Characterization of regional Portuguese kitchens for *alheiras de Vinhais* (PGI) production with respect to the processing conditions, final product quality and legal framing

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**A R T I C L E   I N F O**

Article history:
Received 4 July 2011
Received in revised form 12 December 2011
Accepted 3 January 2012

Keywords:
*Alheira de Vinhais*
Regional kitchens
Processing conditions
Microbiological parameters
Legal framing

**A B S T R A C T**

*Alheira de Vinhais* is a traditional fermented meat product, produced in the North of Portugal, generally in small units called regional kitchens. In the present study, the requisites established by the European and Portuguese normatives and how these are being applied in these kitchens are discussed. In addition, the evaluation of the hygienic, sanitary and environmental conditions in these establishments, as well as, the microbiological quality of the final product are reported.

In order to characterize the processing units, a check-list was applied and microbiological analysis of environmental samples and *alheiras* were performed.

The present work allowed verifying that, despite some shortcomings, the basic hygiene and the overall processing conditions were appropriate for small-scale production of *alheiras*. In fact, the structural and functional conditions of the regional kitchens that were assessed were found to be quite satisfactory and complied with the European and Portuguese normative. Even though there are exceptions in the European regulation for these kinds of products, Portugal has normative applicable to these products that are sufficient to guarantee the food quality and safety. In regards to the microbiological environment air quality, unsatisfactory food processing hygienic conditions were sometimes observed. Microorganisms, such as yeasts/molds, coliforms and *E. coli*, indicative of poor hygiene practices were only found four times on surfaces and equipment. Most of the time, the food handlers had clean hands. Microorganisms associated with foodborne illnesses, such as *Salmonella spp.*, *S. aureus* and *Listeria spp.* were not detected in any sample. Thus, the results obtained showed that the production of this kind of products must be promoted, since good hygiene and manufacturing practices are followed.

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1. Introduction

*Alheiras* are a traditional fermented meat product, very common in rural areas of Portugal since ancient times. Their origin goes back to the end of the fifteenth century and is associated with the presence of Jews in the North of Portugal. In order to protect themselves from being identified as Jews by the Inquisition, they decided to use meat other than pork which they wrapped in dough to make the *alheiras* (Ferreira et al., 2006). The recipe became popular among Christians who eventually added pork to the dish.

*Alheiras* production has been an important source of household revenue in the North of Portugal which has played an important role in the economy of the region. Several small artisanal producers, called *Cozinhas Regionais de Fumeiro*, have arisen. They cannot produce more than 2000 kg of smoked meats per year (*Decreto-Lei No 209/2008*). In 2007, an application pursuant on the protection of geographical indication for *alheira de Vinhais* was submitted to the European Commission, which was approved one year after, as described in the Commission Regulation (EC) No 676/2008. *Alheiras de Vinhais* are smoked sausage, made from the meat of pigs of the Bisaro breed or of cross-breeds that must be 50% Bisaro, poultry meat, regional wheat bread and olive oil from Trás-os-Montes, seasoned with salt, garlic and paprika. Moreover, the geographical processing area is confined to the municipalities of Alfândega da Fé, Bragança, Carrazeda de Ancães, Freixo de Espada à Cinta, Macedo de Cavaleiros, Miranda do Douro, Mirandela, Mogadouro, Torre de Moncorvo, Vila Flor, Vimioso and Vinhais in the Bragança district.
Some works have been performed on microbiological characterization of alheiras (Ferreira et al., 2006, 2007; Talon et al., 2007), showing some concern about their food safety (Ferreira et al., 2007). Nevertheless, the conditions during production may also have an important role. A study performed in processing units of five Mediterranean countries and one from East-Central Europe (Slovakia) showed that these units were colonized at various levels by spoilage and technological microflora (Talon et al., 2007). However, no final product was analyzed. Therefore, it was not possible to infer the role of the processing conditions on the quality and safety of the final products. Few works have been made in order to find out the relationships between the processing conditions and the quality and safety of the final products.

As Portugal belongs to the European Union, it must follow the European legislation requirements linked to food hygiene (EC Regulation No 852/2004 and 853/2004 on the hygiene of food-stuffs and lays down specific hygiene rules for food of animal origin, respectively). However, some requisites are difficult to apply to these kinds of small units and so some exceptions are considered, such as those of traditional products (EC Regulation No 2074/2005). Alheiras de Vinhais belong to this group. In order to protect the consumers, Portugal elaborated specific normative for the establishments where this type of product is produced. The Decreto-Lei No 209/2008 establishes the “State of Practice of the Industrial Activity” called REAI that divides the industrial establishments in three groups (Types 1, 2 or 3). The regional kitchens are included in Type 3 that includes units with 15 or fewer employees and has limited thermal and electrical power contractors.

