PHYSICAL CHARACTERISTICS OF THE LONGISSIMUS TRAIT MUSCLE OF THE ITALIAN AND POLISH HORSE MEAT

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Background

Of the commonest horse-breeding in Italy the Italian Trotter ranks the first (11.260) heads of cattle). It is used as a sports-horse followed by rustic breeds which are currently utilised in country's resorts or for meat production such as the "Avelignese" (9.782), the "Cavallo Agricolo Italiano da Tiro Pesante Rapido" (heavy-cart horse) (6.377), the "Maremmano" (3.540), the "Murgese" ("2.722), the "Bardigiano" (2.200), the 'Sanfratellano" (1.469) and the "Tolfetano" (1.377) (FAO, 2002).

The Italian horse-meat sector is one of the most important all over the world. In 2002 the Italian production accounted for 77.34% of the world wide one and 35.92% of the European one (Fao 2002). In 2002 horse-breeding in Italy counted 285.000, and such a number kept unchanged with respect to the previous year. Also the number of slaughtered animals (278,283) was the same as the previous year (Istat, 2001) (National Poll Institute).

In 2001, according to the last ISTAT information (data) processed by "Assocarni" little less than 300,000 horses were slaughtered in Italy, with an increase by 19,9 related to 2000 of these 69,3% in privately owned slaughter houses. In detail, 278,283 horses and 2,228 including asses, mules and hynnies. To this end it is noteworthy to mention that horse-slaughtering since 1999 at the time of the bovine BSE onset has a positive trend Martuzzi et al., 2002) with significant influence on import-export, and increase in quality of imported meat.

The average yearly per capita meat consumption in Italy is about 13 kg which is 1.6% of total meat quantity eaten in one year (82 kg per capita) (Istat, 2001). Italy, then, ranks the first in Europe for horse-meat consumption which in the other E.U. Countries accounts for 0.4 kg per capita (Martin-Rosset, 2001). Horse-meat consumption greatly varies within the national territory, most horse-slaughter in Italy occurs in Apulia (33.4%), Lombardy (13.7%), Piedmont (10.5%), Veneto (8.5 %) and Latium (5.8%) (Istat, 2001). Home production, despite the limited consumption, cannot meet the market demand, hence the need of importing heads of cattle and meat from abroad mainly Eastern Europe Countries (Martuzzi et al.,2001); for, in 2001 23,156 tons of horse meat were imported with an increase by 25.5% compared to 2000 (Fao, 2002).

Objectives

The aim of this research is to study some quality indicators of carcasses and of horse meat belonging to two different genetic type on the Italian market.

Materials and methods

Twelve female crossbred foals, seven TPR x Abruzzese genetic type and five TPR x Polish genetic type were slaughtered at the age between 24 and 26 months.

After slaughtering all carcasses were weighed and measured pH value. This last was taken from shoulder, leg and Longissimus dorsi (Ld) muscles by means of pH meter (Hanna Instruments HI 9023) equipped with an immersion glass electrode. Then, a sample of the Ld muscle from the 8th and 9th rib was taken to the lab and stored at 4°C. This sample was measured pH values at 24,48, 96 and 168 h, and of colour at 0.75, 48 and 196 h from slaughter. Colour was measured by Microscan XE colour meter through Hunter L* a* b* tridimensional system. Also hue (arctg b/a) and chroma or colour saturation values were measured (= (a2+b2)1/2). Shortly after slaughter samples were taken and put in plastic bags and immediately frozen at –80°C. All samples were defrosted at the same time to carry out the shear force tests before and after cooking and to evaluate cooking loss. For the shear force each meat sample was tested to the core 3 times before and after cooking, and their shear force value was determined by means of WBS test (Warner Blatzer Shear Force) through Instron 9000 texurometer.

In order to evaluate losses due to cooking, samples were weighed before and after cooking, in a convector oven at an inside temperature of the sample of 60° C over 30 minutes, measured by a diving (sinking) probe thermometer. Cooking loss was considered as a percent of the initial weight. The data analyzed for variance werw evaluated by using Student's 't' test (SAS, 1996).

