VALORIZATION OF LOW COMMERCIAL VALUE PORCINE SPLEEN PROTEINS FROM SLAUGHTERHOUSE

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I. INTRODUCTION

This work is part of a project that aims to develop systems to maximize the use of low commercial value porcine co-products from industrial slaughterhouses as a source of proteins of high biological value and ingredients with technological functionality. The offal of slaughtered animals represents 7-17% of their live weight. An efficient utilization of animal co-products and by-products has an important role in the profitability of the meat industry [1]. Spleen is an edible meat by-product from industrial slaughterhouses with a low commercial value that it is generally underutilized. Porcine spleen contains about 17% protein with high biological value, similar to meat and blood [2]. In a previous work, the extraction conditions to obtain protein fractions from porcine spleen were evaluated as function of pH and salt concentration of the extraction buffer [3].

The main objective of this study was assessing the application of porcine spleen-based protein ingredients in meat products such as emulsified cooked pork meat sausages in substitution of soy protein or sodium caseinate.

II. MATERIALS AND METHODS

Two protein fractions -solubilized and insoluble fraction- were obtained from porcine spleens supplied by an industrial slaughterhouse. The soluble protein fraction was spray dried at 140 °C whereas the insoluble fraction was minced and frozen at -20 °C until use.

The proximate composition (moisture, protein, fat, and ash content) of both fractions was determined. Secondly, proofs of concept based on the application of the spray dried soluble protein fraction and raw insoluble protein fraction in substitution of sodium caseinate and soy protein, respectively, were carried out in emulsified cooked meat products such as *mortadella* and *frankfurter* type sausages. Three trials consisting of a pilot scale production of each pork meat sausages were carried out. Each trial consisted on the production of two batches of control and test formulation. The chemical composition, internal colour through CIE L*a*b* parameters, texture attributes by texture profile analysis (TPA), and water holding capacity (WHC) of cooked pork meat sausages with spleen-based ingredients were compared with control ones based on a standard formulation [4].

Data were subjected to analysis of variance (ANOVA) using the IBM SPSS Statistics version 23.0 for Windows (SPSS Inc., Chicago, IL, 2015). The significance level for all tests was established at $P < 0.05$.

III. RESULTS AND DISCUSSION

Table 1 shows the proximate composition of protein fractions from porcine spleen.

Table 1. Proximate composition of protein fractions from porcine spleen (means ± SD, n=5).

	Spray dried soluble spleen protein	Raw insoluble spleen protein
Moisture (%)	6.28 ± 0.22	75.26 ± 0.23
Protein (%)	63.55 ± 0.20	24.7 ± 0.8
Fat (%)	11.10 ± 0.22	1.12 ± 0.21
Ash (%)	8.81 ± 0.91	0.85 ± 0.09

The effects of replacing soy protein or caseinate by porcine spleen-based protein ingredients in emulsified cooked pork meat sausages are shown in Table 2. The results show that using spleen protein concentrates did not significantly (P< 0.05) affect the general characteristics of the sausages.

Table 2. Proximate composition, colour, TPA parameters and water holding capacity (WHC) of emulsified cooked pork meat sausages based on standard formula (control) or with spleen protein fractions (means ± SD, n=3).

	Mortadella type sausage		*Frankfurter* type sausage	
	Soy protein (control)	Insoluble spleen protein	Sodium caseinate (control)	Spray dried soluble spleen protein
Moisture (%)	64.09 ± 0.78	64.26 ± 0.71	64.96 ± 2.0	63.85 ± 1.70
Protein (%)	11.10 ± 0.30	11.7 ± 0.80	10.81 ± 0.36	10.86 ± 0.33
Fat (%)	21.24 ± 0.94	20.27 ± 0.48	22.26 ± 1.15	24.08 ± 1.46
Ash (%)	2.30 ± 0.19	2.06 ± 0.21	1.89 ± 0.24	1.43 ± 0.39
Internal colour				
L*	74.28 ± 1.65	74.21 ± 1.22	69.30 ± 2.14 [a(*)]	58.78 ± 1.55 [b]
a*	9.66 ± 0.67	9.46 ± 1.00	6.46 ± 0.30 [b]	11.12 ± 0.62 [a]
b*	9.57 ± 0.68	9.81 ± 0.70	9.07 ± 0.17 [b]	11.88 ± 0.72 [a]
Texture				
Hardness (N)	16.64 ± 0.50	16.99 ± 0.59	17.07 ± 1.01	16.50 ± 1.38
Adhesiveness (N s)	-0.72 ± 0.06	-0.79 ± 0.18	-0.92 ± 0.10	-1.11 ± 0.17
Elasticity	0.79 ± 0.01	0.77 ± 0.02	0.79 ± 0.02	0.78 ± 0.01
Cohesiveness	0.57 ± 0.01	0.58 ± 0.04	0.61 ± 0.02	0.58 ± 0.02
Masticability	7.60 ± 0.33	7.66 ± 0.81	8.15 ± 0.30	7.47 ± 0.63
WHC (% on total moisture basis)	79.88 ± 1.70	82.30 ± 3.61	71.54 ± 4.78	68.70 ± 5.76

(*) Different letters indicate significant differences between treatments (P < 0.05).

IV. CONCLUSION

Protein fractions from porcine spleen were successfully applied as technofunctional ingredients in meat products models replacing soy protein or sodium caseinate. Recovery and extraction of technofunctional proteins from porcine spleen will allow the valorization of an underused co-product of the meat industry.

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