

SENSORY ACCEPTANCE OF LAMB BURGER PREPARED WITH NATURAL ANTIOXIDANTS

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Abstract – The aim of the present study was to evaluate the addition of natural antioxidants, obtained from two different herbs (oregano and melissa), to lamb burgers, in order to select the most acceptable natural extract to replace the synthetic antioxidant (sodium erythorbate) usually added to this product. The extracts were obtained following a ratio of 1:50 plant mass (g) per volume of solvent (mL). Antioxidant capacity evaluation of the two plant extracts and sodium erythorbate was performed by Folin-Ciocalteu, FRAP and DPPH[•] inhibition methods. Three types of burgers were produced, being one with sodium erythorbate (500 ppm) and two with herbal extracts. The concentrations of natural extracts were calculated to be equivalent to the mean results of the antioxidant power of 500 ppm sodium erythorbate in the three antioxidant capacity methods. For sensory evaluation, an acceptance test with 9-point hedonic scale were carried out. According to the results, there were no differences ($p>0.05$) in the consumers' acceptance among all evaluated samples. It may be concluded that it is possible to replace the synthetic antioxidant sodium erythorbate by any of the two aromatic herbs (natural antioxidants), without compromising sensory acceptance of lamb burgers.

Key Words – Affective test, Antiradical activity, Extraction

I. INTRODUCTION

Nowadays, the demand for healthier products is increasing and represents a major trend worldwide [1].

The industry seeks new sources to reduce the use of chemical additives in order to replace them with natural alternatives, besides increasing the shelf life of food and reducing the incidence of several diseases. Additionally, nowadays there is a great demand for convenience products, and if associated with the use of natural ingredients, will

lead to flavor enhancement and quality maintenance [2, 3, 4].

Since the application and efficiency of natural compounds in food systems depend on the structure of their constituents and their interaction with food components, is extremely important to check the sensory harmonization with the product to be developed [5].

The addition of plant extracts that exhibit antioxidant properties, for example, in processed food products is a great opportunity to promote the intake of functional ingredients without causing drastic changes in dietary habits of the population [6, 7].

Thus, the present study aimed the manufacturing of hamburgers based on lamb meat, adding natural antioxidants extracts from different herbs, in order to select the most acceptable for possible replacement of synthetic antioxidant sodium erythorbate, commonly used in the meat industry.

II. MATERIALS AND METHODS

A. Preparation of natural antioxidants

To obtain the extracts of oregano (*Origanum vulgare*) and melissa (*Melissa officinalis*), the methodology described by Michiels *et al.* [8], with some modifications, was followed.

A chemical solvent mixture (70% acetone, 28% ultrapure water and 2% glacial acetic acid) was used, at a ratio of the 1:50 in weight of plants (g) per volume of solvent (mL).

The samples were subjected to grinding in homogenizing, shaking, centrifugation and filtration, and stored at -18°C.

The extracts obtained were initially concentrated in a rotary evaporator and then submitted to lyophilization process.

B. Evaluation of antioxidant capacity

The samples, as well as the sodium erythorbate, were evaluated for antioxidant capacity by colorimetric methods of Folin-Ciocalteu, FRAP (Ferric ion Reducing Antioxidant Power), and inhibition of DPPH[•] radical (2,2-diphenyl-1-picrylhydrazyl), as described by Wootton-Beard *et al.* [9], with modifications.

C. Processing of the burgers

Burgers formulation consisted of lamb meat (80%), lamb fat trimmings (18%), 2% salt and the antioxidant. Three treatments were processed, being two extracts with natural antioxidants and one with synthetic antioxidant (500 ppm sodium erythorbate).

The quantities of natural extracts to be used were determined by converting the average values obtained for the three methods of antioxidant capacity, compared to the values obtained for the sodium erythorbate concentration of 500 ppm.

D. Sensory analysis

For the sensory evaluation sixty consumers were recruited among students, teachers and employees of FZEA/USP in Pirassununga-São Paulo, where the selection criterion was just to like lamb meat. The recruited consumers were given a free and informed consent form to be read and signed prior to performing the tests.

The burgers were evaluated by affective acceptance tests using a 9-point hedonic scale (1 - "extremely dislike" to 9 - "extremely like"), as described by Meilgaard *et al.* [10].

