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SEASONAL PATTERN OF FLESH QUALITY IMPROVEMENT AND SHELF LIFE EXTENSION OF EUROPEAN SEA BASS BY SLURRY ICE COOLING DURING FISH HARVESTING AND TRANSPORTATION

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Introduction

Fish is highly susceptible to spoilage, which can be caused by both intrinsic chemical reactions and microbial growth. The key to fish preservation is the immediate chilling upon catch or harvest to a temperature slightly above the freezing point and maintaining this temperature throughout the cold chain (Kauffeld et al., 2010). The replacement of conventional flake ice with slurry ice as a slaughtering method may result to improved quality stability during subsequent refrigerated storage and shelf-life extension, in terms of microbial growth, flesh quality and sensory degradation of fish (Ntzimani et al., 2021). The objective of the study was the evaluation of the effect of environmental temperature (seasonality) and cooling medium of fish (slurry ice) during harvesting and transportation on flesh quality and key parameters that determine shelf life of European sea bass (*Dicentrarchus labrax*).

Materials and methods

Whole European sea bass (*Dicentrarchus labrax*) was taken from the net cages in Philosofish S.A. farming facilities (Greece) and within 24 h after slaughtering in slurry ice 0, 50 or 100% slurry ice (prepared from seawater), was transported to the laboratory in polystyrene boxes. Four different mixtures of slurry ice and conventional flake ice were tested, coded as C: slaughtered and transported in 100% flake ice, SC: slaughtered in 100% slurry ice and transported in 100% flake ice, S50: slaughtered and transported in 50% slurry ice-50% flake ice, S100: slaughtered and transported in 100% slurry ice. The ratio of ice (slurry or flake) to fish (w/w) was 1:1 and the temperature of the slurry ice was -3.2°C. Sampling was performed in two different periods, i.e. December 2019 and September 2020, in the same fish farm located in Larymna (Fthiotida, Greece). Upon receipt at the laboratory, all fish samples were stored isothermally at 0±0.2°C. Quality evaluation *Brochothrix thermosphacta*, H_2S-producing bacteria yeasts/molds and *Enterobacteriaceae* spp.), colour, texture, lipid oxidation, proteolytic enzymes, and sensory evaluation.

The activity of major proteases, namely Calpain, Collagenase, Cathepsin B and L responsible for white muscle degradation was measured; a piece of white muscle was extracted from the fillet at slaughter (day 0) and on days 1, 2, 4, 8 and 15 post slaughter, snap-frozen in liquid nitrogen and stored at -80 °C until enzyme extraction. Enzymes were extracted according to Lakshmanan et al. (2005) with slight modifications. The activity of these enzymes was assayed by the Barrett and Kirschke (1981) method with minor changes. Activity was expressed as fluorescence units (FU) change per minute per mg protein.

Results

At sampling, the average water temperature was 18.5°C and 27°C in December 2019 and September 2020, respectively. The ambient water temperature had no significant effect either on the dominant microflora or on the microbial counts and shelf life of the fish products. *Pseudomonas* spp. and H_2S-producing bacteria were the dominant spoilage microorganisms in all samples tested. However, the use of slurry ice instead of the conventional flake ice led to improved quality and microbial stability during refrigerated storage, as well as to a 2-6 day shelf-life extension of whole sea bass stored at 0 °C. This positive effect did not differentiate with water temperature.

The overall activity of the cytoplasmic calpains and of the collagenases was significantly lower at the low water temperature. No such difference was recorded for the lysosomal cathepsin B and cathepsin L activities. However, the highest cathepsin activities were observed in the C group in the high-water temperature. Significant temporal differences in all enzyme activities were recorded in either water temperature and all methods. A significant correlation between calpain and collagenase activities was observed across slaughter methods and water temperatures. A similar significant correlation between cathepsin B and L activities was observed across methods only at high water temperature.

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Discussion and conclusion

The systematic study of the effect of harvesting and transportation conditions on the quality indicators and shelf life during refrigerated storage may provide technological solutions for fish handling with the aim to improve quality and shelf life and reduce food losses during distribution and storage from harvesting up to the consumer level. The use of slurry ice at slaughter appears to lead to improved product quality and extended shelf-life based on microbial growth and intrinsic degrading enzyme activity. It is also evident that water temperature shapes physiological characteristics that are determinant of post-slaughter quality.

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