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

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Background

The meat of equine and mules is a possible alternative source of animal protein in the man's diet and shows low prices when compared to the bovine meat. In Brazil from 1990 to 1997 it was slaughtered approximately 93,500 equine totaling approximately 132,000 tons of meat, with carcasses weighing from 125 to 160 Kg, FAO (2000). Usually, the great majority of the equine meat produced in Brazil is destined to the international market (Italy, France, Belgium and Netherlands) and, in the domestic market, 2/3 of this meat are destined to the industrialization of sausages because the Brazilian consumer has prejudices to this product. Due to this discrimination, there is few works that report the characteristics of this raw material in the conditions that the animals are slaughtered (discard animals). According to FORREST et al. (1979), the meat quality characteristics are influenced by factors before *ante mortem* (slaughter age, sex, race, slaughter methods, feeding) and *post mortem* (cooling time and temperature).

Objectives

The objective of the present work was to analyze the effect of the categories of slaughtered weight and sex on the chemical composition of the *longissimus dorsi* (LD) and *semimembranous* (SM) muscle of equine.

Material and methods

The total of 20 equine (10 males and 10 females), without defined race was conventionally slaughtered in commercial frigorific of Minas Gerais. After they accomplish the rest time the equines were classified in four categories: C1, animals with weights from 168 to 230kg; C2, animals from 125 to 159kg; C3, animals from 103 to 117kg; and C4, animals from 89 to 97kg. The distribution of male and females animals were done at random in the different categories: C1 with 3 males and 2 females; C2 with 4 males and 1 female; C3 with 2 males and three females and C4 with 1 male and 4 females.

The crude protein was quantified by Kjeldahl, the total lipids (TL) were determined by Soxhlet, humidity in greenhouse at 105°C until obtaining of constant weight, and the ashes in muffle at 550°C (AOAC, 1990). All analyses were carried out in triplicate. In the cholesterol determination, the lipids were extracted according to FOLCH et al. (1957). The cholesterol content was determined colorimetrically (BOHAC et al., 1988; adapted by BRAGAGNOLO & RODRIGUEZ-AMAYA, 1995).

The experimental design was completely randomized in factorial 2X4 being two sexes (male and female) and four weight categories (C_1, C_2, C_3, and C_4). Each equine was considered an experimental unit. The results were analyzed by the statistical program SAS 6.12 version (SAS,1985). When the analysis of variance identified differences, the data were submitted to the T test.

Results and discussion

The analysis of variance didn't reveal differences ($P>0.05$) of the sex and slaughtered weight categories factors on the humidity, protein, ashes and fat percentages in the muscles LD and SM (table 1). For humidity, the average values ranged from 74.42 to 76.49g/100g. Similar results were reported by DUFEY (1999) in equines of different ages (74.43g/100g). However, BADIANI et al. (1997) mention lower values (71.57g/100g) in equines from 5 to 10 years. In other species, BRAGAGNOLO AND RODRIGUEZ-AMAYA (1995) mentioned averages in swine of 73g/100g and bovine rump steak with 68g/100g. Pérez et al. (2002) studying sheep of different slaughtered weights (15, 25, 35, and 45kg) observed that lighter animals showed larger humidity content than the heavier animals (76.9; 75.9; 74.9 and 73.9%, respectively). HOWEVER, JARDIM (2001) when analyzing different weight strips at slaughter (30-40; 40-50 and 50 -60 Kg), found averages (77.31; 76.88; 77.20%, respectively). Possibly, the humidity results in the different categories are explained by the fact that all the animals were adult.

The protein averages ranged from 21.60 to 22.59g/100g. Similar results in equine were reported by DUFEY (1999) with 21.31% and by BADIANI et al. (1997) with 20.03g/100g. In capybaras, JARDIM (2001) reported values from 21.03 to 21.99g/100g. In sheep SOUZA (2001) found averages from 20.58 to 21.66g/100g in (LD muscles) sheep with 15, 25, 35 and 45kg live weight.

The average results for ashes were from 0.69 to 1.23g/100g. Those values coincide with the values mentioned by DUFEY (1999) from 1.00 to 1.13g/100g, and by BADIANI et al. (1997) that, when analyzing meat of equine from 5 to 10 years, found values from 0.96 to 1.00g/100g.

The average results found for TL were from 0.65 to 1.99g/100g. DUFEY (1999) mentions values of 1.07, 2.35 and 4.24g/100g for equine colts, 30 months old and adult animals, respectively. BADIANI et al. (1997) find average of 6.63g/100g in animals from 6 to 10 years. Comparing those results, it is observed that the authors reported values from 4.24 to 6.63g/100g of lipids in adults equine. These values are 2 to 3 times higher than the data observed in the present work. These averages from 0.65 to 1.99g/100g for fat in the LD muscle show that the meat of equine slaughtered in the C_1, C_2, C_3, and C_4 commercial categories can be considered thin meat. The equine slaughtered in Brazil are usually discard animals and, in most of the cases, old animals, submitted to inappropriate management conditions in relation to the pastures and other cares. Then, it is possible that the low fat amount is resulted of the management of the animals. Although SINCLAIR & ODEA (1982) have also reported values of 1.02g/100g of fat in the musculature of the equine leg.

The analysis of variance revealed difference ($P<0.05$) for the cholesterol when evaluated the sex factor in the LD muscle. The average values found were from 56.08mg/100g and 36.77mg/100g to female and male, respectively. As the cholesterol is precursory of different metabolic compounds (GUYTON, 1996), it is possible that in the conditions of those animals, the females have presented a larger metabolic requirement of this compound, resulting in lower percentage in the muscles.

