THE EFFECT OF PREGNANCY AND LACTATION STAGE ON THE FATTY ACID PROFILE OF BOVINE MILK

Rocío Barreiro, Patricia Regal, Mónica Díaz-Bao, Beatriz Vázquez-Belda and Alberto Cepeda

Laboratory of Food Hygiene, Inspection and Control (LHICA). Department of Analytical Chemistry, Nutrition and Bromatology.

Universidade de Santiago de Compostela. Lugo. Spain.

INTRODUCTION

- Milk is one of the most nutritionally complete foods. It can sustain the life of human neonate and plays also an important role during adult life.
- The most abundant fraction of milk fat it's saturated (approx 75%). This type of fat is associated with negative effects for human health (heart diseases, weight gain and obesity). In bovine milk, fat is partially produced by rumen bacteria and as such there are also fatty acids with important functions in human health. Short chain fatty acids, for instance, which are not present in other kinds of fat.
- Short and medium chain saturated fatty acids (C4:0-C12:0) have many beneficial effects: cancer prevention, antiviral activities, slow-down tumor growth.
- Vaccenic acid is the predominant isomer of oleic acid in ruminant fat. It is the precursor of the main isomer of conjugated linoleic acid (CLA), rumenic acid, which has many biological functions.
- The polyunsaturated fraction of milk contributes with essential fatty acids to the human diet: linoleic (LA; C18:2n-6) and α-linoleic acid (ALA; 18:2n-3). These fatty acids are the precursors of long chain *n*-6 and *n*-3 families, and they are especially important during gestation and also for neonates.
- Several endogenous and exogenous factors affect milk production and composition (quantity and quality) in dairy cattle. Milk fat percentages and fatty acid profile vary with the stage of lactation and with the pregnancy, two very important endogenous factors.

EXPERIMENTAL

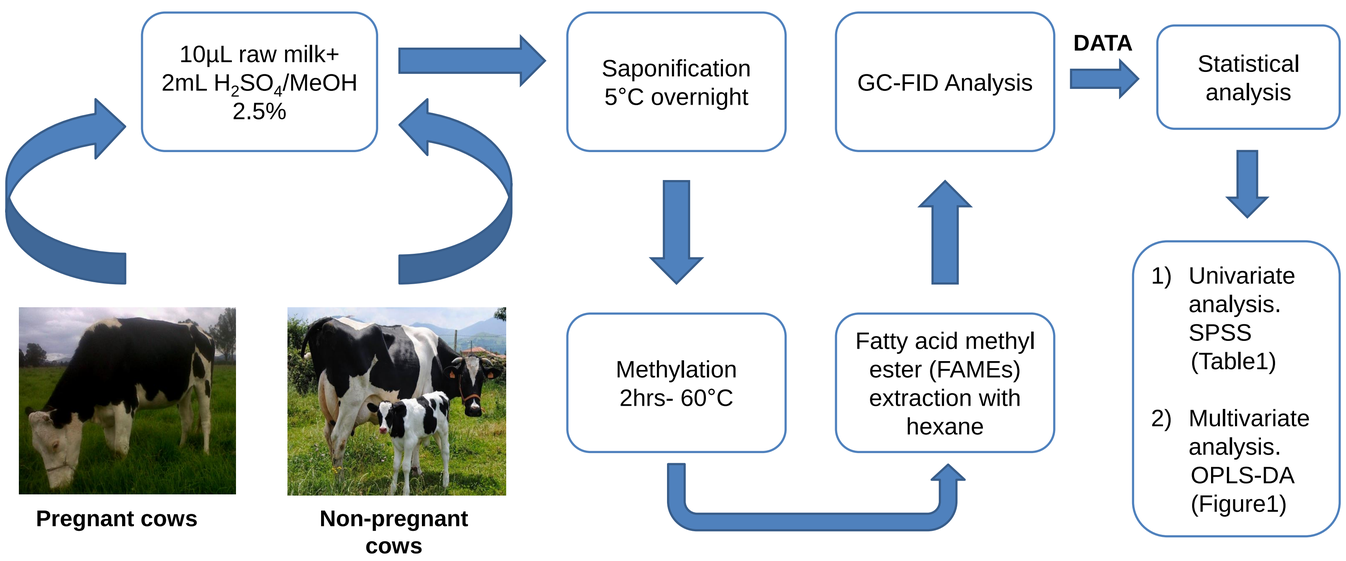

Table1. Fatty acid composition (%wt/wt of total fatty acid) of pregnant and non pregnant cow´s milk. Significance is indicated when the median in pregnant cows is statistically different from the median in non-pregnant cows by Student test: * p< 0,01 and ł p< 0,05.

