INTERRELATIONSHIPS IN FATTY ACID COMPOSITION BETWEEN SUCKLING LAMBS AND THE FEEDING EWE MILK

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Introduction

In Spain, suckling lambs are usually slaughtered immediately after weaning (10-12 kg live weight) and generally have been exclusively fed with milk. It is generally accepted that the fatty acid composition of the adipose depots of suckling animals depends on the composition of the milk they consume (Velasco, 1999). In fact, the impact of a milk-feeding regime on lamb meat quality could be dramatic because milk-fed lambs are to be considered "functional monogastrics" and their rumen underdevelopment protects dietary polyunsaturated fatty acids from dehydrogenation (Napolitano *et al.*, 2002).

On the other hand, it is well known that yield and composition of ewe milk undergoes marked changes throughout the year, depending on the feed availability and metabolic and endocrine changes related to the climate and the advancement of lactation (Hassan, 1995). Breed is another important factor that is closely related to milk quality. At present, there are not many multivariate studies in the literature about this subject. The aim of the present study, was to examine the correlation between fatty acids from ewe milk and suckling lambs.

Materials and Methods

Sixty 25-30 day-old suckling lambs were studied. Two groups of thirty lambs from three different breeds (assaf, castellana and churra) were slaughtered at 11 kg live weight. One of these groups was fed with a basic diet composed of 18% beetroot pulp, 26% alfalfa, 22% barley, 12% corn, 12% soy, 10% cotton. The other group was fed with an added calcium soap diet composed of 18% beetroot pulp, 26% alfalfa, 18% barley, 12% corn, 12% soy, 10% cotton, 4% calcium soap.

Lipids from adipose tissue were extracted using a standard chloroform/methanol procedure (Folch *et al.*, 1957). Lipids from ewe milk were extracted using the International Standard Method described in ISO 14156:2001. Fatty acid composition of lipids were methylated (Murrieta *et al.*, 2003) and analysed by gas chromatography (GC 6890 N, Agilent Technologies, USA) using a capillary column of 100 m × 0.25 mm × 0.20 µm (Supelco, Inc., Bellefonte, PA, USA). One microlitre was injected into the chromatograph, equipped with a split/splitless injector and a FID detector. The oven temperature program was 150ºC increasing at 1 ºC/min up to 165 ºC then increasing at 0,20 ºC/min up to 167 ºC and then increasing 1,50 ºC up to 225ºC where it was maintained for 15 min. Injector and detector temperatures were 250ºC. The carrier gas was helium at 1 ml/min and split (20:1). Fatty acids were expressed as a proportion by total weight.

Data were compared by a multivariate method according to the Multiple-Variable Analysis Procedure of Statgraphics Plus package (Statgraphics Plus for Windows 2.1, Statistical Graphics Corp., 1996).

Finally, only the twelve most important fatty acids were considered: butyric acid (C4:0), caproic acid (C6:0), caprylic acid (C8:0), capric acid (C10:0), lauric acid (C12:0), myristic acid (C14:0), palmitic acid (C16:0), palmitoleic acid (C16:1), stearic acid (C18:0), oleic acid (C18:1 n-9c), linoleic acid (C18:2 n-6) and α-linolenic acid (C18:3 n-3).

Results and Discussion

Significant correlations between ewe milk and suckling lambs fatty acids were found after multivariate analysis. Data are given in Table 1 and show that the most influential milk fatty acids were caproic, caprylic, palmitoleic (saturated fatty acids) and oleic. In suckling lambs, the most influenced fatty acids were palmitoleic, linoleic and α-linolenic (unsaturated fatty acids). Other fatty acids from lamb highly correlated with fatty acids from milk were butyric, lauric and myristic.

Butyric, caproic, caprylic and capric from ewe milk (short-chain saturated fatty acids) were in negative correlation with nine fatty acids from lamb. An increase in these fatty acids from milk caused a decrease in correlated fatty acids from lamb. On the other hand, palmitoleic acid, stearic acid, oleic acid and linoleic acid from milk (long-chain fatty acids) were in positively correlated with palmitoleic acid, linoleic acid and α-linolenic acid from lamb.

Capric acid from lamb had not been significantly influenced by any milk fatty acid. Only oleic acid from lamb was significantly correlated with one fatty acid from milk (butyric acid).

Table 1: Correlations between ewe milk and suckling lamb fatty acids.

Ewe milk fatty acids	Suckling lamb fatty acids											
	A	B	C	D	E	F	G	H	I	J	K	L
A	0,37**	ns	ns	ns	-0,25	-0.32*	ns	-0,41**	ns	-0,24	-0,21	-0,42**
B	0.32*	-0,19	ns	ns	-0.28	-0.29*	ns	-0.40**	0,20	-0.22	-0,28*	-0,38**
C	0,29*	-0,18	ns	-0.15	-0,27	-0,26	ns	-0.33*	0,18	-0,18	-0,32*	-0,31*
D	0,22	ns	-0,16	-0.17	-0,26	-0,23	ns	-0,25	0.20	ns	-0,36**	-0,23
E	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	-0,37**	ns
F	ns	0,28*	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
G	-0.32*	ns	ns	ns	0.26	0.29*	0,20	ns	ns	ns	0,18	ns
H	ns	0,33*	0,46**	ns	ns	ns	-0,35*	0.56**	-0,30*	0.22	ns	0,49**
I	ns	ns	ns	ns	ns	0.17	ns	0,22	-0,29*	ns	0,37**	0,22
J	ns	ns	0.29*	ns	ns	ns	-0.16	0.42**	-0,29*	0.18	0,40**	0,41**
K	-0.23	ns	0.16	ns	ns	0.20	ns	0.41**	-0,17	0.20	0,44**	0,33*
L	ns	0.20	ns	ns	ns	ns	ns	ns	ns	ns	-0.21	0,18

* $P<0.05$ ** $P<0.01$ ns: not significant ($P>0.3$)

A: butyric acid, B: caproic acid, C: caprylic acid, D: capric acid, E: lauric acid, F: myristic acid, G: palmitic acid, H: palmitoleic acid, I: stearic acid, J: oleic acid, K: linoleic acid, L: α-linolenic acid. Negative values indicate an inverse correlation between fatty acids.

On the other hand, α-linolenic acid from milk did not significantly affect any lamb fatty acid meanwhile only lauric acid and myristic acid were each in correlation with only one lamb fatty acid.

Linoleic acid from ewe milk was positively correlated with linoleic acid and α-linolenic acid from lamb. These results mean, according to Napolitano *et al.*, (2002), that lamb rumen underdevelopment protects dietary polyunsaturated fatty acids from dehydrogenation.

Conclusions

An interrelationship was found between ewe milk and suckling lamb fatty acids. The most influential milk fatty acids were caproic, caprilic, palmitoleic and oleic. The most influenced suckling lamb fatty acids were palmitoleic, linoleic and α-linolenic.

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