Conclusions

The different weight and sex categories didn't influence the humidity, the protein, the fat and the ashes of the equine meat in the *longissimus dorsi* and *semimenbranous* muscles. The females show larger amount of cholesterol than the male animals in the *longissimus dorsi* and *semimenbranous* muscles. In the chemical composition of the equine meat, independently of the weight category at slaughter, it is verified a high amount of protein and a reduced amount of lipids (when compared with domestic species), characterizing the equine meat as a thin meat.

References

ASSOCIATION OF OFFICIAL ANALYTIÇAL CHEMISTS. Official Methods of Analysis of the Association of Official Analytical Chemists. 15ed., Arlington, AOAC, 1990.

BADIANI, A.; NANNI, N. GATTA, P.P.; TOLOMELLI, B.; and MANFREDINI, M. Nutrient profile of Horsemeat. Journal of Food Composition and Analysis. 10. p. 254-269.1997.

BRAGAGNOLO, N.; RODRIGUEZ-AMAYA, D.B. Teores de cholesterol em carne suína e bovina e efeito do cozimento. Ciência e Tecnologia Alimentar, Campinas, v. 15, n. 1, p.11-17. 1995

DUFEY, P. A. Fleischqualitat von Pferden unterschiedlichen Alters. AgrarForschung 6 (3). Pg 99-102, 1999.

FAO/WHO. Report of joint expert consulation: consumo de carne de equino no mundo, 2000.

FOLCH, J.; LEES,M.; and SLOANE STANLEY, G.H. A simple method for the isolation and purification of total lipids from animal tissues. Journal Biologics Chem. V. 226, p.497-509.1957.

FORREST, J.C.; ABERLE,E.D.; HEDRICK,H.B.;JUDGE,M.D.; MERKEL,R.A. Fundamentos de ciencia de la carne. Traduzido por BERNABÉ SANZ PÉREZ.Zaragoza:Acribia,1979.364p.

GUYTON , A . C. Tratado de Fisiologia Medica . 9 ed. Rio de Janeiro : Guanabara , 1996 .

JARDIM, N.S. Sexo e diferentes pesos ao abate na qualidade da carne de capivara (*Hydrochaeris hydrochaeris*, L. 1766) – Lavras: UFLA, 2001. 119 p. (Tese – Mestrado em Ciências dos Alimentos).

PEREZ, J. R. O.; BRESSAN, M. C.; BRAGAGNOLO, N.; PRADO, O.V.; LEMOS, A.L.C.S.; BONAGURIO, S. Efeito do peso ao abate de cordeiros Santa Inês e Bergamalia sobre o perfil de ácidos graxos, colesterol e propriedades químicas. Ciência e Tecnologia de Alimentos, Campinas, v. 22, n. 1, p. 11 – 18. 2002

SAS INSTITUTE. SAS user's guide: statistics. 5.ed.Cary, North Carolina, 1985.956 p.

SINCLAIR, A. J.; O'DEA, K. Fats in Human diets through history: is the western diet out of step? In: WOOD, J.D.; FISCHER, A. V. Reducing fat in meat animals. London: Elsevier, 1990. p.1-47.

SOUZA, X. R. Efeitos de grupos genético, sexo e peso ao abate na qualidade de carne de cordeiros em crescimento. Lavras UFLA, 2001. 119 p. (Tese – Mestrado em Ciências dos Alimentos).

Table 1- Average values and standard error (se) for humidity, protein, and ashes of the LD e SM muscles of equine

Muscles	Factors		Humidity	Protein	Ashes	Fat	Cholesterol
LD	Category	C1 (166 a 242 kg)	75.47 ± 0.71	21.83 ± 0.49	0.69 ± 0.11	1.99 ± 0. 48	50.26^{a} ± 7.66
		C2 (115 a 159 kg)	75.29 ± 0.87	22.59 ± 0.60	0.90 ± 0.13	1.99 ± 0. 59	57.19^{a} ± 8.84
		C3 (103 a 113 kg)	75.58 ± 0.71	21.79 ± 0.49	0.71 ± 0.11	1.37 ± 0.48	45.06^{a} ± 6.99
		C4 (89 a 97 kg)	75.59 ± 0.87	22.50 ± 0.60	0.82 ± 0.13	1.26 ± 0.59	33.20^{a} ± 8.56
	Sex	Female	76.01 ± 0.56	21.97 ± 0.39	0.77 ± 0.09	1.39 ± 0.38	56.08^{b} ± 5.53
		Males	75.95 ± 0.56	22.38 ± 0.39	0.79 ± 0.09	1.46 ± 0.38	36.77^{a} ± 5.85
SM	Category	C1 (166 a 242 kg)	74.42^{s}± 0.70	22.53^{s}± 0.73	1.23 ± 0.21	1.62 ± 0.30	56.15^{a} ± 8. 84
		C2 (115 a 159 kg)	75.88 ± 0.86	21.87 ± 0.36	0.79 ± 0.25	0.69 ± 0.36	44.45^{a} ±10.20
		C3 (103 a 113 kg)	76.47 ± 0.70	21.60 ± 0.73	0.84 ± 0.21	0.85 ± 0.30	37.57^{a} ± 8.07
		C4 (89 a 97 kg)	76.49 ± 0.56	22.03 ± 0.89	0.80 ± 0.25	0.65 ± 0.36	45.85^{a} ± 9.88
	Sex	Female	75.63 ± 0.56	21.96 ± 0.58	1.05 ± 0.16	1.21 ± 0.23	50.47^{a} ± 6.38
		Males	75.99 ± 0.56	22.06 ± 0.58	0.78± 0.16	0.70 ± 0.23	41.54^{a} ± 6.75