PREVENTION OF LIPID OXIDATION AND HEME IRON ACCESSIBILITY BY ADDITION OF ROSEMARY (*ROSMARINUS OFFICINALIS L.*) AS AN INGREDIENT IN HAMBURGER

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Introduction

Both natural and synthetic antioxidants are used to retard lipid oxidation in meat (Mielche and Bertelsen, 1994). The shelf-life of meat is limited because of the biochemical changes that involve muscle lipids (lipolysis, lipid oxidation) starting after slaughtering. Oxidation in muscle foods is a degradation process responsible for losses in the nutritional value of meat and for undesirable changes in appearance (flavour, colour) which affect the acceptance by consumers. The most frequent mechanisms of food deterioration are microbiological spoilage and oxidation. In fresh meat and meat product, colour is a strong indicator of quality. The colour of meat is due to a balance between oxymyoglobin oxidation and metmyoglobin reduction. Lipid oxidation may initiate the oxidation of myoglobin to metmyoglobin, and thus, change the colour from red to brown. Several authors have postulated that pigment and lipid oxidation are interrelated and that the rate of meat discolouration is related to the rate of myoglobin oxidation. Spices have been reported to contain components which may be effective like BHA or BHT as an antioxidant.

The aim of this study was to evaluate the effect of increasing levels of rosemary (0.33% and 1%) on lipid oxidation and on iron release from the heme moiety in beef hamburger during refrigerated storage. Studies are going on with other spices (oregano, sage and saffron) and on their respective olive oils extract (D'Evoli *et al.*, in press).

Materials and Methods

Beef muscle, obtained from industry, was minced twice and mixed into a homogeneous sample. Rosemary (*Rosmarinus officinalis L.*) was dried at 40°C in a ventilated oven and then ground; the herb was added to the meat sample at 0.33% and 1% (w/w). Rosemary 0.33% and rosemary 1% were added to 60g meat aliquots, formed into burgers and stored at 4°C for 9 days under fluorescent light. A control sample (a 60g hamburger) was stored in the same condition.

Thiobarbituric acid reactive substances (TBARS) assay was performed as described by Ulu (Ulu, 2004). 10g of raw meat was extracted with 5% TCA and the filtrate was applied to TBA reaction. TBA values were expressed as mg/kg sample.

Metmyoglobin (MMB) was extracted with cold 0.04 M phosphate buffer (pH 6.8) with a sample to buffer ratio of 1:10. After homogenization, samples were centrifuged, and the filtered supernatant was read at 525, 572, and 730nm and the percentage of MMB was determined as indicated by Krzywicki (Krzywicki, 1979).

Heme iron was determined using the acidified acetone extraction method of Lombardi-Boccia *et al.* (Lombardi-Boccia, 2002). The heme iron was determined spectrophotometrically at 640nm and was expressed in mg/100g of meat.

Results and Discussion

Lipid oxidation: Fig. 1 shows the changes in TBARS value. Rosemary 1% hamburgers showed the lowest TBARS values during refrigerated storage. On the other hand rosemary 0.33% didn't show significant differences in TBARS values with respect to the control sample during the storage.

Heme iron destruction: in the control sample the decrease in heme iron content was up to 49% after 8 days of refrigerated storage, by contrast in both the rosemary treated samples it was up to 28% (Fig. 2).

MMB formation: The metmyoglobin formation is showed in Fig. 3. Only the addition of 1% rosemary to hamburger showed to have inhibitory effect on MMB formation during the storage period (below 40%).

Conclusions

In hamburger the presence of rosemary at 1% was effective in inhibiting both lipids and myoglobin oxidation, thus increasing the shelf-life of meat. On the other hand, heme iron degradation was slowed by both the rosemary concentrations (1 and 0.33%); this result suggests that the mechanism which inhibits the heme iron accessibility is quite different from the inhibition mechanism involved in lipids and myoglobin oxidation.

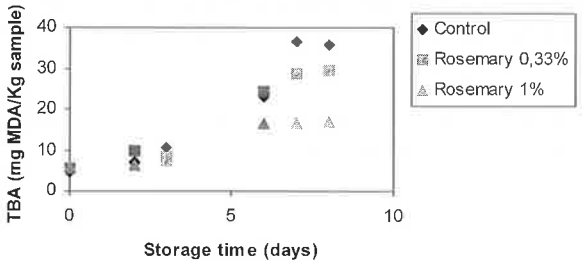

Figure 1: Effect of rosemary on the TBA values in hamburger beef during storage for 8 days at 4°C under fluorescent light.

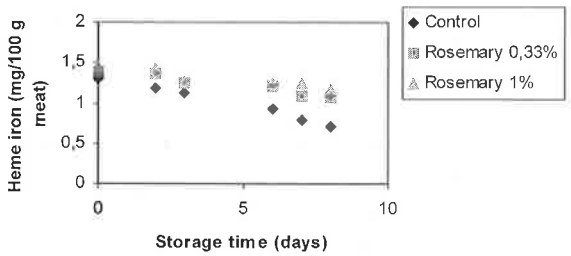

Figure 2: Effect of rosemary on heme iron content in hamburger beef during storage for 8 days at 4°C under fluorescent light.

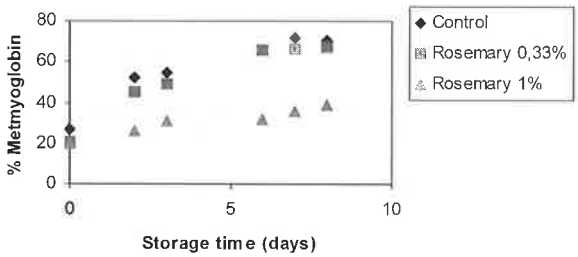

Figure 3: Effect of rosemary on metmyoglobin production in hamburger beef during storage for 8 days at 4°C under fluorescent light.

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