Development and Storage Characteristics of Dehydrated Salt Mince from Low Priced Fish

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The study showed that less initial moisture with high salt content will be the best condition for enhanced storage life of dehydrated salt mince. Between sample I (10% salt per meat weight) and sample II (15% salt per meat weight) the latter was comparatively better in colour, odour and longer shelf-life. At room temperature the dehydrated salt mince has not showed any increase in total bacterial count. It is also found that the storage life of the salt mince can be enhanced to a significant extent by lowering the moisture content to below 10% and increasing the salt content to above 30%. Peroxide value, free fatty acid value, total volatile nitrogen and trimethylamine registered gradual increase during storage at room temperature for all the three samples. Among the three samples, the sample treated with 0.1% citric acid and 0.125% butylated hydroxy anisole was comparatively better in appearance and showed less rancidity as indicated by TBA values, upto a period of 15 weeks and thereafter all the three samples were almost similar in storage characteristics. Hence, the treatment with citric acid and B.H.A. has apparently not much significance in improving shelf-life and quality of salted dehydrated fish mince.

Minced fish is the flesh separated in comminuted form from skin, bones, scales and fins from fish (Grantham, 1981). Yield of minced fish from a number of species of Indian fish was worked by Perigreen (1981). According to him it varies from 29% (in shark) to 57% (in medium size soles). On an average, most of the species give an yield of about 45%. According to Perigreen & Jose (1983) minced threadfin bream has an accepted storage shelf-life at-23°C for 28 weeks beyond which the meat becomes inedible. Perigreen *et al.* (1979) have also calculated yield of minced fish from filleting waste. They have recovered about 6–10% minced meat from various species of fish. However, it should be noted that minced fish has not captured a market in India. This paper deals with the studies on development of dehydrated salted fish mince and its shelf-life at ambient temperatures.

Materials and Methods

Jew fish *(Johnius* sp.) procured from Fort Cochin was brought to the laboratory in ice. Minced meat was prepared by using a hand separator after evisceration, cleaning, washing etc. Two samples were prepared using 10% and 15% salt to the minced meat weight. After proper mixing and shaping, samples I and II were dried in an air oven at 50–52°C (about 20 h). The salted, semi-dried minced meat were packed in polythene and kept at room temperature for stroage studies. For the second batch, after applying salt, the samples were kept in a chill room overnight and dried in a tunnel drier at a temperature of about 50°C (about 22 h). After drying the samples were packed in polythene, sealed and kept at room temperature for storage studies. The chemical as well as the microbiological analysis of the minced meat and partially dried salt mince were carried out periodically.

A third batch of dehydrated salt mince has been prepared from threadfin bream *(Nemipterus japonicus)* using a mechanical meat separator. The yield of minced meat from the whole fish was around 41%. Three samples I, II and III were prepared for detailed studies on microbial,

physical and biochemical changes due to storage at room temperature in sealed polythene covers. From the studies carried out on the earlier batches it was found that 15% salt to minced meat weight was ideal. Samples I and II contained meat plus 15% salt. Sample I, after salting was kept in a chill room overnight and dried in a tunnel dryer after making round shaped blocks. Sample II, after salting was dried immediately in a tunnel dryer. In samples III, 15% salt, 0.1% citric acid and 0.125% butyl hydroxy anisole (B.H.A.) were added and dried in a tunnel dryer immediately like sample II. All the samples were tunnel dried initially and then sundried. The temperature of drying was around 51°c and the period of drying was around 30 h altogether. The dehydrated samples were packed in polythene covers and sealed for storage studies.

The initial analyses of the samples of all the batches were carried out immediately after drying and packing. For the first batch the samples were examined after 4 and 9 weeks and for the second batch after 6 and 14 weeks to assess the quality of the product by physical as well as microbiological changes. In the case of the batch III from threadfin bream, sampling was carried out after 4, 8, 15, 24 and 35 weeks. The quality of the product has been assessed by physical, microbiological and chemical analyses.

Moisture, protein, fat, ash and sodium chloride were determined by AOAC method (1975), peroxide and free fatty acid values by the method of Lea (1952) and AOCS (1946) respectively. The thiobarbituric acid values were estimated by the method of Tarladgis *et al.* (1960). Total volatile nitrogen and trimethylamine were estimated by the Conway microdiffusion method (1947) by using the alcoholic extract prepared from the salt mince samples. All the salted mince samples were first taken for microbiological examination and subsequently for chemical analyses. For all the batches storage studies were discontinued when the samples were not very good for further storage.

