MICRO AND ULTRA STRUCTURAL CHANGES OF *SEMITENDINOSUS* MUSCLE INDUCED BY SOUS VIDE COOKING AND SALTS ADDITION

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Background

The *sous vide* methodology is a cooking-pasteurization technology non-extensively applied in Argentina, that improves final quality of "pre-cooked meat products". Water-holding in these vacuum packaged products is of great importance because it affects their appearance and commercial value. In addition, the final content of water has influence on sensory characteristics of the product. Polyphosphates are commonly used in combination with Sodium Chloride (SC) to increase water retention and reduce cooking losses in the manufacture of meat products. Successful results were obtained with this approach (Vaudagna *et al.* 2000; Sanchez, *et al.* 2003), however concern about structural changes induced by the cooking process and by the presence of both salts required further studies. According to those results, the highest cooking yield was obtained with a final tissue concentration of 0.25% STPP + 0.7% SC and cooking temperatures between 55 and 65 °C.

Objective

To describe the effect of different cooking temperatures (55°C, 65°C or 75°C) and different combinations of Sodium Tripolyphosphate (STPP) and SC on muscle structure of *sous vide* cooked muscles.

Methods

Beef *semitendinosus* muscles were excised from steers carcasses collected at a beef packaging plant 48 h after slaughter. Fat free muscles were injected (10%w/w) with appropriate solutions to obtain a final tissue concentration of 0.25% STPP, 0.7% SC or 0.25% STPP + 0.7% SC. Injected and non-injected samples were then submitted to *sous vide* cooking procedure (Sanchez, *et al.* 2003). Finally, samples from these cooked muscles, and from a similar set of muscles which were not submitted to cooking procedure (uncooked samples) were taken for light (LM) and transmission electron (TEM) microscopy analysis (Pazos *et al.* 2002). Sample from a 30 min. post slaughter (30 min. p.m.) non-injected muscle was included for control purposes.

Results and Discussion

LM of fresh tissue (Fig. 1) showed an increased space between fibres (F) and between fibre bundles (FB) in the case of STPP and SC; SC injected samples showed a distance between fibres of 2.3 m while STPP ones showed 2.5 m, in non-injected samples the distance was 0.8 m. A more compact structure was induced by the injection of both salts. Cooking at 55°C (Fig. 2), made more evident the increment of fluid in the adjacent zone to F and FB, and some F rupture was denoted particularly in SC treated samples. Otherwise, the use of the salt combination induced a structure protection with conserved tissue and abundant water retention. At 65°C (Fig. 3) it was apparent the effect of cooking temperature (CT) on tissue structure, non-treated samples showed a less conserved structure and presence of denatured perimysial collagen (DPC). SC treated samples depicted noticeable fibre rupture, and higher separation between F and between FB. The STPP treatment exerted a protective action on F, however the interstitial space was greater than at 55°C. The use of SC + STPP induced a uniform and well-conserved gel-like structure. When CT was increased to 75°C (data not shown), the temperature effect was more significant than the conservative action exerted by the combination of both salts, giving a picture similar to 65°C but with areas of gel disruption due probably to transverse shrinkage, and a greater amount of DPC.

TEM longitudinal views (not shown) depicted the typical F structure with regular transverse striations (uncooked samples), which was modified by CT showing myofibrils separation, Z-disc fragmentation, and filaments disruption, however the incorporation of both salts gave a more conservative picture. TEM transverse viewing support previous LM results, demonstrating the incorporation of retained water to the filament lattice volume, with the consequent swelling of the myofibrils and reduction of the cell interstitial space.

Conclusions

Structural components of beef *semitendinosus* muscle were modified by CT inducing disintegration of filaments and lateral and longitudinal shrinkage of myofibrils. The combination of STPP and SC salts and 65°C-temperature produced a gel-like structure preserving cellular structure and increasing water holding capacity.

