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Improvement of the healthy properties of a Spanish artisan meat pie maintaining the organoleptic quality

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ABSTRACT

Some artisan products with high fat content, particularly saturated fat, are perceived as unbalanced foods. The "Murcia's meat pie" (MMP) is a Spanish artisan product with ground beef as the main filling ingredient. The aim of this study was to improve the healthy properties of MMP maintaining its original organoleptic quality. Four MMP which were different in the proportion and anatomic location of the cuts of beef were assessed. The MMP most recommended for human consumption was elaborated with ground beef prepared with neck (20 g/100 g) and chuck (80 g/100 g) because of having a lower fat content than the control (37 g/100 g) and the most recommended fatty acid profile. The study showed that a better selection of one or more ingredients can be a valuable strategy for improving the healthy properties of artisan products, without diminishing the sensory attributes. This would allow maintaining the identity, cultural and gastronomic heritage of each country.

1. Introduction

There is general consensus among the different scientific societies and public health organizations about the important role that diet plays in the prevention and treatment of degenerative illnesses. The latest guidelines of the WHO to promote healthy diets include limiting energy intake from fat and reducing saturated fat content of processed foods (WHO, 2003, 2009, 2013). Consumers are becoming more health conscious in their food choices being interested in knowing the nutritional content of foods. Among their main concerns there are the energy value and fat and saturated fat contents in food because of their potential adverse health effects (Brugiapaglia, Lussiana, & Destefanis, 2014; Realini, Guàrdia, Díaz, García-Regueiro, & Arnau, 2015).

Artisan foods are widely recognised as an important part of the nutritional, gastronomic and cultural heritage of different countries. However, many of these artisan products are perceived as nutritionally unbalanced due to their high caloric value and fat content. Murcia's meat pie (MMP) is a Spanish artisan product, typical of the gastronomy of the Region of Murcia, filled with ground beef (GB) as the main ingredient (Ruiz-Cano et al., 2013). Its current caloric value (>300 kcal/100 g), caloric content from fat (50 kcal/100 g) and saturated fat content (45–50 g/100 g total fat) represent an important limitation for its consumption into a balanced diet. The improvement of the healthy properties of artisan foods, through a more adequate selection of one or more of their ingredients, could be an effective strategy to avoid disappearance of some of this type of traditional products.

GB, the main filling ingredient of MMP, is a meat rich in fat and saturated fat (Aldai, Dugan, & Kramer, 2010) and it is perceived for consumers as an unhealthy food (Scollan et al., 2006). It has been demonstrated that GB can be healthier through a better selection of the anatomical location of the cuts (Turk & Smith, 2009).

On the other hand, fat is a key component that affects sensory food attributes. Therefore, a significant reduction of its content in food products should be made carefully, because it could affect their organoleptic characteristics and reduce the overall acceptability (Jiménez-Colmenero, Triki, Herrero, Rodríguez-Salas, & Ruiz-Capillas, 2013; Youssef & Barbut, 2011).

Hence, the aim of this study was to improve the MMP healthy properties, a Spanish artisan meat product, maintaining its excellent and appreciated organoleptic quality. The potential imp-

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rovements investigated in the present study were: a) Reduction of the fat content; b) Modification of the fatty acid profile and fat quality indexes; c) Reduction of the energy value and d) Maintenance of the original sensory attributes of this product.

2. Materials and methods

2.1. Raw materials

Beef meat (fresh post-rigour meat of different cuts of the beef carcass: neck, chuck and thick flank) were kindly provided by a local processor (Faustino y José Damian, S. L., Llano de Brujas, Murcia). Commercial available wheat flour (moisture 13.9 g/100 g, protein 11.8 g/100 g), lard, salt, spices and eggs used in the formulations were purchased from a local market in Murcia (Spain).

All the chemicals and standard reagents used were from Sigma Aldrich (Buchs, Switzerland). Milli-Q system (Milli-Q Corp. Bedford, MA) ultra-pure water was used.

2.2. Formulation and processing of Murcia's meat pie

Four GB samples were prepared with simple mixtures of different cuts of the carcass, in the following proportions: GB1: thick flank 65 g/100 g and neck 35 g/100 g, GB2: thick flank 80 g/100 g and neck 20 g/100 g, GB3: chuck 80 g/100 g and neck 20 g/100 g and GB4: defatted chuck 80 g/100 g and neck 20 g/100 g. The defatted chuck was prepared by removing all subcutaneous fat and intermuscular fat from the muscle. Beef meat mixtures were ground in a 2 cm plate meat grinder (Mainca, Granollers, Spain). The sample GB1 was taken as a reference for being the most commonly used by bakers in the elaboration of MMPs.

The GB samples were vacuum-packaged and stored at 0 °C until required for product manufacture. Spices used in the formulation were: ground black pepper (0.4 g/100 g), nutmeg (0.05 g/100 g), garlic powder (0.6 g/100 g), paprika (0.7 g/100 g) and salt (3.2 g/100 g).

