71st ICoMST
GIRONA - CATALONIA - SPAIN
3rd-8th August - 2025

VALORIZATION OF A PROTEIN FRACTION FROM PORCINE SPLEEN

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I. INTRODUCTION

Nowadays, there is increasing interest in developing strategies for the efficient and sustainable use of animal by-products since they are a good source of valuable proteins. This work is framed in a project entitled "Functionalization of alternative proteins by the application of dynamic homogenization technologies and ultrasounds". The primary objective of the project is to identify strategies for enhancing the functionality of proteins that are not commonly consumed, using dynamic homogenization technologies such as Ultra High Pressure Homogenization (UHPH), and Ultrasound (US), which induce structural modifications that impact the techno-functional properties.

The offal of slaughtered animals represents 7-17% of their live weight. An efficient utilization of animal co-products and by-products plays a significant role in the profitability of the meat industry [1], either as a source of high-quality protein or as food ingredient with technological functionality [2]. Spleen is an edible meat co-product from industrial slaughterhouses. Due to its low commercial value it is generally underutilized. Porcine spleen contains about 17% protein with high biological value, similar to meat [3]. In a previous study, the optimal extraction conditions for obtaining protein fractions from porcine spleen were evaluated [4]. Furthermore, the applicability of porcine spleen-based protein ingredients as meat replacers [5] or potential substitutes of functional agents (sodium caseinate or soy protein) [6] in cooked emulsified meat products was also determined.

The aim of this study was the physico-chemical characterization and the evaluation of some techno-functional properties of a spray-dried protein fraction from porcine spleen, as a basis for further elucidation of the modifications induced by the application of US and UHPH technologies.

II. MATERIALS AND METHODS

The production of porcine spleen protein concentrate (SPC) followed the method established in a previous study [5]. Porcine spleens were polished by removing the fat and the splenic artery and vein. They were then cut into several small portions and minced using a cutter. The soluble protein fraction was extracted by mixing the ground spleen with sodium citrate buffer (0.1 M, pH 5) at a ratio of 1:0.5 w/v in a cutter at 400 rpm for 30 min. The resultant product was separated by centrifuging at 20,000 x g for 15 min at 20 °C. The soluble extract was directly dehydrated at 140 °C by spray drying in a BUCHI Mini Spray Dryer.

The proximate composition (moisture, protein, fat, and ash content) was determined according to official AOAC methods [7]. The water activity was determined using Novasina equipment; and the color evaluation was assessed with a Minolta colorimeter and expressed in the CIE L*a*b* color space. Protein solubility at pH 5 and pH 7 was determined according to Paiva Gouvêa et al. [8]. Water and oil holding capacities (WHC and OHC) were carried out as described by Gundogan and Karaca [9]. Gelling properties were determined as described by Boye et al. [10], with the least gelling concentration (LGC) of the protein concentrate defined as the minimum concentration required to form a firm gel.

III. RESULTS AND DISCUSSION

Table 1 shows the proximate composition of protein fraction from porcine spleen. The water activity value at 25 °C was 0.328 ± 0,064, indicating good microbiological stability.

Table 1. Proximate composition of protein ingredient from porcine spleen (means ± SD, n=6).

	Spray-dried spleen protein
Moisture (%)	6.38 ± 1.80
Protein (%)	63.57 ± 1.47
Fat (%)	10.75 ± 0.79
Ash (%)	9.53 ± 0.15

The colour parameters and some techno-functional properties of the ingredient are shown in Table 2. The spleen protein powder showed a light pink colour and good water and oil holding capacities. The protein solubility was higher than 80% at pH 7, although it decreased to values around 50% at pH5.

Table 2. Colour parameters and techno-functional properties of spray-dried spleen protein ingredient (means ± SD, n=3).

CIE colour parameters		Techno-functional properties	
L* (lightness)	71.85 ± 0.85	Solubility (%) - pH 7	85.13 ± 5.48
a* (redness)	11.71 ± 1.47	Solubility (%) - pH 5	50.91 ± 1.40
b* (yellowness)	16.60 ± 0.62	WHC (g/g)	2.43 ± 0.16
C* (Chroma)	20.33 ± 1.24	OHC (g/g)	2.08 ± 0.03
H (Hue)	54.92 ± 2.84	LGC (% protein, w/v)	2.33 ± 0.58

WHC: water holding capacity; OHC: oil holding capacity; LGC: least gelling concentration.

IV. CONCLUSION

The results highlight the technological potential of porcine spleen protein extracts for applications in the food industry. This initial characterisation is key to assessing the suitability of different technologies (US and UHPH) for functionalising underutilised proteins. This represents a valuable opportunity for the recovery and transformation of meat co-products into functional ingredients with high added value, in line with the criteria of the circular bio-economy.

ACKNOWLEDGEMENTS

This research was supported by FUNALPRO project (reference number PID2023-150303OB-I00), funded by the Spanish Ministry of Science, Innovation and Universities (MICIN/AEI/10.13039/501100011033) and by ERDF/EU. The authors also acknowledge Spanish Ministry of Universities for financing E. Ramon's studies (grant number 2024-COLAB-00093) and Norfrisa S.A. (Girona, Spain) for the porcine spleen samples.

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