

ACCEPTABILITY OF OVINE HAMBURGER PATTIES WITH INCREASING ADDITIONS OF PEANUT AND α -TOCOPHEROL

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Abstract – The effect of the addition of crushed peanuts (0, 10, and 20%) and of α -tocopherol (α -TF, 0 or 1%) to the acceptability of ovine hamburger patties was investigated. A discontinuous and structured ten-point scale was used to rank acceptability, tenderness, and taste. With the addition of crushed peanuts, the acceptability and tastefulness decreased independently from α -TF additions. It is therefore considered convenient to study the effect of different ingredients and/or processed peanut types in order to improve the lipid profile without affecting product acceptability. On the other hand, the addition of α -TF did not affect the acceptability of the hamburgers, supporting its use as an antioxidant to improve the shelf life of the products. The lipid fractions were subjected to ¹H NMR spectroscopy, and the results were consistent with peroxide index (PI) determinations and revealed the modifications to the lipid profile.

I. INTRODUCTION

In Uruguay, the consumption of ovine meat is lower than that of bovine meat, being exports its key role. Regardless, the product added value in either case has been practically absent. The development of alternative meat products using industry low commercial value sub-products (trimmings) has been assessed in our country (1-3). Similarly, Ballesteros made a complete review of the production and innovation of ruminant meat products (4). However, these products have been strongly questioned because their consumption is associated with chronic and degenerative diseases. For this reason, functional meat products are seen as an opportunity to improve the image of meat and satisfy the demand of healthier foods from consumers. Since the ingestion of saturated fatty acids (SFA) is above the recommended levels in most occidental countries, it is considered that an

increase in the intake of oleic acid would benefit the health of consumers by improving the dietary balance between SFA and monounsaturated fatty acids (MUFAs). This effect could be reached by changing food habits or by means of applying technical alternatives over traditional products. For instance, peanut oil is rich in MUFAs and polyunsaturated fatty acids (PUFAs), with linoleic acid (C18:2) and oleic acid (C18:1) making up nearly 80% of its lipid composition (5). At the same time, it is possible to lower fatty acid oxidation in these products through the addition of antioxidants that would extend the shelf life of the product.

The object of this study was to evaluate, through a consumer test, the effect of adding increased amounts of crushed peanut and α -TF to the acceptability of hamburgers made of ovine trimmings (80% meat, 20% fat).

II. MATERIALS AND METHODS

Hamburger patties were prepared from ovine trimmings containing 20% fat, provided by Frigorífico San Jacinto (NIREA S.A.). Increasing amounts of ground peanuts and α -TF were incorporated, leading to one set of patties containing 0, 10, and 20% of ground peanut, and one with the same ground peanut content and 1% α -TF. This led to 6 treatments that were assessed under 2 factors. The ovine trimmings were processed in a semi industrial meat grinder with a 10 mm plate, followed by the addition of the ground peanut and the other ingredients (salt, garlic, white pepper, oregano and sugar), and further processing of the emulsion with a 6 mm plate. The resulting mixture was then molded into 10 cm diameter hamburger patties, packed in sealed bags, and stored at -10 °C, away from light, until used in the studies. For the consumer test, the patties were thawed at 4 °C in a

refrigerator, wrapped in aluminum foil, and cooked in a double plate grill until a thermocouple-measured temperature of 70 °C was reached in the thermal center. Each patty was then subsampled, and everything was maintained in a container inside a plate warmer at 35 °C until each sample were assigned to each consumer.

For the consumer study, 100 individuals in 10 sessions of 30 minutes were used (70 men and 30 women averaging 31.2 ± 12.2 years of age), in a complete and balanced block designed experiment. A discontinuous and structured ten point scale was used to rank acceptability, tenderness, and taste, being “1” very poorly acceptable, very hard, and very tasteless, and “10” very acceptable, very tender, and very tasteful.

For the estimation of oxidative degradation in all the raw hamburger samples stored at 10 °C, the peroxide index (PI) of the lipidic fraction extracted with an hexane/isopropanol (3:2) mixture was studied (AOCS Cd 8-53). The resulting lipid fractions were also dissolved in CDCl₃ and subjected to ¹H NMR spectroscopy to evaluate oxidation levels and unsaturation profiles. These studies were carried out on a Bruker AVANCE III 400 NMR spectrometer working at a ¹H frequency of 400.13 MHz, employing parameters from the literature (6,7). Particular attention was given to the spectral region corresponding to the allylic (R-CH=CH-CH₂-R, 1.95 to 2.00 ppm) and bisallylic (R-CH=CH-CH₂-CH=CH-R, 2.75 to 2.80 ppm) protons, as increases in the intensities of these signals are directly related to increases in the PUFA content.

A generalized linear model was used for the statistical analyses of the consumers test, assuming a multinomial distribution that included session, consumer nested to a session, treatment, and interaction between treatments as parameters. The MIXED protocol as implemented in the SAS 9.1 statistical package was employed (8).

III. RESULTS AND DISCUSSION

As expected, the effects of session and consumer were always significant ($p \leq 0,0001$). These are presented in Table 1.

