Changes in Major Protein Fractions of Oil Sardine *(Sardinella longiceps)* and Mackeral *(Rastrelliger kanagurta)* During Frozen Storage

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Oil sardine *(Sardinella longiceps)* and mackerel *(Rastrelliger kanagurta)* were frozen stored for a period of 6 months at –18°C. Changes in their protein fractions were followed periodically by protein fractionation with appropriate buffers. In the case of both oil sardine and mackerel, the myofibrillar fraction showed decrease with rise in the denatured fraction as the storage period increased. In the sarcoplasmic protein fraction mackerel protein showed definite decrease whereas oil sardine showed only a very mild decrease in its content. Both oil sardine and mackerel showed a definite increase as far as non protein fractions are concerned with increase in storage period.

Eventhough a lot of work has been done on the changes in the proteins of avian and mammal muscle during storage, work on the changes in fish muscle protein is scanty. A study on the changes in fish muscle protein is all the more important in view of Connell's (1961) observation that proteins of fish do not necessarily behave like avian or mammalian muscle.

Sawant & Magar (1961) followed the course of protein denaturation in frozen fish. Moorjani *et al.* (1962) and Baliga *et al.* (1962, 1962a, 1969) have studied changes in muscle proteins of fresh water fishes. Govindan (1962) studied protein fractions in ice stored prawns. Devadasan & Nair (1970, 1977) reported the protein fractionation of ice stored sardine, prawns, mackerel and lactarius. Shenoy & Pillai (1971) and Shenoy & James (1972) reported the course of protein denaturation in frozen fish. Changes in frog muscle protein has been studied by Devasan & Nair (1980).

Masayuki Kochi & Shitokeu Era (1959) studied the meat proteins of yellowfin tuna. Acid soluble proteins of squid muscle has been studied by Kumitsugu Kitabayashi & Sengi Ishikawa (1962). Maruyama & Suzuki (1968) and Shiro Konagaya *et al.* (1970) studied the changes of proteins in ice stored mackerel and fractionated the proteins of jellified meat of tuna respectively.

Changes in fresh water fish protein during frozen storage have been reported by Awad *et al.* (1969). The present study describes the changes in the major protein fractions of two commercially important fishes namely, oil sardine and mackerel.

Materials and Methods

Fresh oil sardine *(Sardinella longiceps)* and mackerel *(Rastrelliger kanagurta)* of adult size obtained from the local market were used for the study. They were thoroughly washed in cold water and packed in polythene paper as blocks of 10 nos. in the case of oil sardine and 5 nos. in the case of mackerel. They were quick frozen in a contact plate freezer and stored at -18°C. Initial analysis of the samples was carried out. Extraction procedure and buffers used for the fractionation of muscle protein were the same as reported by Devadasan & Nair (1970) except that for extraction of sarcoplasmic protein phosphate buffer of 0.05 M was used. Samples were analysed initially at intervals of 15 days and towards the end monthly. Nitrogen was determined by Kjeldahl method (Hawk, 1954).

Results and Discussion

Changes in the muscle protein nitrogen fractions of oil sardine and mackerel during frozen storage are given in Table 1. The sarcoplasmic protein nitrogen of mackerel decreased from the initial value of 32.12% to 19.12% during the 6 months of frozen storage whereas in oil sardine the reduction was from 29.79 to 22.18%. Both in mackerel and oil sardine the myofibrillar fraction showed a decrease of about 50% from the initial value, the percentage being 11.52 to 5.8 and 7.7 to 4.1 respectively. The lower value for the myofibrillar fraction may be due to the following reasons (1) some of the myofibrill may get extracted in the sarcoplasmic extract also as reported by Matsumoto, (1957) in squid, (2) extraction of sarcoplasmic proteins is causing some modification in the residual protein as suggested by Dyer & Dingle, (1961) and (3) presence of free fatty acid in the muscle can inhibit the extraction of muscle proteins as observed by Devadasan & Nair (1971).

In both oil sardine and mackerel the denatured fraction registered an increase with decrease of myofibrillar protien. The stroma fraction did not show

Table 1. *Changes in the protein nitrogen fractions of mackerel and sardine during frozen storage*

	Weeks	Protein nitrogen extracted with buffer, μ=0.05; pH 7.2 at 0°–5°C (a)	Protein nitrogen extracted by buffer, μ=0.5 from the residue from (a) (b) at 0°–5°C	Protein nitrogen extracted with 0.1 N NaOH at room temperature from the residue from (b)	Stroma* nitrogen	Non protein* nitrogen
Mackerel	0	32.12	11.52	48.12	7.21	12.51
	2	31.54	9.68	50.61	7.18	12.86
	4	30.89	9.62	53.15	6.36	13.66
	6	—	—	—	—	—
	8	25.48	9.56	57.96	6.96	13.68
	10	25.62	9.17	58.07	7.14	14.32
	14	23.09	8.37	61.40	7.15	15.63
	18	20.52	7.64	64.25	7.32	16.73
	22	19.98	6.37	65.86	7.52	17.32
	24	19.12	5.80	67.30	7.54	18.69
Oil sardine	0	29.79	7.70	56.36	6.15	6.27
	2	29.29	6.81	58.04	5.86	6.70
	4	29.59	6.65	58.39	5.37	7.29
	6	—	—	—	—	—
	8	28.47	5.55	59.28	6.70	12.27
	10	27.95	5.45	61.44	5.16	12.41
	14	26.53	4.97	63.80	—	13.14
	18	25.01	4.32	63.91	6.06	13.40
	22	24.57	4.21	64.28	5.94	13.92
	24	22.18	4.13	66.14	6.05	14.60

*Values expressed as % of total nitrogen

much variation throughout the storage period. The increase of non protein nitrogen in oil sardine was from 6.3 to 14.6% and in mackerel it was from 12.5 to 18.7%.

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