PHYSICO-CHEMICAL CHARACTERIZATION OF FRESH SAUSAGE ENRICHED WITH DIFFERENTE PROTEINS

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Abstract – The effect of different source of protein on physico-chemical parameters of sausages (chemical composition, color and pH, WHC and texture values) was examined. A total of fifteen fresh sausages [control (soybean protein) and modified batches (pea and seaweed proteins)] were used in this study. The pH values, protein and ashes content were significantly (*P*<0.05) affected by protein source. On the other hand, sausages manufactured with seaweed showed the lowest L* (50.12, 52.67 and 33.96 for control, pea and seaweed groups, respectively) and a* (22.84, 22.16 and 0.59 for control, pea and seaweed groups, respectively) values. Finally, WHC did not influence by protein source, whereas the lowest hardness values were observed in seaweed batch.

Key Words – Textural parameters, pea, *Chlorella* seaweed, color, chemical composition

I. INTRODUCTION

Proteins are one of the macronutrients group in food and play an important role [1]. According to World Health Organization (WHO), the intake of protein is 0.8 g/Kg for females and 0.85 g/Kg for males per day in adults. This quantity could be increase in population groups with major need for protein as sportsmen and seniors [2]. In addition, the functional protein and bioactive peptides are very important from the point of view of the healthy properties for having different biological effects. In the diet it is recommended to combine animal and vegetable proteins which have specified bioactivity [3]. Therefore, the aim of this study was to evaluate the physico-chemical parameters of fresh sausage manufactured with protein from soybean, pea and seaweed (*Chorella)*.

II. MATERIALS AND METHODS

A total of 15 fresh sausages were manufactured: 5 control (1% soybean protein), 5 pea (1% pea protein) and 5 seaweed (1% *Chlorella* protein). The other ingredients used were: lean and far pork (83.93%), water (12.94%), potato starch (1.01%), vegetable fiber (1.01%) garlic (0.10%) and oregano (0.004%). The pH values (digital portable pH-meter equipped with a penetration probe), color parameters (portable colorimeter to estimate meat colour in the CIELAB space), chemical composition, water-holding capacity (WHC) and textural profile analysis (TPA) were determinated according to Pateiro *et al.* [4]. ANOVA of one way using SPSS package (SPSS 19.0, USA) was performed and LSM were separated using Duncan's t-test ($P < 0.05$).

III. RESULTS AND DISCUSSION

The physico-chemical parameters of the three sausage batches are shown in Table 1. In all cases, the pH values were within an acceptable range and showed similar values than determined by other authors [5] in Toscana sausages samples. There were statistical differences among groups on pH values, since the sausages manufactured with *Chlorella* presented the lowest pH values. With regard to color parameters, luminosity (L*) and redness (a*) values were higher in control and sausages manufactured with pea protein than those found in sausages elaborated with *Chlorella* protein. In addition, redness values from seaweed sausages were close to zero which indicates that samples are green color [6].

The results from chemical composition showed significant differences ($P < 0.05$) on protein and ashes content. Results of water and IMF obtained were similar to those determined in Toscana sausages [7], ranging from 62.5 to 67.5% and from 12.2 to 19.6%, for water and IMF values, respectively. Concerning protein and ashes content, the lowest values were noticed in fresh sausages elaborated with pea protein (15.4, 14.68 and 15.32% for control, pea and seaweed groups, respectively) for protein content and (2.97, 2.83 and 2.93% for control, pea and seaweed groups, respectively) for ashes values. These values were in the range that those reported by other authors in previous studies [7,8].

WHC has a great importance in the final value of the meat and in the consumer acceptance. We found that different sources of proteins did not affect the cooking losses of fresh sausages. All textural parameters obtained from TPA test were significantly (P>0.001) influence by protein source. In this regard, hardness values showed significant (P < 0.05) differences among three groups, since the highest hardness values were observed in control group (32 N) followed by sausages manufactured with pea (24.1 N) and sausages elaborated with seaweed (21.5 N).

Table 1.- Effect of source protein on physico-chemical parameters of fresh

	Control	**Pea**	***Chlorella***	**SEM**	**SIG**
pH	6.06	6.04	5.98	0.01	*
Color parameters					
Luminosity (L*)	50.12	52.67	33.96	2.26	***
Redness (a*)	22.84	22.16	0.59	2.77	***
Yellowness (b*)	13.48	13.7	11.8	0.41	n.s.
Chemical composition (%)					
Moisture	64.71	64.23	64.56	0.37	n.s.
IMF	12.11	14.75	14.01	0.52	n.s.
Protein	15.4	14.68	15.32	0.10	**
Ashes	2.97	2.83	2.93	0.02	*
WHC					
Cooking loss (%)	3.98	3.64	4.34	0.13	n.s.
TPA test					
Hardness (N)	32	24.1	21.5	1.30	***
Springiness (mm)	0.83	0.81	0.71	0.02	***
Cohesiveness	0.35	0.33	0.28	0.01	***
Gumminess (N)	11.3	8.10	6.10	0.60	***
Chewiness (N·mm)	9.40	6.50	4.30	0.60	***

SEM: Standard error of the mean
SIG: Significance: *** (P<0.001), ** (P<0.01), * (P<0.05), n.s. (not significant)

IV. CONCLUSION

The results obtained in this work showed that physico-chemical parameters of fresh sausages were affected by the inclusion of pea and seaweed proteins. The use of pea protein did not show significant differences on pH and color parameters, whereas the inclusion of *Chorella* modified both parameters. Thus, the addition of pea protein could be interesting to elaborate new food including functional protein and bioactive peptides.

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