REFORMULATING TRADITIONAL MEAT PRODUCTS: CHORIÇAS DE VINHAIS WITH GELLED EMULSION BASED ON CHIA OR HEMP OIL

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I. INTRODUCTION

Choriça de Vinhais is a traditional Portuguese cured sausage made with pork meat and fat, garlic, salt, and spices. The recipe has been passed down through generations and is considered a delicacy in the region [1]. However, with the increasing demand for healthier and more sustainable food options, there is a growing interest in developing new formulations of traditional products [2]. In this study, we will explore the addition of gelled emulsions (with buckwheat flour and hemp or chia oil), as source of healthy compounds. Hemp oil and chia oil are both rich in unsaturated fatty acids, vitamins, and minerals, and have been associated with health benefits such as reducing inflammation and improving heart health [3]. The gelled emulsion (GE) technology allows a better incorporation of the oils into the sausage mixture, resulting in a more homogeneous distribution of healthy fats [2,3]. The objective of this study is to evaluate the effect of the gelled emulsions on the lipid profile, nutritional properties and lipid oxidation of reformulated Choriça de Vinhais.

II. MATERIALS AND METHODS

In this study, a batch of traditional choriça with 20% pork backfat was used as the control (C), which was then added with two different GEs at 10%: buckwheat-GE with chia oil (Chia10) and buckwheat-GE with hemp oil (Hemp10). The emulsions were made with a ratio of 4:4:1.5:0.5 of water, chia or hemp oil, buckwheat flour, and gelatin as gelling agent [3]. The formulation of the choriças was: native Bísaro pork meat with a ratio meat/ fat of 80:20. The meat was macerated with a 1:1 mixture of water and red wine (8% total liquid) and then 2% salt, 0.03% pepper and 0.02 of garlic in powder was added (all these ingredients are related to 100% meat ingredients). The samples were analysed using official methods to determine total fat content, and gas chromatography was used to identify and quantify fatty acids. Dietary fat quality indices were calculated based on the lipid profile, and the Rosmini *et al*. [4]. method was used to determine lipid oxidation. Significant differences were determined by means of ANOVA and Tukey test ($P<0.05$).

III. RESULTS AND DISCUSSION

As expected, the addition of both GEs resulted in an increase in the amount of fat between 1-5 percental points, depending of the GE used. However, the addition of both GEs resulted in a significant decrease ($P<0.05$) in total saturated fatty acids (SFA) content of 4% in Chia10 and 10% in Hemp10 compared to the control sample. The choriças made with GE (Chia10 and Hemp10) showed a slight reduction in palmitic, stearic, and oleic fatty acids, along with an increase in the amount of polyunsaturated fatty acids, particularly α-linolenic and linoleic acids. The Hemp10 sample had a value of 14.83 g/100 g of fat for α-linolenic acid, while the Chia10 sample had a value of 6.05 g/100 g of fat for linoleic acid, according with the majoritarian fatty acid in the respective oils. Table 1 shows some indices widely used as indicators of dietary fat quality. The thrombogenic index (TI) decreased

(P<0.05) by 36% and 29% for Chia10 and Hemp10 samples, respectively. The hipocholesterolemic/Hipercholesterolemic index (h/H) decreased in reformulated choriças which is related with a decrease in the CVD risk. Both samples showed an increase in n3 fatty acids content with the addition of GE, but the increase was greater in the Hemp10 sample (64% increase compared to C). All sausages added with GE presented higher (P<0.05) TBARs values than the control sample [C: 0.64 mg MDA/kg; Chia10: 2.20 mg MDA/kg; Hemp10: 1.28 mg MDA/kg].

Table 1 Health indices of control (C) and reformulated choriças

	C	Chia10	Hemp10	SEM	P-value
∑SFA	38.3^{a}	36.7^{ab}	34.5^{b}	0.760	0.049
∑UFA	58.9^{b}	60.9^{ab}	62.9^{a}	0.788	0.039
∑MUFA	47.8^{a}	44.3^{b}	44.2^{b}	0.785	0.015
∑PUFA	11.0^{a}	16.5^{ab}	18.8^{a}	1.526	0.026
SFA/UFA	0.65^{a}	0.60^{ab}	0.55^{b}	0.020	0.040
n6/n3 ratio	15.4^{a}	1.61^{b}	5.19^{b}	2.659	0.002
AI	0.49^{a}	0.46^{b}	0.41^{b}	0.022	0.006
TI	1.22^{a}	0.78^{b}	0.87^{b}	0.090	0.006
h/H	2.21^{b}	2.44^{a}	2.63^{a}	0.087	0.028
n6	9.24^{b}	9.81^{b}	15.1^{a}	1.232	0.023
n3	0.60^{c}	6.09^{a}	2.91^{b}	1.013	0.002

SFA: saturated fatty acids; UFA: unsaturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: Polyunsaturated fatty acids; AI: atherogenic index; TI: thrombogenic index; h/H: hipocholesterolemic/Hipercholesterolemic index. For the same row, values followed by different letter (a-c) indicate signifcant differences according to Tukey's HSD post-hoc test (P<0.05)

IV. CONCLUSION

The use of gelled emulsions as source of healthy oils is a strategy technologically viable in the reformulation of traditional meat products in view of improving their lipid profile (increasing PUFA and decreasing SFA). Chia and hemp-based gelled emulsions were successfully used in the reformulation of Choriças de vinhais with significant improvement in their lipid profile and dietary fat quality indices.

ACKNOWLEDGEMENTS

This work was supported by the grant of Carmen Botella-Martínez from Miguel Hernandez University (Spain) and the ERASMUS mobility grant by EU. The authors are grateful to the Foundation for Science and Technology (FCT, Portugal) for financial support through national funds FCT/MCTES (PIDDAC) to CIMO (UIDB/00690/2020 and UIDP/00690/2020) and SusTEC (LA/P/0007/2021).and to Laboratory of Carcass and Meat Quality of Agriculture School of Polytechnic Institute of Bragança 'Cantinho do Alfredo'. All authors are members of the healthymeat network funded by CYTED (119RT0568).

REFERENCES

1. Teixeira, A., Domínguez, R., Ferreira, I., Pereira, E., Estevinho, L., Rodrigues, S. & Lorenzo, J. M. (2021). Effect of NaCl replacement by other salts on the quality of Bísaro pork sausages (PGI Chouriça de Vinhais). Foods 10: 961.
2. Domínguez, R., Lorenzo, J.M., Pateiro, M., Munekata, P.E.S., Alves Dos Santos, B., Basso-Pinton, M., Cichosli, A.J. & Campagnol, P.C.B. (2022). Main animal fat replacers for the manufacture of healthy processed meat products. Critical Reviews in Food Science 9: 1-20. Botella-Martínez, C., Pérez-Álvarez, J. Á., Sayas-Barberá, E., Fernández-López, J. & Viuda-Martos, M. (2021). Assessment of chemical, physicochemical, and lipid stability properties of gelled emulsions elaborated with different oils chia (*Salvia hispanica* L.) or Hemp (*Cannabis sativa* L.) and Pseudocereals. Foods 10: 1463.
3. Rosmini, M., Perlo, F., Pérez-Álvarez, J. A., Pagán-Moreno, M., Gago-Gago, M., López-Santoveña, F. (1996). TBA test by an extractive method applied to pate. Meat Science 42: 103-110.