		Pregnant			No-Pregnant		
	No. Of cows	*N=10*			*N=8*		
	n=samples	*n=20*			*n=16*		
		Mean	±	SD	Mean	±	SD
	Age of cow (days)	1368	±	445.09	1603.62	±	464
	Lactation days	215.7	±	63.34	33.87	±	16.88
	Pregnant days	115.7	±	53.83			
%wt/wt of all FAs	**Fatty acids**						
Saturated FA (SFAs)							
C6:0	Caproic acid	2.814	±	0.458	2.693	±	0.303
C8:0	Caprylic acid	2.187	±	0.367	1.923	±	0.319
C10:0 ł	Capric acid	3.938	±	1.189	2.676	±	0.858
C11:0	Undecylenic acid	0.310	±	0.146	0.177	±	0.118
C12:0	Lauric acid	4.469	±	0.620	4.288	±	0.647
C13:0 ł	Tridecanoic acid	0.250	±	0.074	0.167	±	0.079
C14:0	Myristic acid	13.146	±	1.623	12.853	±	1.927
C15:0 ł	Pentadecanoic acid	1.624	±	0.258	1.252	±	0.425
C16:0	Palmitic acid	28.687	±	4.042	31.039	±	3.346
C17:0*	Margaric acid	0.731	±	0.093	0.951	±	0.178
C18:0	Stearic acid	8.087	±	0.952	8.744	±	1.685
C20:0	Arachidic acid	0.093	±	0.015	0.089	±	0.012
C22:0	Behenic acid	0.039	±	0.006	0.035	±	0.004
C24:0	Lignoceric acid	0.011	±	0.006	0.013	±	0.005
Total SFAs		65.216	±	1.677	65.845	±	4.292
Monounsaturated FA (MUFAs)							
C14:1 n-5*	Myristoleic acid	2.207	±	0.500	1.447	±	0.298
C16:1 n-9c		0.305	±	0.059	0.363	±	0.074
C16:1 n-7c	Palmitoleic acid	2.756	±	0.445	2.671	±	0.812
C16:1 n-5*		0.062	±	0.011	0.132	±	0.063
C17:1 n-9*		0.357	±	0.042	0.587	±	0.225
C18:1 n-9c	Oleic acid	21.777	±	0.894	21.777	±	3.290
C18:1 n-7c*	Vaccenic acid	0.438	±	0.060	0.652	±	0.157
C20:1 n-11*		0.144	±	0.025	0.115	±	0.010
C20:1 n-9c ł	Gondoic acid	0.060	±	0.011	0.088	±	0.031
C22:1(n-11)		0.022	±	0.007	0.017	±	0.003
C22:1(n-9)	Erucic acid	0.017	±	0.007	0.014	±	0.005
isomeros 18:1		1.088	±	0.574	0.873	±	0.806
Total MUFAs		29.233	±	1.384	28.731	±	4.111
n-6 Polyunsaturated FA (PUFAs)							
C18:2 n-6c	Linoleic acid (LA)	2.452	±	0.258	2.825	±	0.369
C18:2(n-6) 9,12t		0.283	±	0.042	0.230	±	0.066
C18:2(n-6) 9t,12t*		0.037	±	0.011	0.065	±	0.027
C18:3 n-6	γ-Linolenic acid	0.042	±	0.015	0.035	±	0.011
C20:2 n-6*	Eicosadienoic acid	0.373	±	0.068	0.045	±	0.014
C20:3 n-6*	Dihomo-γ-linolenic acid	0.220	±	0.051	0.144	±	0.035
C20:4 n-6	Arachidonic acid (AA)	0.328	±	0.074	0.278	±	0.068
Total n-6PUFAs		3.421	±	0.395	3.626	±	0.430
n-3 Polyunsaturated FA							
C18:3 n-3	α-linolenic acid (ALA)	0.423	±	0.062	0.450	±	0.133
C18:4 n-3	Stearidonic acid	0.076	±	0.017	0.070	±	0.028
C20:5 n-3	Eicosapentaenoic acid (EPA)	0.066	±	0.008	0.073	±	0.015
C22:5 n-3c	Clupanodonic acid (DPA)	0.086	±	0.020	0.083	±	0.038
C22:6 n-3	Docosahexaenoic acid (DHA)	0.031	±	0.010	0.031	±	0.010
Total n-3PUFAs		0.682	±	0.070	0.702	±	0.167
CLA c9,t11*		1.304	±	0.173	0.971	±	0.090
CLA t10,c12		0.121	±	0.022	0.111	±	0.024
Total PUFAs		5.516	±	0.586	5.394	±	0.624