The four types of GB were used for the elaboration of the MMPs according with the formulation and processing for the MMP previously described by Ruiz-Cano et al. (2013). The MMPs were elaborated by three artisan bakers from the Bakery Enterprises Association in the Region of Murcia (AREPA). Each type of MMP was elaborated in triplicate.

2.3. Proximate analysis and caloric value estimation

Samples of GB and MMP were analyzed after homogenization for moisture (Method nº 945.15), ash (Method nº 942.05), crude protein (Kjeldahl method, factor = 6.25, Method nº 920.54), and crude fat (Method nº 920.39) contents, according to the AOAC methods (AOAC, 2000; AOAC, 2006).

Total caloric values (kcal) for MMP were estimated on the basis of a 100 g portion using values for protein (×4 kcal/g), carbohydrate (×4 kcal/g) and fat (×9 kcal/g) (Moreiras, Carbajal, Cabrera, & Cuadrado, 2011). Carbohydrate contents were calculated by the difference (meaning 100-the sum of moisture, protein, fat and ash).

2.4. Determination of fatty acid profiles

Fatty acids (FAs) were extracted from 0.5 to 1.0 g of sample, by homogenising in 20 ml of chloroform/methanol (2:1 v/v) in an ultra-tissue disrupter (IKA Ultra-Turrax T25 dig. IKA Werke GmbH & Co. KG/Germany). Total lipids were prepared according to the method of Folch, Lees, and Stanley (1957). Fatty acid methyl esters (FAME) were separated and quantified by gas–liquid chromatography using an SP™ 2560 flexible fused silica capillary column (100 m long, internal diameter of 0.25 mm and film thickness of 0.20 mm) (Supelco 2560 SPTM, Bellefone, PA, USA) in a Hewlett Packard 5890 gas chromatograph (Bellefone, PA, USA).

2.5. Lipids nutritional quality indexes

The data from fatty acids composition analysis were used to determine the nutritional quality of the lipid fraction. The following indexes were calculated:

- Total saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA).
- Unsaturated fatty acids/saturated fatty acids ratio [(MUFA + PUFA)/SFA] and polyunsaturated fatty acids/saturated fatty acids ratio (PUFA/SFA) (Pérez-Llamas, Martínez, Carbajal, & Zamora, 2012).
- Atherogenicity index (AI) = [(C12:0 + (4 × C14:0) + C16:0)]/(ΣMUFA + Σn−6 + Σn−3) (Ulbricht & Southgate, 1991).
- Thrombogenicity index (TI) = (C14:0 + C16:0 + C18:0)/[(0.5 × ΣMUFA) + (0.5 × Σn−6) + (3 × Σn−3) + (Σn−3/Σn−6)] (Ulbricht & Southgate, 1991).
- Hypocholesterolemic fatty acids/hypercholesterolemic fatty acids ratio (H/H) = [(C18:1n−9 + C18:1n−7 + C18:2n−6 + C18:3n−6 + C18:3n−3 + C20:3n−6 + C20:4n−6 + C20:5n−3 + C22:4n−6 + C22:5n−3 + C22:6n−3)/(C14:0 + C16:0)] (Fernández et al., 2007).

2.6. Sensory evaluation of Murcia's meat pie

A consumer panel consisting of 80 people between 30 and 65 years among the staff of the university was used for the sensory tests. The sensory attributes (colour, appearance, texture, taste, flavour and overall acceptability) were evaluated using a hedonic descriptive scale of nine points (1 = dislike extremely, 9 = like extremely).

2.7. Statistical analysis

The results were expressed as mean ± standard deviation (SD). The normality of the variables was confirmed by the Shapiro–Wilk test and homogeneity of variance by the Levene test. Statistical differences among the groups were assessed by one-way ANOVA analyses, followed by the Bonferroni or Games Howell test, depending on the homogeneity of the variables. The level of significance was set at $p < 0.05$ for all analyses. All data were analyzed by the computer application SPSS for Windows® (version 19.0, SPSS Inc., Chicago, USA).

3. Results

Table 1 shows the proximate chemical composition of the four types of GB tested. Comparatively, GB3 and GB4 showed significantly lower fat content ($p < 0.05$) and higher moisture and protein ($p < 0.05$) that GB1 and GB2.

The fatty acid profile of the four analyzed GB is shown in Table 2. In all cases, the quantitatively most important FAs were palmitic (C16:0), stearic (C18:0) and oleic (C18:1n−9). The content of linoleic acid (C18:2n−6) and arachidonic (C20:4n−6) were found higher in GB3. The contents of *trans*-FA of the four types of GB ranged from 0.83 to 1.52 g/100 g total FAs. Comparatively, GB3 presented lower proportion of SFA ($p < 0.05$) and higher of MUFA ($p < 0.05$) among the four types of GB. The proportion of PUFA was significantly lower in the GB1 and GB4 comparatively with GB2 and GB3 ($p < 0.05$).