Relationship of Certain Chemical Attributes to Sensory Quality of Frozen-stored Mackerel and Ocean Perch

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Relationship of Certain Chemical Attributes to Sensory Quality of Frozen-stored Mackerel and Ocean Perch*1

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Abstract

The quality of frozen-stored mackerel and pacific ocean perch was organoleptically scored. Different portions of their thawed muscle were examined for degenerative change of nucleotides (K-value), TBA value and extractability of actomyosin. The correlation between quality scores and chemical values was analysed.

Both K-value and TBA value for the ventral portion of fish muscle were highly or moderately significantly and inversely related to scores, whereas actomyosin extractability did almost insignificantly, regardless of muscle location. The regression lines of the relation between scores and attributes were more steeper in mackerel than in ocean perch. The levels of K-value and TBA value for the same assigned score were higher in the ventral than in the dorsal muscle.

Thus, it is inferred that single or combined data of the selected attributes obtained with the ventral muscle of fish may be more effective in evaluating the quality of frozen-stored fish.

The various chemical tests have been reported for assessing the quality of frozen-stored fish. But a little work has been published to determine the correlation of them with organoleptic quality[1-3]. In the previous report[4], the authors described that the extent of nucleotides degradation, content-ratio of meto-myoglobin to total myoglobin, and the acid value and peroxide value of lipids in the muscle of frozen-stored skip-jack were respectively higher significantly correlated with its quality as scored organoleptically. They also demonstrated that certain combination of the tests mentioned above is possibly more effective for the quality assessment than single application of the test.

This paper describes a study of the correlation between the values of three chemical variables and sensory quality of the commercially frozen-stored mackerel and pacific ocean perch. It also deals with the difference in the level of chemical variables between the fish species and muscle location of individual fish.

Materials and Methods

Frozen samples

Fifteen of each of round mackerel and deheaded pacific ocean perch, which had

*1 Objective Evaluation of Frozen-stored Fish Quality–II

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been commercially sotred at −10°C or −25°C for different periods, were used for the test. The former fish averaged ca. 29 cm (range, 27~32 cm) in length and ca. 410 g (range, 315~530 g) in weight, and the latter averaged ca. 17 cm, and 188 g. For each test, two or three fish were randomly withdrawn from different lots of frozen-stored fish. The fish, after its quality was scored organoleptically in a frozen state, was thawed to internal temperature of about 1°C in running water of about 15°C and then filleted.

Organoleptic evaluation

The sensory assessment was carried out by a trained panel of 5 members, consisting of the foreman of fish plant and buyer of fish market. The appearance of frozen samples and the odor and flavor of fillets from the thawed samples were examined. The overall quality was scored on a 5 point scale, ranging from 5 for excellent to 1 for very poor. When the majority of panel agreed on a score for a given fish, the score was accepted. Where there was scatter of opinion the average score was adopted.

Chemical determination

The tests were done on the samples of three portions taken from anterior region of the ordinary muscle of each thawed fillet; i. e., about 5 mm of the muscle beneath the skin (outer portion) and about 5 mm of the muscle adjacent to the back bone (inner portion) of dorsal muscle, and the muscle of ventral region (ventral muscle).

The samples were analyzed for the extent of nucleotides-degradation (K-value), the amount of extractable actomyosin (extractability) and the TBA value, indicating a oxidative deterioration of lipids. These were determined by the same methods as described previously[4].

Results

The relationship between three chemical attributes and overall quality scores are shown in Figs. 1, 2 and 3. Although actomyosin extractability was significantly correlated with quality scores in the ventral muscle of mackerel, its relationship to scores was not significant both in the dorsal muscle of mackerel and in the muscle of ocean perch. The levels of extractability in the ventral muscle were generally lower for the same indicated score, than in the dorsal muscle of two fish species. The difference of level between the muscle locations was noticeable in the case of mackerel (Fig. 1).

K-values for muscle of both species were highly significantly and inversely related to the sensory score, with the exception of the value for the dorsal muscle in ocean perch. TBA values for muscle of both species, except the dorsal muscle in mackerel, were also, though moderately, significantly and inversely related to sensory quality of fish. The slope of regression line of these relations was steeper in mackerel than in ocean perch. The levels of these values for the same indicated scores were higher

in the ventral than in the dorsal (outer and inner) muscle of both fish species. Their higher levels in the ventral muscle correspond in the meaning to the lower levels of actomyosin in the same muscle (Figs. 2 and 3).

Discussion

As far as the correlation coefficient from limited data in this paper is concerned, both K-value and TBA value for the ventral muscle are realized to be applicable to quality test of the frozen-stored fish. But the protein extractability appears to have relatively little value in evaluating the quality (Table 1).

