Evaluation of the effect of replacing fat pork by peanut on textural properties of an emulsified meat product.

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Introduction
Fat is one of the essential components in the flavor and texture of processed meat products, due to the direct effect in functional properties such as water-binding properties, emulsion, and lubricant capability. Regardless of these, different studies [1] show how the reduction of saturated fatty acids in the diet has a positive effect on public health as it lowers rates of coronary artery disease. For those reasons, governmental departments such as the American Heart Society 2006 [2], restrict the consumption of saturated fatty acids to no more than 7 g/100g of the total energetic intake of diet. Hydrocolloids, vegetal, and animal proteins have been studied to replace the use of fat in sausages and other meat products to mitigate the adverse effects of saturated fatty acids and produce healthier meat products [3]. Innovations introduced in the food industry refer to new functional approaches, in this regard the rabbit meat has been cataloged as functional meat, owing to the correct balance between the nutrients, principally because of the high amount of good quality protein, and the low-fat content [4]. In 2016 it was tested with more than 1800 persons, that the substitution of red meat for alternate protein sources like fish, beans, eggs, or white meat such as rabbit, reduces the incidence of metabolic syndrome [5]. Parallel to these studies, nuts and especially peanuts have probed his value as a dietary ingredient to reduce the risk of hypertension and coronary disease [6]. The high content of omega-3 fatty acids, as well as other monounsaturated fatty acids and other bioactive compounds including several antioxidants, make the peanuts a perfect candidate for fat substitution in processed meat products to balance the lipid profile. Finally, the consumer's evaluation of the quality of meat products is defined by sensory experience. Therefore, the objective of this work was to evaluate the effect of the addition of peanut, in sensory and texture attributes an emulsified rabbit meat product.

Methods and material
Sausage preparation
Rabbit meat and pork fat were ground (3 mm) and stored at -20°C for 1 hr. until use. Additives of the sausage formula were weighted. Peanut was grounded in a grain mill down to a particle size of 0.1 mm. In order to process the sausage, the grounded rabbit meat, sodium chloride, sodium nitrite, and sodium tripolyphosphate were placed in a cutter, when the mixture reached 7°C, the remaining ingredients, water and 90% of the fat were added, until complete homogenization. The paste was divided into exact halves so that one could be added with the remaining fat, and the other added with the grounded peanut. Both formulas were mixed in the cutter for 2 more minutes each.

The homogenous paste was stuffed in 32 mm diameter plastic casings and cooked in an oven until the internal product temperature reached 72°C. After cooking the sausages were cooled in a shower and storage in a refrigerator (4°C) for 20 hrs. The samples were packed in a vacuum sealer and stored in the same refrigerated conditions until analysis.

Sensory evaluation
The samples of both formulas were cut in 2 cm long cylinders and assigned with a random 3 digit number each. The sausages were served room temperature. The panel consisted of 50 non-trained judges from 20 to 27 years old. Panelists were asked to evaluate the samples on a non-structured scale (12cm), concerning the texture, color, and overall acceptability. Each point marked was converted to a numerical value from 0 expressing dislike extremely to 10 expressing like extremely, according to the location in the line. Each panelist was presented with one of each formula in the session.
Textural profile analysis (TPA)

In a sausage, it is prevalent to evaluate the texture profile to determine not only the desirability of the product by the consumers but also the structural integrity of the protein matrix (Fig. 1). TPA of the rabbit sausages was tested using texture analyzer (Texture Analyzer, TA-XT Plus, LLOYD instruments, England), 4 samples (2 cm length and 2 cm diameter) for each formula were manually cut and compressed twice to 50% of the original height. In these experiments, hardness, chewiness, and adhesiveness of sausages were determined.

![Textural profile analysis (TPA)](image)

**Figura 1.** Textural profile analysis (TPA)

Results and discussion

The effect of replacing pork fat by grounded peanut on sensory attributes is shown in Table 1. It is worthwhile to note that neither formula had an advantage on textural attributes. General acceptability and texture scores were around 7 from 10, for both sausages with non-significantly (P≥0.05) differences, while color was significantly (P≤0.05) affected by the addition of peanut, as the ANOVA shows, for which the values of 5.2 and the whole fat formula has values the 6.5.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Color</th>
<th>Flavor</th>
<th>Texture</th>
<th>General acceptability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% fat substitution</td>
<td>6.5 ± 0.23a</td>
<td>6.1 ± 1.33a</td>
<td>6.07 ± 2.47a</td>
<td>6.88 ± 1.86a</td>
</tr>
<tr>
<td>10% fat substitution</td>
<td>5.2 ± 0.34b</td>
<td>5.8 ± 1.28a</td>
<td>5.91 ± 2.45a</td>
<td>6.18 ± 2.51a</td>
</tr>
</tbody>
</table>

Different letters in the same column indicate significant differences (P≤0.05).

The use of meat rabbit as a principal ingredient was commented for more than half of the panel, as a strangely sweet flavor, as tasty but not familiar. The general acceptability was not affected, neither the texture, because the addition of peanut did not affect the structure of the sausage in a significant way to a non-trained panel, who did not recognize the slight decrease in hardness of the peanut added formula. Color otherwise did show the addition of a strange ingredient, because the seed coat even in the particle size, showed little brown points in the surface of the sausage. The replacement of pork fat by grounded peanut affected (P≤0.05) the TPA parameters of the rabbit meat sausage. The replacement of 10% fat, was measured with a significant (P≤0.05) lower hardness, adhesiveness, chewiness than the control. This outcome can be explained by the interference of the peanut in the formation of the meat protein matrix [6]. Other investigators reported a similar behavior but in meat emulsions added with walnut and treated with high pressures, suggesting that the incorporation of the peanut interferes in the formation of the meat matrices [7].
Table 2. TPA Analysis

<table>
<thead>
<tr>
<th>Samples</th>
<th>Hardness</th>
<th>Adhesiveness</th>
<th>Chewiness</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% fat substitution</td>
<td>5.89 ± 0.83a (N)</td>
<td>-29.0 ± 9.34a (N)</td>
<td>4.02 ± 0.18a (N)</td>
</tr>
<tr>
<td>10% fat substitution</td>
<td>4.38 ± 0.13b (N)</td>
<td>-16.6 ± 2.36b (N)</td>
<td>2.79 ± 0.13b (N)</td>
</tr>
</tbody>
</table>

Different letters in the same column indicate significant differences (P≤0.05).

Conclusion
The replacement of fat by grounded peanuts can be a useful option to reduce the intake of pork fat in meat products and increasing the consumption of compounds that are potentially beneficial to health.

References