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RESEARCH PAPER

Effect of water washing on the qualityof minced meat prepared from marine cat fish (*Aurius* sp.)

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ABSTRACT

Effect of washing with chilled water (meat : water ratio 1:2) on the quality of mince from marine catfish (*Aurius* sp.) was studied. Samples of minced meat were drawn at the end of washing for analysis of physical, chemical and microbiological characteristics. Washing the meat reduced fat and water soluble protein. Reduction in total plate count was marginal. No significant improvement in mince meat characteristics was noticed after 2nd wash on the 1st wash. Washing of mince meat of marine cat fish for single time, with a suspension time of 5 min. was found to be optimum in improving the meat characteristics.

Key words : Water washing, Minced meat, Marine cat fish, Quality of meat.

Water washing of minced meat is an important step in the production of different value added products as it removes water soluble sarcoplasmic muscle proteins, micro-organisms, enzymes (proteases), pigments/ blood, lipid, heam compounds etc. (Noguchi, 1974). In addition to removing these undersirable compounds, washing also helps in concentrating the actin and myosin group of protein to give a good gel. The number of cycles, contact time and wash water to mince ratio determine the mince meat quality (Lee,1984). Hastings (1989) compared the properties of gels prepared from unwashed and washed mince and the washed samples showed better elasticity. Such washing significantly improves the colour and odour as well as the texture of final product (Miyauchi *et al.*, 1973). Washing removes substances that promote protein denaturation during frozen storage and enhance the functional properties of proteins (Aguilar *et al.*, 1989). However, water washing has also some disadvantages like loss of protein up to 25% and also loss of soluble micronutrients including vitamins, minerals and free fatty acids (Bligh and Regier, 1976)

The present study was undertaken to find out the effect of water washing on the quality of minced meat from marine catfish.

MATERIALS AND METHODS

Marine catfish (*Aurius* sp.) was procured in fresh condition from the Digha coast, West Bengal under iced condition and processed immediately in the laboratory. Fish was washed thoroughly, dressed, washed again and meat was separated using a meat picking machine. This picked meat was minced in a mincer and then washed in chilled water at the ratio of 1:2, (meat to water) with a suspension time of 5 min. After washing, the meat was transferred to a thin muslin cloth and pressed in a hydraulic screw press to remove excess water. After washing, the samples were collected and analysed for changes in proximate composition and other chemical and microbiological parameters. Similarly, 2nd wash was given with chilled water considering same ratio of 1:2 (meat : water) with a suspension time of 5 mins. Then the meat was dewatered using hydraulic screw press and the dewatered meat samples after 2nd wash were collected and analysed for changes in proximate composition and other chemical and microbiological parameters.

Moisture, total protein, crude fat and crude ash were determined by the method described in (AOAC,1975). Salt soluble protein (SSP), water soluble protein (WSP) and non-protein nitrogen (NPN) were estimated following the method of Srikar and Chandru (1983). Peroxide value (PV) was determined according to the method of Jacobs (1958), free fatty acids (FFA) by the method described by Takagi *et al.* (1984) and total volatile base nitrogen (TVBN) by the method recommended by Beatty and Gibbons (1937) using Conway's microdiffusion unit. Horiba M.5 pH meter was used to determine pH. Total bacterial plate counts (TPC) were estimated according to the method described by APHA (1976).

RESULTS AND DISCUSSION

The physical and organoleptic characteristics of cat fish are presented in Table 1. The average total length, width and weight of fish were 37.33 cm, 10.10 cm and 580.83g, respectively. The yield of meat at different stages

Table 1 : Physical and organoleptic quality characteristics of cat fish N = 18

A. Physical characteristics				
Sr. No.	Characteristics	Min. value	Max. value	Average value
1.	Total length (cm)	29.0	44.0	37.33
2.	Weight (g.)	340.0	850.0	580.83
3.	Width (cm.)	8.5	11.4	10.10
B. Organoleptic characteristics				
Sr. No.	Characteristics	Description		
1.	Appearance	Bright and shining		
2.	Eyes	Bright with transparent cornea		
3.	Gills	Bright red and free from discoloured mucous		
4.	Texture	Firm		
5.	Condition of stomach	Does not tear a mark when pressed with finger		
6.	Odour	With characteristic fresh cat fish		
7.	Overall quality	Good		

Table 2 : Yield of meat at different stages of processing

Sr. No.	Processing stage	Yield (%)
1.	After dressing	59.28
2.	After meat picking	33.21
3.	After mincing	31.03

of processing is presented in Table 2. The yield of dressed fish, yield of picked meat and yield of meat after mincing was 59.28 %, 33.21% and 31.03 %, respectively. Generally, the yield of dressed fish directly relate to the size of fish and also species. Effect of washing with chilled water on the biochemical and microbial characteristics on mince meat is presented in Table 3.

