Effect of grape seed extract on colour, sensory properties and oxidative stability of beef

Gomez I. [1]*, Insausti K. [1], Marin R. [1], Mendizabal J.A. [1], Garcia S. [1], Sarries M.V. [1], Zudaire G. [1], Beriain, M. J. [1]

[1] Escuela Tecnica Superior de Ingenieros Agronomos, Universidad Publica de Navarra (UPNA), Campus de Arrosadia s/n, 31006, Pamplona, Spain.

Abstract— **The effect of grape seed extract (GSE) on colour, sensory properties and oxidative stability of raw beef patties stored at 2 ºC for 10 days was studied. Fresh beef was ground, then mixed with GSE (0, 500, 1250 and 2500 mg/kg of meat) and salt (2%). The patties were elaborated, stored at 4 ºC and evaluated the days 0, 1, 3, 6, 8 and 10 after processing. The instrumental colour was determined using the CIELAB system, the oxidative stability was evaluated according to the value of thiobarbituric acid-reactive substances (TBARS), and the colour and odour were evaluated by a panel of semi-trained judges. All doses of natural antioxidants were effective preventing rancidity of the product. In general, the addition of grape seed extract reduced the values of L*a*b*. Sensory variables of colour and odour were greatly influenced by the display time, resulting in off-odour and dark colour. Due to the high efficiency of the natural antioxidant, it can be concluded that the lowest dose would be enough to prevent rancidity of meat.**

Keywords— **grape seed, beef, sensory properties**

* Corresponding author to provide phone: 34948169106; fax: 34948168430; e-mail: inma.gomez@unavarra.es

I. INTRODUCTION

Antioxidants prevent or delay the oxidation of oxidizable organic substrates. A wide variety of antioxidants exists and can be classified according to their natural and synthetic origin. Because studies indicate possible adverse health effects from the use of synthetic antioxidants, their safety has been questioned and the use and applications of natural antioxidants is increasing. Polyphenols are a type of natural antioxidants that, in addition to its antioxidant properties, have specific biological activities that provide beneficial and healthy effects for the human body [1].

Ground beef is more bound to colour deterioration and oxidation than are its whole muscle counterparts. Colour and oxidation stability are very important to retail shelf life. The use of natural antioxidants, such as GSE, can help to improve the nutritional quality of beef without affecting oxidative stability or cause adverse effects on sensory characteristics, thus offering a more competitive product on the market.

The aim of this work was to study the effect of grape seed extract on colour, sensory properties and oxidative stability of beef.

II. MATERIAL AND METHODS

A. Product manufacture

Four treatments (two batches per treatment) of beef patties with a different formulation (mg GSE per kg of meat) were established: Control (0), A1 (500), A2 (1250) and A3 (2500). Fresh beef was ground, then mixed with GSE (0, 500, 1250 and 2500 mg GSE/kg of meat) and salt (2%). The patties were elaborated, overwrapped in PVC, stored at 2 ºC and then evaluated after days 0, 1, 3, 6, 8 and 10 of display (exposure to light: 10 hours/day).

B. TBARS and Colour evaluation

Thiobarbituric acid reactive substances (TBARS) values were determined, for the days 0 and 10 and in duplicate for each treatment, using the method described by [2] and expressing the results as mg malonaldehyde/kg meat.

CIE (1976) L*a*b* colour values were measured through display using a Minolta CM2002 spectrophotometer with a D65 illuminant and a 10º standard observer. Measurements were averaged over five non-overlapped zones of each patty, changing the instrument orientation each time.

C. Sensory analysis

A semi-trained sensory panel of 15 panellists assessed beef odour and colour through display. Panellists rated odour and colour using a 15 cm line anchored at each end with the terms: on the left side "non detectable off-odour", "bright fresh red meat" and on the right side "extreme off-odour", "brown, greenish, discoloured meat", respectively. The acceptability limit was anchored in the middle of the line (7.5 cm from each end). The results were quantified by measuring the distance in centimetres of the panellists mark from the left side.

D. Statistical analysis

The experiment was replicated two times. Data shown in the figures are the means. Analysis of variance (ANOVA) and the tukey test were performed to find out significant differences ($p \leq 0.05$) within studied factors, antioxidant doses and storage time. All the statistical analyses were computed using SPSS software (SPSS V. 18.0, SPSS Inc. USA).

III. RESULTS AND DISCUSSION

Figure 1 shows the effect of time and the addition of GSE on the parameter TBARS. The antioxidant dose effect was significant ($p \leq 0.01$) for the two days analyzed, and the Control was the most oxidized (from 0.44 to 5.29). So, the GSE was very effective in the three doses given, preventing the oxidation of the product. Other studies, also confirm that the GSE retards the formation of TBARS in raw and cooked beef [3, 4, 5, 6, 7].

In the graphs of the colour coordinates (Fig. 2) it should be noted that lightness (L*) and redness (a*) were lower in the Control for the ten days. Moreover, the parameters L* and b* of the treatment with the lower dose of GSE (A1) evolved differently than the other treatments (C, A2 and A3). The dose of GSE influenced significantly ($p \leq 0.05$) the three colour coordinates, but in general, no clear differences were observed between doses of GSE used. Similar results were found by [5] when studying the colour of refrigerated beef with addition of sulfite at low concentrations.

