ASSESSMENT OF POLAR LIPIDS (PHOSPHO- AND SPHINGOLIPIDS) IN A NATURALLY ENRICHED OMEGA-3 CHEESE

Cristina Santurino[1], Natalia García[2] , María V. Calvo[1] and Javier Fontecha[1]
[1]Institute of Food Science Research (CIAL-CSIC/UAM), Madrid, Spain
[2]Instituto Tecnológico Agrario de Castilla y León (ITACyL), Valladolid, Spain

INTRODUCTION

Dairy polar lipids represent a natural source of bioactive compounds that positively affect to the human health. Several studies have evidenced that supplementation of the ruminant diet with extruded linseed exerts great influence on improving the polyunsaturated fatty acids (PUFAs) profile of milk and milk products. However, there is scarce information on modifications in both distribution and composition of polar lipids (PLs) such as phospho- and sphingolipids that take place after this supplementation, in cheese samples.

METHODOLOGY

In this study, a naturally omega3-enriched cheese was elaborated using milk from goats fed a commercial supplement based on extruded linseed (Lodyn-Milk™). With the aim to examine whether any change occurred as consequence of diet supplementation, HPLC-ELSD was used for a complete lipid classes analysis of the fat extracts from milk and cheese (Castro-Gómez *et al*, 2014).

RESULTS

A significant changes in the nutritional profile of the cheese was observed as results of diet supplementation (Table 1). In addition to the significant reduction of saturated fatty acids (SFA), an increase of PUFA content (6% *vs* 12%) occurs in functional cheese. In particular, the total content of n-3 was 8-fold higher than in control cheese, and consequently the n6/n3 index decreased significantly (8.1 *vs* 1.20).

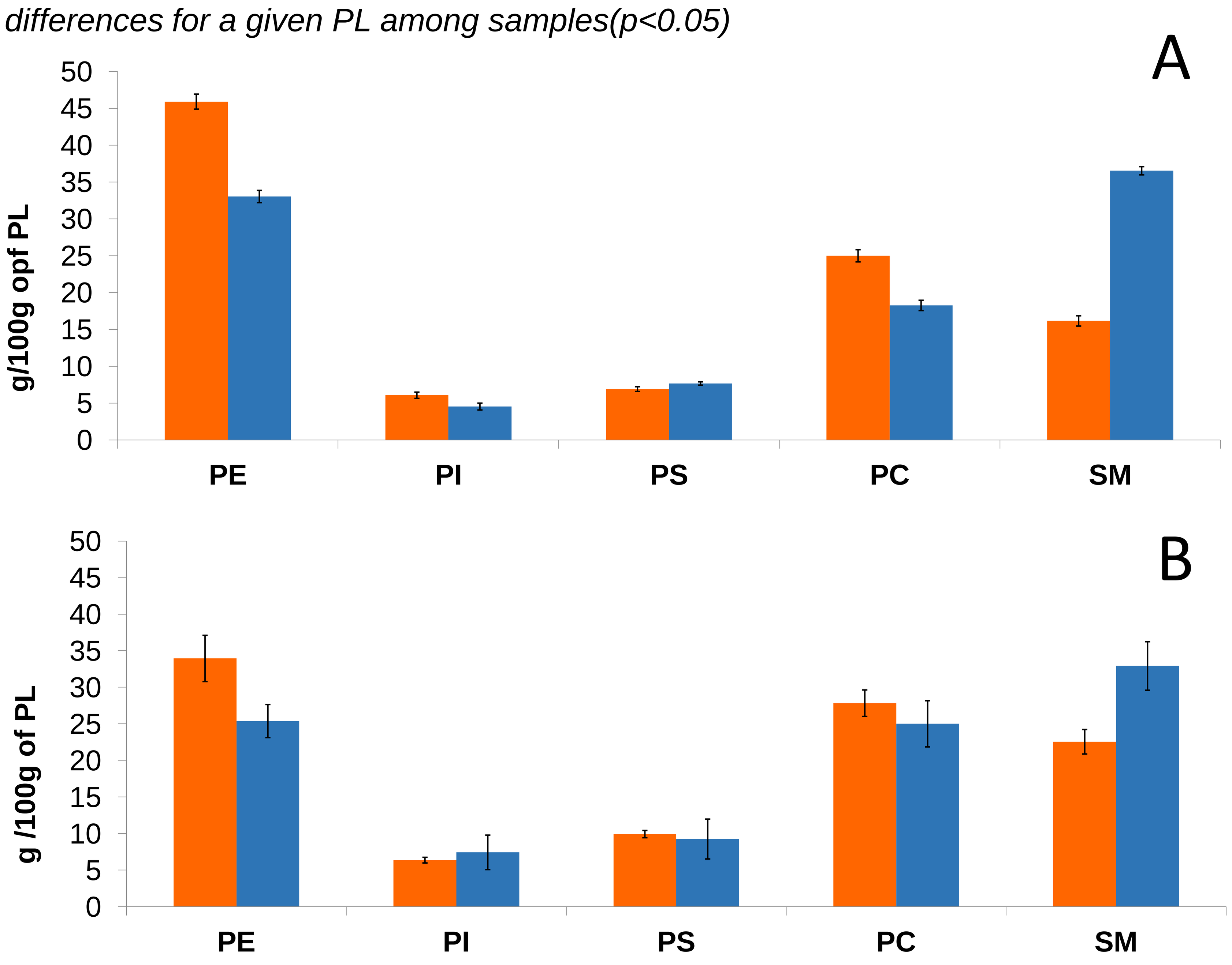
As expected triacylglycerides (TAG) were the main components of the neutral lipids in all samples (Table 2).