According to Park and Morrisesy (2000), nearly one third of minced fish meat consists of blood, myoglobin, fat and sarcoplasmic protein which impede the final quality of the surimi gel. Washing necessarily help in removal of these undesirable matters. In the present study, washing was done two times and the proportion of water to minced meat was 2:1, giving a suspension time of 5 minutes. It was considered to give only two washings to the minced meat of catfish taking into account of low fat content of the fish meat.

In the present study, it was noticed that moisture content of catfish mince increased form 76.88 to 79.91% and 80.13% after 1st and 2nd wash, respectively due to hydrophilic nature of myofibrillar protein (Table 3). After washing, the water retention capacity of the mince increases (Lin and Park, 1996). Since myofibrillar protein is the major protein responsible for water retention of meat (Offer and Trinick, 1983), removal of sarcoplasmic protein through washing, in turn, increases the concentration of the myofibrillar protein and subsequently enhances the water retention capacity of washed mince. Along with washing, the dewatering is also an important step to maintain the moisture content in mince meat around 80%. A good quality surimi usually contains less than 85% moisture. In the present study, a hand operated screw press was used for dewatering the mince meat prepared from catfish. There was a significant reduction in the fat content from 3.18 to 1.78% after 1st wash with chilled water, which accounts for a reduction of 44.03% ($P<0.05$). Tiwari (1995) has reported a reduction of 73.5% fat after three washing cycles in the mince of *Sardinella longiceps*. However, there was no significant reduction of fat content between two washings.

The use of chilled water for washing is a pre-requisite to maintain the high quality of surimi and removal of non-protein nitrogenous fractions. The washing resulted in the decrease of protein content due to the removal of sarcoplasmic and non-protein nitrogenous fractions. The protein content decreased significantly from 18.65 to 15.06% after first washing ($P< 0.05$) but no significant

Table 3 : Effect of water washing on biochemical and microbial characteristics on mince meat prepared from cat fish

Sr. No.	Characteristics	Before washing	Dewatered meat after 1st wash	Dewatered meat after 2nd wash
1.	Moisture (%)	76.88	79.91	80.13
2.	Crude protein (%)	18.65	15.06	14.95
3.	Crude fat (%)	3.18	1.78	1.7
4.	Total ash (%)	1.10	0.95	0.95
5.	pH	7.48	7.33	7.4
6.	SSP(% of total protein)	76.12	86.3	88.5
7.	WSP(% of total protein)	18.05	6.70	4.7
8.	NPN (mg%)	390.0	360.0	348.5
9.	TVBN (mg%)	5.74	4.58	4.55
10.	PV (meq of O_2/ kg of fat)	3.04	2.53	2.5
11.	FFA (% of Oleic acid)	9.52	7.22	7.34
12.	TPC (cfu/g)	6.3×10^4	6.1×10^4	5.4×10^4

difference was noticed between two washings. There are reports of decrease in protein content during washing (Roussel and Cheftel, 1998). The loss of protein in the present work was of the order of 19.24% due to 1st cycle of water washing. It was seen that the pH value decreased from 7.48 to 7.33 after 1st week. A considerable amount of NPN, TVBN, PV and FFA were also reduced from 390 to 360 mg %, 5.74 to 4.58 mg %, 3.04 to 2.53 milliequivalent of O_2 / kg of fat and 9.52 to 7.22 % of oleic acid due to water washing. In the present study, the reduction of TVBN, PV and FFA was observed to the extent of 20.21%, 16.28% and 24.16%, respectively due to 1st washing with chilled water ($P<0.05$) and afterwards no significant reduction due to 2nd wash. Considerable reduction in NPN (61.29%), TVBN (50.21%), FFA (58.00%) and PV (36.76%) were also observed in mince meat of Indian oil sardine (*Sardinella longiceps*) due to four times water washing (Ravishankar *et al*.,1993). It was significant to note that WSP decreased to the extent of 62.88% from the minced meat of catfish due to first washing ($P<0.05$). The removal of WSP greatly benefited to improve the jelly strength of the meat, which is very much required for the preparation of different value added products (Shyamasunder *et al*., 1988). Further, significant reduction of 29.85% of WSP in mince meat was recorded due to 2nd wash.

Total plate count (TPC), which was of the order of $6.3x10^4$ cfu/g subsequently decreased to $6.1x10^4$ cfu/g after first washing and $5.4x10^4$ cfu/g after 2nd washing with chilled water. The washing procedure also improved the colour, odour and appearance of fish mince. The unwashed mince was slight reddish in colour having fishy odour. Washing resulted in blunt colour and notable reduction in odour of the mince due to removal of odour producing compounds and colour. Verma (1992) had also reported an improvement in its overall acceptability due to water washing of the flesh. Thus, it can be concluded that wash of mince meat (meat : water ratio 1:2) of marine catfish (*Aurius* sp.) for one time with a suspension time of 5 min. was found to be optimum in improving the jelly strength of meat, which is very much required for the preparation of different value added products.

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