REAI focus on several aspects in trying to prevent the risks associated with the exploration of these industrial establishments, in order to guarantee public health, security of persons and their belongings, hygiene and safety of the work places and the quality of the environment, in addition to other points.

No study has been performed until now that discusses the legal framework for alheira de Vinhais in terms of their processing conditions and final quality and safety. Thus, the aim of the present work is to obtain knowledge on these subjects, regarding the following topics: i) Evaluation of the hygienic, sanitary and environmental conditions in regional kitchens, as well as the characterization of food handlers; ii) Discussion about the requisites established by the European and Portuguese normative and how these are being applied; iii) Evaluation of the microbiological quality of the final product; and iv) Establishment of relationships between the working conditions and the final product quality.

2. Material and methods

2.1. Processing units

This study was conducted from December 2009 to March 2010, in three regional kitchens (A, B and C), located in the Trás-os-Montes region, Northeast of Portugal. In order to evaluate the processing conditions, three visits were performed and a check-list applied. During these visits, samples from the environment, working surfaces, equipment and tools, as well as from the hands of food handlers were collected. During the last visit, the final product (alheiras de Vinhais) was collected.

2.2. Check-list

The main topics included in the check-list in order to characterize the processing units were: (i) Products produced; (ii) Working months; (iii) Food handlers characterization (number and qualifications); (iv) Machines and equipment available; (v) Water used; (vi) Energy types; (vii) Main sources of noise and vibrations; (viii) Pest Control Program; (ix) Firewood; (x) Temperature monitoring; (xi) Structural characteristics, namely in regards to the hygiene capacity (washing and disinfection); (xii) Tools and materials; and (xiii) Installations.

2.3. Sampling procedure

Surface samples from mincing, mixing and stuffing machines, cutting tables, deboning knives and cutting bread machines were collected, according to ISO 18593:2004, after the cleaning and disinfection procedures routinely followed by each producer. Twenty two samples were collected using sterile swabs dampened in peptone water. Areas of 25 and 100 cm² were analyzed.

The microbiological air quality was evaluated by the simple sedimentation technique. Air samples were taken in quadruplicate in the processing zone, drying zone and exterior of the building. The right and left hands of food handlers were analyzed by using sterile swabs moistened in peptone water that were passed over the entire surface of the hands and between the fingers. Five alheiras were collected in each kitchen after drying to be ready for selling. All samples were transported to the laboratory in portable, insulated cold-boxes and stored at 4 °C until analysis.

2.4. Laboratory analyses

In the alheiras, the pH was determined directly with a Crison pH-meter (Crison) equipped with a 52—32 puncture electrode. The water activity (aw) was assessed using the HygroPalm aw-1 equipment with a probe measuring over the range 0—1 aw, with temperature control.

The microorganisms analyzed in the surface samples were mesophiles, yeasts/molds, coliforms, Escherichia coli and Staphylococcus positive coagulate, namely S. aureus. In air sampling, Petri dishes with medium were left opened for 15 min. Plate Count Agar (PCA) and Potato dextrose agar (PDA) mediums were used for evaluate the total number of mesophiles and yeasts/molds, respectively. Their counting was performed after incubation for 24—48 h at 37 °C and for 5 days at 25 °C, respectively. Results were expressed on colony forming units per cm² and week (cfu/cm².week)). In food handlers hands the microorganisms analyzed were coliforms, Escherichia coli and S. aureus.

In relation to alheiras, twenty-five grams of samples were added to 225 ml of sterile buffered peptone water and homogenized in a stomacher for 2 min. Decimal dilutions were prepared in peptone water for microbial counting. The following microbiological counts were performed: (i) Deteriorative flora, namely total mesophiles and yeasts/molds; (ii) Microorganisms indicative of deficient microbiological quality and fecal contamination – total coliforms and Escherichia coli; and (iii) Microorganisms responsible for foodborne diseases, such as Listeria monocytogenes, Salmonella spp. and S. aureus.

The media and the conditions of incubation were the following for the microorganisms: (i) Mesophiles: PCA incubated at 35 °C for 72 h, according to the International Standard ISO 4833:2003; (ii) Yeasts/molds: PDA with 0.1 g/l of chloramphenicol, incubated at 25 °C for 5 days, according to the International Standard ISO 7954:1998; (iii) Staphylococcus positive coagulate: Baird-Parker medium enriched with egg yolk with tellurite, incubated for 48 h at 37 °C, according to the Portuguese Standard NP 4400-1:2002; (iv) Total coliforms and Escherichia coli: SimPlate method (Biocontrol®) incubated at 37 °C for 24 h; (v) Listeria spp.: Immunoprecipitation method (VIP Listeria, Biocontrol®), using Fraser broth modified with lithium chloride as primary selective enrichment broth and Listeria buffered (BLED) as the secondary selective enrichment broth; and (vi) Salmonella spp.: Immunodiffusion