CHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF MURRAH BUFFALOES MEAT SUBMITTED TO DIFFERENT PERIODS OF AGEING

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Abstract – The aim of this study was to evaluate the quality of Murrah buffaloes *Longissimus dorsi* muscle during different stages of ageing. Muscle samples were collected from 10 animals between 20 - 24 month-old, after 24 hours *post mortem*. After the slaughtering, the meat samples were submitted to 0, 7, 14 and 21 days of ageing and proximate composition, cholesterol and microbiological analysis were performed. According to the data, it was observed that there wasn't any association between the different stages of ageing and cholesterol levels of the meat and proximate composition, except for the ash content, which showed a significant quadratic effect (P<0.05). The ageing also did not affect the microbiological quality of the meat (P<0.05). Thus, it was conclude that the ageing doesn't affect the microbiological quality, the concentrations of cholesterol and proximate composition of Murrah buffaloes meat, except for the ash content.

I. INTRODUCTION

Ageing consists in a process of keeping the meat, after the process of *rigor mortis*, under-refrigeration (0º C) for a period of time that can vary from 7 to 28 days and it aims to improve the organoleptic characteristics of the meat, in which the most important are tenderness, juiciness and flavor (1). This technological process has been extensively studied in beef (2; 3), but there is great deficiency of information about buffalo meat . Moreover, the literature doesn't correlate the aging with chemical and microbiological characteristics of the meat in this species. That requires researches that demonstrate possible changes of these characteristics during aging. Thus, the present study was developed to evaluate the effects of different aging times on the chemical and microbiological characteristics on young buffalo's meat.

II. MATERIALS AND METHODS

For this research, ten 24 month-old male buffaloes of Murrah race were used. They were finished in feedlot and slaughtered at the slaughterhouse Fribordogue - SP, under State Inspection Service (SISP). Carcases remained in cooling chambers for 24 hours, after this period, was held section of *Longissimus dorsi* muscle between the 8th and 13th ribs. All samples were transported to the Laboratory of Food Science in the Faculty of Animal Science, UNESP - Dracena, where were separated transverse sections with approximately 2.5 cm of width in BECCARO Band Saw model 255, following the protocol of sampling. Then each section was vacuum packaged in Packing JETVAC®, posteriorly, these samples remained under-refrigeration (0°C) in the maturation chamber for 0, 7, 14 and 21 days until the analyses time. The completely randomized design was used with four treatments and ten replicates per treatment, set out in split plots, being the plots consisted of the animals and the subplots days

of ageing. The analyzes of the aged samples evaluated were: proximate composition according to the AOAC method (1990), cholesterol by the enzymatic method described by Saldanha et al. (2004) and microbiological analysis of meat according to the methodology described by Downes and Ito (2001). Data were submited to statistical analysis using the statistic program SAS 9.2 (SAS Institute, 2008) to perform the analysis of polynomial regression for each variable, at 5%.

III. RESULTS AND DISCUSSION

The proximate composition and cholesterol concentration data of *Longissimus dorsi* muscle of Murrah buffaloes submitted to different periods og aging are shown in Table 1.

Table 1. Proximate composition and cholesterol concentrations means of *Longissimus dosi* muscle in Murrah buffaloes submitted to different ageing periods.

	Means	Ageing days				CV (%)	R
		0	7	14	21		
M[1]	75,6	75,7	75,4	75,9	75,3	0,94	Ns
P[2]	23,5	23,1	23,0	23,3	24,7	8,44	Ns
EE[3]	1,15	1,08	1,33	1,00	1,17	51,5	Ns
A[4]	1,06	1,10	1,06	1,04	1,05	2,60	Q[1]
Ch[5]	49,9	48,5	57,4	43,7	49,4	16,5	Ns

[1]M = Moisture (%); [2]P = Protein (%); [3]EE = Ether Extract (%); [4]A = Ashes (%); [5]Ch = Cholesterol (mg/100g de carne). CV – Coefficient of variation, R – Regression, Ns - Not significant; L – Linear; Q – Quadrátic.

Y[1] = 0,0002x2 - 0,0076x + 1,0973 (R2 = 0,99)

According to data, the regression wasn't significant to the content of protein, moisture, lipids and cholesterol concentrations (P>0.05). Only the ash content presented significant regression with aging time (P<0.05), being characterized by a quadratic behavior, in which the lowest value of ash was found after 19 days of ageing with 0.96% (Fig. 1).

Literature relations between meat chemical composition and storage during extended periods of ageing weren't find. However, even with changes in the mean values, the content of ash is still within the standard suggested by Geay et al. (2001) for human consumption (1 to 2%).

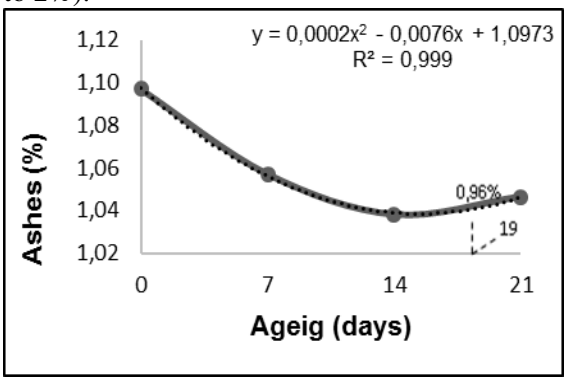

Fig. 1. Ash content over time of ageing of *Longissimus dorsi* muscle of buffaloes.