The sensory evaluations of odour and colour attributes changed significantly ($p \leq 0.001$), and higher scores were obtained over time as show in figure 3. This is due to the deterioration of the product resulting from the degradation of colour and odour. Moreover, the dose did not influence significantly ($p > 0.05$) odour and colour, except on day 6, where the treatment with higher doses of GSE (A3, 2500 mg/kg meat) presented the highest scores. [8] found no visual differences in colour and odour between control and antioxidant treatments in frozen beef for four months. The appearance of off-odours and darkening would restrict the shelf life of these products up to 3 days, although TBARS values were within the acceptable limits up to 10 days.

IV. CONCLUSIONS

All doses of natural antioxidants were effective preventing rancidity of the product. In general, the addition of grape seed extract reduced the values of L*a*b*. Sensory variables of colour and odour were greatly influenced by the display time, resulting in off-odour and dark colour. Due to the high efficiency of the natural antioxidant, it can be concluded that the lowest dose would be enough to prevent rancidity of meat.

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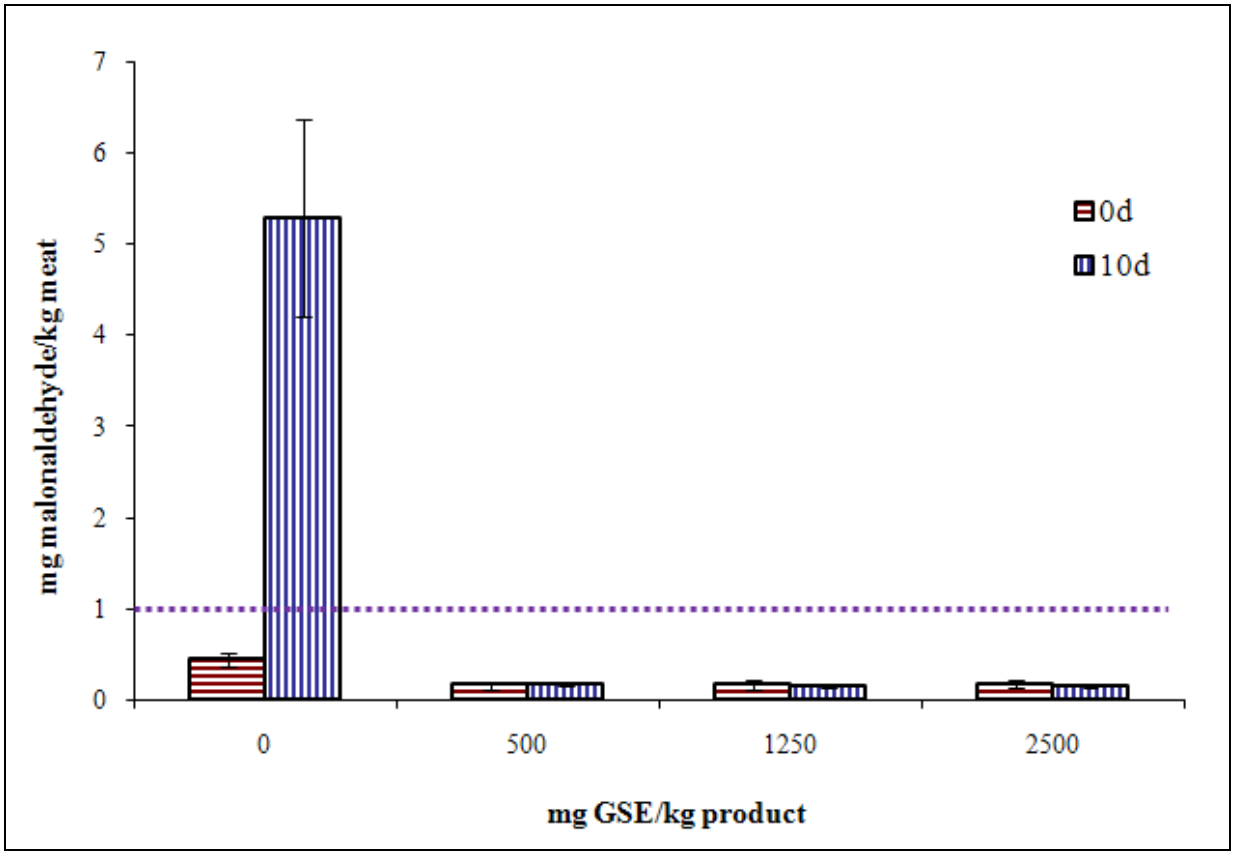

Fig. 1. TBARS values (mg malonaldehyde / kg meat) of the treatments in the days 0 and 10 (1.00 mg malonaldehyde/kg product: limit oxidative rancidity, according to [9]).

