INFLUENCE OF WEIGHTS AND SEX ON THE PHYSIOCHEMICAL COMPOSITION OF EQUINE (*EQUUS CABALLUS*) MEAT

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Background

In Brazil, according to FAO data (2000) it was slaughtered approximately 93,500 equine and mules corresponding to 132 thousand tons of meats produced in the period between 1990 to 1997. In Minas Gerais the exports of this meat reached annual marks of 5 thousand tons in 2001 and 2002. Usually, these officials data refer to animals slaughtered under under federal inspection and they are destined to the export for countries of European Community. This meat type, traditionally, has as limited factor for the consumption the prejudice. On the other hand, there are legal devices that allow the slaughter, preparation and distribution of this meat in the national market since the products that contain this meat relate its presence in the label. This has stimulated its use in the sausage industry (about 2/3 of the whole equine meat produced have this destiny). Associate to this, the economical cost of the animals for slaughtering is very inferior to that of the bovine because they are usually animal of discard or old animals. These aspects are stimulating the acquisition of the equine meat and its use. However, the data that characterize the physiochemical quality of the meat and the nutritional quality are unknown what difficult the popularization, commercialization and industrialization work of the meat.

Objectives

The objectives were to evaluate the effect of the weight and sex on the decline of *post mortem* pH, weight loss by cooking, shear force and color of the muscles in the *longíssimus dorsi* and *semimenbranosus* muscles of equine.

Material and methods

Animal: the total of 20 equine (10 males (M) and 10 females (F)), without defined breed was conventionally slaughtered in commercial frigorific in the south of Minas Gerais, MG, Brazil. The pH readings were carried out in the *longíssimus dorsi* (LD) and *semimenbranosus* (SM) muscles of the half left carcass in the following times: 1, 2, 4, 6, 8, 10, 12, 15, and 24 hours *post morten* (p.m.), with portable digital potenciometer. The samples for color, weight loss by cooking (PPC) and shear force (FC) determinations were collected in three different portions from the LD and SM muscles (cranial, medial, and caudal portions) thawed to 10ºC. The samples color was evaluated by the CIE L*a*b* system. The samples were removed from the cranial, medial and caudal portions of the LD and SM muscles, split up in cubes of 15cm of width and 10 cm of thickness and exposed to the air by 30 minutes. The measures were taken in the three portions of both muscles, in three different points of each portion. The average value of these 9 readings was used in the statistical analysis. The weight loss by cooking (PPC) was determined according to description of AMASA (1978). After the PPC determination the samples were used for the shear force (FC) analysis. For FC determination fractions from the samples were removed, obeying the longitudinal sense of the fibers. In the FC analysis, for each experimental unit 9 samples were removed (2.5 cm x 1 cm x 0.2 cm).The FC was determined in the LD and SM muscles, using a texturemeter coupled to the Warner-Bratzler probe in a scale ranging from 0 to 10 Kgf (Wheeler & Koohmaraie, 1994). The average value of the 9 samples of each experimental unit was used in the statistical analysis. For the color, PPC and FC analyses, an completely randomized experimental design was used in a factorial 2x4, being two sexes (male and female) and four weight categories (C_1,C_2,C_3,and C_4). The results were analyzed by the statistical program SAS version 6.12 (SAS,1985).

Results and discussion

The installation of the *rigor mortis* in equine occurred between 14 and 18 hours *post mortem* when the muscle reached the pH 5.9. The weight category and sex factors didn't influence the final pH (average of 5.72). However, females reached the pH value of 5.9 before the males (Figure 1). WEYNERMMAN (1997) found pH averages of 5.65 and 5.70, and PÉREZ (1999), comparing the equine and bovine pH observed averages of final pH of 5.8 and 5.36. The average values of PPC and FC are represented in the Table 1. For PPC it was found difference ($P<0.05$) for the different weight categories, in which lighter equine presented larger losses (52.42%) than the heaviest ones (41.90%). BONAGURIO (2001) studying lambs in different weight strips mentioned that with the weight increase at slaughter there was a decrease of PPC. There was not difference for the factor sex and its interaction with weight in the LD and SM muscles with the average values from 43.14 to 46.68 (male) and from 43.69 to 50.27 (female), respectively. For FC, the found averages were of 4.32 and 4,04 kgf in the LD and SM muscles, respectively. Sex and weight category didn't influence FC. RODRIGUES' results (2002) for FC were of 1.87 kgf ± 0.19 for the LD muscle in young equine and 2.39 kgf ± 0.20 for adults and of 2.67 kgf ± 0.25 for the SM muscle and 4.04 Kgf ± 0.65 in the adults. For color in the muscle (Table 2), the sex influenced ($P<0.05$) the brightness (L*), and females showed larger brightness (32.07) than males (28.96). The weight categories at slaughter affected ($P<0.05$) the red tenor (a*) in the LD and SM muscles (heavier animals showed a more intense red (25.35 and 21.49 in the LD and SM muscles, respectively) than the lighter animals (19.49 and 19.22 in the LD and SM muscles, respectively). The weight category ($P<0.01$) and sex ($P<0.05$) factors influenced in the yellow tenor (b*), and heavier equine showed higher values (1.88 and 1.40 in the LD and SM muscles, respectively) than equine with intermediate weight (with variation averages of 0.71 – 0.82 and 0.07 – 1.28 in the C_2 and C_3 categories, LD and SM muscles, respectively) and light animals (-2.18 and –2.11 in the LD and SM muscles, respectively). In equine, larger b* was observed in females (-1.18) than in males (0.15) in the SM muscle. Meats from of heavier equine showed larger red tenor and larger yellow tenor than those from lighter equine or of intermediate weight. Similar results were described by BONAGURIO (2001) that working with lambs found superiors L* values for females (38.88 to 29.49) in relation to males (36.30 to 27.21). With relation to the different categories, differences were not observed in the LD and SM muscles, with average variation from 27.39 to 30.99.

