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Total, Non-volatile Free Fatty Acids as a Freshness Index for Hake (*Merluccius hubbsi*) Stored in Ice

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ABSTRACT

Total, non-volatile free fatty acids (FFA) content was determined in hake muscle during fish storage in ice. FFA increased linearly in every season according to freshness loss as determined by sensory scoring. FFA determination is proposed as a valuable alternative to sensory scoring in determining fish deterioration in ice.

Key words: Hake, *Merluccius hubbsi*, freshness index, ice storage, free fatty acids.

1 INTRODUCTION

Hake freshness has been traditionally evaluated through sensory assessments.[1] Recent developments to replace sensory scoring by physical or chemical methods have been introduced.[2] These methods, however, do not provide enough sensitivity in the first 5–10 days of storage and the detected changes are too small to follow the storage life of hake stored in ice. A good improvement seemed to be the viscosity determination of soluble muscle protein extracts taken from hake stored in ice.[3] This parameter, however, is subject to non-linear seasonal variations.[4]

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The increase in total non-volatile free fatty acids (FFA) has been correlated with anchovy ripening in brine,[5] a process during which extensive changes in chemical compounds other than lipids occur.[6] The main objective of this work was to study the possibility of using total, non-volatile FFA release in fish muscle as a non-sensory freshness index for hake stored in ice.

2 EXPERIMENTAL

Hake (*Merluccius hubbsi*) was caught from fishing grounds on the Argentinian platform in the South Atlantic Ocean during all seasons, and over a period of 2 years from 1979 to 1981. Fish samples were obtained from commercial vessels and kept in ice after catching and throughout the storage period studied in each experiment.

From time to time at least six specimens were taken at random from different boxes, and sensorily evaluated by a panel of trained people.[2]

Fillets obtained from each specimen were taken off and minced to obtain a uniform muscle paste, to be allotted to dry weight and total, non-volatile FFA determinations.

Twenty grams of six minced fillets were homogenized with 50 ml ethanol in a Braun MRA homogenizer. Homogenates were filtered through Whatman No. 1 filter paper, and 0·1 ml aliquots of the filtrate used to measure FFA according to the method described by Smith.[7] Calibration curves were obtained for each analysis set, by using palmitic acid (C16:0) as the standard. FFA determinations were done in quadruplicate. Results were expressed as milliequivalents of palmitic acid per 100 g wet tissue. Data points in Figs 1–3 are mean values of at least six samples.

3 RESULTS AND DISCUSSION

Hake freshness was evaluated on fish kept in ice through the sensory scoring method developed by Lupín *et al.*[2] Figure 1 shows sensory assessment versus days in ice during different seasons, and up to 18 days total storage time.

A similar linear response was obtained when muscle total non-volatile FFA content versus storage time in ice was determined, whatever the season (Fig. 2).

When FFA levels in hake muscle and sensory scores from fish kept in ice were depicted together, a good correlation could be obtained (Fig. 3).

Lack of trained people to form the sensory panel on some occasions and a failure of FFA determinations, due to unforeseen events, account for the unmatched points depicted in Figs 1 and 2.

The evidence presented here shows that FFA level in muscle could be used instead of the subjective sensory scoring method, in determining hake freshness. This has a triple significance. First, since a linear correlation between FFA and storage time has been obtained (Fig. 2), FFA level could be used to calculate how many days hake has been kept in ice after catching. Second, since a sensory score 3–3·5 is the borderline for freshness acceptability,[2] and this corresponds to 0·4–0·5

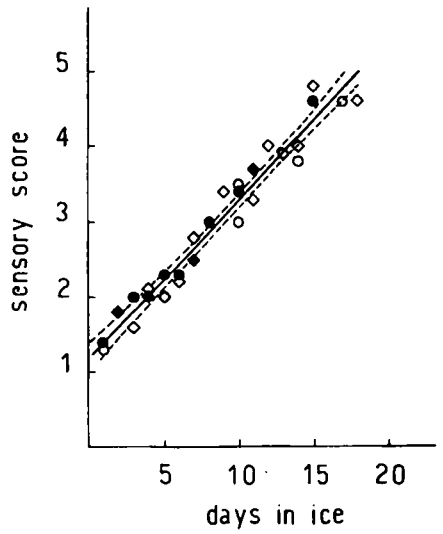

Fig. 1. Time course of sensory scores in hake stored in ice during different seasons. □, summer; ■, fall; ○, winter; ●, spring. Each point represents samples taken from at least six different specimens. Solid line represents regression line for sensory scores versus days in ice. Dashed lines represent confidence limits for $P<0{\cdot}05$.