However, the presence of TAG was reduced (~3%) both in cheese and milk, as a consequence of diet supplementation, which might indicate greater post-milking lipolysis, since an increase (2-fold) in the diacylglicerides (DAG) level also occurred.

The total content of polar lipids (PL) was about 0.07g/100g fat, and no significant differences were found among diets or as results of milk processing into cheese.

As regards the individual components in the PL fraction, phosphatidylethanolamine (PE), phosphatidylcholine (PC) and sphingomyelin (SM), were the main compounds in the control milk (Figure 1A), according to data previously published by Castro *et al* (2014) for goat milk.

***Figure 1**. Effect of diet supplementation on distribution of polar lipids in goat milk (**A**) and in cheese (**B**). Control (■) and Functional (■). Asterisk means significant differences for a given PL among samples(p<0.05)*



	MILK		CHEESE	
	Control	Functional	Control	Functional
SFA	68.1 ± 0.60	57.3± 0.95*	67.1 ± 1.08	56.5 ± 2.03*
MUFA	26.4 ± 0.92	31.7 ± 0.78*	26.6 ± 0.78	31.8 ± 1.41*
PUFA	5.5 ± 0.29	11.0 ± 0.17*	6.3 ± 0.33	11.7 ± 0.20*
Total n6	4.11 ± 0.20	5.39 ± 0.14	4.19 ± 0.04	5.00 ± 0.11
Total n3	0.43 ± 0.07	3.71 ± 0.07*	0.49 ± 0.02	4.05 ± 0.06*
n6/n3	9.5 ± 1.86	1.4 ± 0.02*	8.6 ± 1.68	1.2 ± 0.03*

***Table 1**. Effect of diet supplementation (Lodyn-Milk ™) on lipid profile in goat milk and cheese. Asterisk means significant differences for a given FA among diets (p<0.05).*

Lipid class (g/100g fat)	MILK		CHEESE	
	Control	Functional	Control	Functional
TAG	97.5 ± 0.48	94.9 ± 0.64	98.0 ± 0.33	95.05 ± 0.1
DAG	2.35 ± 0.49	4.95 ± 0.65*	1.95 ± 0.32	4.61 ± 0.1*
FFA + CHOL	0.04 ± 0.003	0.05 ± 0.01	0.05 ± 0.01	0.27 ± 0.04*
PLs	0.066 ± 0.01	0.074 ± 0.002	0.079 ± 0.03	0.071 ± 0.008

***Table 2**. Effect of diet supplementation (Lodyn-Milk ™) on lipid classes distribution in goat milk and cheese. Asterisk means significant differences for a given lipid class among diets (p<0.05).*

The supplemented diet significantly diminished PE and PC levels, but simultaneously caused a marked increase (16% *vs* 36.5%) in the concentration of SM. The latter might be an interesting issue due to the beneficial effects on human health attributed to SM (Castro-Gómez *et al,* 2015).

Although the supplementation effect was noticeable, some changes in PL were observed in cheese as compared with milk (Figure 1B).

This is probably related to the effect of technological processes (thermal and mechanical treatments) on the organization of lipids (Lopez *et al,* 2015). During cheesemaking specifically, the fat is concentrated in the curd, the milk fat globule membrane is disrupted, and then fragments can migrate to the whey altering the phospholipid:lipid ratio in cheese.

Thus, although the amount of SM also raised by diet supplementation, the increases attained was lower than that observed in milk.

CONCLUSION

In addition to improving the nutritional profile, the diet supplementation leads to an enrichment of SM in the functional milk that can be interesting from the point of view of human health. However, the effect of treatments applied during cheesemaking should be taken into account as they could alter the distribution of some individual PLs.

REFERENCES

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