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COMPARATIVE STUDY OF THE CHEMICAL AND MICROBIOLOGICAL COMPOSITION OF THE INDUSTRIAL AND HAND-MADE TRADITIONAL SAUSAGE "ALHEIRA"

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Please refer to Folio 53.

INTRODUCTION

"Alheira" is a typical portuguese sausage, which originated in the XVI century (Alves, 1925) and it is still produced on a large scale in the north-east region of Portugal.

The home-made production of "alheira" is still very frequent in rural regions, although it has been decreasing as a consequence of the abandonment of agrarian activity and emigration. The industrial production has therefore been increasing and some small industries in the Trás-os-Montes region support their economy on its production.

This sausage is highly appreciated by consumers and the demand for home-made meat products has been increasing in the last few years, but the production has been insufficient to meet this demand.

The technological process of "alheira" consists of boiling all the meat (pork, beef, chicken and some times game) in water with salt, garlic and parsley. Some of the water is then poured over previously cut bread slices to make a consistent paste. Finally boneless meat, (in small pieces), paprika, melted pork fat or olive oil and more garlic are added. The stuffing is inserted into a thin-wall cattle gut and submitted to a dry-smoke process for two or three days in a traditional smoke house (Martins and Fernandes, 1990).

The aim of this work was to compare the chemical and microbiological composition of this sausage, as manufactured by "home-made" and industrial methods.

MATERIAL AND METHODS

The study was based on thirty samples from home-made production and thirty samples from industrial production, randomly drawn from home producers and small industries in the region respectively.

The moisture, fat, protein, ash and salt content (NaCl) were determined according to the relevant AOAC procedures (1990) . Nitrogen free extract was calculated by difference. The pH was measured directly on the paste with a pH meter (model microph 2002, Crison). The Aw was determined using a Rotronic Higroskop DT at 25°C.

Microorganism plate counts were conducted to determine the sanitary aspects of this process. For this purpose, the microorganisms enumerated and media used included: mesophilic (PCA - Difco - 0479-three days at 30°C); total mold and yeast (CRBA - Difco 0703 with chlorotetracycline - five days at 25°C); coliform bacteria (BGB - Difco 0007 - two days at 30°C); *Escherichia coli* (BGB - Difco 0007; Peptone water for indol production - two days at 44.5°C - Portuguese standard methods - 2308/86); *Staphylococcus aureus* (pré enrichement-Chapman broth - one day at 37°C; isolation and confirmation on Baird Parker Agar with EY tellurite - Difco 0779 - one day at 37°C). The coagulase activity was determined with bacto coagulase plasma (Difco 0286 - Portuguese standard 2260/86); sulfite reducing *Clostridium* spores (VL with natrium sulfite and iron alum - five days at 37°C - Portuguese standard 2262/86);

Salmonella (pré enrichment on buffered peptone water - one day at 37°C; enrichment on Rapaport broth - Biomérieux - 41214 and selenite cistine broth - Difco 0684 - one day at 37°C; isolation and identification - BGA-Difco 0285 and DCL one or two days at 37°C; confirmation Kliger Iron agar - Difco 0086 - one day at 37°C; rapidec Z - Biomérieux 03400 - sorology - Difco 2264 (Portuguese standard 870/88).

The Student Newman Keuls test was used to evaluate the significance of the differences amongst batches.

RESULTS AND DISCUSSION

The results of chemical composition of home-made and industrial "Alheira" are presented in Table 1.

The home-made product was found to be more heterogeneous than the industrial one, which might be explained by the use of familiar recipes, which are very different between producers.

No significant differences were observed in Aw, pH, moisture and fat among the batches. The protein, ash and salt content were significantly different, being slightly higher in the industrial batch. The NFE content was higher in the home-made batch, probably as a result of being calculated by difference, reflecting the lower level of protein.

Although the traditional parameters of this sausage, traditionally an IMF (Intermediate Moisture Food), the Aw and/or pH values of these products was not sufficiently lowered to stabilize the majority of products. Only thirteen percent of the home-made batch were considered stable because they presented pH<4.5 (Figure 1).

For all of the bacteria strains studied in this work, the industrial batch presented higher values, probably because the stability parameters were not sufficiently reduced in order to accomplish bacterial inhibition.

The presence of faecal and teluric microorganisms may be explained by the possible lack of hygienic conditions and professional education of workers in some small industries. The microbiological quality of the raw material was a very important factor, particularly with regard to chicken meat and fresh pork gut, both of which could be a vehicle for faecal microorganisms.

The presence of a high number of *Staphylococcus aureus* in the industrial batch indicates that manual manipulation could be a critical consideration in industrial production.

CONCLUSION

Despite the differences found between the batches, the chemical composition of home-made and industrial "alheira" were not very different, from a nutritional point of view.

The microbiological profile was slightly different, such that the industrial "alheira" was of a lower quality, probably because it has been changed to a High Moisture Food, due to the reduction of the ripening and smoking time.

The hazard potential associated with alimentary toxical infection is low because production conditions are not optimum for its growth or toxin production. Otherwise, even if the microorganisms or its toxins were present, the cooking preparation, whether by roasting or frying, is always enough to inactivate their growth or potency.
It is important to control the critical points throughout the process, particularly at the raw material and manipulation end of the process, to reduce contamination, and at the ripening process, to confer characteristics of stability to the product. Otherwise, it will be necessary to adapt the transport and commercialization conditions to the characteristics of the product.

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Table 1. Approximate composition of home-made and industrial "Alheira"*.

	Home-made X	s	Industrial X	s
N	30		30	
Aw	0.97[a]	0.006	0.97[a]	0.006
pH	5.55[a]	0.768	5.27[a]	0.366
Moisture, %	52.80[a]	8.695	54.63[a]	3.097
Protein, %	10.57[a]	2.236	12.80[b]	3.154
Fat, %	16.97[a]	6.883	16.27[a]	2.264
NFE, %	17.68[a]	3.916	14.61[b]	3.095
Ash, %	1.94[a]	0.231	2.13[b]	0.375
NaCl, %	1.66[a]	0.255	1.87[b]	0.282

* Each value is the mean of two repetitions.
[a,b] Means followed by similar superscripts do not differ significantly (P>0.05).
N = number of samples; NFE = nitrogen-free extract

Table 2. Counting of microorganisms on home-made and industrial Alheira (log CFU/g) (n =30).

	Molds	Yeasts	Mesophilic bacteria
Home-made X	<2.0	4.49[a]	7.92[a]
s	--	1.363	1.114
Industrial X	<2.0	5.31[b]	9.33[b]
s	--	0.600	0.351

[a,b] Means followed by similar superscripts do not differ significantly (P>0.05).

Table 3. Number of samples of Alheira containing Coliform bacteria, E.coli, Stphy.aureus and sulfite reducing Clostridium.

	Coliforms 0.01g	E.coli 0.01g	Stapy. aureus 0.01g	Sulfite reducing Clost. 0.01g
Home-made	27	11	8	2
Industrial	30	18	24	1