

EFFECT OF PARTIAL REPLACEMENT OF PORK FAT WITH HEALTHIER OILS ON THE PHYSICOCHEMICAL OF DRY-RIPENED SAUSAGE OF CACHENA BREED

Borrajo, P.¹, Gómez, B.¹, Pérez-Santaescolástica, C.¹, Carvalho, F.A.L.², Bis-Souza, C.V.³, Barretto, A.C.S.³, Domínguez, R.¹, Pateiro, M.¹, Franco, D.¹, Lorenzo, J.M.^{1*}

¹Centro Tecnológico de la Carne de Galicia, rúa Galicia nº4, Parque Tecnológico de Galicia, San Cibrao das Viñas, 32900, Ourense, Spain, ²Department of Food Engineering, College of Animal Science and Food Engineering, University of São Paulo, 225 Duque de Caxias Norte Ave, Jardim Elite, postal code 13.635-900, Pirassununga, São Paulo, Brazil, ³Meat and Meat Products Laboratory, Department of Food Technology and Engineering, UNESP – São Paulo State University, Street Cristóvão Colombo, 2265, Zip Code 15054-000, São José do Rio Preto, SP, Brazil.

*Corresponding author email: jmlorenzo@ceteca.net

I. INTRODUCTION

Nowadays, obesity and cardiovascular diseases are changing food consumption habits; these changes have fostered the development of products with functional ingredients that meet the market demands for maintaining a healthy body [1]. Sausage elaboration consists in a mixture of chopped meat (beef, beef/pork or beef), lard, salt, different additives (nitrite, nitrate, antioxidants, etc.), spices and starter cultures [2], which have been stuffed into casings, fermented and dried. The most important constituent of the fermented sausages is the fat due to its influences on the texture and flavour of the final product [3]. On the other hand, olive oil is the main source of fat of the Mediterranean diet. It is a principally source of highly-nutritive fatty acids and of hundreds of prime-antioxidant micronutrients, as carotenes, vitamin E, phenol compounds, and squalene. It also contains around 3.5-21% linoleic and 55-85% oleic acid [4]. Canola oil is characterised by its lowest SFA level and an excellent omega-6/omega-3 ratio among the vegetable oils and by its higher ratio (UFA/SFA) compared with animal fats so it is attributed several healthy benefits [5]. Therefore, in recent years, these trends in health and lifestyle have been focused on reducing the consumption of animal fats [6]. Thus, the aim of the present study was to investigate the effect of fat replacement by olive and canola oils on the physico-chemical properties of dry-ripening sausage of Cachena breed.

II. MATERIALS AND METHODS

Elaboration of Prosella gels are carried out the day before of the preparation of sausages. Water and olive oil (batch 2), water and canola oil (batch 3) were mixed for one minute in a bowl cutter (Sirman, mod C15VV, Marsango, Italy) at room temperature. Then, the Prosella VG NF4 gel (Colin Ingrédients) was added and homogenized during 3 min and put in a bowl. After 2 hours, the mix was jellified and was vacuum packed and kept refrigerated at 4 °C until it was used. Cachena lean, pork fat, commercial sausage preparation (542 salchichón without E-124, Ceylamix, Valencia, Spain) and (only in batches 2 and 3) Prosella gel with different oils were minced (TOP-114, Barcelona Spain) through a 12 and 8 mm diameter mincing plate at 2–4 °C and vacuum mixed (Fuerpla, mod OA 85, Valencia, Spain). Different amounts of canola and olive oil were added and mixed in the corresponding batch. The mix was maintained at 4°C for 24 h and then was stuffed into natural bovine casings (50-55 mm diameter) with vacuum filling machine (Sia, mod Junior, Barcelona, Spain), reaching a final weight of around 400 g. The sausages were fermented for 1 days at 20 °C and 80% relative humidity (RH) and then transferred into a drying-ripening chamber where they were kept for 32 days at 11-13°C and 75% RH. Eight replicates of each batch were taken for the analyses. Physicochemical, colour and textural properties were evaluated following methods described by Fonseca *et al.* [3]. The effect of different fat source on physicochemical properties was examined using a one-way ANOVA, with IBM SPSS Statistics 23 software package.

