EFFECT OF EMULSION IVERMECTIN WITH VITAMINS A, D3, E INJECTION ON COMMERCIAL BRAZILIAN MIXED CROSSED BREED BEEF MEAT QUALITY

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Introduction

Brazil, in 2003, was ranked as the first beef exporter country in the world comprising of 195 mi herds being around 140 mi of *Bos indicus* breed representing an important segment for the country economy (IBGE, 2005). Ivermectin is a semi synthetic macro cyclic lactone insoluble in water and soluble in organic solvents and acts as endo-ecto parasiticide capable of eliminating parasites from animal gastro intestinal (Ndong et al., 2005). It acts by inhibiting parasites nerve transmission through neuron hyper polarization (Keisleer, 1993). It has been routinely injected by itself and recently a commercial emulsion came out mixed with vitamins A, D_3, and E. As it is known, diet supplemented vitamins A, D_3, E possess the function of protecting animal health and subsequently enriching the meat quality. Essentially, vitamin A gives a further protection to the epithelial tissues and to increase the amount of meat marbling up to 23 mo of age (Akio et. al., 1998) and presents an antioxidant role (Morrisey et al., 1998). The use of dietary vitamin D_3 few days before slaughtering improved *longissimus* texture (Swanek et al, 1999, Montgomery et al., 2002) because of the increase of calcium ions availability to enhance calpain enzyme system activity. The role of vitamin E as a natural antioxidant has been recognized by stabilizing polyunsaturated phospholipids inhibiting lipid oxidation at cell membranes (Liu et al., 1995; Soares et al., 2003, 2004).

Objectives

The objective of this work was to investigate the effect of subcutaneous injection of emulsion ivermectin with vitamins A D_3, E on commercial Brazilian beef herds on *Longissimus dorsi* lipid oxidation and texture

Methodology

Samples

Eighteen crossed breed bovine between European, *Bos taurus*, and Nelore, *Bos indicus,* male, raised on pasture, averaged weight of app. of 350 kg were randomly divided into two lots: Control Lot (CL) (n=9) and Injected Lot (IL) (n=9). One subcutaneous 8.0 mL injection of an oily emulsion (ADE-TEC®) containing 80 mg of ivermectin mixed with 2.0 mi UI vitamin A, 0.56 mi UI vitamin D_3 and 400 UI vitamin E was shot exactly 52 days before slaughtering. After injection, animals were confined under a ration diet of 40 to 50 kg constituted by triticale and corn, 0.5 kg cotton seeds, 300 g of soybean meal, 300 g of oat and 140 g of minerals (1% limestone, 1% dicalcium phosphate and 98% of salt) for each animal per day. Animals were slaughtered in a commercial abattoir and the carcasses were kept under refrigeration at 6±1°C for 2 days and *Longissimus dorsi* m. was selected and sliced and packed and individually coded. Thereafter, samples were frozen at –18°C.

Texture measurement

This measurement was carried out in refrigerated 2 days stored samples and also in 90 days frozen samples and cooked in plastic bags in water bath at 85° C until the internal temperature reached the value of 75°C. Samples were cut in size of 1x2x1cm and submitted to WBS TATX-2i for texture measurement and results were expressed in Newtons.

Lipid oxidation analysis

This determination was carried out following the technique of Tarladgis et al. (1964) in 2 days post mortem samples and in frozen samples kept at -18ºC after 30 and 60 days of storage

Statistical analysis

Results were submitted to STATISTICA program version 5.0 (Oklahoma, USA 1995). Student t test was employed to determine the significance level between CL and IL in relation to lipid oxidation and texture.

Results & Discussion

Meat texture

Table 1 shows the results of WBS measurement after injection of an emulsion of ivermectin mixed with vitamins A, D_3, E in a beef longissimus m. The 2 days refrigerated samples and its cooked samples were 19.6% and 13.6% more tender, respectively in relation to control samples ($p \leq 0.05$).

Table 1. Effect of a subcutaneous injection of emulsion invermectin mixed with vitamins A, D_3, E on shear force values of *Longissimus dorsi m*. beef kept under 2 days refrigeration and its cooked sample.

Treatments	Shear force (N) Fresh samples	Shear force (N) Cooked samples
Control lot	$32.87^{a} \pm 3.54$	$65.44^{a} \pm 8.78$
Injected lot	$26.41^{b} \pm 3.62$	$56.49^{b} \pm 8.81$

[ab] Means followed by different letters on the same column are significantly different by Student t test ($p \leq 0.05$). N: Newtons

These results are the consequence of the vitamin D_3 properties to regulate calcium ions absorption therefore potentializes the calpain protease system activity as first shown by Swanek et al (1999) further corroborated by other reports (Montgomery *et al.* 2000). Calcium ions would preferentially be deposited on Z-lines thus initiating the meat sarcomere degradation hence tenderizing the meat (Whipple and Koohmaraie, 1993). Despite of being located in the tropics region there was the possibility of increasing calcium deposits within the tissues and this fact could be a health hazard to the animals (Montgomery *et al.* 2002). This was not the case since no problem regarding to the health was observed.

Lipid oxidation

Table 2 shows the results of lipid oxidation measured as TBARS (Tarladgis et al., 1964) after injection of an ivermectin emulsion mixed with vitamins A, D_3, E in a beef *longissimus* m. Analysis was carried out in 2 days post mortem refrigerated samples and in 30 and 60 days stored frozen *longissimus* samples. Results show that refrigerated meat from treated animals presented 22.6% lower lipid oxidation than control samples. Treated frozen stored samples of 30 and 60 days presented 22.6 and 30.7% lower rancidity in relation to controlled samples ($p \leq 0.05$).

Table 2 – Effect of a subcutaneous injection of emulsion invermectin mixed with vitamins A, D_3, E on lipid oxidation measured as TBARS (mg/kg) of *Longissimus dorsi* m. beef kept under 2 days refrigeration and 30 and 60 days frozen samples.

Samples	Control lot (n=9)	Injected lot (n=9)
Fresh	$0.14^{a} \pm 0.03$	$0.11^{b} \pm 0.02$
30 days frozen	$0.11^{a} \pm 0.03$	$0.09^{b} \pm 0.01$
60 days frozen	$0.15^{a} \pm 0.05$	$0.11^{b} \pm 0.03$

[ab] Means followed by different letters on the same line are significantly different by Student t test ($p \leq 0.05$).

Few reports are available with vitamin A as having an antioxidant role (Palace et al., 1999) however much is known about vitamin E. Recent reports clearly emphasizes meat rancidity inhibition by dietary α-tocopherol since it accumulates at cell membranes through its polar portion linkage to polyunsaturated phospholipids (Faustman et al.,

1989). Because of this further fatty acids stability, it has been pointed out that it inhibits the phospholipase A_2 activities thus preventing the initiation of formation of abnormalities such as PSE in pigs and poultry (Cheah et al., 1995; Olivo et al., 2001, Soares et al, 2003). By inhibiting rancidity formation, α-tocopherol and other vitamins also enhances the meat color (Hill et al., 1995), although not evaluated in this experiment. Our results indicate that ADE-TEC® presents beneficial effects by not allowing the growth of animal gastro intestinal parasites and also enhancing desirable meat qualities for the consumers as tenderness and lipid fraction stability.

Conclusions

The emulsion ivermectin enriched with a mixed of vitamins A, D_3, E, apart from preventing the gastrointestinal parasite infection inhibits meat lipid oxidation and improves its tenderness.

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