RESULTS AND DISCUSSION

- The fatty acid composition of milk clearly varies with pregnancy in the cow. The two groups of cows are different as it may be seen in the plot (Figure1), constructed using their fatty acids profiles.
- There were no statistically significant differences between the total amount of SFAs, MUFAs or PUFAs but studying milk fatty acids individually some differences between pregnant and non-pregnant cows were observed.
- Non-pregnant animals had slightly lower levels of C12:0 and C14:0 but higher levels for C16:0 and C18:0. A low level of total saturated fraction it is associated with a lower risk of heart disease, lower weight gain and reduced obesity risk.
- Oleic acid will remain constant independently of the pregnancy status. Vaccenic acid was higher in non-pregnant group. This fatty acid is an important natural *trans* precursor of conjugated linoleic acid (CLA), which was clearly higher in pregnant cows.
- Milk from non-pregnant cows was slightly richer in the essential fatty acids (LA and ALA) and also in the long chain PUFAs: EPA and DHA. The *n*-3 fatty acids reduce the risk of cardiovascular disease, type 2 diabetes, hypertension, cancer and certain disruptive neurological functions, among other benefits.

CONCLUSIONS

The fatty acid composition of milk clearly varies as a result of pregnancy in the cow. In some aspects, milk from pregnant animals seems more adequate, but some particular fatty acids and other components may lead us to the opposite theory.

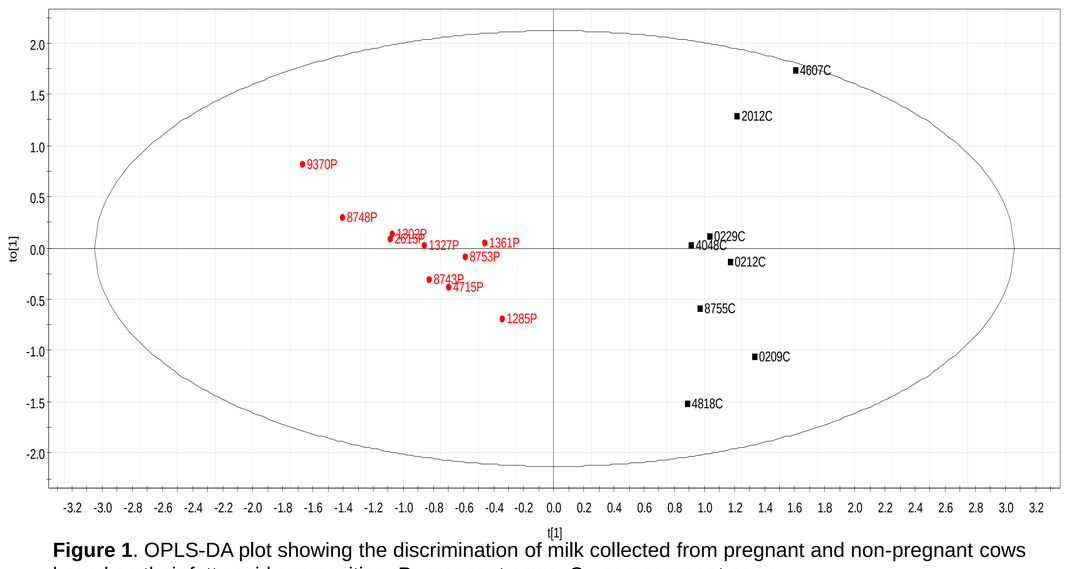

Figure 1. OPLS-DA plot showing the discrimination of milk collected from pregnant and non-pregnant cows based on their fatty acid composition. P=pregnant cows. C= non-pregnant cows.

References

Can be supplied by authors under petition (Corresponding author's e-mail: patricia.regal@usc.es)

Poster presented at the Euroresidue VIII (Egmond aan Zee, The Netherlands) May 23-25, 2016