Quality of lipid fraction in Tuscan sheep cheese (Pecorino Toscano DOP)

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ABSTRACT: Bulk milk from dairy ewes of North Tuscany was sampled and analyzed for the fatty acids profile. Cheese was then made out of milk, pasteurized and fortified with *Lactobacilli.* The same analysis was performed on the lipid fraction of samples of the freshly made cheese and of samples of the same cheese, but ripened for different times: 30, 60, 90, 120 days of ageing. As a result, cheese making did not affect the acidic composition of the lipid fraction of the original milk and, furthermore, ageing up to 120 days had no important effect on the same composition. It is confirmed that Pecorino cheese is a sound, healthy, functional food.

Key words: Ewe milk, Ewe cheese, CLA.

INTRODUCTION – The acidic composition of milk fat of ruminant animals is characterized by the short chain fatty acids (SCFA), butyric ($C_{4:0}$) to capric ($C_{10:0}$), and by vaccenic ($C_{18:1}$ *trans* 11) and rumenic ($C_{18:2}$ *cis* 9 *trans* 11) acids, which are not present in significant amounts in fats of different origin. All these acids are acknowledged as beneficial to human health because they are prevention agents against atherosclerosis, diabetes, obesity and some types of carcinoma (Pariza *et al*., 2001). But milk fat contains also other acids, common to other fats, such as myristic ($C_{14:0}$) and palmitic ($C_{16:0}$), considered harmful because they are possible cause of cardio-vascular diseases (Ulbricht and Southgate, 1991). On the contrary, oleic acid ($C_{18:1}$ *cis* 9) is beneficial and important for flavour and taste.
Since, within certain limits, it is possible to manipulate the acidic composition of milk fat by dietary means, increasing the beneficial components and decreasing the harmful ones, aims of the present work were three: i) monitoring the fatty acid composition of bulk sheep milk collected by a cheese factory in the North of Tuscany, just to have a snap photo of the present situation in order to, possibly, improving it in the future; ii) checking the impact of pasteurization of milk and its enrichment with selected *Lactobacilli*, on the acidic pattern of milk fat and iii) studying the evolution of the acidic components of cheese throughout its ripening, from the very moment of cheese making to 120 days of ageing.

MATERIAL AND METHODS – The samples of bulk milk were collected in the Spring 2004. They were: 3 samples of raw milk; 3 samples of pasteurized (73°C for 15 seconds) milk and 3 samples of the same pasteurized milk, fortified with selected *Lactobacilli*. The sampled cheese was made up from the pasteurized fortified milk, as it is usually made in the cheese factory. At 0, 30, 60, 90, 120 days from cheese making, 3 samples of cheese from three different loaves were collected at each time of ageing.
Fat was extracted from milk, according to the modified method of Buccioni *et al*. (2004) and from cheese, according to Folch *et al*. (1957). The fatty acid profile was determined by gas chromatography after Sehat *et al*. (1998).
All experimental data were statistically analyzed using a linear model with a variation factor fixed at 3 levels for milk samples or at 5 levels for cheese samples (SAS, 2001).

RESULTS AND CONCLUSION – Firstly, a comparison between raw, pasteurized and pasteurized-fortified milk was made in order to check whether the different treatment prior to cheese making exerted any effect. The results are in table 1. Pasteurization appears to have significantly depressed ($P<0.01$) both $C_{18:1}$ *trans* 11 and *trans* 10, the good and the evil one, while EPA ($C_{20:5}$ n-3) was increased ($P<0.05$). Fortification with *Lactobacilli* didn't improve the quality of milk in any case with the only exception of vaccenic acid and $C_{18:4}$ n-3.

Table 1. Profile of major fatty acids in milk samples (g/100 g lipids).

acid	raw	pasteurized	pasteurized-fortified	SEM
$C_{10:0}$	6.19	6.40	6.24	0.16
$C_{12:0}$	3.86	3.94	4.05	0.08
$C_{14:0}$	10.46	10.87	11.07	0.22
$C_{14:1}$	0.16	0.16	0.15	0.01
$C_{15:0}$	1.18	1.26	1.18	0.04
$C_{16:0}$	23.36	24.72	24.81	0.62
$C_{16:1}$	1.10	1.15	1.13	0.03
$C_{17:0}$	0.65	0.66	0.68	0.02
$C_{18:0}$	10.04	10.52	10.43	0.09
$C_{18:1}$ trans 12	0.32	0.17	0.20	0.06
$C_{18:1}$ trans 11	3.35^{A}	3.21^{B}	3.31^{A}	0.02
$C_{18:1}$ trans 10	0.39^{A}	0.30^{B}	0.45^{C}	0.009
$C_{18:1}$ trans 9	0.28	0.28	0.23	0.02
$C_{18:1}$ cis 12	0.13	0.15	0.12	0.01
$C_{18:1}$ cis 11	0.47	0.43	0.49	0.07
$C_{18:1}$ cis 9	16.72	17.48	17.46	0.37
$C_{18:1}$ cis 7	0.26	0.27	0.28	0.01
$C_{18:2}$ cis 9 cis 12	1.70	1.78	1.35	0.24
CLA total	1.63	1.71	1.59	0.04
$C_{18:2}$ trans 9 trans 12	0.12	0.12	0.12	0.008
$C_{18:3}$ n-3	0.95	0.94	0.95	0.001
$C_{18:4}$ n-3	0.08^{a}	0.03^{b}	0.07^{a}	0.001
$C_{20:4}$ n-3	0.10	0.09	0.09	0.03
$C_{20:5}$ n-3	0.04^{a}	0.07^{b}	0.06^{b}	0.007