Results and Discussion

Proximate composition of the minced meat of batch I and II (Jew fish) and batch III (threadfin bream) are given in Table 1A and the proximate composition of the dehydrated salt mince immediately after drying for all the three batches are given in Table 1B. From Table 1B, it can be noticed that the batch III samples contain less moisture and more salt compared to the other two batches. From the storage studies of the batches I and II it was noticed that less moisture and high salt content would be the best condition for enhanced storage life. The optimum moisture and salt content for the salt mince was used for the batch III experiment to below 10% for moisture and above 30% for salt content for a better storage life at room temperature.

Table 1a. *Proximate composition of the minced meat*

	Jew fish		Threadfin bream
	Batch I	Batch II	Batch II
Moisture, %	78.05	79.05	78.40
Fat, %	1.82	0.90	1.69
Protein, %	19.05	19.09	18.50
Ash, %	1.23	1.10	1.24

Table 1b. *Proximate composition of the dehydrated salt mince*

Parameters	Batch I		Batch II		Batch III		
	Sample I 10% salt	Sample II 15% salt	I 10% salt	II 15% salt	I	II	III
Moisture %	23.87	33.17	24.25	30.25	4.86	5.59	3.61
Fat %	3.71	4.63	2.50	2.31	6.44	6.05	5.96
Protein %	51.79	42.99	51.80	45.50	49.70	51.09	50.59
Ash %	24.21	23.1	24.27	29.31	37.59	36.45	39.77
Sodium chloride %	18.80	18.65	19.70	24.40	32.38	35.90	36.02

Microbiological characteristics of the minced meat as well as dehydrated salt mince immediately after drying are presented in Table 2. Comparatively lower total plate count for the minced meat for all the three batches indicates the hygienic handling and preparation. Dehydrated salt mince immediately after preparation for all the batches showed comparatively lower bacterial count. Coliforms, streptococci and staphylococci were absent in all the samples analysed.

Table 2.* *Microbiological characteristics of the minced meat and dehydrated salt mince*

	Fresh minced meat TPC/gm	Dehydrated salt mince sample I	sample II
Batch I	3.7×10^4	2.30×10^4	1.80×10^3
Batch II	4.0×10^4	1.40×10^4	1.40×10^4
Batch III	4.0×10^4	6.30×10^2	5.20×10^3

*Coliforms, streptococci and staphylococci were absent in the minced meat as well as the dehydrated salt mince. In the case of sample III for batch III the TPC was only around 1000.

Table 3 provides the storage characteristics of the salt mince for samples I (meat plus 10% salt) and II (meat plus 15% salt) for batch I and II at room temperature in polythene covers. The variation in moisture content of the samples may be attributed to the change in moisture content of the individual salt mince cakes to a great extent. In the case of sample I with comparatively low moisture content for both the batches the total count has come down due to storage. For sample II with comparatively high moisture content, the total bacterial count has increased to some extent due to storage. The physical parameters like colour, odour etc. indicated that sample II (meat + 15% salt) was comparatively better than sample I (meat + 10% salt). At the end of the storage period, for both the batches yellow colouration and rancid smell were comparatively more and further storage studies were discontinued.

Table 4 gives the changes in moisture, protein and lipid contents of the three samples of the batch III (threadfin bream) salt mince samples. The moisture content of all the three samples has doubled due to storage for a period of 36 weeks at room temperature

Table 3. *Storage pattern of dehydrated salt mince for batch I and II samples*

Parameters	Batch I			Batch II			Samples
	Initial	After 4 weeks	After 9 weeks	Initial	After 6 weeks	After 14 weeks	
Moisture %	23.87	20.60	25.14	24.25	25.22	24.47	I
	33.13	32.67	36.48	30.21	27.57	24.89	II
Total plate count per gm*	2.3×10^4	1.9×10^4	4×10^3	1.4×10^4	2.1×10^3	4.0×10^3	I
	1.80×10^4	4.5×10^4	3×10^3	1.9×10^4	2.6×10^3	2×10^4	II
Colour	Very good (white)	Good (Slight yellow)	Yellow discolouration	Very good	Slight yellow colour	Deep Yellow	I
	"	Good	"	"	Good	Slight yellow	II
Odour	Good	Slight rancidity	Strong rancidity smell	Good	Slight rancidity smell	Strong rancidity smell	I
	"	"	"	"	Good	Slight rancidity	II

