after procurement was washed thoroughly by running water and kept in deep freezer (-20°C) over night. On the next day, frozen fish was thawed at room temperature (35°C) and scaling, head removal, gutting and rinsing was done properly to get a clean mass of flesh. The whole fish was cut longitudinally, using a sharp knife to obtain pieces of 7-8 cm in length and 1-2 cm in thickness. Salt (2g), TSPP (0.4g) and spice mix (2g) were then sprinkled on the cut pieces. Each lot of 100g pieces were separated for preparing each treatment used with experimental work. After incorporating the additives (salt and TSPP), spice mix and mustard oil (10 ml) in four lots of fish pieces (each weighing 100g), proper mixing was done and were kept for marination for half an hr. The prepared samples were then cooked separately in conventional and microwave oven. The temperature maintained in conventional oven was 140°C for 20 min. (10 min. one side,

10 min. other side) in which internal temperature (78±2°C) was recorded at the geometric centre of the cooked fillets with the help of thermometer to ascertain that the fish fillets had been cooked properly. In microwave oven the fish pieces were cooked for 2min. (2450 MHz, 800W). In this case internal temperature (70±2°C) was recorded. The cooked fillets weighing 8.2-8.6g were packed in each polypropylene pouches (100 gauge) and then heat sealed. The packaged samples were stored at refrigerated temperature (4±1°C) and shelf life evaluation was carried out up to 12 days at 4 days interval (0,4,8 and 12 days). Fillets were reheated in microwave oven for 30 sec. before analysing each parameter evaluation at different storage intervals.

Results and Discussion

Selection of different time-temperature combinations in conventional and microwave oven

Results depicted in Table1 and 2 measured by the descriptive scale for the selection of different time-temperature combinations to evaluate doneness of the fish fillets. In conventional oven cooking three temperatures (140, 150 and 160˚C) were selected for standardizing the product doneness after cooking for 10, 20 and 30 min. (Table 2) The fish fillets immediately taken out from oven were subjected to sensory testing. It was observed that at 140˚C and 20 min. cooking, the descriptive scale rating was highest (3.0) and after 10 min, the rating was just 1.0, which confirms that the product was not completely cooked. 30 min of cooking made the product overcooked with rating 0. Similar was the observation rating in 150˚C. When 160˚C temperature was adopted for judging the product doneness, it was observed to be over cooked after 20 and 30 minutes.

The results indicating the descriptive scale data regarding selection of optimum time (min.) of microwave cooking to standardize the doneness of the products was also observed (Table 3) and the data revealed that after cooking the products in three time selection modes i.e. 1, 1.5 and 2 minutes, the products cooked for two minutes in microwave oven rated the highest (3.0) compared to that of cooking by other two time selection mode i.e. 1.33 (1.5 min.) and 1.0 (1min.).The fish fillets preferred 2 min. in microwave oven as rated highest by sensory evaluation. Hence after standardization, 2 min. time for microwave cooking was selected and the other two i.e. 1 and 1.5 min. cooking was rejected for further preparation of the products.

Spice mix standardization by assessment of color of fish fillet

Effect of different concentrations of spice mix on color of fish fillet cooked by the two oven cooking methods was studied and the data is presented in Table 4. Laboratory prepared spice mix (LPSM) with 1, 2 and 3% levels were taken for the study to judge the effect of the spices (concentration level) on color of the fish fillet, to standardize the best level of use in conventional and microwave oven cooking and for incorporation in fish fillet preparation. At 2% spice mix concentration level the LPSM showed the best results in terms of color score (8.2) in conventional oven cooked fillets When color assessment was done for microwave oven cooked fillets, at the 2% spice mix concentration level the LPSM showed the highest color score (8.0). However, while comparing these two methods of cooking for spice mix standardization, the color effect attained by LPSM was most acceptable at 2% concentration level for the fish fillets cooked in conventional (8.2) and microwave (8.0) oven and this formulation of spice mix developed during the study, was selected further to be incorporated in fish fillet preparation. In conventional cooking the color score was more (8.2) than in microwave oven (8.0) which may be due to enhanced non-enzymatic browning (maillard reaction). LPSM with 2% concentration level proved to be the most accepted one in producing color to the products may be due to prepared by mixing more spice ingredients in higher amounts. The lower and higher concentration levels used in the preparation of LPSM (1% and 3%) are not found to be suitable in compared to 2% level spice mix may be due to less and more intense color effect produced.

Spice mix standardization by assessment of over all acceptability of the fish fillet

Effect of different spice mix on over all acceptability of fish fillet cooked by the two oven cooking methods was studied and presented in Table 5. At 1% concentration level of spice mix, fillets were found below the acceptable range i.e. 4.7 (LPSM). The over all acceptability of spice mix (1%) on fish fillet cooked in microwave oven were also low in LPSM (4.5).The LPSM attained the highest scores at 2% level in fish fillets for over all acceptability after cooking in conventional (8.0) and microwave oven (8.2).

