ELSEVIER

Food Chemistry 77 (2002) 377–385

Food Chemistry

www.elsevier.com/locate/foodchem

Analytical, Nutritional and Clinical Methods

Changes in myofibrillar proteins during processing of salted cod (*Gadus morhua*) as determined by electrophoresis and differential scanning calorimetry

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Received 19 August 2001; accepted 1 October 2001

Abstract

The effects of salt-curing, drying and rehydration on muscle proteins in cod (*Gadus morhua*) were studied during the processing of heavily salted cod or "bacalhau". The aim was to observe conformational stability and possible degradation or denaturation, with sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) and differential scanning calorimetry (DSC). The salting process significantly decreased the heat stabilities of both myosin and actin. The decrease in water content during dry-salting did shift the transition temperatures slightly back to higher temperatures. The results, from the SDS-PAGE, showed that the myosin heavy chain (MHC) was cleaved into smaller sub fragments in the salting process with the two heavy meromyosin fractions (HMM S1 and S2) and the light meromyosin (LLM) fraction being the most abundant. Actin was less affected than myosin.

Keywords: Salted cod; Bacalhau; *Gadus morhua*; Protein denaturation; Differential scanning calorimetry (DSC); Electrophoresis (SDS-PAGE)

1. Introduction

Salting of fish is an old and traditional method to improve shelf life. Highly salted food products develop different organoleptic properties from the fresh product, which are often preferred by consumers. Salted cod, frequently referred to by the Spanish term for cod "bacalhau", has been produced in Iceland for centuries and has been one of the nations primary export products (Thorarinsdottir, Arason, Bogason, & Kristbergsson, 2001). The traditional markets for salted fish have been in Spain, Portugal and Latin America.

Salted cod is a heavily salted product, where the salt concentration reaches approximately 20%. The salt concentration affects the stability and denaturation of proteins and thereby such physicochemical factors as water-holding capacity (WHC). The addition of sodium chloride above the isoelectric point of proteins (pI), to meat systems, causes swelling and an increase of WHC (Honikel, 1989). The salt ions are believed to cause weakening of the interaction between oppositely charged side chains, which results in swelling. A measurable increase in WHC has been observed by the addition of more than 1% salt (0.17 M NaCl). Maximum swelling has been estimated at approximately 5% but, at higher concentrations, the myofibrilar proteins rapidly loose water through the salting-out process. Similar effects have been suggested for fish muscle (Akse, Gundersen, Lauritzen, Ofstad, & Solberg, 1993). At higher salt concentration in the muscle, or above 9–10%, the proteins may denature, resulting in stronger protein–protein bonds, shrinkage of the muscle and dehydration (Borgstrom, 1968; Hamm, 1985; Morrissey, Mulvihill & O'Neill, 1987; Offer & Trinick, 1983; Wilding, Hedges & Lillford, 1986).

Polyacrylamide gel electrophoresis (PAGE) is a technique in which proteins are placed in an acrylamide gel where the anode and cathode are located at opposite ends of the gel.

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0308-8146/02/$ - see front matter
PII: S0308-8146(01)00349-1