

# RELEVANT PARAMETERS RESPONSIBLE FOR THE DURABILITY OF VACUUM-PACKAGED COOKED SAUSAGE - INITIAL MICROBIAL LOAD, WATER ACTIVITY, AND STORAGE TEMPERATURE

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## I. INTRODUCTION

Vacuum-packaged cooked sausages are one of the most produced meat products, being crucial to the economy of several countries around the world [1]. The growth of ropy slime-forming bacteria is a common defect in vacuum-packaged meat products and cause the product rejection before the expiry date prescribed by the manufacturer [2]. As a strategy to mitigate it, food industries add preservatives and change the sausages' recipe or use more severe parameters during the cooking process to obtain a more effective microbial lethality. However, those alternatives partially hurdle microbial growth, and heat-resistant groups, such as clostridia and *Bacillus*, remain in the product [3]. This study aimed to investigate the impact of three factors contributing to the spoilage of vacuum-packaged cooked sausages: storage temperature, initial microbial load, and aw.

## II. MATERIALS AND METHODS

Samples, totalling 115 packages (n = 5 packages per group) for microbiological trial and 69 packages (n = 3 packages per group) for physico-chemical analyses, were obtained from meat industries (N = 23) located in the Southeastern region of Brazil. An AcquaLab Lite device (Decagon, Washington, USA) was used for aw measurements. The microbial growth predictor named MicroLab\_ShelfLife was used to perform the durability study. Multiple Factor Analysis (MFA) was used to simultaneously evaluate variables' effects (initial microbial load, temperature fluctuation profile for each season, and aw) on sausages' durability. Similarities and discrepancies among the samples were grouped by Agglomerative Hierarchical Clustering (AHC), using Addinsoft (2019) - XLSTAT statistical and data analysis solution, Boston, USA.

## III. RESULTS AND DISCUSSION

The influence of the combined factors (temperature fluctuation, initial microbial load, and aw) on the durability study was demonstrated in Figure 1. As indicated by the RV

coefficients obtained from the MFA, the durability of vacuum-packaged cooked sausages was mainly affected by the temperature (0.906), followed by the initial microbial load (0.755) and aw (0.624) (Figure 1A). Three clusters of similarity were observed, which were statistically (AHC) classified as C1 (groups #1, #3, #12, #13, and #18), C2 (groups #8 and #17), and C3 (groups #7, #9, #14, #15, and #16) (Figures 1B and 1C).

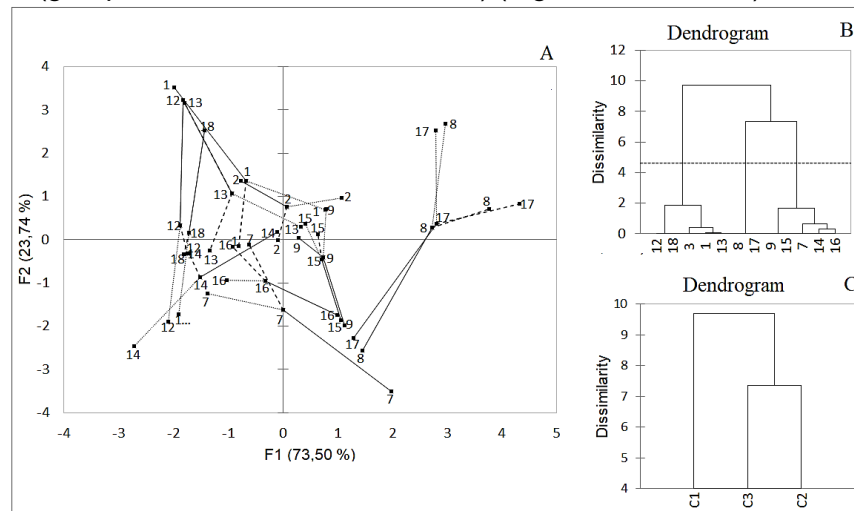


Figure 1. Influence of the temperature fluctuation for each season, initial microbial load, and water activity (aw) on sausages' durability.

The present study demonstrates the relevance of cold chain management during the distribution of sausages, highlighting temperature as a crucial parameter to extend the durability of vacuum-packaged cooked sausages. Thus, summer is the critical period resulting in the product spoilage, especially in tropical climate countries where the average temperature during summer may be close to the optimum temperature for the growth of mesophilic microorganisms [4].

#### IV. CONCLUSION

Temperature is the main factor related to the spoilage of vacuum-packaged cooked sausages. Although none of the evaluated parameters should be neglected, the present study reveals that cold chain management throughout logistic distribution and retention of the products for sale is crucial to avoid product spoilage.

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