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Food and Agriculture Organization of the United Nations

Programme final et invitation au

# 4ème COLLOQUE INTERNATIONAL SUR LES FROMAGES D'ALPAGES

les 4 et 5 juillet 2002, Aoste, Italie
à l'Institut agricole régional (IAR)

sur le thème général

## Alpage, fourrage, laitage, fromage : Mieux connaître la filière

Dans le cadre du réseau coopératif inter-régional de recherche et de développement (FAO/CIHEAM) pour les pâturages et les cultures fourragères
Sous-réseau des pâturages de montagne
Groupe de travail : Qualité des produits laitiers

L'année 2002 a été décrétée année internationale de la Montagne. De plus, l'IAR d'Aoste célèbre cette année son 50ème anniversaire.

Les langues officielles seront l'anglais et le français. Il n'y aura ni traduction simultanée, ni comptes-rendus publiés. Chaque intervenant est libre de publier son travail dans la revue scientifique de son choix. Une communication dans la revue Herba est possible. Prendre contact avec Jakob Troxler de la RAC (cf. liste des participants.

La participation au colloque est gratuite. Un résumé des communications et posters sera distribué au début du colloque. Les résumés doivent être adressés par e-mail ou par fax à l'organisateur, Jacques Olivier Bosset, avant le 15 juin 2002.

University of Turin - Faculty of Agriculture
Di.Va.P.R.A. - Food Technology

# CLA in Ossolano cheese from mountain and valley pastures

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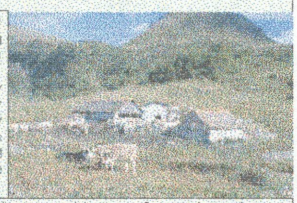
## INTRODUCTION

Lipids are very important components of human food which carry out indispensable life functions. Modern guidelines for a healthy diet recommend however to reduce animal fat consumption especially if rich in saturated fatty acids in relationship to their by now well-demonstrated hypercholesterolaemic effect. But it is important to remember that there are also unsaturated fatty acids which may not only reduce the cholesterol content in the blood, but in some cases even have anti-tumor effects.

Very important among these compounds are the conjugated linoleic acids (CLA) and their increased content in milk may have favourable impact in the areas of cancer research, human nutrition, and the public perception of dairy products. CLA are the only fatty acids shown unequivocally to inhibit carcinogenensis in exeperimental animals. An example of this effect on tumor incidence is shown in the some studies where the reduction of the DMBA-induced mammary tumors depended on increasing dietary levels of CLA.

The relationship between retinol-liver intake and CLA is also very significant. High concentration of Retinil-Esters and the CLA in the diet starts PPARalfa Receptors, involved in the retinol-carrier protein gene expression (CRPB) which promote the retinol accumulation vs retinil-esters in the liver cells.

In milk the fatty acids are derived from two major sources. Acetate and 3-OH-butyrate originating from ruminal fermentation are the carbon sources for the $C_{4:0}$ to $C_{14:0}$ and the one-half $C_{16:0}$ fatty acids. The remaining $C_{16:0}$ and all of the longer chain fatty acids are derived from blood lipids. Blood lipids may be derived from digestion and absorption of dietary fat or from mobilization of fatty acids from adipose tissue. Therefore diet could modify the chemical composition of milk and thus influence the composition of milk products.



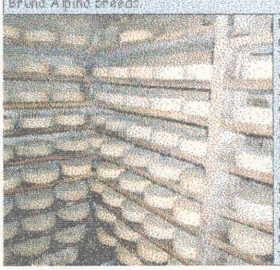
Recent studies have shown that pasturing or feeding cows with green forage determines an increase of the unsaturated long chain fatty acids and a reduction of the short chain saturated ones. This effect is particularly evident in the artisan mountain cheeses due to prolonged grazing on a variety of vegetal essences even though there are not yet many studies on these particular products. The aim of this work was to verify if also for the Ossolano cheese, one of the best-known Piedmont cheeses it were possible to note a difference between the mountain pasture product from that of the valley pasture in relationship to the fatty acid content.

## MATERIALS AND METHODS

The 'Ossolano' cheese is a round semi-hard cheese weighing 8-9 Kg and made using raw milk exclusively from Bruna Alpina cows. This cheese is produced in the north of Piedmont, in the alpine zone bordering Switzerland.

For the cheesemaking raw cow milk is coagulated without starter at 34-37 °C by adding bovine rennet. The curd is cut with a wire cutter into 3-4 mm curd particles. The curd-whey mixture is heated to 45-48 °C over a period of 40-45 min and then stirred at the same temperature for a further 40 min. The curd is finally removed and placed in moulds, drained and pressed for 24 hours. The cheeses are then removed from the moulds, salted dry for 48 h after which they are ripened at 8-12 °C in curing rooms at high humidity (80-90%).

The survey was carried out on 66 cheese samples of which 24 were from the summer production of seven mountain farms located between 1500 m and 2200 m and 42 from the winter production of six valley farms. Summer feeding was exclusively in mountain pastures whereas hay and concentrate were used for winter feeding. All the herds were made up of Bruna Alpina breeds.



Each sample was collected from a whole cheese ripened for 60 days.
The fatty acid methyl esters were prepared by trans-esterification with potassium hydroxide according to ISO 5509:2000E and analysed on a Varian gas chromatograph using a DB-WAX capillary column (30 m length, 0.25 mm internal diameter, 0.25 µm phase thickness; J&W Scientific Inc.), a split-splitless injector (split 1:60) and a flame ionization detector. The injector and detector temperature was 250 °C. Helium was used as a carrier gas (1 $mL \cdot min^{-1}$). Oven temperature, initialy kept at 35 °C for 5 min, was programmed to rise from 35 to 220 °C at 2 $°C \cdot min^{-1}$ remaining at the maximum temperature for 5 min thereafter. Each sample was analysed two times.

