PHYSICAL-CHEMICAL CHARACTERISTICS OF AGED BEEF FROM STEERS SUPLEMENTED WITH α-TOCOPHEROL ACETATE

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Introduction

The color and the lipid stability are limiting factors, among others, on the quality and the acceptability of meat and of meat products. The lipid oxidation, which results on free radicals forming, can lead to the oxidation of meat pigments and to the production of rancid odors and off flavors. Therefore, the muscle stability depends mainly on the balance between the oxidant agents, such as alfa-tocopherol and pro-oxidants, including the polyunsaturated fatty acids concentration and the free iron within the muscle.

Specifically, in the case of refrigerated vacuum packed meat, it may occur the loss of quality of the product caused by color changes (Cross et al., 1986). The refrigerated meat decolorizing is consequence of myoglobin alterations, commonly due to some lipid oxidation reactions. Therefore, meat flavor and shelf-life are mostly limited by the occurrence of lipid oxidation and surface decolorizing. In this particular case, some technologies has been tested recently, aiming to guarantee the quality of bovine beef during storage, standing out the use of vitamin E (α-tocopherol) in animal food feeding prior to slaughtering (Dufrasne et al., 2000; Grady et al., 2001; Sullivan et al., 2002). Besides retarding lipid oxidation, this antioxidant can diminish myoglobin oxidation.

Objectives

The objective of this study was to evaluate the effect of vitamin E supplementation (VITE) on the physical-chemical characteristics of the aged *Longissimus dorsi* muscle, (LD) of 24 Nellore steers, with 30 months of age, confined for 98 days with a high proportion of concentrate in diet.

Material and methods

Daily, half the animals received 1000 mg -tocopherol acetate added to 100 g of corn meal, the other half received 100 g of corn meal without any additives. The animals were slaughtered when the backfat thickness, measured between the 12th and 13th ribs with and ultrasound equipment, reached 6 mm. Twenty four hours after slaughtering, 4 samples with 2,5 cm were cutted from the (LD), individually vacuum packed and kept at 0-1°C, for 1, 7, 14 or 21 days, and finally frozen at -25°C. There were realized pH analyses, with a handheld phmeter, model HI8314 (Hanna Instruments), water holding capacity (WHC) calculated as [WHC=We/(Wb+We) x100] were Wb is the weight of the beef and We the weight of the exudate. The color of the meat was determined in triplicates using a HunterLab portable colorimeter (mod. MiniScan XE), using CIElab system scale. There were also realized vitamin E and cholesterol analyzes in the first day of aging for 12 samples of LD (Katsanidis et al., 1999).

The equipment used for the vitamin E and cholesterol determination was a high performance liquid chromatograph (HP series 050), with simultaneous detection at several wave lengths. The systems were controlled by the software *CHEMSTATION-HP*. The absorbance spectra were registered at 295 nm and 210 nm, for vitamin E and cholesterol, respectively (Katsanidis et al., 1999).

The identification was done through comparison of the retention time of the samples with the blank, by chromatography and by the obtained spectra. The statistical analyzes were done by the GLM procedure of the software SAS .

Results and discussion

There were not found significant differences for the pH and LD values between the VITE and the Control group along the aging time (Figure 01). These results agree with those of Cannon et al. (1996), who also evaluated the pH of pork meat supplemented with vitamin E and did not find statistical differences among treatments either. Also, there was not significant difference between time and treatment for the WHC (Figure 02). However, Mitsumoto et al. (1998) studied the LD vacuum packed and kept refrigerated at 1°C for 6 days and observed that the meat of the animals supplemented with 5000 mg of vitamin E significantly lost less water by exudation than the control samples, maintaining the integrity of the membranes and keeping the sarcoplasmatic components, resulting in less exudation loss. The L* and a* color parameters had linear effects of aging time ($p<0.01$) (Figures 03 and 04). The b* parameter, had cubic effect ($p<0.01$) among the days of aging, for the muscle (LD) but were not affected by the treatments (Figure 05). A possible explanation for the high L* values could be the presence of liquid over the meat surfaces, causing higher moisture and higher values for the 21st day of aging. In general, a* did not vary with the time, almost for all aging periods, therefore, presumably there was not any protecting effect of the membranes due to vitamin E supplementation. However, the loss of color pigment did not occur in the studied times, moreover, in spite of the vacuum package, the color of the meat was recovered after the packaging removal due to the myoglobin oxygenation (Abularach et al., 1998). Therefore, the decolorizing rate looks to be related to the efficiency of the oxidative and enzymatic processes, decreasing the meat control systems of the metamyoglobin levels. Gatellier et al. (2001) studied the color characteristics of refrigerated meat for up to 9 days and further vacuum packed for 13 days more at 8°C under controlled illumination. These authors used Charolês bovines supplemented with 1000 mg of α-tocoferyl acetate, for 111 days before slaughtering and observed the positive effect, although not significant, on the meat decolorizing rate of the supplemented animals. Correlating the results from the supplemented animals with the control group, in general no significant difference was observed between the treatments. However, the vitamin E concentration of the LD, at day 1 of aging, presented significant interaction ($p<0,01$) between the treatments and levels of concentrate, with mean values of 1.7 mg/kg and 4.7 mg/kg, for the control group and VITE, respectively. Dufrasne et al. (2000) also found a significant increase of the α-tocopherol concentration in the *Longissimus thoracis* muscle of bovines, stored at 4°C for up to 14 days, with controlled illumination, with values of 1.9 mg/kg of VITE in the meat of studied animals and 0.9 mg/kg in the meat of the control group. These results indicated, that there were possible effect on the lipid oxidation with low -tocopherol concentration in the aged meat for up to 14 days. However, there were not found studies of vitamin E supplementation related to levels of concentrate in bovine feed.

