The Effect of Washing on the Quality of Minced Catfish During Frozen Storage

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The effect of washing minced catfish in water, sodium chloride solution (1%) and ascorbic acid solution (0.1%) in improving the quality and frozen shelf-life has been studied. Washing improved the colour and reduced the non-protein nitrogen contents and extractable nitrogen. Denaturation was more in samples washed in salt and ascorbic acid solutions. Rancidity as measured by PV and organoleptic studies showed significant reduction in washed samples. The frozen storage life was significantly enhanced by washing.

Minced fish has shorter frozen storage life compared to fillets or whole fish. The mixing of bone marrow exudate, catheptic enzymes, enzymes from blood, lipids and inorganic constituents in the minced fish affect texture, flavour and appearance and reduce the frozen storage life. The changes in fat and protein of minced fish during frozen storage have been studied by Crawford *et al.* (1972), Joseph & Perigreen (1983), Lee & Toledo (1977), Laird *et al.* (1980), Nakayama & Yamamoto (1977) and Young & Tableros (1982). The contamination of mince with skin pigments, dark meat and blood reduce the colour. Washing has significant effect in improving the colour, reducing many of the oxidative changes and enhancing the frozen shelf-life of minced fish (Grantham, 1981; Rodger *et al.*, 1980; Miyauchi *et al.*, 1975).

Little attention has been given in production, utilization, frozen shelf-life and improving the quality of minced fish from under-utilized fishes in tropical countries. The aim of the present work is to study the effect of washing in water and different solutions on the changes in quality of mince during freezing and frozen storage.

Materials and Methods

Fresh catfish, *Tachysurus* sp. (average weight 255 g) were collected and washed thoroughly, head and gut removed, filleted and skinned. Mince was prepared from skinless fillets using a hand operated meat mincer, divided into 4 lots, and processed as follows:

I. Control without washing
II. Washed in chilled water
III. Washed in 1% chilled sodium chloride solution
IV. Washed in 0.1% chilled ascorbic acid solution

Five litres of water/solution were used for every kg of mince and the temperature was maintained at 2 to 5°C during washing. The mince was kept in chilled water/solution for 15 min with occasional stirring, filtered through a nylon net and pressed. The samples were weighed before and after washing and the percentage loss was calculated based on the original weight of the sample.

300 g of the samples were packed in waxed duplex cartons lined inside with 150 gauge polythene sheet, quick frozen in a contact plate freezer at −40°C and kept at −20±1°C for storage studies.

The frozen samples were sealed in a polythene bag, and kept in running water for 60 to 70 min for thawing and drained over a wire mesh for 10 min and analysed. Moisture, fat, total nitrogen and non-protein nitrogen (NPN) were determined by the method of AOAC (1975), peroxide value (PV) and free fatty acids (FFA) by the method of Lea (1952) and AOCS (1946)

Table 1. *Changes in weight, moisture, fat, NPN, TMAN, TVBN and alpha amino nitrogen due to washing*

Samples	Washing loss %	Moisture %	Fat, dry wt. basis %	NPN mg/100g	TMAN mg/100g	TVBN mg/100g	Alpha amino nitrogen mg/100g
I	0	77.98	5.4	331	3.44	12.0	44.0
II	18.6	80.64	3.9	160	2.10	4.9	15.4
III	16.5	79.5	3.8	161	1.90	3.9	15.4
IV	18.0	80.16	4.0	160	1.60	6.1	13.6

respectively. The changes in extractability were followed by the method of Dyer *et al.* (1950). The alpha amino nitrogen of the samples was determined from the trichloracetic acid extract by the method of Pope & Stevens (1939) and trimethylamine nitrogen (TMAN) and total volatile base nitrogen (TVBN) by the microdiffusion method of Conway (1947). Organoleptic studies were conducted as described by Joseph & Perigreen (1983).