Regarding the chemical composition of buffaloes' *Longissimus dorsi* evaluated independent of ageing time, it is observed that the moisture, protein and ash content did not differ much when compared to Andrighetto et al. (2008), that worked with Murrah buffaloes terminated in 150 days of confinement and found mean values of 74.70%; 20.87% and 1.08% respectively for moisture, protein and ash. The data is still in accordance with the values found in the literature, which states that the meat has about 75% water, 19 to 25% protein and 1 to 2% minerals and carbohydrates (4).

However, the content of fat differ of some data compared to the literature, Andrighetto et al. (2008) obtained 3.15% at 150 days confinement and Mattos et al. (1997) obtained average grades of 0.60% ether extract. According with Geay et al. (2001), this fact can be explained because altogether, the nature and quantity of lipids stored in muscle are dependent on the feeding, digestion, intestinal absorption, hepatic metabolism and the transport system of these lipids. Regarding the amount of cholesterol found in meat buffalo regardless of the ageing time, the values differ to those described by Calabro et al. (2014), that working with Mediterranean buffaloes confined, found lower values of cholesterol (32.34 mg/100g of meat). Moreover, Hautrive et al (2012) assessing the concentration of cholesterol in beef found values of 60.96 mg/100g of meat, that is higher than the one found in the present study. It indicates that the meat with low cholesterol may be better for human health, including the buffalo meat as one of the healthiest meat.

The mean values for microbiological analysis of buffalo meat aged for 0, 7, 14 and 21 days and vacuum packed are in Table 2. According to data, the regression analysis was not significant, which means that there was not association between ageing time and groups of bacteria analyzed in the flesh of buffaloes (P>0.05).

Table 2. Means of the microbiological analysis of *Longissimus dorsi* muscle of Murrah buffaloes in different stages of ageing.

	Mean	Days of ageing				CV (%)	R
		0	7	14	21		
TBC[1]	4,01	3,12	4,51	4,22	4,21	30,26	Ns
P[2]	3,25	3,02	3,19	3,01	3,86	43,67	Ns
E[3]	2,85	2,95	2,97	2,60	2,89	39,97	Ns

[1]TBC = Total bacterial counts (log UFC/g); [2]P = Psychrotrophic (log UFC/g); [3]E = Enterobacteriaceae (log UFC/g. CV – Coefficient of variation, R – Regression, Ns - Not significant; L – Linear; Q – Quadrátic.

However, when we talk about microbiology, a more critical eye is necessary because any change in the values, although not significant, is considered important. Thus, if data are numerically analyzed, it is observed that in the total bacterial counts and psychrotrophic groups there was an increase in the number of bacteria in aged meat when compared to meats that haven't undergone ageing.

About the total bacterial counts, according to Nortjé et al. (1989), the count up to 3.0 log UFC/g can indicate good hygiene and an efficient commercial operation. Fung et al. (1980) reported that contaminated meat has values greater than 7 log UFC/g of mesophilic. However, to Delazari (1987), countings above of 5.0 log UFC/g after 9 days of storage under refrigeration at 2°C, characterizes poor quality meat. According to Roça and Serrano (1995) the beginning of the deterioration of the meat can be characterized by the deterioration of the surface, when total bacterial counts are in the range of 6.0 log10UFC/ge is succeeded by strange odors (7.0 to 8.0 log10UFC / g). The undesirable flavor changes require levels from 8.0 to 9.0 log10UFC/g and the maximum score (9.0 log10UFC / g) appears in the form of surface slime. In this study, the total bacterial counts found are according to the established standard for meat comsuption since the maximum found was 4.51 log UFC/g, lower than that reported by most authors, except Nortjé et al. (1989).

The psychrotrophics are able to grow under refrigeration at 7°C or less (temperature used in the process of ageing) and represent microorganisms that can cause deterioration of the meat. Captures et al., (1999) reported that concentrations above of 7 log UFC/g changed the meat organoleptic characteristics, thus, the counts of psychrotrophic found also are according to the established standard for the consumption of meat, since the maximum found was 3.86 log UFC/g, lower than that reported by these authors.

According to the evaluated data for the Enterobacteriaceae group in function of aging time, it is observed the lowest values when compared with the other groups of bacteria. However, the mean value at 21 days of aging (2.89 log UFC/g) were higher than the one observed by the Manço (2006) that found values equal to 1.43 log UFC/g. This observed difference between the values is probably related to the initial number (0 days) and the hygienic procedures adopted throughout all the stages of handling the product. When comparing the mean values after 24 hours of the animals slaughter in the present study (2.95 log UFC/g) to Manço (2006)'s work that found mean values, on the second day of aging, of 1.0 log UFC/g, a considerable difference can be noticed. The high initial contamination can accelerate the growth of these microorganisms due to changes in the profile of these bacteria growth curve.

The presence of enterobacteriaceae is often used as an indicator of possible fecal contamination from improper processing or post-processing contamination (5), thus, there was a greater contamination in meat samples of this study when compared to those described by literature.

IV. CONCLUSION

The meat ageing of young Murrah buffaloes does not interfere in the microbiological quality, in the concentrations of cholesterol and in its chemical composition, except for

the ash content, which shows variations in their average values.

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