Results and discussion

Table 1 shows post mortem pH values of Italian and Polish mares meat. pH measurements 45 minutes after slaughter were considerably higher in Polish mares for both the fore-quarter and rear one muscles ($P < 0.01$). The meat pH of the Italian mares is higher ($P< 0.05$) than the Polish mares one only 48 hours after slaughter.
Ld colour values measured at different post mortem times are shown in table 2. Shortly after slaughter meat colorimetric parameters of the Polish mare were remarkably different from those of the Italian mares. Conversely, at 48 hours both a* and b* values appeared higher in the foreign meat ($P<0.05$). Moreover, always at 48 hours, the Polish mares meat showed a lesser hue ($P <0.05$) and a higher saturation ($P <0.05$), appearing more intensely coloured. After one week storage (168 h) the situation is alike, since Polish mares showed higher redness index and chroma ($P <0.05$), thus indicating a more vivid colour. Investigations by Robelin et al (1984) on other breeds confirm our results related to the effect of sex and genotype on the horse meat colour.
The consistency of meats (table 3) belonging to the two genotype under investigation is nearly the same both for raw and cooked. Ld shear force data show that force needed for cutting raw meat of mares was similar. An instrumental force significantly ($P<0.05$) higher was necessary to cut cooked meat samples of polish mares. Literature reads that the genotype as well as other factors (Boccardi et al., 1979;Robelin et al, 1984; McCormick, 1999) affect meat tenderness relating to three classes of muscular proteins: the connective tissue, (collagen, elastin, reticulin, mucopolysaccharide of the basal substance) the myofibris (actin, myosin and tropomyosin) and the sarcoplasm (sarcoplasmic proteins, sarcoplasmic reticulum) (Lawrie 1983).
Shrink or drop in weight results following to cooking loss evidence a water retention capacity being nearly the same between the Italian and Polish mares. Final pH, obtained after post-mortem glicolysis, directly affects denaturation and proteolysis degree of sarcoplasmic proteins. These phenomena, in turn, influence meat tenderness, water retention capacity and colour (Lawrie, 1985). A high pH indicates a lesser proteic denaturation and a lesser proteolysis during ripening (Raduco-Thomas, 1989) and explain the major capacity of proteins in retaining water (Cook, 1926; Empey, 1933).

Conclusions

The results of this research leads to the following considerations :

- pH was not influenced by the genotype effect ;
- when slaughtered meats of the two genetic types under study showed a nearly similar colour. During storage lapse Polish mares meat intensified its colour more than the Italian mares one.
- The Italian and Polish meat tenderness was the same both cooked and raw. Similarly this behaviour was also noted for cooking loss.

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Table 1 - pH values of different sections of the carcass and Ld, at different post mortem times, of the Italian and Polish mares.

			ITALIAN	POLISH
		Rear quarter	6,50 B	6,80 A
45 min.	pH_1	*Longissimus dorsi*	6,36	6,46
		Fore quarter	6,37 b	6,78 a
24 h	pH_2	*Longissimus dorsi*	5,77	5,71
48 h	pH_3	*Longissimus dorsi*	5,84 a	5,71 b
96 h	pH_4	*Longissimus dorsi*	5,79	5,76
168 h	pH_2	*Longissimus dorsi*	5,85	5,77

Table 2 - Colorimetric characteristics of Ld of Italian and Polish mares at different post mortem times.

TIME	COLOR	ITALIAN	POLISH
45 min	L*	30,79	31,03
	a*	11,32	12,93
	b*	12,29	13,31
	HUE	47,27	45,85
	CHROMA	16,72	18,57
48 h	L*	34,79	36,50
	a*	10,63 b	14,44 a
	b*	15,72 b	18,39 a
	HUE	56,33 a	52,00 b
	CHROMA	19,02 b	23,40 a
168 h	L*	34,02	34,87
	a*	10,15 b	11,58 a
	b*	14,71	15,96
	HUE	55,28	53,94
	CHROMA	17,91 b	19,71 a

Table 3 - Physical characteristics.

		ITALIAN	POLISH
WBS	Row	0,87	0,86
	Cooked	2,47 b	2,92 a
Cooking loss (%)		38,30	39,15