Result and Discussion

The changes in weight, moisture, fat, non-protein nitrogen, trimethylamine nitrogen, total volatile base nitrogen and alpha-amino nitrogen due to washing are given in Table 1. On an average, the weight loss during washing was 18% and the gross protein loss was reported to be upto 25% (Grantham, 1981). About 2% increase in the moisture level was noticed and it was found difficult to bring down the moisture to original level after washing. The fat loss was about 2% on dry weight basis. The weight loss on washing might be mainly due to the loss of soluble proteins, non-proteins and other soluble constituents. The loss of non-protein components reduced the characteristic flavour of the washed mince substantially. About 50% loss in non-protein nitrogen was noticed by washing and substantial loss was observed in TMAN and TVBN. The TVBN loss was more in sample III while TMAN showed the lowest value in sample IV

Table 2 shows the changes in extractable nitrogen during frozen storage. The difference in extractability among the samples was significant. The water washed samples showed 26% loss in solubility compared to control. This was attributed to the loss of soluble proteins and non-proteins. The low values of protein extractability in samples III and IV might be due to the denaturation of proteins as a result of washing in salt solution and ascorbic acid solution respectively.

Table 2. *Changes in extractable nitrogen (% of total nitrogen) during frozen storage*

Weeks of storage	I	II	III	IV
0	72.4	46.2	26.3	24.6
4	60.2	29.2	24.7	23.9
10	40.2	23.7	23.8	21.0
16	36.4	23.6	22.6	22.5
22	34.2	24.2	22.1	21.4
28	33.1	22.9	23.2	20.9

Table 3 presents the changes in FFA and PV during frozen storage. Washing reduced FFA and had a significant effect in reducing the FFA formation during storage. The effect of washing was almost the same in all the three samples. PV was also reduced by washing. Sample III showed a higher PV among the washed samples and this might be due to the effect of salt. Control samples showed a rapid change in PV during storage.

The result of sensory evaluation is presented in Table 4. Washing increased the acceptability which might be due to the loss of characteristic catfish flavour which was not appreciated by many consumers and also due to the improved colour of the washed sample. The control had a soft texture, dark colour and a peculiar odour characteristic of catfish, while all washed samples had slight fibrous texture and white colour. The improvement in colour was more in

Table 3. *Changes in FFA and PV during frozen storage*

Weeks of storage	FFA (% Oleic acid) I	II	III	IV	PV (Milli. equivalent/kg fat) I	II	III	IV
0	5.46	2.28	1.78	3.41	11.03	3.35	8.83	5.46
4	8.29	2.35	3.05	2.82	15.80	5.60	11.80	5.52
10	13.56	4.42	6.02	4.41	23.5	7.20	149.0	6.10
16	18.26	5.20	7.05	5.20	29.7	8.20	17.10	7.20
22	17.23	5.40	7.80	5.51	38.5	7.90	16.20	6.90
28	16.50	5.50	7.90	5.90	36.2	8.3	19.2	8.10

Table 4. *Changes in organoleptic scores of minced catfish samples during frozen storage*

Weeks of storage	I	II	III	IV
0	7.0	7.5	7.5	7.5
4	6.2	7.0	7.3	6.5
10	5.5	6.5	6.5	6.0
16	4.5	6.0	6.3	5.5
22	4.1	5.5	6.0	5.5
28	3.0	5.0	5.0	4.5

samples washed in water and salt solution while sample washed in ascorbic acid solution had a slight dark appearance. The washed samples were in acceptable condition upto 28 weeks storage while the control became unacceptable by the taste panel after 22 weeks storage due to the development of off odour and unpleasant flavour. The texture of sample IV became dry on storage.

Minced fish which is highly contaminated with pigments, blood and dark meat can be improved in colour and appearance by washing. As a result of the loss of soluble proteins which are mainly enzymes, significant reduction in the deteriorative chemical changes are noticed. The forzen storage life of the mince is also improved by washing.

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