POSTMORTEM CHANGES AND TENDERNESS OF SANTA INES SHEEP AS INFLUENCED BY AGE

Oliveira, Izabelle[1]; Silva, Teófilo J.P. [1]; Freitas, Mônica Q. [1]; Paulino, Flávia O.[1]

[1] Universidade Federal Fluminense UFF Niterói/RJ/Brazil E-mail: mtatjps@vm.uff.br

Background

Many concerns have been developed about the characteristics of ovine fresh meat that contribute to its palatability. Consequently, the scientific approach has advanced to understand more about the properties of postmortem muscle and the factors affecting it (MARSH & THOMPSON, 1958; SMITH et al., 1976; WHEELER & KOOHMARIE, 1994). Variability in tenderness of meat of lambs is a major quality defect (CLARE et al., 1997). A specific carcass weight is preferred in every country and even in every region (SAÑUDO et al., 1996), however the meat of light weight lambs was tender than heavy weight (LLOYD et al., 1981). Little is known about the post mortem changes during rigor mortis development and the inherent level of meat tenderness of Brazilian Santa Ines breed.

Objectives

The objectives of this study were to determine 1) the postmortem changes of muscles *longissimus thoracic et lumborum* and *triceps brachii* of ovines aged approximately 6 and 15 months and 2) tenderness and sensory evaluation of chops at 48 h.

Methods

Twelve intact male ovines Santa Ines breed were randomly assembled been six at 38.83 ± 3.18 kg live weight (lamb) and six at 52.97 ± 5.20 kg (yearling mutton). They were humanly slaughtered at Campos dos Goitacazes slaughterhouse - Rio de Janeiro and dressed according to standard procedures. The carcasses were placed in a 1ºC chill cooler for 24h with air velocity of 1m/s. At either 1h, 5h, 8h, 10h, 12h, 15h and 24h after exsanguinations, temperature was measured with a metal thermometer at *longissimus* muscle and from each carcass was sampled for pH determination (SILVA et al., 1993) and for sarcomere length determination (SILVA et al., 1993). Temperature of chilling room was registered at specific times. After 48 hours of exsanguination chops were cooked to 75ºC final internal temperature and after chilled to 3ºC, three 1.27 cm – diameter cores parallel to longitudinal muscle fiber orientation, were obtained from each chops for Warner – Bratzler shear force determination (WHEELER & KOOHMARIE, 1994). An eight –member trained sensorial panel (CROSS et al., 1978) evaluated warm 1cm^3 samples for tenderness using 8 point scales. Data were analyzed by ANOVA (F test) and Pearson's correlation procedure of SAS (1999) for a repeated measures design.

Results and Discussion

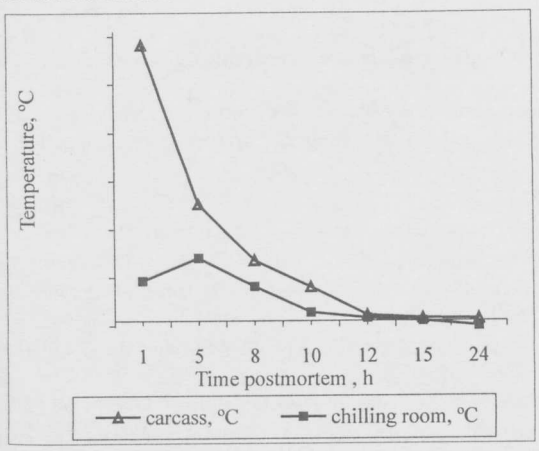

Figure 1. Postmortem changes in chilling room of ovines carcass during industrial chilling.

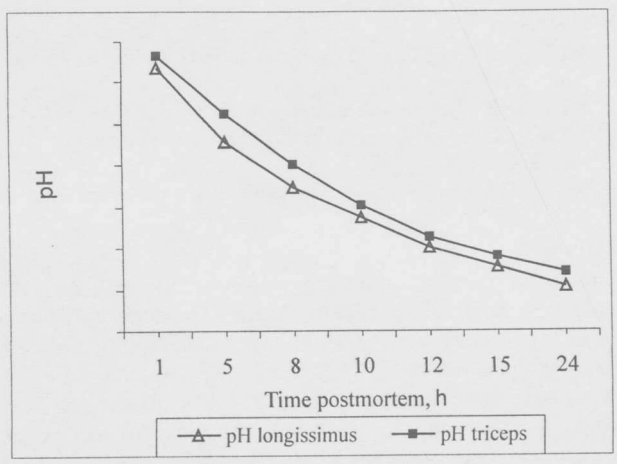

Figure 2. Postmortem changes in pH of *longissimus thoracis et lumborum* and *triceps brachii* muscles during the industrial chilling.

Temperature and pH decline of the *longissimus thoracic et lumborum* and *triceps brachii* were typical for the chilling conditions used and are shown in Figures 1 and 2. The mean values of carcass temperature were 28.58 ± 4.52ºC (1h), 6.26 ± 1.02ºC (8h) and 0.24 ± 0.11ºC (24h). The pH means values of *longissimus* and *triceps* were 6.67 ± 0.04 and 6.73 ± 0.05 (1h) and 5.61 ± 0.05 and 5.68 ± 0.03 (24h) respectively. The mean value of pH did not show difference between *longissimus* and *triceps* muscles ($p > 0.01$). WHEELER & KOOHMARAIE (1994) reported that ovine *longissimus thoracis et lumborum* initial pH was 6.66 ± 0.16 and 5.81 ± 0.07 (24h). BRESSAN et al. (2001) observed in ovine *longissimus* dorsi pH of 6.58 at 2h after exsanguinations and 5.74 at 24h. These values agree well with the pH obtained immediately following postmortem in this experiment.