Table 1: Recipe for fish fillet preparation

Ingredients Used	Amount added
Fish pieces	1.0 kg
NaCl	20g
TSPP	4.0g
Mustard Oil	100 ml
Spice mix	20g (Added only in spice containing products)

Table 2: Selection of different time-temp. combinations to evaluate doneness of fish fillet (using descriptive scale) in conventional oven

Product	Temperature Selection (°C)	Time (Minutes)		
		10	20	30
Fish fillet	140	1.0 ± 0.0	3.0 ± 0.0	0.0 ± 0.0
	150	2.0 ± 0.0	3.0 ± 0.0	0.0 ± 0.0
	160	1.66 ± 0.58	0.0 ±0.0	0.0 ±0.0

Table 3: Selection of time to evaluate doneness of fish fillets (using descriptive scale) in microwave oven

Type of product	Time of cooking (Min)		
	1	1.5	2
Fish Fillet	1.0 ± 0.0	1.33 ± 0.58	3.0 ± 0.0

Table 4: Effect of different concentration level and type of spice mix on color of fish fillet

Conc of spice (1%)	Color Score (9point hedonic scale)	
LPSM	Conventional	Microwave
1	5.2 ±0.8	7.0 ± 0.6
2	8.2 ± 0.8	8.0 ± 0.0
3	6.0 ± 0.6	6.1 ± 0.4

LPSM Laboratory Prepared Spice Mix

Table 5: Effect of different concentration level of spice mix on over all acceptability of fish fillet

Conc. of spice mix (%)	Colour Score (9 Point Hedonic Rating Scale)	
	Conventional oven	Microwave oven
	LPSM	LPSM
1	4.7 ± 0.5	4.5 ± 1.0
2	8.0 ± 0.0	8.2 ± 0.4
3	6.1 ± 0.4	6.5 ± 0.5

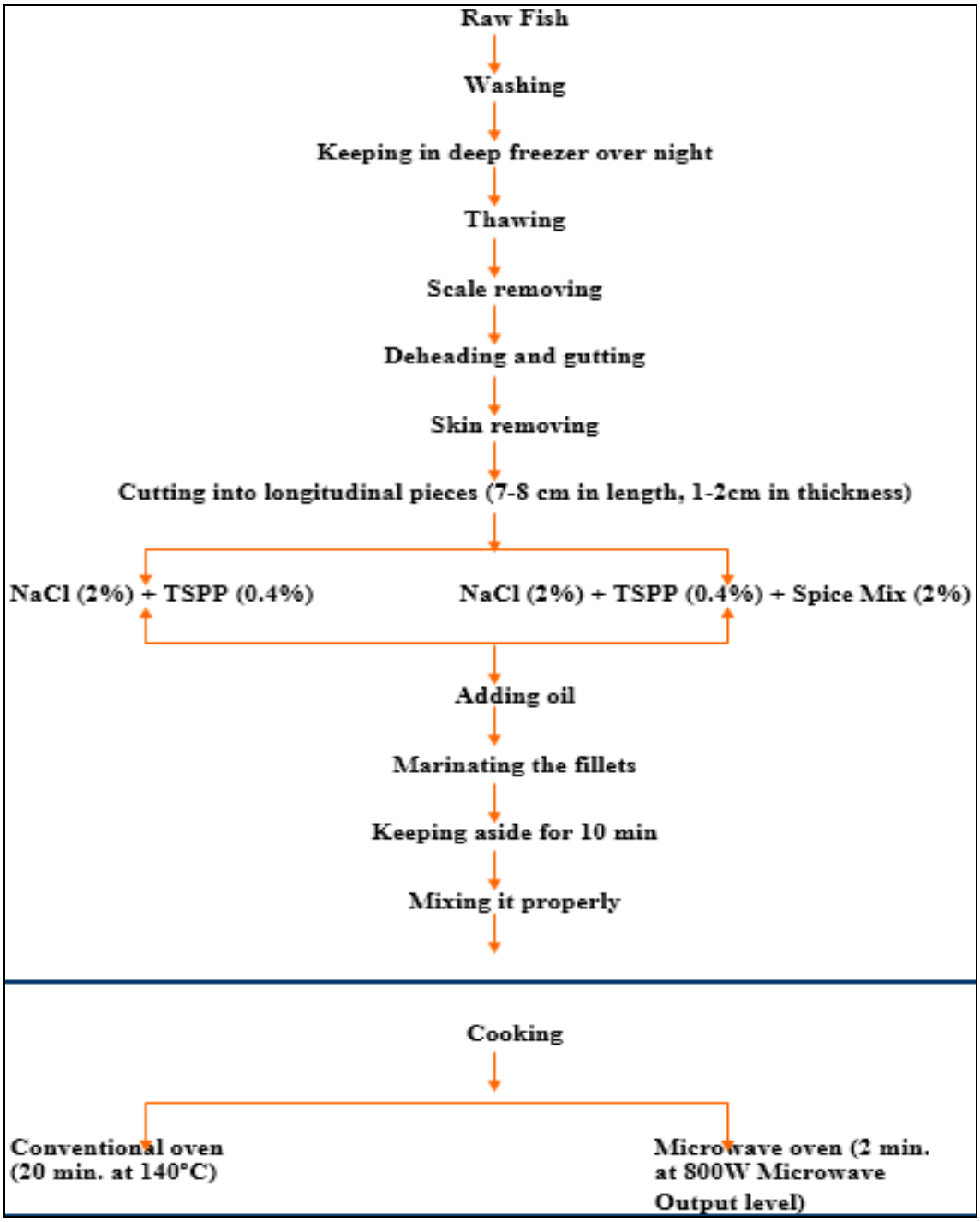

Fig 1: Flow sheet for the preparation of fish fillet using Conventional and Microwave oven cooking

Conclusion

LPSM (2%) was selected to be incorporated as spice mix during emulsion preparation and for further fish fillet preparation. It might be due to essential oils of some of the spices used for LPSM preparation that helped in enhancing the overall acceptability leading to increased palatability of the

fish fillets. Similar findings for fish balls was also obtained [1]. Carps are the backbone of Indian freshwater aquaculture comprising about 85% of total fresh water production [4] Among the Indian major carps the contribution of catla alone is about 30% towards the total production which is used for development of fish fillet. Fish fillets prepared were excellent in taste, color and over all acceptability.

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