III. RESULTS AND DISCUSSION

Statistical analysis did not show significant differences ($P>0.05$) on protein and fat content, presenting mean values of 30.82 and 26.68% for protein and fat, respectively. On the other hand, moisture content decreased with the presence of both oils regardless the type (30.03 vs. 28.37 and 28.32% for control, olive and canola

groups, respectively). This finding is in agreement with data reported by Lorenzo et al. [1] who observed higher values in control group. Regarding ash content, modified sausages presented higher values compared to control batch. A similar trend was found by Lorenzo et al. [1] who studied the effect of the partial replacement of pork backfat by encapsulated fish oil in konjac glucomannan matrix on physico-chemical properties of fermented sausages. The lower TBARS values observed in olive oil were caused by antioxidant compounds and high content of monounsaturated fatty acids [7], whereas the addition of canola oil incremented slightly the lipid oxidation. Replacement of fat by oils had a significant effect on lightness and redness of the fermented sausages, where the control presented the highest luminosity values and the lowest redness values. Finally, hardness, gumminess and chewiness were significantly affected by the fat replacement, showing the lowest values in control group. This outcome is in agreement with previous studies [1, 2] who indicated that fat reduction in pork sausages caused an increase in the hardness and chewiness.

Table 1. Effect of partial replacement of pork fat by olive and canola oil on physicochemical composition, color and textural parameters.

		Control	50% Olive Oil	50% Canola Oil	SEM	Sig.
Physicochemical properties	Moisture (%)	30.03b	28.37a	28.32a	0.281	*
	Protein (%)	30.90a	31.33a	30.24a	0.299	ns
	Fat (%)	27.74a	25.64a	26.67a	0.516	ns
	Ash (%)	4.87a	6.36b	5.81b	0.188	**
	TBARS (mg MDA/kg)	0.85ab	0.66a	0.93b	0.046	*
Color parameters	Luminosity (L*)	60.42b	57.41a	56.07a	0.648	**
	Redness (a*)	11.13a	11.99b	12.59c	0.290	***
	Yellowness (b*)	17.77a	18.30ab	17.61a	0.221	*
Textural parameters	Hardness (kg)	25.34a	36.54b	35.79b	1.282	***
	Springiness (mm)	0.53a	0.53a	0.53a	0.008	ns
	Cohesiveness	0.39a	0.38a	0.39a	0.004	ns
	Gumminess (kg)	9.97a	13.72b	13.81b	0.453	***
	Chewiness (Kg.mm)	5.29a	7.22b	7.31b	0.261	***

SEM, standard error of the mean; Sig, significance; *** (P<0.001), ** (P<0.01), * (P<0.05), n.s. (not significant). ^{a-c} Mean values in the same row (corresponding to the same parameter) not followed by a common letter differ significantly (P<0.05).

IV. CONCLUSION

To conclude, the development of sausage with olive and canola oils is technologically feasible. However, additional studies of the effect of partial replacement of pork backfat by these oils on sensory properties are needed to obtain a clearer understanding of this product.

V. ACKNOWLEDGEMENTS

Authors are grateful to Xunta de Galicia (grant number FEADER 2016/21A) for the financial support. Special thanks to CACHENAS SAN BREIXO (Triacastela, Lugo) for the Cachena samples supplied for this research. Acknowledgements to INIA for granting Paula Borrajo with a PhD scholarship (grant number CPD2016-0030).

VI. REFERENCES

- Lorenzo, J. M., Munekata, P. E. S., Pateiro, M., Campagnol, P. C. B., & Domínguez, R. (2016). Healthy Spanish salchichón enriched with encapsulated n- 3 long chain fatty acids in konjac glucomannan matrix. *Food Research International* 89: 289-295.
- Gómez, M., & Lorenzo, J. M. (2013). Effect of fat level on physicochemical, volatile compounds and sensory characteristics of dry-ripened "chorizo" from Celta pig breed. *Meat Science* 95: 658-666.
- Fonseca, S., Gómez, M., Domínguez, R., Lorenzo, J.M. (2015). Physicochemical and sensory properties of Celta dry-ripened "salchichón" as affected by fat content. *Grasas y Aceites* 66: e059
- Utrilla, M.C., García, A., Soriano, A. (2014). Effect of partial replacement of pork meat with an olive oil organogel on the physicochemical and sensory quality of dry-ripened venison sausages. *Meat Science* 97: 575-582
- Monteiro G.M., Souza, X.R., Costa, D.P.B., Fariab, P.B., J. Vicente, J. (2017). Partial substitution of pork fat with canola oil in Toscana sausage G.M. *Innovative Food Science and Emerging Technologies* 44: 2-8
- dos Santos, L.A.A., Lorenzo, J.M., Gonçalves, C.A.A., dos Santos, B.A., Heck, R.T., Cichoski, A.J., & Campagnol, P.C.B. (2016). Production of healthier bologna type sausages using pork skin and green banana flour as a fat replacers. *Meat Science* 121: 73-78.
- Bloukas, J.G., Paneras, E.D., Fournitzis, G.C. (1997). Sodium lactate and protective culture effects on quality characteristics and shelf-life of low-fat frankfurters produced with olive oil. *Meat Science* 45: 223-238.