There was not significant difference on the cholesterol concentration in the (LD) of VITE supplemented steers compared to the control group. with values of 39.5 mg/100g of VITE in the meat of studied animals and 44.5 mg/100g in the meat of the control group. In experiment realized by Bragagnolo (1997) there were presented cholesterol values in fresh LD (although not supplemented with VITE) of 44 mg/100 g for Nellore. It seems to be a relationship between the energy rate in diet and the meat cholesterol concentration. According to Abu-Tarboush et al. (1993), animals fed with low energy diets, presented higher levels of cholesterol within the adipose tissue, without significant differences in the muscular tissue, agreeing with the results of the present study.

Conclusion

At this point of the research, it can be stated that the supplementation with VITE in Nellore steers did not presented positive effect over the physical-chemical characteristics of the (LD) aged for up to 21 days.

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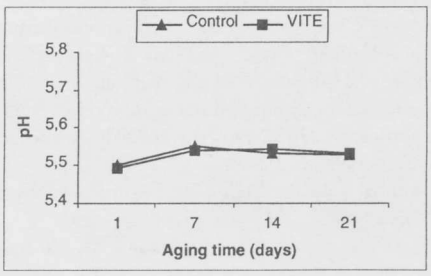

Figure 01 –*Longissimus dorsi* muscle pH variation with aging time.

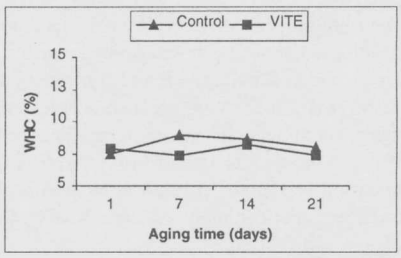

Figura 02 – *Longissimus dorsi* muscle Water holding capacity (WHC) variation with aging time.

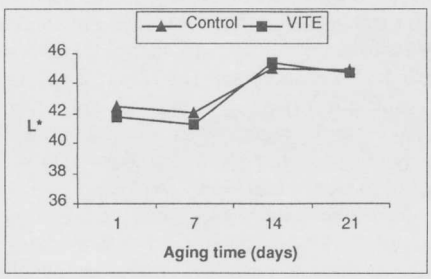

Figure 03 – *Longissimus dorsi* muscle L* parameter variation with aging time.

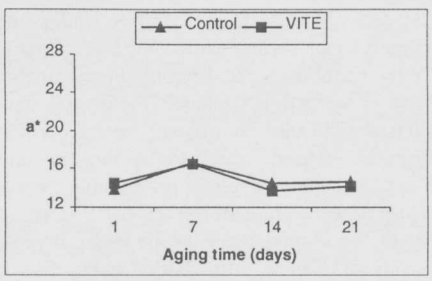

Figure 04 – *Longissimus dorsi* muscle a* parameter variation with aging time.

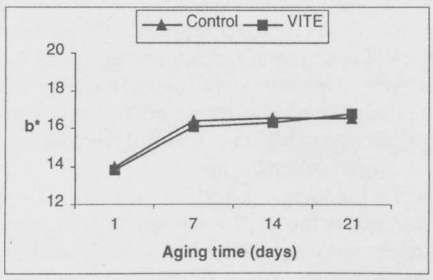

Figure 05 - *Longissimus dorsi* muscle b* parameter variation with aging time.