Sarcomere length (Figure 3) of *longissimus* at 1 h was 2.25 ± 0.12 µm and significaticantly difference ($p < 0.01$) of *triceps brachii* (1.80 ± 0.10µm) and at 24h (1.70 ± 0.05µm vs. 1.59± 0.05µm , respectively). The maximum contraction of *longissimus* occurred at 12h (1.45 ± 0.06 µm) and of *triceps* at 15h (1.46 ± 0.06µm) . WHEELER & KOOHMARAIE (1994) reported sarcomere length of *longissimus* at 0 h was 2.24µm and 1.69µm at 24h postmortem. SMITH et al. (1976) found sarcomere length of 1.78µm at 72h in ovine *longissimus*. These data indicate that glycolysis had proceeded to completion and that the muscles could be cooked and sheared without the possibility of fiber shortening interfering with tenderness measurement. There is little doubt that muscle shortening that accompanies rigor mortis results in reduced tenderness (MARSH & THOMPSON, 1958, WHEELER & KOOHMARAIE, 1994).

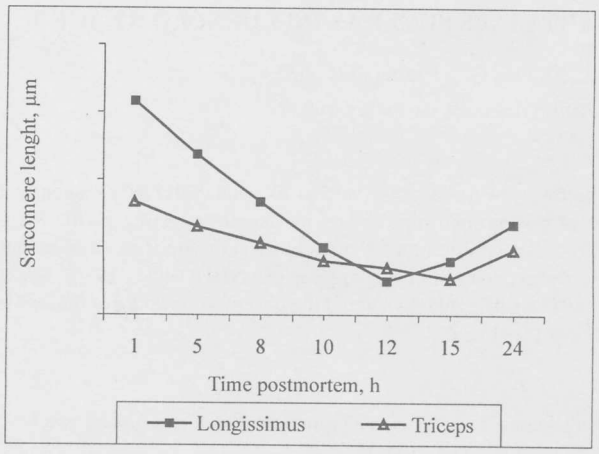

Figure 3. Postmortem changes in sarcomere length of ovine carcass during industrial chilling.

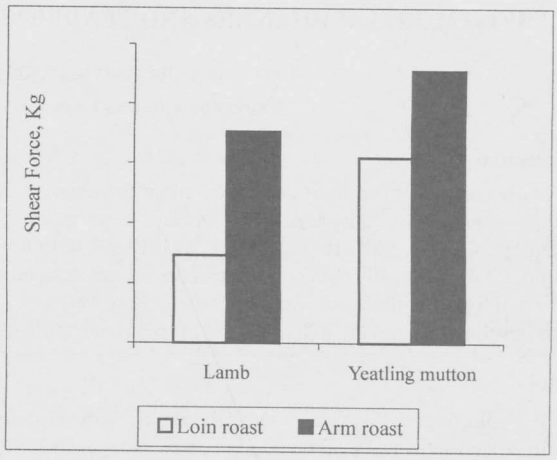

Figure 4. Warner – Bratzler shear of ovine loin roast and arm roast at 48h postmortem.

Figure 4 shows the mean values of Warner – Bratzler shear force of ovine loin roast (2.73 ± 0.14 kg) is lower ($p < 0.01$) than yearling mutton loin roast (3.55± 0.13 kg) and in same way the arm roast (3.77 ± 0.10 vs. 4.28 ± 0.19 kg). These results concur with those of LLOYD et al. (1981), who reported that tenderness measured by shear force change significantly ($p<0.01$) with age (2.17 ± 0.18 kg vs. 2.68± 0.08 kg) for *longissimus* muscle. On the other hand, the mean values of arm roast shear force of lamb and yearling mutton were greater ($p < 0.05$) than loin roast. Levels of collagen and the relative amounts of highly cross-linked collagen have been associated with meat quality and meat tenderness (SAÑUDO et al., 1996). Tenderness as evaluated by the taste panel, was more desirable ($p < 0.01$) for the ovine loin roast than for yearling mutton loin roast and arm roast. Correlation coefficients were computed relating carcass temperature, pH and sarcomere length and were 0.95 and 0.93, respectively. These coefficients were significant at 1% level. Taste panel and Warner – Bratzler shear values were moderately correlated ($r = 0.77$, $p < 0.01$) and agree with data reported by LLOYD et al. (1981).

Conclusions

• Temperature and pH decline of muscles *longissimus thoracis et lumborum* and *triceps brachii* were typical for the chilling industrial conditions used.

• The point of maximum contraction occurred at the 12ª hour for the *longissimus* muscle and at the 15ª hour for the *triceps* muscle.

• The meat of yearling mutton was tougher than lamb and the muscle *longissimus thoracis et lumborum* was more tender than the muscle *triceps brachii.*

• Ovine loin roast was more desirable by the taste panel than the other ones.

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