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FERMENTATION AND MICROBIOLOGICAL GROWTH IN DRY-FERMENTED SAUSAGES AND THEIR HYBRID ANALOGUES

Garcia-Solivelles, Sara.*; Belloch, Carmela.; Flores, Mónica.

[1] Instituto de Agroquímica y Tecnología de Alimentos, Paterna (Valencia), Spain

*Corresponding author email: saragarsol@iata.csic.es

I. INTRODUCTION

The production of meat analogues is a challenge for the food industry, because of the difficulties to mimic the organoleptic characteristics of the traditional products [1]. The fermentation and drying process, as well as the inoculation of an appropriate microbial starter, are key factors affecting the flavor of traditional dry-fermented sausages. In meat analogues, the sensorial properties are strongly affected by the release of off-flavors from the vegetal ingredients. An acceptable alternative to reduce the consumption of meat, while reducing the effect of the plant ingredients, could be the production of dry-fermented hybrid sausages where part of the animal ingredients is replaced with equivalent ones from plant origin. These dry-fermented hybrid sausages could be produced applying the traditional process and, their overall characteristics could be more similar to the traditional products [2]. The aim of this study was to evaluate the fermentation processes of dry-fermented sausages and their hybrid alternatives by analyzing differences in pH, water activity and microbial counts.

II. MATERIALS AND METHODS

Two formulations of dry-fermented sausages were manufactured, control sausages (C) containing 100 % animal ingredients (pork lean and back-fat), and hybrid sausages (OG) where 50 % of meat batter was replaced by vegetal ingredients (texturized pea protein and sunflower oleogel [3]). Three independent replicates of each formulation were manufactured. A commercial microbial starter TRADI 302 containing *Lactobacillus sakei*, *Staphylococcus carnosus* and *S. xylosus* was added to both formulations. Sausages were fermented and dried in a climatic chamber with controlled temperature and humidity until 30 d and, afterwards, kept under vacuum at 11°C until 42 d. Weight loss was measured daily. Sampling was performed at different stages of the process, initial (0 d), fermentation (6 d) and drying (41 d). Measurement of pH and water activity (aw) was done using a portable pH-meter HI 99163 and an Aqualab 4TEV water activity meter, respectively. Microbial analysis, lactic acid bacteria (LAB) and yeast and molds (Y&M), was done using plate counts [2]. Statistical analysis was done using XLSTAT 2018 software (Addinsoft, Barcelona, Spain) applying a model that included the effect of the vegetal ingredients and the processing time as fixed effects and, the replicates as random effect. Means were compared using the Tukey test.

III. RESULTS AND DISCUSSION

The results showed differences between the control (C) and hybrid (OG) formulations. Differences in drying were observed between the two formulations (Figure 1). OG sausages showed a faster drying rate, reaching 40 % weight losses 9 d before C sausages. Water activity decreased during processing in both formulations, although at 41 d hybrid sausages showed higher aw than C sausages (Figure 2A). This higher aw value in the hybrid formulation could be related to the vegetal protein extraction which involved a preliminary soaking in water of the texturized pea protein [2], which might have affected aw evolution. The evolution of pH along the process was the same in both formulations, decreasing during fermentation and increasing during drying. At the initial stage, the pH value was higher in the hybrid (OG) than in control (C) sausages, but at the end of the process, pH value was lower in hybrid (OG) sausages. A similar microbial evolution, lactic acid bacteria (LAB) and yeast and molds (Y&M), was observed in both formulations during the process (Figure 2B). In general, microbial counts increased from the beginning to the fermentation stage, and these values were maintained along the drying. In case of Y&M, no differences between formulations were found. In case of LAB, higher counts were found in hybrid (OG) than in control (C) formulations. The lower LAB counts in control (C) sausages at the end of the process could be due to the lower water activity value, as reported in Garcia-Solivelles et al. [2].

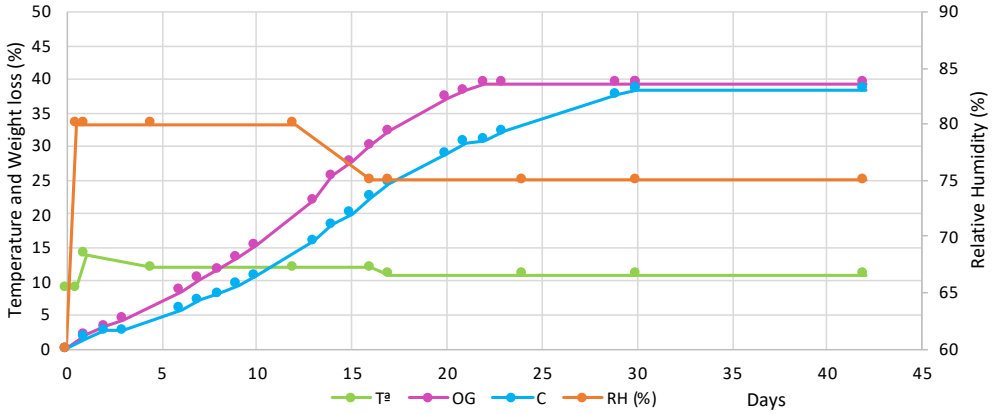


Figure 1. Drying rate (weight losses) of dry-fermented control (C) and hybrid formulations (OG) and chamber conditions (temperature Tª and relative humidity RH).

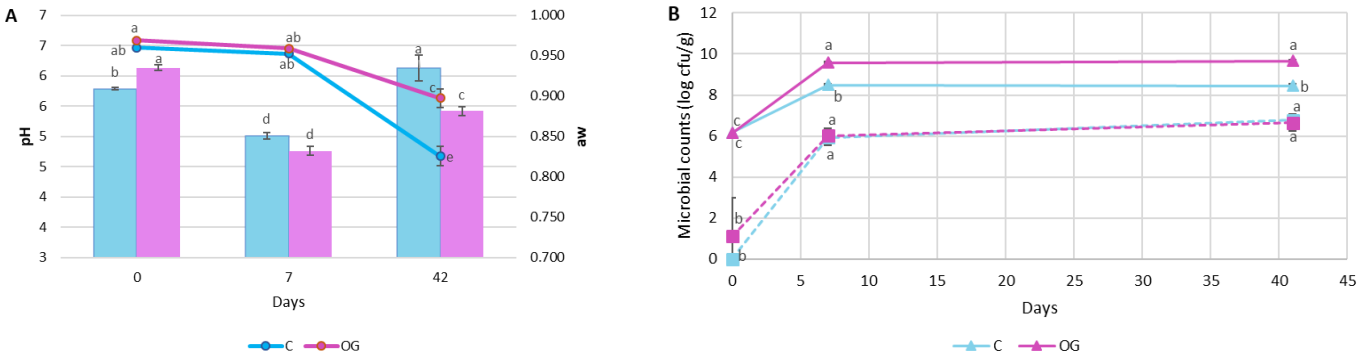


Figure 2. Evolution of pH (bars) and aw (lines) of dry-fermented control and hybrid formulations (A) and microbial growth (B), LAB (lines) and Y&M (dash lines).

IV. CONCLUSION

In conclusion, the faster drying rate observed in hybrid sausages was related to the higher LAB counts and lower pH values reached at the fermentation and drying stages. This could be probably due to the high fermentation susceptibility of vegetal proteins in contrast to pork muscle proteins.

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