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ASSESSING MICROBIAL QUALITY AND ACCEPTABILITY IN MEAT PRODUCTS FROM DIFFERENT RETAIL SOURCES

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I. INTRODUCTION

Meat hold considerable importance in the Portuguese diet, serving as a primary source of essential nutrients. Projections indicate a continued rise in global consumption of these products throughout the 21st century [1]. However, the inherent composition of meat creates a favorable environment for a diverse range of microorganisms. While this microbiota plays a crucial role in the spoilage processes that limit product shelf life, leading to economic losses and environmental concerns, it also presents a significant food safety challenge due to the potential presence of pathogenic strains and the risk of foodborne illnesses [2]. Understanding the factors that influence the microbial quality and consumer acceptability of meat products across different retail types is therefore paramount for ensuring both safety and minimizing waste. This study aimed to assess the effect of retail establishment type in Northern Portugal on the levels of spoilage microorganisms and the consumer acceptability of a range of meat samples.

II. MATERIALS AND METHODS

A total of 126 meat samples were collected from the Vila Real district of Northern Portugal, from hypermarkets and small local establishments. The sample pattern was as follows: 11.9% meat-based products ('alheira' and 'moura'), 34.1% meatballs and hamburgers, 7.1% meat skewers, 11.9% breaded meat, 23.8% minced meat, 4.8% fresh sausages, and 6.3% meatloafs. Samples were collected and transported to the laboratory under refrigeration conditions (0-4°C) in insulated containers with ice packs. Subsequently, all samples underwent microbiological analysis to evaluate total mesophiles at 30ºC, *Enterobacteriaceae*, Lactic Acid Bacteria (LAB) and *Pseudomonas* spp., according to the ISO norms. Data were analyzed using SPSS statistical software (SPSS Ver. 30.0; IBM, Chicago, IL, USA). ANOVA one-way was used to evaluate the effect of type of product and type of establishments 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, followed by LAB, *Pseudomonas* spp., and *Enterobacteriaceae*. Consistent with findings from other studies, mesophiles are often the predominant microbial group isolated from meat [3]. The highest values were obtained in meatloaf for all tested microorganisms, while fresh sausage registered the lowest counts. This results can be attributed to their increased susceptibility to contamination due to processing methods like grinding, which creates a larger surface area and releases nutrient-rich fluids that promote bacterial growth [4]. Statistical analysis demonstrated a highly significant effect of product type on the microbial counts of all analyzed microorganisms ($p < 0.001$).

Table 1 – Microbiological counts (means and standard deviation) for type of product and microorganisms tested.

Microorganisms	Meat products	Hamburgers and meatballs	Meat skewers	Breaded meat	Minced meat	Fresh sausage	Meatloaf
Mesophiles	6.06 ± 1.44	6.68 ± 1.45	6.32 ± 1.13	5.26 ± 1.08	6.01 ± 0.73	5.09 ± 0.85	7.18 ± 0.60
Enterobacteriaceae	1.84 ± 2.55	3.4 ± 1.19	2.67 ± 1.86	2.47 ± 1.15	3.79 ± 1.27	2.03 ± 0.37	3.91 ± 0.47
LAB	3.08 ± 2.37	4.87 ± 1.55	3.14 ± 1.89	3.66 ± 1.35	4.14 ± 0.96	3.36 ± 0.77	6.08 ± 0.83
Pseudomonas spp.	0.22 ± 0.7	6.05 ± 2.15	2.30 ± 1.75	3.96 ± 2.82	1.35 ± 1.31	0.60 ± 0.73	6.86 ± 1.02

Figure 1 illustrates the overall product acceptability categorized by the type of establishment. Statistical analysis revealed a highly significant effect of product type on microbial counts ($p < 0.001$), with fresh sausage registering the highest acceptability and meatloaf the lowest. Mesophiles exhibited the lowest acceptability, with only 69.84% of samples being acceptable, as shown in the figure below. In contrast, LAB recorded the highest acceptability, with 97.62% acceptable meat samples. Furthermore, the type of establishment had a statistically significant effect on overall acceptability ($p \leq 0.05$), with hypermarkets achieving an acceptability of 66.22% and small local establishments 48.08%, likely influenced by differences in exposure time and handling conditions.

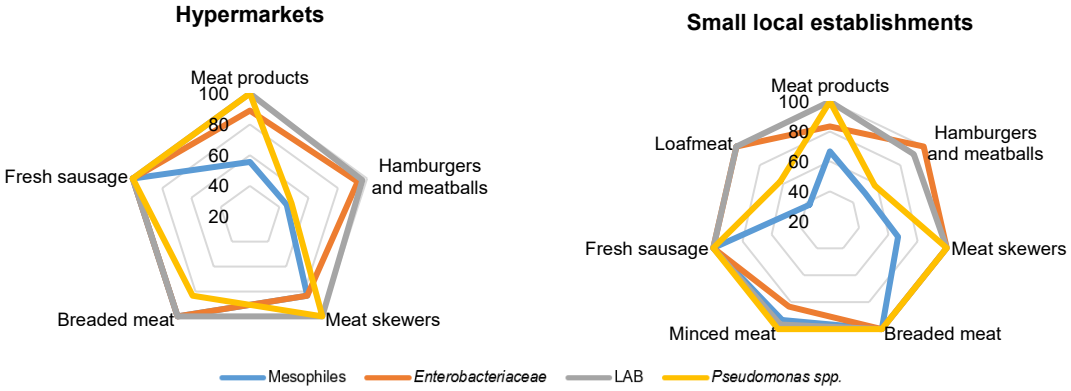


Figure 1. Results of the global acceptability (%) in hypermarkets and small traditional local shops.

IV. CONCLUSION

In conclusion, this study highlights the influence of the retail environment on the microbiological quality and acceptability of different meat products in Northern Portugal. While mesophilic counts indicated a general need for improved hygienic practices across the sector, the statistically significant differences observed between hypermarkets and small local establishments suggest that factors inherent to these settings, such as handling and storage, significantly impact microbial loads. These findings underscore the importance of targeted interventions, particularly within small local establishments, to enhance food safety standards and ensure a consistently high level of quality for meats, regardless of where they are purchased.

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