Soluble protein extraction facilitates the salt-induced swelling of pork meat

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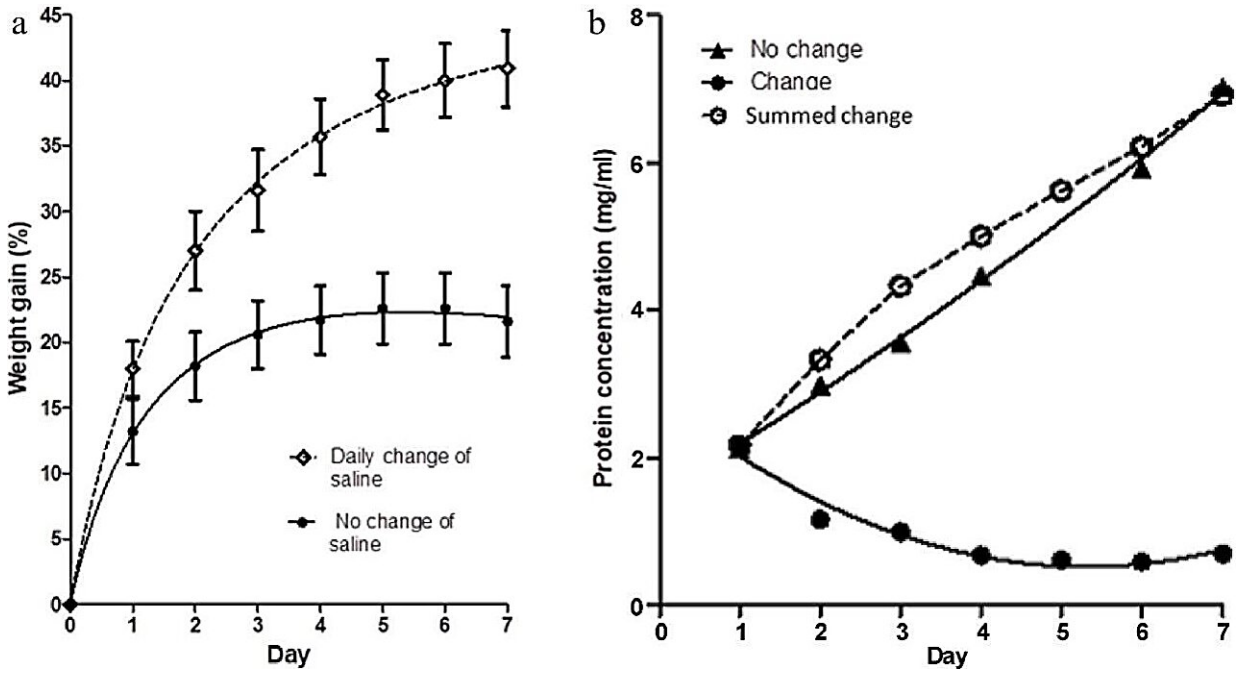

(a) The percentage weight change in muscle blocks measured each day over a 7-d period of immersion in 3% NaCl solution, with two treatments; maintenance of the same saline solution throughout (no change of saline), and replacement of the saline each day with fresh, pre-chilled, 3% NaCl solution. Values shown are means ± standard errors. (b) Concentration of protein in the two saline baths (change and no change) on each day, measured just before replacement of the saline in the 'change' case. Each point is the mean of two determinations. Summed change is the cumulative concentration of protein in the salines of the treatment with daily changes of solution. Credit: TranSpread

Salt-induced swelling is a crucial phenomenon in pork meat processing, significantly influencing the meat's water-holding capacity (WHC). Existing theories focus on the role of myofibrillar proteins, especially myosin and actin, in swelling. However, the involvement of soluble proteins, such as sarcoplasmic proteins in salt swelling remains unclear. Thus, elucidating the role of these soluble proteins has practical implications for improving processing and enhancing pork quality.

Food Materials Research published an online paper entitled "The extraction of soluble proteins aids salt swelling of pork meat" on 27 June 2023.

This study utilized multiple changes of fresh saline to analyze the effect on weight gain of blocks of porcine longissimus muscle while enclosing the blocks in dialysis tubing or suspending them in an excess of 3% NaCl solution alone to compare swelling.

The results showed that treatments with unrestricted dissolved protein efflux to saline yielded protein concentrations that exceeded the anticipated levels from solely sarcoplasmic proteins, suggesting that there was some partial solubilization of myofibrillar proteins (e.g., myosin or actomyosin) in these treatments.

The results also showed that daily saline exchanges increased the weight gain of the meat blocks, possibly attributed to stabilization of the ionic concentration in the soluble or to the excretion of soluble protein. The dialysis membrane reduced protein efflux and attenuated meat swelling compared to meat in free solution. In addition, dialysis membranes did not inhibit swelling regardless of meat status (fresh or frozen/thawed), but frozen and thawed samples showed significant differences in weight gain between open and closed dialysis bags.

SDS-PAGE analysis of proteins in saline from each treatment showed

that samples of saline without a fully semipermeable barrier contained actin (42 kDa) and myosin (220 kDa), as well as a variety of soluble (sarcoplasmic) proteins. However, the samples from the salines with closed dialysis bags showed a significant decrease of proteins above the nominal molecular weight cut-off of the dialysis membrane used (14 kDa).

In conclusion, this study illuminates that soluble proteins in meat in the presence of NaCl affect meat swelling by reducing structural proteins in the myofibrillar lattice. In addition, factors that cause denaturation of sarcoplasmic proteins after death (e.g., low rigor pH and/or high temperatures) also affect the salt-swelling behavior of meat.

These findings not only redefine our understanding of meat swelling dynamics, but also pave the way for optimized meat processing technologies, which will enhance the quality of meat products worldwide.

More information: Peter P. Purslow et al, The extraction of soluble proteins aids salt swelling of pork meat, *Food Materials Research* (2023). DOI: 10.48130/FMR-2023-0011

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