

EFFECT OF SEX AND AGEING ON BEEF QUALITY OF HYPERTROPHIED PIEMONTESE BREED

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Background

Tenderness is the qualitative characteristic that mostly affects the acceptability of the meat. It depends on several factors, like age and sex of the animal, muscle type, temperature and length of storage. The latter is considered a key factor in reducing the toughness caused by *rigor mortis* and consequently in improving the tenderness (Koochmaraie, 1996). But ageing is an expensive process, especially for the cost of refrigeration and for weight losses, occurring either from the surface of the carcass as water evaporation or from butchered joints as exudate. For these reasons in practice the economic consideration frequently predominates on the control of the quality.

On the other hand it is well known that hypertrophied animals, like Piemontese subjects, produce a very tender meat because of a low background toughness. This consideration, together with the negative aspects above mentioned, can lead to shorten the ageing length.

Objectives

The aim of this investigation was to study the effect of the sex and ageing length on the water holding capacity and tenderness, determined as Warner-Bratzler shear, of the *longissimus thoracis et lumborum* from hypertrophied Piemontese animals.

Methods

Forty five animals (15 females and 30 males), reared in different farms of Liguria Region, were slaughtered and processed at the same slaughterhouse. The average age and weight of the animals were, respectively: 598 d (s.d. 68.62) and 458 kg (s.d. 55.50) for the females; 544 d (s.d. 96.50) and 540 kg (s.d. 73.44) for the males.

At 24 hs *post mortem* the pH was measured with an Ingold spear electrode into the *longissimus thoracis* (13th T.V.) of the right side. The *longissimus thoracis et lumborum* between 1st L.V. and 9th T.V. was taken from the right side and transferred to the laboratory, where it was immediately divided into the samples required for the established analyses and kept at 2°C. The analyses were: sarcomere length (at d 1), determined by laser diffraction method (Koolmes *et al.*, 1986); drip losses at 3, 7, 11 d *post mortem* on a 3 cm thick steak (Barton-Gade *et al.*, 1994); cooking losses at 1, 3, 7, 11 d *post mortem* on a 4 cm thick steak, kept in a water bath until an internal temperature of 70°C was reached (Barton-Gade *et al.*, 1994); shear force (kg) at 1, 3, 7, 11 d *post mortem* on cylindrical cores 2.54 cm in diameter, taken parallel to muscular fibres and obtained from the steaks previously employed for cooking losses analysis; the shear force was measured with an Instron 1011 equipped with a Warner-Bratzler shear and calibrated on a slipping speed of 50 mm/min.

The data were analysed by GLM repeated measures procedure of SPSS package (SPSS, 1997), considering day of storage as within subjects factor and sex as between subjects factor.

Results and discussion

The pH showed a normal value (5.46), both for males and females, and similar to that already observed in the same breed (Destefanis *et al.*, 1994). The sarcomere length was 1.73 µm and was not affected by the sex. The observed value is slightly higher than that previously reported for the same breed (Barge *et al.*, 1997).

On the whole, the values of pH and sarcomere length indicate that glycolysis *post mortem* underwent a regular development and cooling conditions of carcasses did not represent a risk of cold shortening.

The results of drip losses, cooking losses and Warner-Bratzler shear are reported in table 1.

Concerning the sex, females showed higher drip losses and cooking losses as well as lower WB shear, but none of the differences were significant.

Ageing length induced a significant ($P < 0.01$) increase of the drip losses in relation to the day of determination. The highest decrease in weight occurred between d3 and d7 (-76%) and a further decrease of 28% was observed between d7 and d11. This result confirms that the storage greatly affects the drip (Barge *et al.*, 1996). Also Honikel and Potthast (1991) observed in Deutsches Fleckvieh breed an increase of drip losses due to storage time; the females showed higher, but not significant, values, in comparison with males and steers.

Cooking losses were not influenced by storage length, as already found by Bondesan *et al.* (1998) in Blonde d'Aquitaine crossbred young bulls.

Therefore, in relation to water holding capacity, our results confirm that the length of storage strongly affects the drip losses, but has a negligible effect on the cooking losses (Honikel and Hamm, 1994).

Ageing affected WB shear values that significantly ($P < 0.01$) decreased as the storage length increased, in agreement with several results (Koochmaraie, 1996; Devine *et al.*, 1996). In the total period (between d1 and d11) WB shear was almost halved, but the decreasing rate was different in relation to the period considered: the largest variation occurred between d1 and d3 (-29.8%), while the subsequent decrease was 10.3% between d3 and d7, and 14.7% between d7 and d11. Within days, the variability of WB shear was very high (C.V. 28÷35%), but decreased with time. Consequently, the ageing had the positive effect in reducing not only the shear force, but also the variability among samples, depending in part on the heterogeneity of the animals and rearing conditions.

Therefore, the concerned slaughterhouse, which sells the meat at retail in own butcher shops within 7 days *post mortem*, could further improve meat tenderness by a careful management of the the operating conditions.

Conclusions

The ageing is a basic step to improve meat tenderness, even though associated to higher drip losses. As tenderness is the most important characteristic for the consumer acceptance, the ageing length could be introduced as a criterion of qualitative differentiation also in the hypertrophied Piemontese breed characterized by a low background toughness.

Pertinent literature

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Acknowledgements

Research supported by MURST 60%. Thanks to Regione Liguria and CAB for collaboration.

Table 1. Effect of sex and ageing time on Water holding capacity and Warner-Bratzler shear

Variable	Factor		mean	s.e.
Drip losses (%)	Sex	Females	4.78	0.19
		Males	4.96	0.31
	Storage (d)		4.60	0.22
		3	2.86 ^A	0.17
		7	5.03 ^B	0.21
		11	6.44 ^C	0.25
Cooking losses (%)	Sex	Females	19.87	0.30
		Males	20.18	0.49
	Storage (d)		19.55	0.35
		1	20.49	0.54
		3	19.22	0.59
		7	20.35	0.54
		11	19.40	0.54
WBs (kg)	Sex	Females	7.74	0.35
		Males	7.43	0.57
	Storage (d)		8.06	0.41
		1	10.80 ^A	0.57
		3	7.58 ^B	0.43
		7	6.80 ^C	0.31
		11	5.80 ^D	0.27

Means within a column with different letters differ significantly ($P < 0.01$)