Table 1 Effect of peanuts and tocopherol additions to the patties in the consumers test.

Treatment	Acceptability (1-10)	Tenderness (1-10)
Peanut (%)	0,0001	0,0001
0	7,3a	7,4a
10	6,4b	6,5b
20	5,9c	6,2c
Tocopherol	ns	ns
without	6,5	6,7
with	6,5	6,7
Peanut by tocopherol	ns	0,05
Treatment	Acceptability (1-10)	Tenderness (1-10)
Peanut (%)	0,0001	0,0001
0	7,3a	7,4a
10	6,4b	6,5b
20	5,9c	6,2c
Tocopherol	ns	ns

ns: $p \geq 0,05$. a,b,c: $p \leq 0,05$

The addition of α -TF did not affect acceptability nor the other evaluated parameters of the product regardless of composition. On the other hand, the incorporation of ground peanuts to the hamburger patties was detrimental to the attributes evaluated by the consumers, particularly when the reference patties are compared to those containing 10% ground peanuts. It is likely that the use of ground peanuts as opposed to peanut oil had an impact in the results, as this additive was easily detected by the consumers.

Adding ingredients with a higher MUFA and PUFA content to the formulation of the patties, such as peanuts, improves the lipid profile. However, they also make the product more susceptible to oxidative degradation and would compromise its shelf life. It is therefore noteworthy that the addition α -TF, which would reduce oxidation, did not affect the acceptability of the hamburger patties. On the other hand, and independently from the treatments that were assayed, the acceptability values are considered acceptable, particularly in the ages ranging from 30 to 50 years as opposed to those with ages under 30 years. These results are in agreement with those presented in earlier reports (1-3), and would indicate that the commercial use of ovine trimmings for the elaboration of hamburger patties could generate a product with a higher added value from a low cost raw material. This

would lead to a better value for the carcasses of adult ewes below 22 Kg.

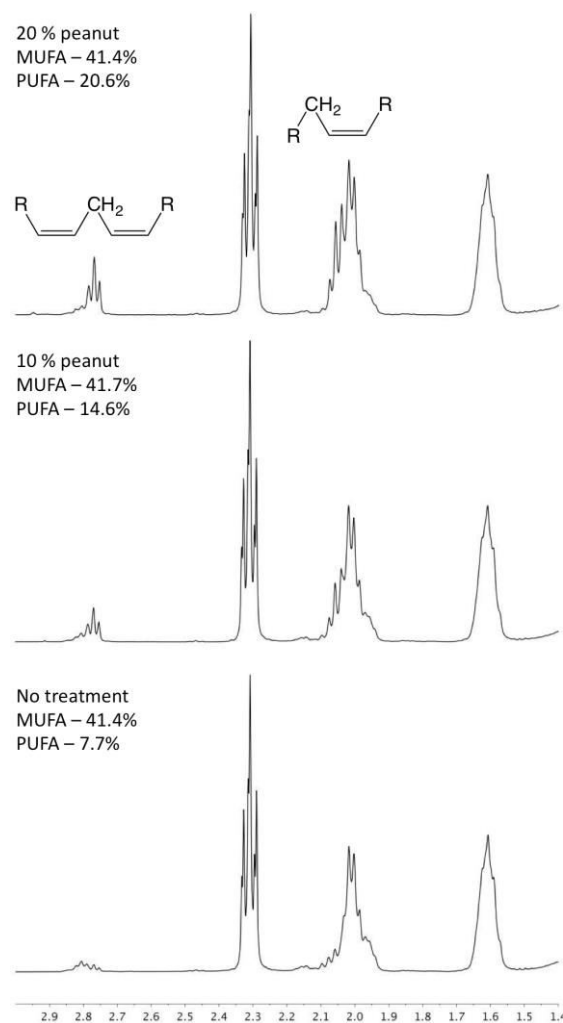


Fig. 1. Selected region of the ^1H NMR lipid profile of hamburgers containing increasing amounts of ground peanut. Signals from homoallylic and allylic protons are indicated.

Regarding the PIs, these did not show significant differences between treatments ($p \leq 0.10$), which is to be expected considering the short storage times of the samples prior to use. The ^1H NMR spectra obtained, presented in Fig. 1, are consistent with the estimated PIs. The most salient aspect of the latter results is that they show that the method allows to easily distinguish and quantify differences in the lipid profiles for each treatment. Indeed, the rise in the level of PUFAs in the lipid extracts as the amount of ground peanut increases is evident from the spectra (Fig. 1).

IV. CONCLUSION

Hamburgers elaborated from ovine trimmings have a reasonable acceptability among consumers. The use of α -TF in the formulation did not affect this acceptability. Although it improves the lipid profile of the material employed for the preparation of the patties, the use of ground peanuts is sensory detrimental to the final product. Therefore, a different presentation or other ingredients would be necessary to accomplish this.

^1H NMR spectroscopy is a promising method which needs further development for application in the meat industry. The technique allows for the quantification of lipid oxidative degradation, and, as shown here, can also be employed to monitor variations in the lipid profile that reflect changes in the content of MUFAs and PUFAs.

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