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EFFECT OF REFRIGERATED STORAGE TIME ON QUALITY CHARACTERISTICS AND MICROBIAL STABILITY OF VACUUM-PACKAGED *"CHORIZOS"* WITH SOY PROTEIN ISOLATE ADDED.

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Background

The past fifteen years have witnessed a change concerning consumer demands towards quality of food as well as a strong development of hyper and supermarkets as the principal means of food marketing. This increased the need of the industry to extend the shelf life of their products from a microbiological standpoint and considering sensory properties and overall appearance.

Chorizo is a typical ground meat product which is manufactured with beef, pork meat and pork fat, additives and spices characteristic for the flavor of this kind of products. Drip loss, observed in vacuum packaged *chorizos*, appears as a critical organoleptic problem. Soy proteins (flours, concentrates and isolates) used as additives in foods, especially in meat products, improve functional properties of the system such as water retention and gelling ability. The greatest objection when using soy proteins are the off-flavors that they generate (Williams and Zabik, 1975). Among the different types, soy protein isolate (SPI) provides the best functional properties while minimizing the off-flavors due to its greater protein content (90-92%) (Pedersen, 1995). A further advantage in the use of soy proteins is the antioxidant activity which some fractions of these proteins have been reported to posess. Romjin et al. (1991), found that addition of 8% SPI had a significant effect on the reduction of the TBA values on a beef system, being the 7S and 9S fractions the principal fractions responsible for this behaviour. It is not clear the effect of the soy protein on the microbial safety of meat products. It would be expected the soy protein added meat products to have a lower shelf life than all-meat products due to the high pH of soy protein and its nutrient contribution for the growth of microorganisms. Several authors reported a faster growing rate of spoilage bacteria in ground beef products with 20% of soy protein added (Keeton and Melton, 1978; Harrison et al., 1981) while Liu et al. (1991) found no differences in microbial load in soy-beef patties compared with all beef patties.

Objective

To investigate the effect of refrigerated storage time on quality characteristics of vacuum packed *chorizos* with SPI added.

Methods

For the production of *chorizos*, boneless beef and pork arm clod *(T. Brachii, Deltoideus)* and pork fat were used. Meat cuts were trimmed of fat prior to the grounding of the ingredients. The formulation of the control samples consisted of 27% beef meat, 22 % pork meat, 28% pork fat and crushed ice. All the additives utilized accounted for the 3% of the formulation. The percentage of ice added was adjusted in order to obtain the amount of drip loss observed in commercial products of this kind, resulting in 20% for all formulations. Lean meat ingredients and pork fat were ground through a 7 mm hole plate, using a Hobart Model T215 GA chopper and were mixed with 2% sodium chloride, 0.5% trisodium poliphosphate, 0.02% sodium nitrite, 0.05% sodium erythorbate, 0.1% white pepper, 0.03% powder hickory nut, 0.1% powder soft chili and 0.2% garlic flakes. Samples treated with SPI followed the same formulation as the control. 2.5% SPI (Cordis SRL, Argentina) was added together with the additives. All the ingredients were mixed for 3 minutes and introduced in 38-40 mm natural pork casings. During the whole process temperature was controlled in order to be kept under 5°C. The samples were kept at 1-2°C for 24 hours, and were weighed before vacuum packing (MULTIVAC) in cryovac bags (GRACE, Argentina). Samples weighing 160 g approximately were packaged one per bag and stored at 1-2 °C for 16 days.

Drip loss (DL) was determined daily at days 1 to 5 and at days 8, 11 and 14 after vacuum packing, by weighing the samples and calculated as the mass loss during the storage time after packing. pH and proximate chemical analysis for fat, proteins and moisture were determined in duplicate according to AOAC (1984). The a_w values were measured using an a_w -meter (Novasina, TH2/RTD-33/BS) at 25°C. TBA was performed in triplicate at days 0, 5, 8, 11 and 14 according to the modified Witte procedure (Pensel, 1990).

Aerobic plate counts (APC), *Enterobacteriaceae* and *Lactobacillus* were determined at each storage interval according to APHA, 1992 (American Public Health Association).

For sensory evaluation, samples were cooked for 30 minutes at 165°C oven temperature. A trained seven-member panel evaluated flavor at the different storage intervals. A nine-point hedonic scale was utilised for chorizo flavor intensity 9 = extremely intense 0 = extremely bland. Paired test was used. Training consisted in four sessions where the panellists were served samples without soy protein addition and samples with different concentrations of SPI: 5, 7.5 and 10%. Triangle Test and paired test were performed. Samples were randomly served to panellists, in individual booths under green lights in order to mask colour and textural differences.

Data were subjected to Analysis of Variance (Statistical Analysis System, Release 6.12, SAS Institute Inc., Cary, NC, USA.) for evaluations of chemical and physical observations. T-Test (SSPS Package) was performed for differences in *chorizo* flavor intensity between treatments, within days. Least Significant Difference was used for multiple comparisons for sensory attributes. Three samples were randomly selected at each storage interval for all chemical and physical analysis.

Results and Discussions

Formulations with (SPI) added had significantly lower drip loss than the control samples at each storage interval studied ($p<0,05$). Furthermore *chorizos* with SPI did not increase drip loss significantly during the 14 days whereas for control samples this effect was significant from day 1 to day 14 as shown in Table 1. The lower drip loss of SPI added samples confirms the ability of SPI to absorb and retain water.

