

# STUDIES ON THE MORPHOLOGICAL CHANGES OF BEEF DURING FREEZING PROCESSES

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## Abstract

The freezing process can cause several morphological changes in meat, with the most significant ones being the formation of ice crystals, damage to muscle fibers, and protein denaturation. During the freezing process, water molecules transform into ice crystals, which can lead to the breakdown of meat fibers. The aim of this study was to analyze the changes that occur in beef after freezing and to observe the differences between refrigerated and thawed samples using two different storage methods: vacuum-packed (wet chilling/ freezing) and unpacked (dry chilling/ freezing). Beef samples were subjected to slow freezing, both dry and wet freezing, with a temperature drop of 0.45 - 0.48°C/hour. The most notable changes after thawing were observed in physical parameters, pH, and texture indicators. The pH of the samples decreased during thawing, with the dry freezing method showing a more pronounced decrease (from a pH value of 6.43 in the chilled sample to a pH of 5.69 after thawing). Shear force (N) and the energy required for shearing (mJ), which reflect the textural qualities of the meat, demonstrated an increase in tenderness as the values of these parameters significantly decreased after thawing. The average values shifted from 87.08 N/1351.02 mJ (wet-chilled sample) and 89.29 N/1389.80 mJ (dry-chilled sample) to the lowest values observed in the wet thawed sample, with averages of 49.14 N/778.14 mJ. The impact of the studied factors on the chemical components was minimal. Humidity decreased from initial values of 75.66% (wet refrigeration) and 75.64% (dry refrigeration) to 75.46% (wet thawing) and 74.94% (dry thawing), with a more noticeable decrease in the case of dry thawing.

**Key words:** beef quality, freezing / thawing, texture