## RESULTS

The composition of fatty acids with 4 to 20 carbon atoms for the analysed cheeses is shown in Table 1.

| | Valley cheeses | | Mountain cheeses | |
|---|---|---|---|---|
| | × | σ | × | σ |
| $C_4$ | 3.51 | 0.37 | 3.11 | 0.22 |
| $C_6$ | 2.34 | 0.21 | 1.73 | 0.19 |
| $C_8$ | 1.47 | 0.18 | 0.99 | 0.19 |
| $C_4+C_6+C_8$ | 7.32 | 0.67 | 5.84 | 0.54 |
| $C_{10}$ | 3.01 | 0.47 | 1.92 | 0.44 |
| $C_{10:1}$ | 0.37 | 0.10 | 0.23 | 0.05 |
| $C_{12}$ | 3.25 | 0.85 | 2.07 | 0.39 |
| $C_{13}$ | 0.11 | 0.04 | 0.12 | 0.05 |
| $C_{14:0}$ | 11.92 | 0.85 | 8.32 | 0.82 |
| $C_{14:0}$ branched | 0.20 | 0.07 | 0.22 | 0.04 |
| $C_{14:1}$ | 1.04 | 0.14 | 0.67 | 0.11 |
| $C_{15:0}$ | 1.24 | 0.14 | 1.48 | 0.23 |
| $C_{15:0}$ branched | 1.03 | 0.15 | 1.19 | 0.11 |
| $C_{16:0}$ | 30.74 | 1.89 | 24.26 | 1.00 |
| $C_{16:0}$ branched | 0.41 | 0.08 | 0.38 | 0.08 |
| $C_{16:1}$ | 1.48 | 0.14 | 1.65 | 0.19 |
| $C_{10:0}+C_{12:0}+C_{14:0}+C_{16:0}$ | 48.93 | 3.37 | 36.57 | 2.14 |
| $C_{17:0}$ | 0.74 | 0.20 | 0.93 | 0.13 |
| $\Sigma C_{17:0}$ branched | 1.22 | 0.15 | 1.30 | 0.26 |
| $C_{17:1}$ | 0.34 | 0.09 | 0.41 | 0.12 |
| $C_{18:0}$ | 10.17 | 0.95 | 12.72 | 1.06 |
| $C_{18:1}$ | 21.48 | 1.74 | 29.37 | 1.75 |
| cis-9, trans-11-$C_{18:2}$ | 0.89 | 0.18 | 2.23 | 0.42 |
| trans-9,cis-11-$C_{18:2}$ | | | | |
| $\Sigma C_{18:2}$ | 2.48 | 0.55 | 2.95 | 0.48 |
| $C_{18:3}$ | 0.75 | 0.15 | 1.30 | 0.25 |
| $C_{18:0}+C_{18:1}+C_{18:2}+\Sigma C_{18:2}+C_{18:3}$ | 34.69 | 2.67 | 46.33 | 2.36 |
| $C_{18:1}+C_{18:2}+\Sigma C_{18:2}+C_{18:3}$ | 24.71 | 1.90 | 33.62 | 1.71 |
| $C_{20:0}$ | 0.15 | 0.06 | 0.28 | 0.10 |
| $C_{20:1}$ | 0.14 | 0.06 | 0.19 | 0.06 |
| Σ saturated fatty acids | 71.51 | 3.33 | 61.00 | 1.75 |
| Σ unsaturated fatty acids | 28.08 | 1.92 | 36.77 | 1.66 |

Because of the different compositions of diet, short ($C_4$, $C_6$, $C_8$) and medium chain ($C_{10}$, $C_{12}$, $C_{14}$ and $C_{16}$) saturated fatty acids and their totals are significantly more abundant in the valley cheeses whereas the stearic ($C_{18:0}$) and arachidic ($C_{20:0}$) acids are greater in the mountain products confirming the results of other Authors.
The long chain mono- and poli-unsaturated fatty acid content ($C_{18:1}$, $C_{18:2}$, $C_{18:3}$) as well as their sum are significantly higher in mountain products. Particularly important for nutritional purposes are the conjugated linoleic acids (CLA) as the cis-9, trans-11/trans-9, cis-11-linoleic acid and the sum of the other five geometric and positional isomers including the cis-9, trans-12/trans-9, cis-12-linoleic acid which are reported with the red color in Table 1.
In the mountain cheeses the content of all the CLA and in particular some c-9,t-11-$C_{18:2}$ thought to be the only isomer with biological activity is significantly higher than in the other cheeses.
This very high concentration may be due not only to diet but also to the activity of the milk-contaminating microflora and the cooking of the curd.
In fact the agitation of cheese curd during cooking facilitates CLA formation by incorporating air into cheese curd and enhancing the initiation of lipid oxidation and production of linoleic radicals. In addition the agitation and the heating of the cheese increases interaction between proteins and fat globules and enables proteins to donate hydrogen to convert linoleic acid radicals to CLA.

## CONCLUSION

Also in the case of "Ossolano" cheese the differences of feedings between the plain and alpine farm influence the composition of milk fat significantly and therefore the cheeses produced in the two areas. In particular the most evident effect is the decrease of saturated fatty acids in the alpine cheeses and the increase of the unsaturated ones. The results showed that the milk CLA concentration is a good weapon to prevent and to fight the tumor and the liver utilises the PPARalfa receptors action to achieve the reduction of, for example, mammary or others kinds of tumor. This is not only of nutritional interest for the non-negligible portion of essential fatty acids (linoleic and linolenic acids) but could be used to indicate the mountain origin of the cheese in the prospect of an application "Protected Denomination of Origin" (PDO).

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