*Coliforms, streptococci and staphylococci were absent for all the samples

Table 4. *Changes in moisture, protein and lipid content of the batch III (Threadfin) salt mince*

Samples and period of storage (weeks)		Moisture %	Protein %	Fat %
	Initial	4.86	49.70	6.44
Sample I	4	6.34	49.52	6.38
	8	6.64	50.97	5.88
	15	6.64	50.71	5.98
	24	8.91	51.61	5.58
	36	8.65	52.87	5.58
Sample II				
	Initial	5.59	51.09	6.05
	4	9.08	47.80	6.13
	8	5.68	50.27	5.73
	15	10.84	49.69	5.72
	24	9.18	49.75	5.15
	36	8.89	48.37	5.14
Sample III				
	Initial	3.61	50.59	5.96
	4	6.75	50.25	6.35
	8	9.14	48.51	5.82
	15	7.11	47.15	5.74
	24	8.81	49.88	5.95
	36	8.20	52.86	5.87

in sealed polythene covers. As the samples were dried thoroughly, the individual salt mince cake variation for moisture content may be quite negligible. Corresponding with change in moisture, change in protein content has been observed. But the lipid content of all the three samples were more or less the same or slightly decreased.

Figs. 1, 2 and 3 show the changes in peroxide value, free fatty acid value and thiobarbituric acid value respectively of the dehydrated salt mince of the batch III samples. It can be observed from Fig. 1 that, all the three samples increased in peroxide value gradually upto a period of 24 weeks. However prolonged storage upto 36 weeks resulted in the lowering of peroxide value considerably. Among the three samples I, II and III the sample treated with B.H.A. and citric acid (III) showed comparatively lower peroxide value. For free fatty acid value also all the three samples showed

Table 5. *Changes in total volatile nitrogen and trimethyl amine contents of dehydrated salt mince samples from threadfin bream meat*

Samples	Period of storage in weeks	Total volatile nitroen mg/100g	Trimethyl amine mg/100g
I	Initial	39.84	13.28
	4	79.70	26.50
	8	82.59	55.06
	15	146.90	91.86
	24	168.00	65.33
	36	125.20	111.29
II	Initial	38.14	12.71
	4	106.6	40.00
	8	110.0	68.76
	15	180.06	90.32
	24	167.10	74.27
	36	203.08	135.39
III (Treated)	Initial	31.73	9.52
	4	116.82	51.92
	8	130.38	82.50
	15	169.64	98.21
	24	176.39	83.55
	36	166.30	152.47

a gradual increase due to storage. Compared to the three samples, sample I (15% salt and chilled overnight) showed a lower value for free fatty acid. Sample III showed comparatively higher free fatty acid value upto 24 weeks and thereafter the value has decreased slightly. But in sample II the increase was slightly on the higher side towards the end. One peculiarity observed was that the thiobarbituric acid value has decreased due to storage of the dehydrated salt mince for all the three samples as seen in Fig. 3. For sample II (15% salt and dried immediately) the initial value was quite low and due to storage the value has not increased much except after 15 weeks. For samples I and III the initial value were about 5 mg/kg of sample but considerably decreased after a period of 4 weeks, thereafter the decrease was not much.

Changes in total volatile nitrogen and trimethylamine contents of samples from threadfin bream are given in Table 5. All the samples showed a rapid increase in

both TVN and TMA values. Initially, comparatively lower values were shown by the treated samples (sample III). But after 4 weeks the increase was quite high like the other two samples. In general dried salt mince showed an abrupt change in volatile nitrogen content due to the storage at room temperature in scaled polythene covers. Prolonged storage from 24 weeks to 36 weeks doubled the TMA values whereas the total volatile nitrogen has not showed any significant increase during this period.