Conclusions

The pH drop in the *longíssimus dorsi* and *semimembranosus* muscles in the females happens faster than in males. In equine, the installation of the *rigor mortis* happens between 14 to 18 hour *post mortem*. The weight category at slaughter of equine affects the weight loss by cooking, so that samples of the *longíssimus dorsi* and *semimembranosus* muscles originated from lighter animals lose more water than those of the

heaviest animals. The shear force is not affected by the weight or sex categories showing a general average of 4.17 Kgf. This value characterizes the equine meat as a soft meat.

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TABLE 1. Average values of weight loss by cooking (PPC) in the LD and SM muscles in different categories and sex and its standard error (± SE) of equines.

Category	PPC	FC
Longíssimus dorsi		
C1	41.43 [a] ± 2.35	4.29 [a] ± 0.47
C2	42.78 [a] ± 2.88	4.00 [a] ± 0.57
C3	44.10 [a] ± 2.35	4.29 [a] ± 0.47
C4	45.34 [a] ± 2.88	4.68 [a] ± 0.57
M	43.14 [a] ± 1.85	4.43 [a] ± 0.37
F	43.69 [a] ± 1.85	4.20 [a] ± 0.37
Semimembranosus		
C1	41.90 [a] ± 2.62	4.36 [a] ± 0.35
C2	48.85 [a] ± 3.21	3.95 [a] ± 0.43
C3	50.61 [ab] ± 2.62	4.00 [a] ± 0.35
C4	52.42 [b] ± 3.21	3.84 [a] ± 0.43
M	46.61 [a] ± 2.07	4.04 [a] ± 0.28
F	50.27 [a] ± 2.07	4.03 [a] ± 0.28

Averages followed by the same letter in the row are statistically equal by the f and test of Tukey at 5% of significance.

TABLE 2. Average values for Brightness (L) , red tenor (a*) and yellow tenor (b*) in the LD and SM muscles in different categories and sex and respective standard error (±SE) of equines.

Category	L	a*	b*
	LD		
C1	30.24[a] ± 1.27	23.35[a] ± 0.63	1.88[a] ± 0.58
C2	30.99[a] ± 1.56	20.14[b] ± 0.77	-0.82[b] ± 0.71
C3	30.05[a] ± 1.27	19.38[b] ± 0.63	-0.71[b] ± 0.58
C4	30.77[a] ± 1.56	19.49[b] ± 0.77	-2.18[b] ± 0.71
M	28.96[b] ± 1.00	20.26[a] ± 0.50	-0.37[a] ± 0.46
F	32.07[a] ± 1.00	20.92[a] ± 0.50	-0.50[a] ± 0.46
	SM		
C1	30.33[a] ± 1.27	21.49[a] ± 0.78	1.40[a] ± 0.49
C2	30.14[a] ± 1.55	18.71[b] ± 0.95	-0.07[b] ± 0.60
C3	30.16[a] ± 1.27	18.49[b] ± 0.78	-1.28[bc] ± 0.49
C4	27.39[a] ± 1.55	19.22[ab] ± 0.95	-2.11[c] ± 0.60
M	28.26[a] ± 1.00	18.73[a] ± 0.61	0.15[a] ± 0.39
F	30.25[a] ± 1.00	20.22[a] ± 0.61	-1.18[b] ± 0.39

Averages followed by the same letter in the row are statistically equal by the f and test of Tukey at 5% of significance.

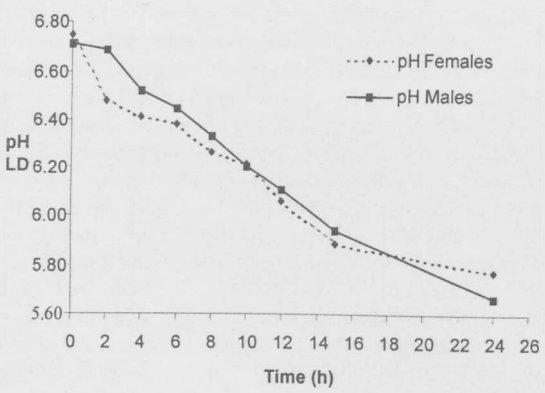

FIGURE 1: Average of the pH values in the LD muscle

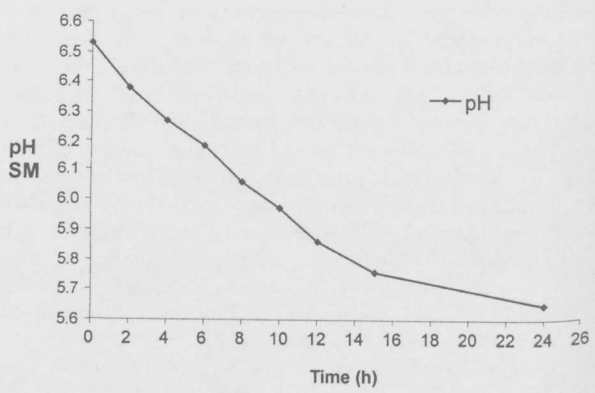

FIGURE 2: Average of the pH values in the SM muscle