The samples were cooked using an electric griddle at 180°C until 72°C internal temperature and were stored in an oven at 60°C for a maximum of 30 minutes before served individually to the participants, inside disposable plastic cups that were coded by three-digit numbers. A randomized

complete block design was used, and the panelists assessed the attribute overall quality.

E. Statistical analysis

The results were analyzed using analysis of variance (ANOVA), considering the effects of consumers in the statistical model, with SAS (Statistical Analysis Software) version 9.1.3. The means were compared using Tukey's test at 5% significance level.

III. RESULTS AND DISCUSSION

According to the results of Folin-Ciocalteu, it was observed that oregano extract had a higher reducing power ($p < 0.05$) in mg of gallic acid/g of dry sample than melissa extract (Table 1-A). Similar results to oregano were found in studies by Aranha *et al.* [11] and Gawlih-Diziki [12].

Between the samples evaluated by FRAP methodology, the extracts of oregano and melissa did not differ ($p > 0.05$), in μmol of Trolox/g of dry sample (Table 1-B), indicating the same capacity of both extracts to reduce the oxidant complex Fe^{+3} [13].

Regarding the inhibition of DPPH[•] radical method, results showed similar behavior when compared to the Folin-Ciocalteu method, in which the oregano showed higher antiradical power ($p < 0.05$) in % equivalent of Trolox/g of dried sample when compared to melissa extract (Table 1-C). In this case, probably there was the extraction of a greater amount of antioxidant compounds of oregano that allowed a greater stabilization of the radical after reaction [14].

Table 1 Final results to Folin-Ciocalteu (mg of gallic acid/g) – A, FRAP (μmol of Trolox/g) – B and DPPH (% Trolox/g) – C.

Extract	Antioxidant capacity		
	$M \pm SD^2$		
	A	B	C
Oregano	74.01 \pm 7.33 ^a	472.32 \pm 15.96 ^a	9.06 \pm 0.10 ^a
Melissa	46.18 \pm 3.02 ^b	464.83 \pm 25.96 ^a	5.57 \pm 0.46 ^b

¹Mean; ²Standard Deviation.

Results obtained for sodium erythorbate

antioxidant power were 46.65 ± 608.83 mg of gallic acid/g of dry sample, 7044.53 ± 266.34 μ mol of Trolox/g of dry sample and $100.24 \pm 30.8\%$ equivalent of Trolox/g of dry sample for Folin-Ciocalteu, FRAP and inhibition of DPPH[•] radical methods, respectively.

Against of the values obtained, despite the lower antioxidant capacity of aromatic herbs compared to sodium erythorbate, numerous studies have reported satisfactory results in relation to the reduction of deterioration through the use of natural extracts [15, 16, 17, 18] which probably enables the substitution of synthetic compounds.

From the results obtained, there were performed calculations of equivalence to antioxidant capacity of natural extracts in relation to the antioxidant capacity of 500 ppm sodium erythorbate, obtaining average values of 5710.75 and 7916.89 ppm, for oregano and melissa, respectively. Then, the amounts of the extracts to be added to the meat products were determined, being 7.35 ± 0.44 and 10.65 ± 0.45 ml/kg, respectively, for the extracts above cited.

For sensory evaluation, among the selected participants, 71.67% were female and 61.67% were between 20 and 40 years old. Consumers' acceptance of different samples did not differ ($p > 0.05$) for overall quality attribute (Table 2). In other words, sensory analysis did not allow the selection of one of the extracts, but in general, the average attributed scores were near to 7.0 ("like moderately").

Table 2 Acceptance test of burger samples with the two natural antioxidants and sodium erythorbate.

Sample	Sensory attribute
	Overall Quality
	$M^1 \pm SD^2$
Sodium erythorbate	6.88 ± 1.35^a
Oregano	6.87 ± 1.35^a
Melissa	6.42 ± 1.35^a

¹Mean; ²Standard Deviation.

IV. CONCLUSION

From the results obtained, one can conclude that the two aromatic herbs represent a good alternative and a quite viable solution for the replacement of synthetic antioxidant, certainly contributing to the formulation of products with healthier appeal.

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