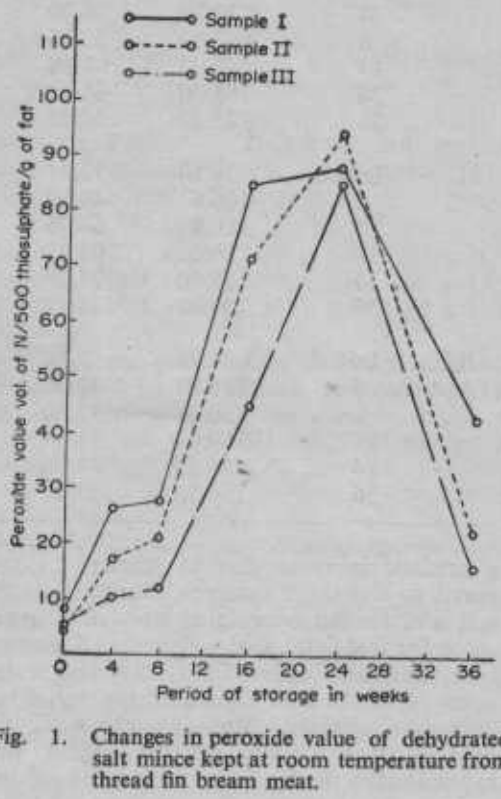

Fig. 1. Changes in peroxide value of dehydrated salt mince kept at room temperature from thread fin bream meat.

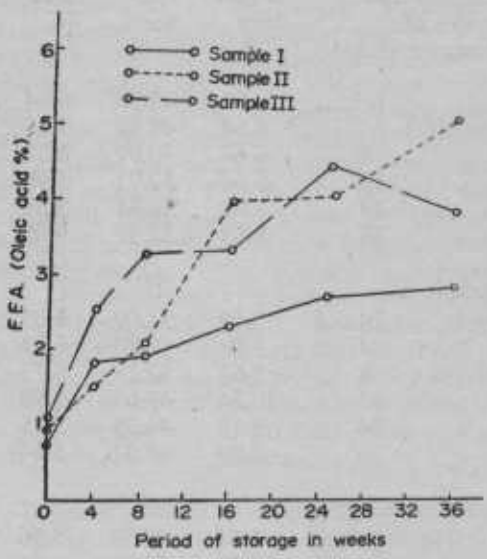

Fig. 2. Changes in free fatty acid value of dehydrated salt mince kept in room temperature from thread fin bream meat.

Bacterological characteristics of the three samples are given in Table 6. The total bacterial count of all the three samples decreased due to storage at room temperature after a period of 36 weeks. Below 10% moisture and above 30% salt present in the samples may be the reason for lower bacterial count for the stored samples. Compared to the three samples, sample III (treated with B.H.A. and citric acid) and sample

Table 6. *Changes in Total bacterial count per g of the dehydrated salt mince samples from threadfin bream meat*

	*Total plate count/g period of storage in weeks					
	Initial	4	8	15	24	36
I	6.3×10^2	8×10^2	2.2×10^3	7.5×10^2	5.5×10^2	8×10^2
II	5.2×10^3	2.2×10^3	2.2×10^3	1.1×10^3	1.0×10^3	8×10^2
III	1×10^3	9×10^2	1.1×10^3	2×10^2	4.5×10^2	1×10^3

*Coliforms, streptococci and staphylococci were absent for all the samples

I (15% salt to meat weight and chilled overnight) showed lower bacterial count initially as well as on storage.

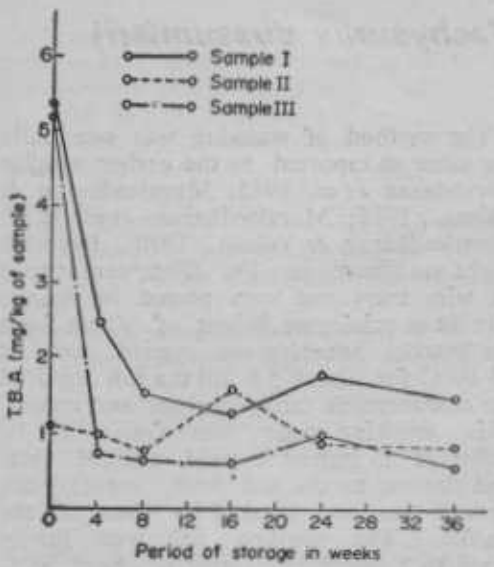

Fig. 3. Changes in T. B. A. value of dehydrated salt mince kept at room temperature from thread fin bream meat.

The studies on the storage characteristics of dehydrated salt mince showed that less initial moisture with high salt content will be ideal for enhanced storage life at room temperature. A reasonable shelf-life can be attained (few months) by lowering the moisture content to below 10% and increasing the salt content to above 30% for the dried salt mince at room temperature. Biochemical, physical as well as microbiological changes of the samples agree with the above observation. Treatment with citric acid (0.1%) and B.H.A. (0.125%) has apparently not much significance in shelf-life and quality of salted dehydrated fish mince from threadfin bream.

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