

ACCEPTABILITY OF FRESH MEAT AND MEAT PRODUCTS OBTAINED IN DIFFERENT TYPES OF ESTABLISHMENTS

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I. INTRODUCTION

Meat and meat products are a significant part of the Portuguese diet [1], being an important source of nutrients. However, its composition favours the proliferation of a wide range of microorganisms. The microbiota present can be responsible for the deterioration processes with shelf-life reduction, economic losses and a considerable environmental impact [2]. Also, the microorganisms present in these products can be a source of pathogens, with an important impact on public health, being a potential cause of foodborne diseases [3,4]. The aim of this study was to determine the effect of different kinds of retail establishments from the North of Portugal on the microbial levels and acceptability for consumption of several types of fresh meats (minced meat, meatball, hamburger, fresh sausage, breaded meat and meat skewers) and meat-based products (“alheira” and “moura”).

II. MATERIALS AND METHODS

Collection of 75 samples of meat preparations was undertaken, 48 from hypermarkets and 27 from small traditional local shops, 20% were meat-based products, 12% were meatballs and hamburgers, 12% were meat skewers, 8% were breaded meat, 40% were minced meat and 8% were fresh sausage. Samples were collected and transported to the laboratory in refrigeration conditions in 10 minutes. All samples were evaluated for Mesophiles, Enterobacteriaceae, *E. coli*, Lactic Acid Bacteria (LAB), *Pseudomonas* spp., *L. monocytogenes* and *S. aureus*, according to the ISO norms. Data were analysed using SPSS statistical software (SPSS Ver. 29.0; IBM, Chicago, IL, USA). ANOVA one-way was used to evaluate the effect of type of product on microbial counts. Fisher's exact test was performed to find significant differences in its microorganisms' prevalence (P-value <5%).

III. RESULTS AND DISCUSSION

In Table 1 are presented the means and standard deviation for each microorganism detected in each kind of product. It was observed that the higher counts of microorganisms were obtained for Mesophiles and LAB. On the other hand, the levels of *L. monocytogenes* and *S. aureus* were the lowest detected in all samples. The highest values in Mesophiles were obtained in meat skewers, while minced meat registered higher counts of Enterobacteriaceae and LAB. Regarding *Pseudomonas* spp., *E. coli* and *S. aureus*, the most contaminated product was meatballs and hamburgers. Finally, breaded meat presented the highest values concerning *L. monocytogenes*. The differences in microbiological counts between types of products were significant (P<0.05) for Mesophiles, very significant for Enterobacteriaceae (P<0.01) and highly significant (P<0.001) for *Pseudomonas* spp. Regarding the foodstuffs' acceptability (Table 2), no significant differences (P = 0.327) were observed between small local establishments and hypermarkets. However, the hypermarkets registered a higher acceptability (77.1%) compared to small local establishments (66.7%), probably due to the exposure time and manipulation conditions. These results are in line with the study of [1], that reported samples acquired in hypermarkets registered a higher acceptability (81.6%) compared to those obtained in small local

establishments (68.9%). Hamburgers and meatballs registered 77.8% of global acceptability, followed by minced meat (76.7%), meat skewers (66.7%) and meat-based products (46.7%).

Table 1. Microbiological counts (means and standard deviation) for type of product and microorganism.

Type of product	Mesophiles	Enterobacteriaceae	LAB	<i>Pseudomonas</i> spp.	<i>E. coli</i>	<i>S. aureus</i>	<i>L. monocytogenes</i>
Meat-based products	6.06 ^a	1.84 ^b	3.08	0.22 ^c	0.5	nd	0.18
Meatballs and hamburgers	6.19 ^a	2.57 ^{ab}	3.33	2.82 ^a	1.24	0.35	0.04
Meat skewers	6.32 ^a	2.67 ^{ab}	3.14	2.30 ^{ab}	0.9	0.28	0.13
Breaded meat	4.57 ^b	1.86 ^{ab}	2.64	0.85 ^{bc}	0.23	nd	0.2
Minced meat	6.01 ^a	3.79 ^a	4.14	1.35 ^b	0.52	0.21	0.07
Fresh sausage	5.08 ^{ab}	2.03 ^{ab}	3.36	0.60 ^{bc}	0.13	nd	nd
SD	1.09	1.40	1.59	1.02	0.75	0.64	0.29
P-value	0.011	0.004	0.173	<0.0001	0.115	0.502	0.712

For each type of product, means that do not have the same letter, differ significantly ($P < 0.05$). nd – not detected.

Table 2. Global acceptability (number and %) by type of product and type of establishment.

	Meatballs and hamburgers (n=9)	Meat skewers (n=9)	Breaded meat (n=6)	Minced meat (n=30)	Fresh sausage (n=6)	Meat-based products (n=15)	Total (n=75)
Small local establishments	n=9 (n=7/ 77.8%)	n=6 (n=4 / 66.7%)	-	-	n=3 (n=3 / 100%)	n=9 (n=4 / 44.4%)	n=27 (n=18 /66.6 %)
Hypermarkets	-	n=3 (n=2/ 66.7%)	n=6 (n=6/ 100%)	n=30 (n=23/ 76.7%)	n=3 (n=3/ 100%)	n=6 (n=3/ 50%)	n=48 (n=37/ 77.1%)

Besides, and not presented in the previous tables, significant differences of acceptability were only obtained for the Mesophiles levels ($P = 0.039$), with small local establishments showing the lowest percentage of acceptability. These results can demonstrate deficient hygienic practices in meat handling on small local establishments and may also indicate deficiencies in the storage temperatures.

IV. CONCLUSION

The present study concludes that the contents of pathogenic microorganisms (*E. coli*, *L. monocytogenes* and *S. aureus*) were not observed at levels considered unsatisfactory. Regarding Mesophiles levels, this work demonstrated the need for improvements in hygienic meat handling practices and conditions, particularly on small meat retail establishments.

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