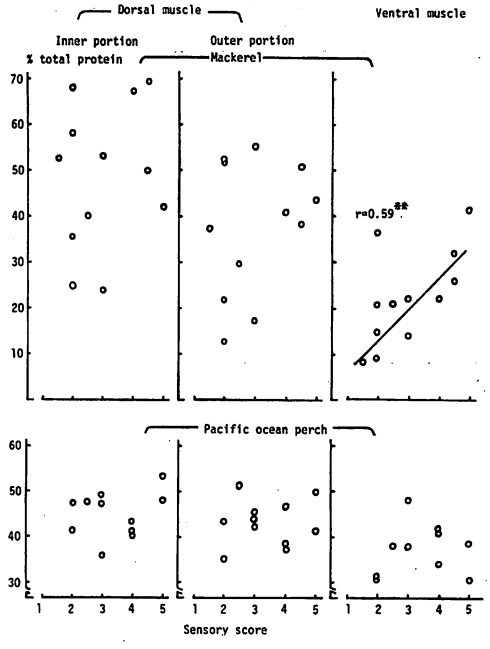

Fig. 1. Relation between extractable actomyosin and sensory score for frozen-stored fish. (**, $p<.01$)

The combination of K-value and TBA value increases the percentage of the variance in fish-quality accound for. A similar conclusion was previously reached from an examination of the correlations between widely selected chemical attributes and quality scores for the frozen-stored skip-jack. It is inferred, therefore, that the objective tests for frozen-stored fish would give a better evaluation if applied in the selection of attributes which reflect the qualitative changes resulting mainly from initial freshness of fish and the deteriorative changes resulting from freeze-storage. The considerations

Table 1. Correlation coefficients between quality-scores of frozen-stored fish and chemical attributes of ventral muscle of thawed fish.

Correlation	Coefficients[a]	
	Mackerel	Pacific ocean perch
Simple,		
Score vs Actomyosin (AM)	+0.59**	+0.20
〃 vs K-value (KV)	−0.68*	−0.65×
〃 vs TBA value (TBA)	−0.60*	−0.54*
Multiple,		
Score vs AM·KV	0.79*	0.43
〃 vs KV·TBA	0.87**	0.67×
〃 vs TBA·AM	0.71	0.64

a; ** $p<.01$, * $p<.05$, × $p<.10$

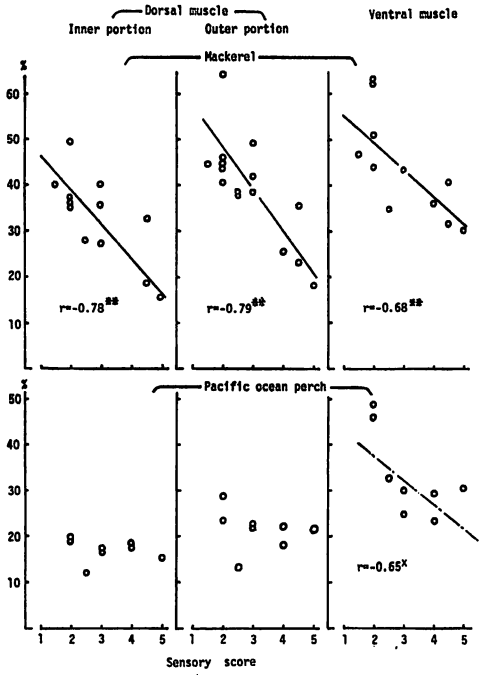

Fig. 2. Relation between K-value and sensory score for frozen-stored fish. (**p<.01, × p<.10)

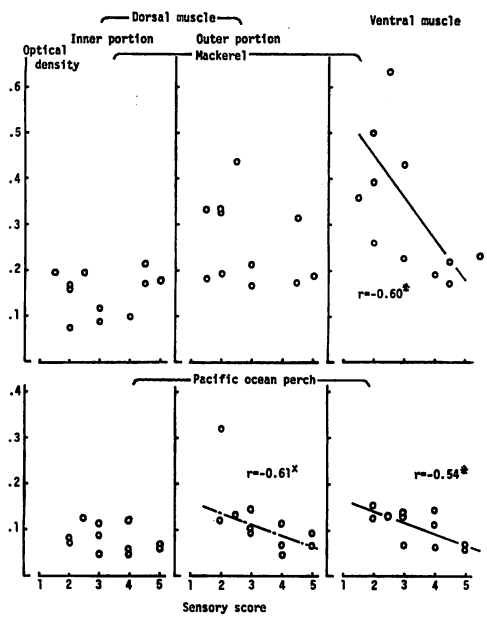

Fig. 3. Relation between TBA value and sensory score for frozen-stored fish. (**,<.01 *, p<.05 ×, p<.10)

mentioned above are essentially the same as those discussed by CONNEL et al.[5]

On the other hand, it is worth noting that both K-value and TBA value of ventral muscle were higher in their level, as compared with the respective values of dorsal muscle, regardless of fish species. The fact suggests that the deteriorative changes in ventral muscle of frozen-stored fish has occurred more rapidly in its ventral muscle than in dorsal muscle. In this respect, the tests for ventral muscle may serve more effectively for evaluating the quality.

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