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**Abstract**—In order to describe the chemical and physical characteristics of beef from Piemontese steers slaughtered under and over 24 months of age a study was carried out on twenty hypertrophied Piemontese steers belonging to the two commercial categories. Twenty four hours after slaughtering the cold dressing percentage was recorded and the pH was measured on *longissimus thoracis*. After 8 days of ageing, the following analyses were performed on *longissimus thoracis et lumborum*: pH; chemical composition; haem iron content; hydroxyproline content and collagen solubility; colour (L, a<sub>L</sub>, b<sub>L</sub>); drip losses; cooking losses; shear force on raw and cooked meat. No differences were observed between the two categories except for cold dressing percentage. The actual commercial division of steers in the two age classes does not seem justified as the animals have similar meat quality characteristics from a nutritional and organoleptic point of view.

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**Index Terms**— Piemontese breed, steers, age at slaughter, meat quality

## I. INTRODUCTION

THE current agricultural policy of the European Union considers a reorientation of agricultural production encouraging the diversification and the promotion of quality products linked to the geographical origin or to the traditional methods of production [7].

Concerning beef production, the castration of Piemontese bulls was an usual practice, when the animals were used mainly for draft purpose, but later it was abandoned for technical, economic and social reasons [4]. More recently there has been a renewed interest for this kind of production because of market requests for top quality steer's meat suitable for the preparation of typical and traditional dishes.

At the present, two commercial categories of animals can be found. One includes steers slaughtered between 16 and 24 months of age, the other includes subjects older than 24 months. In order to promote the quality of this meat and apply for a designation of origin (i.e., protected geographical indication, PGI; [6]) objective reference data are needed.

As few data were available, the aim of this study was to describe the chemical and physical characteristics of beef from Piemontese steers of the two commercial categories.

## II. MATERIALS AND METHODS

The study was carried out on twenty hypertrophied Piemontese steers reared under local production system. At slaughter, 9 animals were under 24 months of age (group 1) 11 were older than 24 months (group 2).

The animals were reared in 10 different farms and slaughtered at a mean age of 677 days (s.d. 23.07) for group 1 and 984 days (s.d. 150.71) for group 2. Average slaughter weight was 660 kg (s.d. 71.42) in animals of group 1 and 628 kg (s.d. 58.73) in group 2.

At slaughterhouse the animals were weighed and 24 hours after slaughter cold dressing percentage and pH on *longissimus thoracis* were recorded, and samples of *longissimus thoracis et lumborum* (between the 11th T.V. and 1st L. V.) were collected from the right side of each animal.

After 8 days of ageing at 4 °C the following analyses were performed: water, protein, ether extract [2] and haem iron content [9]; hydroxyproline content [10] and collagen solubility (2h at 80 °C; [14]); L, a<sub>L</sub>, b<sub>L</sub> colour parameters according to the Hunter system using a Minolta CR 331 C Colorimeter [5]; drip losses, on a steak of about 80 g and 1.5 thick, kept 48hs at 4 °C in a plastic container with a double bottom [12]; cooking losses, on a 4 cm thick steak, sealed in a polyethylene bag and heated in a water bath up to 70 °C of internal temperature, then cooled under running water for about 30 min [3]; shear force on cylindrical cores 1.27 cm in diameter, cut perpendicular to the longitudinal axis of the muscle fibres, and obtained from raw and cooked meat. Shear force was measured using an INSTRON 5543 equipped with a Warner-Bratzler shear device and calibrated on a slipping speed of 200 mm/min [1].

The data were analysed by ANOVA using GLM procedure [15], considering the commercial category as the main effect.

### III. RESULTS AND DISCUSSION

The results are reported in table 1.

Slaughter age considerably influenced cold dressing percentage, which was 11% higher in group 1 in comparison with group 2 ( $P < 0.01$ ).

With regard to meat traits, no differences were observed between the two groups, except for shear force of raw meat.

It is possible to make some considerations by comparing the results of this study with those of a previous investigation on Piemontese steers reared in an experimental station and slaughtered at a mean age considerably lower (562 days) [8].

Lightness, hue and cooking losses observed in the two studies were very similar. Therefore these traits do not seem to be influenced by the range of age considered (from 562d to 984d).

On the contrary, in the present study the ether extract content was more than double, the hydroxyproline content was higher and the collagen solubility was lower, in comparison with results of Destefanis et al. [8]. The higher intramuscular fat, probably due to the older age of the animals, also improved drip losses (1.77%, group 1 and 1.48%, group 2 vs 2.98%), according to Lawrie & Ledward [11], who affirm that muscles with a high intramuscular fat tend to have a high water holding capacity. In any case, it must be underlined that the low intramuscular fat content ( $< 2.5\%$ ) is a particular characteristic of meat from hypertrophied Piemontese cattle breed.

At present, we are not able to justify the higher hydroxyproline content found in this research (about 20% higher) in comparison with value observed in steers 19 months old while the lower collagen solubility (10.57% and 11.77% vs 17.14%) is clearly due to the older age of the animals.

Shear force of raw meat was significantly lower in group 1 ( $P < 0.05$ ), while no differences were observed between the two groups for shear force of cooked meat, which showed higher values in comparison to raw meat. In this regard, Purslow [13] reported that cooking increases the intramuscular connective tissue contribution to toughness in the range 20-50 °C and that the measurements on raw meat are a poor predictor of cooked meat texture. However, it must be stressed that the shear force values were very low ( $< 40$  N), reflecting the high meat tenderness of Piemontese breed.

### IV. CONCLUSION

In conclusion, apart from the best cold dressing percentage of steers under 24 months, the results show that the usual commercial division of steers in two classes, under 24 months and over 24 months, does not seem justified as the animals have similar meat quality characteristics from a nutritional and organoleptic point of view.

### ACKNOWLEDGEMENT

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Table 1. Slaughtering performance, chemical and physical characteristics of meat.

	Group 1 (age < 24 months)		Group 2 (age > 24 months)	
	Mean	S.E.M.	Mean	S.E.M.
Cold dressing percentage (%)	68.05A	0.84	61.26B	0.76
pH <sub>24</sub>	5.48	0.01	5.45	0.01
Water (%)	73.31	0.37	73.59	0.34
Protein (%)	22.78	0.19	22.37	0.17
Ether extract (%)	2.20	0.41	2.36	0.37
Haem iron (µg/g)	16.51	0.85	15.29	0.77
Hydroxyproline (µg/g)	441.96	47.30	477.35	42.78
Collagen solubility (%)	10.57	0.84	11.77	0.76
Lightness	33.35	0.62	33.11	0.56
Redness (a <sub>L</sub> )	22.66	0.34	22.43	0.31
Yellowness (b <sub>L</sub> )	7.19	0.21	7.12	0.19
Hue	17.60	0.26	17.56	0.23
Chroma	23.77	0.39	23.54	0.35
Drip losses (%)	1.77	0.15	1.48	0.13
Cooking losses (%)	17.24	0.98	17.06	0.89
Warner-Bratzler raw meat (N)	20.33b	1.78	25.90a	1.61
Warner-Bratzler cooked meat (N)	39.93	2.30	37.83	2.08

Means within a row with different letters (a, b; A, B) differ significantly (P<0.05; P<0.01)