



Effect of Ultimate pH and Degree of Doneness on Fiber Degradation of Nellore *Longissimus Lumborum* Muscle

J. D. R. Mera, F. A. Ribeiro*, M. A. Almeida, and C. J. Contreras-Castillo

University of São Paulo, Piracicaba, Brazil

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Objectives

The objective of this study was to evaluate the degradation of fibers in meat classified into three ultimate pH (pH_u) groups: low ($5.5 \leq pH \leq 5.8$), intermediate ($5.8 < pH < 6.2$), and high ($pH \geq 6.2$) pH_u , cooked to various degrees of doneness: very rare (55°C), medium rare (65°C), and very well-done (80°C).

Materials and Methods

The *Longissimus lumborum* muscles of Nellore crossbred bulls ($n = 9$) were purchased from a commercial abattoir located in the state of São Paulo, Brazil. The muscles were collected at 24 h *post mortem*, according to the three pH groups using a pH meter coupled to a puncture electrode glass. At 48 h *post mortem* samples were roasted in an electric oven until these reached their corresponding final internal temperatures. Muscle fiber degradation was evaluated using scanning electron microscopy (SEM). Muscle portions ($6.0 \times 3.0 \times 3.0$ mm) were cut in the transversal direction of the muscle fibers and fixed for 1.5 h in Karnovsky solution (Karnovsky, 1965), prepared with small modifications (2.5% glutaraldehyde (v/v) and 2.5% formaldehyde in 0.05 M cacodylate buffer, pH 7; and 1 mM calcium chloride). The fixative solution was replaced by 30% glycerol (v/v), and then the samples were cryofractured in liquid nitrogen and post-fixed with 1% osmium tetroxide (w/v). After this, the samples were dehydrated at increasing concentrations of acetone (30, 50, 70, 90,

100%) and dried to the critical point of CO_2 . Then, the samples were sputtered with a 30 nm gold layer, and observed in a scanning electronic microscope (LEO 435 VP, Leo Electron Microscopy Ltd., Cambridge, England) at an acceleration voltage of 20 kV. The samples were photographed at $650 \times$ magnification.

Results

Micrographs of muscle fibers are shown in Fig. 1. At an internal temperature of 55°C , no degradation was observed in any of the three pH_u groups. However, at 65°C formation of aggregates appeared in the low and intermediate pH_u groups (yellow arrows in Fig. 1), which did not occur in the high pH_u category. The degradation was more pronounced at an internal temperature of 80°C in all pH_u groups. In the low pH_u group disintegration of muscle fibers occurred while in the intermediate pH_u aggregates were observed, and these began to appear in the high pH_u group as well. The small changes observed in the high pH_u samples compared to the other pH_u groups can be a consequence of little thermal denaturation of myofibrils and maintenance of their native configuration, given that they are so far from their isoelectric point.

Conclusion

The degradation of muscle fibers was dependent on pH_u and internal temperature of roasting. The higher degradation in the low pH_u can be consequence of higher thermal denaturation of myofibrils in this group.

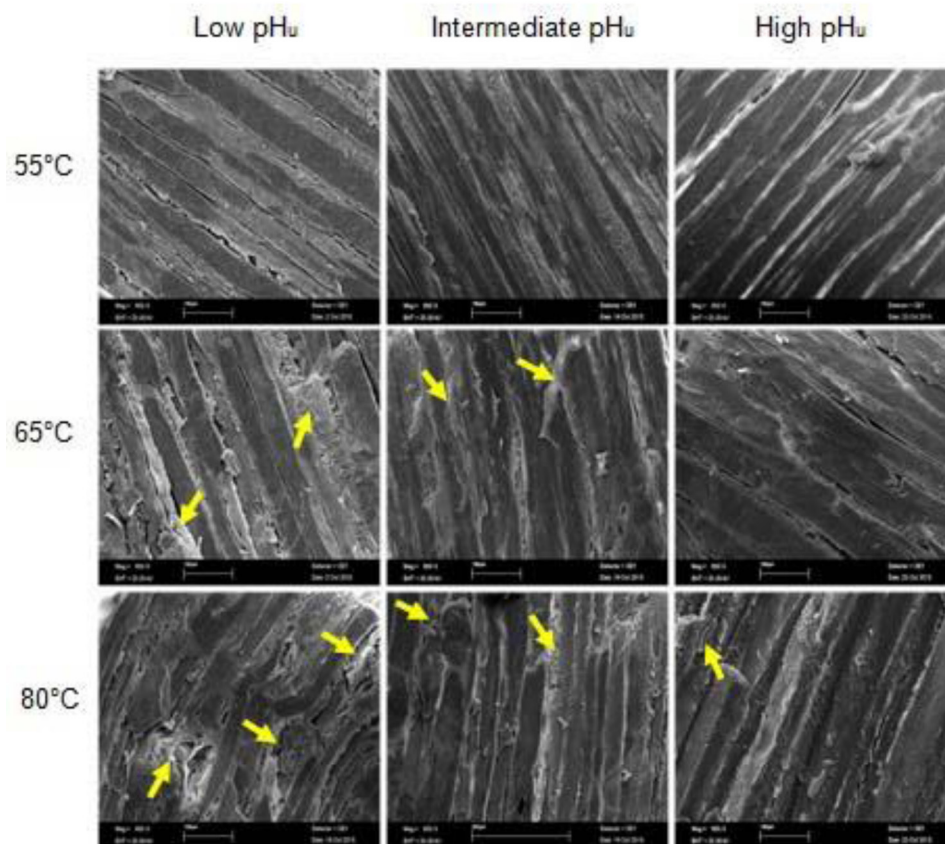


Figure 1. Scanning electron micrographs of bovine muscle fibers at different ultimate pH and roasted to varying degrees of doneness (55, 65, and 80°C).