^{A,B,C} = P<0.01; ^{a,b} = P<0.05.

In table 2 (on the next page) the evolution of the acidic pattern of cheese fat throughout ripening is presented. The harmful saturated acids $C_{12:0}$, $C_{14:0}$ and $C_{16:0}$ go up and down, but generally speaking do not change dramatically with ripening. The most harmful one, $C_{14:0}$, seems to decrease in the short term (P<0.05). $C_{18:0}$ decreased as well, but its effect on human health is considered neither beneficial nor harmful. Oleic acid ($C_{18:1}$) diminishes with ripening also, but the differences are practically irrelevant. Total CLA was not modified, so demonstrating a substantial stability to oxidation.

In conclusion, it may be observed that: i) cheese making did not change the fatty acid profile of milk fat: basically, the same profile was found in the lipid fraction of cheese; ii) ripening had practically no influence on the same profile, with meaningless ups and downs.

Generally speaking, Pecorino cheese is to be considered as an healthy, functionally beneficial food.

Table 2. Evolution of fatty acids composition of cheese fat with ageing (g/100 g lipids).

acid	0 d	30 d	60 d	90 d	120 d	SEM
$C_{10:0}$	6.25	6.05	6.69	6.15	6.38	0.17
$C_{12:0}$	3.96 ^{ab}	3.84 ^{a}	4.19 ^{b}	3.89 ^{a}	3.98 ^{ab}	0.08
$C_{14:0}$	11.24 ^{ab}	11.08 ^{ab}	11.55 ^{a}	11.07 ^{b}	11.22 ^{ab}	0.14
$C_{14:1}$	0.19	0.19	0.19	0.18	0.19	0.009
$C_{15:0}$	0.69	1.26	1.29	1.26	1.24	0.25
$C_{16:0}$	25.44 ^{a}	25.25 ^{ab}	25.17 ^{ab}	25.14 ^{ab}	24.88 ^{b}	0.18
$C_{16:1}$	1.19	1.18	1.18	1.16	1.15	0.02
$C_{17:0}$	0.68	0.69	0.68	0.69	0.68	0.002
$C_{18:0}$	10.69 ^{a}	10.74 ^{a}	10.11 ^{b}	10.63 ^{ab}	10.21 ^{ab}	0.15
$C_{18:1}$ trans 12	0.26	0.28	0.26	0.26	0.29	0.004
$C_{18:1}$ trans 11	3.48	3.47	3.46	3.53	3.51	0.12
$C_{18:1}$ trans 10	0.42	0.43	0.38	0.38	0.93	0.03
$C_{18:1}$ trans 9	0.28	0.28	0.25	0.29	0.32	0.02
$C_{18:1}$ cis 12	0.13	0.17	0.17	0.13	0.16	0.006
$C_{18:1}$ cis 11	0.29	0.32	0.30	0.29	0.31	0.008
$C_{18:1}$ cis 9	17.92 ^{a}	17.91 ^{a}	17.57 ^{b}	17.60 ^{b}	17.54 ^{b}	0.20
$C_{18:1}$ cis 7	0.41	0.57	0.55	0.60	0.60	0.09
$C_{18:2}$ cis 9 cis 12	1.91	1.92	1.89	1.94	1.92	0.03
CLA total	1.72	1.79	1.67	1.75	1.73	0.04
$C_{18:2}$ trans 9 trans 12	0.12	0.14	0.14	0.17	0.14	0.01
$C1_{8:3}$ n-3	1.01	1.04	1.00	1.03	1.01	0.03
$C_{18:4}$ n-3	0.10	0.10	0.10	0.10	0.10	0.006
$C_{20:4}$ n-3	0.10	0.11	0.11	0.11	0.09	0.006
$C_{20:5}$ n-3	0.10	0.09	0.09	0.09	0.09	0.02

^{a,b} = *P<0.05.*

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