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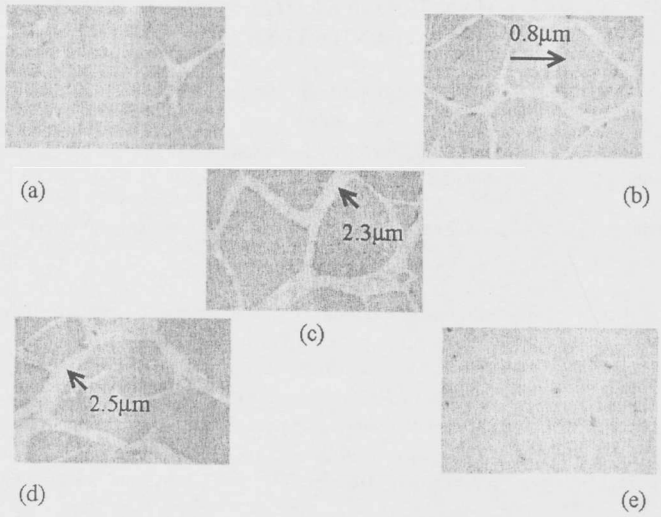

Figure 1: Ligth microscopy of uncooked tissue, 40X. (a) 30 min pm, (b) 48 h post-morten (c) 0.7% SC, (d) 0.25% STPP, (e) 0.25% STPP + 0.7% SC. Arrows indicate distance between fibres

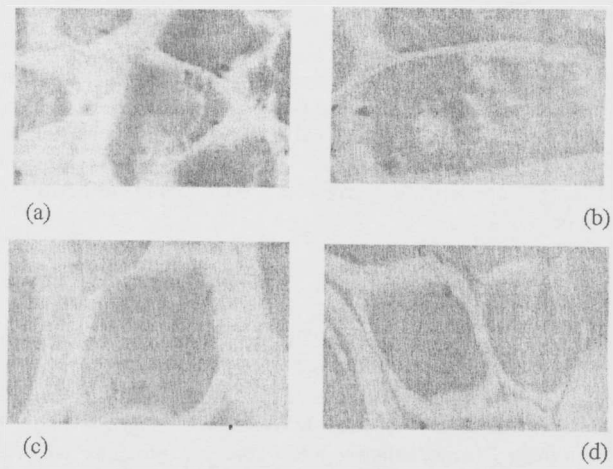

Figure 2: Ligth microscopy of 55 °C *sous vide* cooked tissue, 40X. (a) 48 h pm (b) 0.7% SC, (c) 0.25% STPP, (d) 0.25% STPP + 0.7% SC

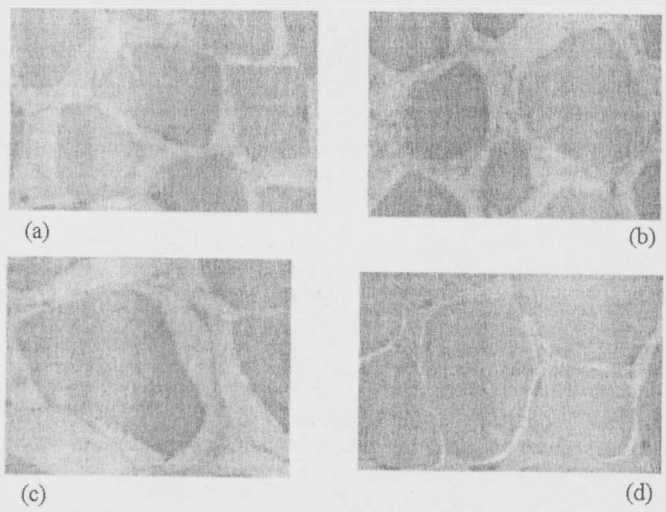

Figure 3: Ligth microscopy of 65 °C *sous vide* cooked tissue, 40X. (a) 48 h pm (b) 0.7% SC, (c) 0.25% STPP, (d) 0.25 % STPP + 0.7% SC