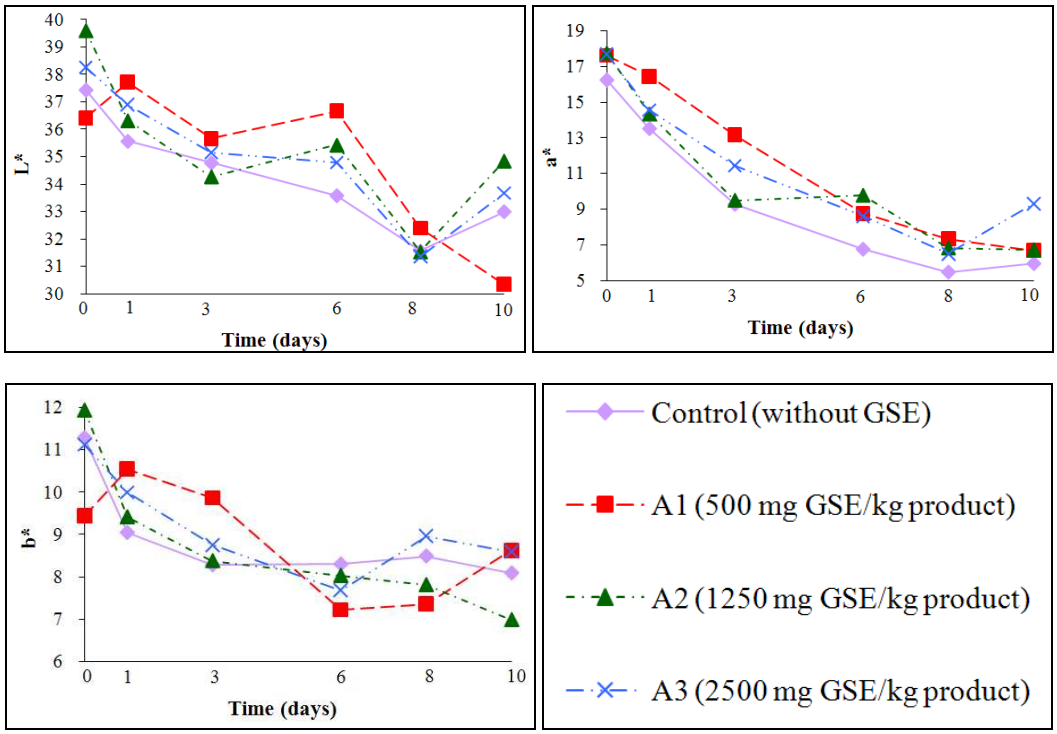

Fig. 2. Effect of GSE on L*a*b* coordinates during 10 days of refrigerated storage.

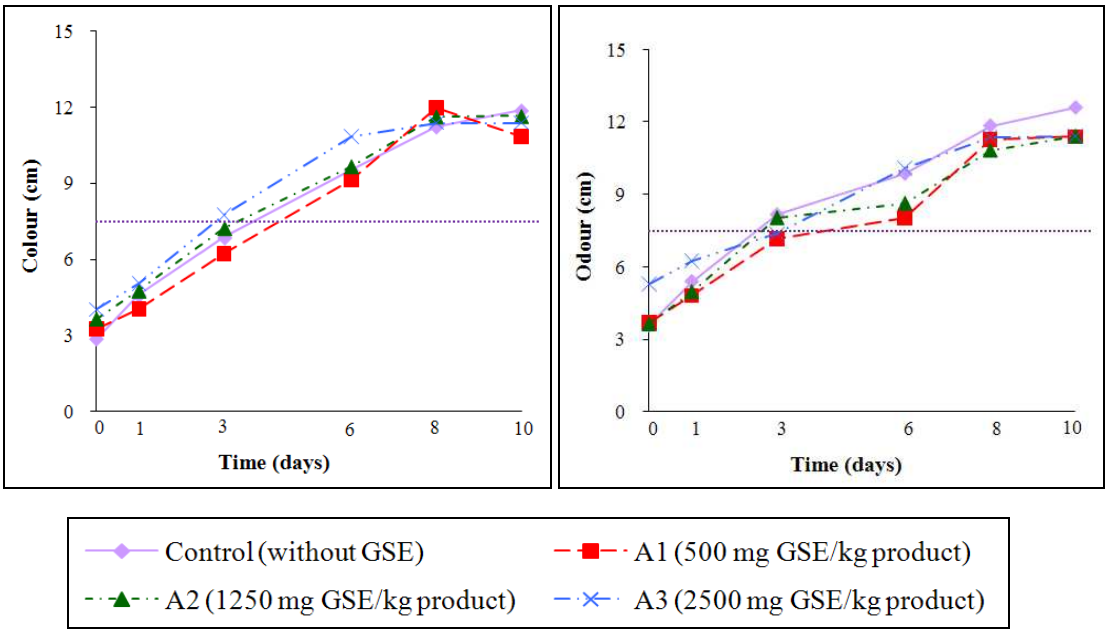

Fig. 3. Sensory evaluation of colour and odour of beef patties during 10 days of refrigerated storage (15 cm: maximal decoloration and off-odour scores; 7.5 cm: acceptability limit).