Table 2 shows *chorizo* flavor intensity scores obtained during sensory evaluation. *Panelists* detected differences ($p<0.05$) between control samples and samples with SPI added for *chorizo* flavor intensity at days 0 and 5 but found no significant differences at days 8, 11 and 14 (Table 2). Matulis et al. (1995), have found a decrease in flavor intensity when increasing soy protein addition on frankfurters up to 3%. However, these results were not evaluated at different time intervals, nor the product formulation is identical.

Significant differences ($p<0.05$) were observed for protein content being higher for *chorizos* with SPI added (12.7%) compared to control samples (10.3%). No differences were observed related to moisture and fat content (data not shown). The addition of SPI did not increase pH significantly ($p>0.05$) compared to the control samples. On the other hand, pH values decreased significantly ($p<0.05$) as storage time increased as it is shown in Table 2. Also, Table 2 shows the TBA values obtained for control and SPI-added

samples as a function of time. The TBA analysis of variance showed that the interaction between treatment and storage time was significant ($p<0.05$). For each treatment, the TBA values increased as the storage time increased. These results agree with those of Chen and Ockerman (1995), who found a significant interaction between storage time and treatment with 2% SPI on TBA values of Chinese pork meat balls. The a_w values for control and treated samples were 0.977 and 0.973 respectively, being the difference not significant. Katsaras and Peetz (1994), evaluated water activity of bologna-type sausages with addition of up to 2% soy protein isolate and found no differences among treatments. No differences were found between untreated samples and SPI-added ones as regards APC, *Enterobacteriaceae* and *Lactobacillus.* For both control (Figure 1) and SPI samples, *Enterobacteriaceae* and APC did not increase markadely from day 0 to day 5; on the other hand *Lactobacillus* increased 1 log CFU/g in this period, which would indicate a better adaptation to oxygen restriction and refrigerated storage. At 8 and 11 days of storage, APC and *Lactobacillus* increased, inhibiting *Enterobacteriaceae* growth, which according to our results remained in the lag phase. At days 14 and 20 APC and *Lactobacillus* kept growing whereas *Enterobacteriaceae* continued in the same values.

Conclusions

SPI added chorizos maintained high organoleptic properties during its shelf life. Results indicate that SPI may be used for *chorizos* to improve overall appeareance and acceptability during refrigerated storage time.

References

APHA. 1992. Compendium of Methods for the Microbial Examination of Foods. American Public Health Association. Third Edition. Washington DC

Chen, P.H. and Ockerman, H.W. 1995. Effect of carrageenan, whey protein concentrate, isolated soy protein and microcrystalline cellulose on the chemical, physical and sensory quality of refrigerated or frozen reduced fat chinese pork meat balls.

Katsaras, K. And Peetz,P. 1994. Soy Protein. Effects on the technological and morphological properties of bologna-type sausage. Fleischwirtsch. 74 (8), 839-842.

Keeton J.T. and Melton, C.C. 1978. Factors associated with microbial growth in ground beef extended with varying levels of textured soy protein. J. Food Sci. 43, 1125.

Liu, M.N.; Huffman, D.L.; Egbert, W.R.; Mc Caskey, T.A. and Liu, C.W. 1991. Soy protein and oil effects on chemical, physical and microbial stability of lean gound beef patties. J. Food Sci. 56 (4), 906-912.

Ockerman, H.W. 1985. Quality control of post mortem muscle tissue (1): meat and additives analysis. Department of Animal Sciences, The Ohio State University, OH 43210.

Pensel, N.A. Thesis. Influence of experimental conditions on porcine muscle and its effect on oxidation. The Ohio State University. 1990.

Romjin, A.; Cuppett, S.L.; Zeece, M.G.; Parkhurst, A.M.; Lee, M.L. 1991. Impact of soy protein isolate and specific fractions on rancidity development in a cooked refrigerated beef system. J. Food Sci. 56 (1) 188-190.

Williams and Zabik, 1975. Quality characteristics of soy - Substituted ground beef, pork, and turkey meat loaves. J. Food Sci. 40,502

Table 1: Effect of refrigerated storage time on drip loss of vacuum packed *chorizos*

	Drip Loss					
	Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 11**	**Day 14**
Control	1.08^{b2}	1.16^{b2}	1.45^{c2}	1.98^{d2}	2.37^{f2}	2.5^{f2}
SPI	0.16^{a1}	0.19^{a1}	0.18^{a1}	0.23^{a1}	0.33^{a1}	0.28^{a1}

$^{a-f}$ Means in the same row with different superscript are significantly differentl ($p<0.05$)

$^{1-2}$ Means in the same column followed by different numbers are significantly different ($p<0.05$)

Table 2: Influence of storage time and soy protein addition as measured by pH and TBA.

	Day 0		Day 5		Day 8		Day 11		Day 14	
	Control	**SPI**	**Control**	**SPI**	**Control**	**SPI**	**Control**	**SPI**	**Control**	**SPI**
pH	6.20	6.22	6.23	6.26	6.21	6.24	6.10	6.04	5.88	5.96
TBA	0.084	0.102	0.152	0.078	0.203	0.141	0.190	0.141	0.220	0.194
Flavor	8.14^{1a}	6.14^{*b}	8.07^{1a}	5.93^{*b}	6.04^{2b}	6.11^{*b}	6.57^{2b}	$7.71^{\#b}$	6.43^{2b}	6.07^{*b}

^{ab} Means followed by different letters within days are significantly different ($p<0,05$).

$^{*\#12}$ Means followed by different superscripts for control samples and for SPI samples in time, are significantly different ($p<0,05$).

Figure 1: Microbiological determinations on control samples.