POLYSACCHARIDE HYDROGELS WITH OLIVE OIL TO DEVELOP SUSTAINABLE MEAT PRODUCTS WITH A HEALTHIER LIPID CONTENT

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I. INTRODUCTION

The meat sector is currently facing complex challenges, defined by the social requirements of safety, quality and sustainability and a consumer who demands healthier products. In this regard, different strategies have been proposed for incorporation of healthy oils in a gel-like matrix to form oil bulking agents with potential to use as animal fat replacers in meat products [1]. These would contribute to reducing the use of raw materials of animal origin, as part of the current interest in finding new product formulations that meet societal concerns. The aim of this work was to evaluate composition and technological and structural properties, of frankfurters formulated using polysaccharide hydrogels with olive oil as animal fat replacers.

II. MATERIALS AND METHODS

Four different samples were elaborated (Table 1): two controls with pork backfat (PF), normal-fat (NPF) and low-fat (LPF) and two reformulated in which the PF was completely replaced by polysaccharides hydrogels with olive oil (HO) to prepared normal (NHO) and low fat (LHO) frankfurters [2]. Additives added: 2.0 g/100 g NaCl; 0.30 g/100 g sodium tripolyphosphate; 0.012 g/100 g sodium nitrite; and 0.5 g/100g flavouring. HOs were prepared mixing in a homogenizer sodium alginate, $CaSO_4$, sodium pyrophosphate and inulin (2.25%) with water and olive oil [3]. Composition (moisture, ash, protein and fat), technological properties (processing loss (PL), pH, hardness and color) and structural characteristic, using FT-Raman spectroscopic, were determined in all frankfurters [2, 4]. Results were evaluated by ANOVA followed by Tukey's test ($p<0.05$).

Table 1- Formulation [% meat, pork backfat (PF), polysaccharides hydrogels with olive oil (HO), and water] of frankfurters.

Samples*	Meat (%)	PF (%)	HO (%)	Water (%)
NPF	63	21	-	13.19
LPF	63	9	-	25.19
NHO	63	-	32.5	1.69
LHO	63	-	14.0	20.19

*formulated with normal (NPF) and low (LPF) por backfat (PF) content and with polysaccharides hydrogels with olive oil (HO) used as total PF replacers in normal (NHO) and low (LHO) fat content samples. Means ± standard deviation. Different letters in the same column indicate significant differences ($P<0.05$).

III. RESULTS AND DISCUSSION

Moisture ranged between 60.5 to 71.9% and the highest ($p<0.05$) values were observed in low-fat frankfurters (LPF and LHO) according to the formulation (Table 1). Ash contents varied between 2.79 and 4.42%, of which the frankfurters with HO (NHO and LHO) displayed the highest ($p<0.05$) values. Protein content was similar ($p>0.05$) in all frankfurters. Fat content ranged between 9.8 and 20.4%, and the highest ($p<0.05$) values were recorded in normal-fat frankfurters (NPF and NHO) according to formulation (Table 1). All frankfurters showed similar ($p>0.05$) pH values (Figure 1A). When compared,

samples with similar level of fat to those reformulated with HO presented lower ($p<0.05$) PL and higher ($p<0.05$) hardness (Figure 1A). The lowest ($p<0.05$) a* values corresponded to samples with HO (NHO and LHO), while these frankfurters showed the highest ($p<0.05$) b* values. These findings could be attributed to NHO and LHO containing the lowest amount of meat material and highest amount of olive oil, which are related to a more pronounced yellow color. Analysis of the 2800−3025 cm^{-1} region from Raman spectra showed that the lowest $Iv_sCH_2/Iv_{as}CH_2$ value (I2850/I2880 cm^{-1}) (Figure 1B) corresponded to samples reformulated with OH (NHO and LHO). These results indicated more lipid acyl chain disorder which suggests more lipid-protein interactions in frankfurters elaborated with HO as pork backfat replacer. A significant correlation was found between processing loss, hardness and this specific structure. These results are in concordance with previous findings obtained in similar meat products [2].

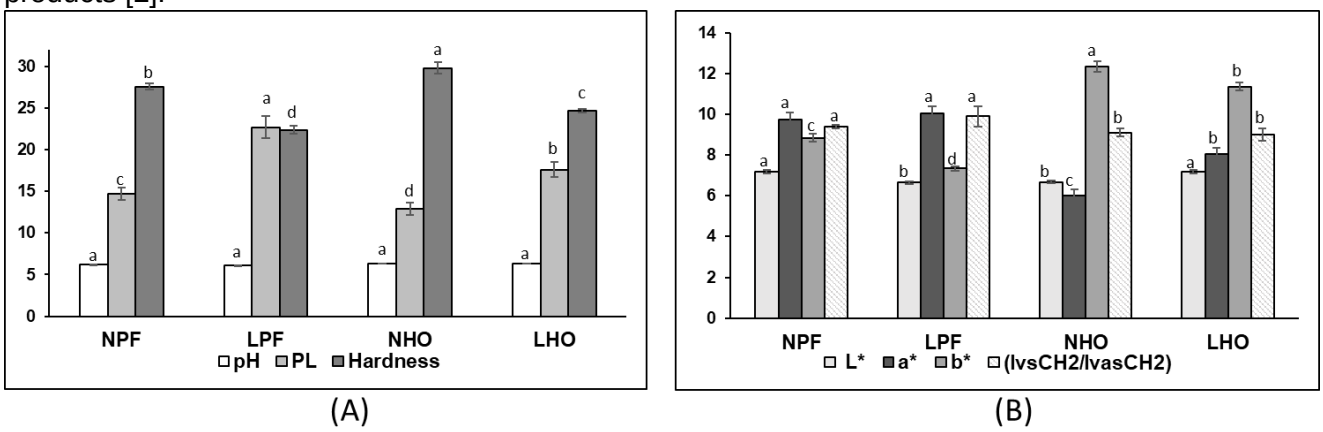

Figure 1. (A) pH values, processing loss (PL) and hardness (B) color parameters (L*/10, a*, b*) and $Iv_{as}CH_2/Iv_sCH_3$ /10 relative intensity from Raman spectra frankfurters. See Table 1 for sample denomination. Different letters in each parameter indicate significant differences ($p<0.05$).

IV. CONCLUSION

The strategy based on using polysaccharide hydrogels with olive oil as an animal fat replacer in frankfurters simultaneously improved their lipid content and reduced the use of meat raw materials, in line with current trends. Besides, this reformulation procedure does not negatively affect technological properties of the final meat product. On the other hand, an interesting relationship was found between protein and lipid interactions and specific technological properties such as texture or processing loss.

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