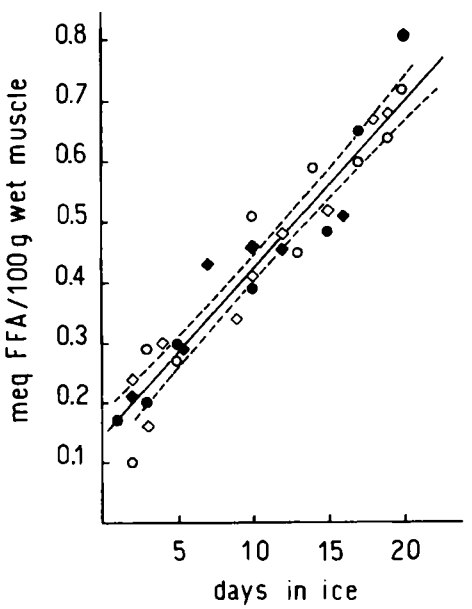

Fig. 2. Time course of total, non-volatile FFA in hake stored in ice during different seasons. Solid line represents regression line for FFA versus days in ice. See Fig. 1 for symbols.

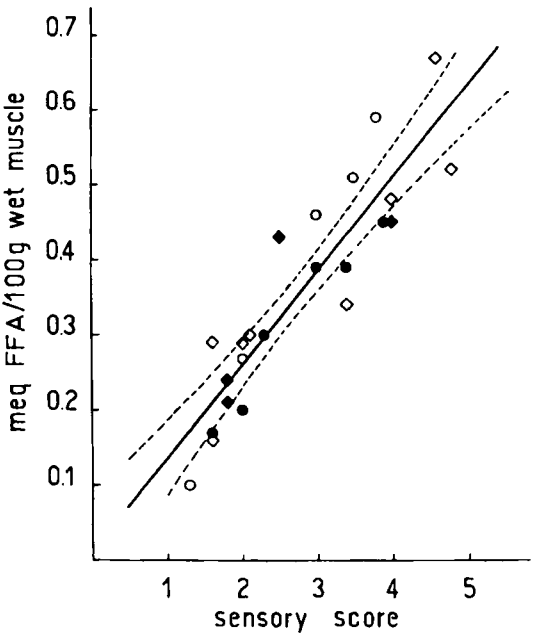

Fig. 3. Total, non-volatile FFA versus sensory scores for hake stored in ice during different seasons. Solid line represents regression line for FFA versus sensory scores. See Fig. 1 for symbols.

FFA meq %, the latter values could be used as the borderline for hake consumption and processing, independently of the season. Third, FFA could serve to control freshness in fillets, where sensory scoring is less appropriate than in whole fish.

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REFERENCES

1. da Encarnaçao, C. J. Quality control development in fish and fish products. (In Span.). *Fisheries Development Project FAO-Argentine Technical Communication No. 39*, 1974, FAO.
2. Lupín, H. M.; Giannini, D. H.; Soulé, C. L.; Davidovich, L. A.; Boeri, R. L. Storage life of chilled Patagonian hake (*Merluccius hubbsi*). *J. Food Technol.* 1980, **15**, 285–300.
3. Crupkin, M.; Barassi, C. A.; Martone, C.; Trucco, R. E. Effect of storing hake (*Merluccius hubbsi*) on ice on the viscosity of the extract of soluble muscle protein. *J. Sci. Food Agric.* 1979, **30**, 911–913.
4. Barassi, C. A.; Crupkin, M.; Martone, C. B.; Trucco, R. E. Seasonal variation in the viscosity of the extracts of muscle proteins of hake (*Merluccius hubbsi*) stored on ice. *J. Sci. Food Agric.* 1982, **32**, 303–305.

5. Roldán, H. A.; Barassi, C. A.; Trucco, R. E. Increase on free fatty acids during ripening of anchovies (*Engraulis anchoita*). *J. Food Technol.* 1985, **20,** 581–585.
6. Filsinger, B.; Barassi, C. A.; Lupín, H. M.; Trucco, R.E. An objective index for the evaluation of the ripening of salted anchovy. *J. Food Technol.* 1982, **17,** 193–200.
7. Smith, S. W. A new salting-out technique for colorimetric free fatty acid assays. *Anal. Biochem.* 1975, **67,** 531–539.