“Persistency of conjugated linoleic and vaccenic acids in Argentine Tybo and Sardo cheeses produced from natural high CLA milk “

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Milk : Functional Foods

Introduction

- Functional foods: foods with additional properties on human health benefits that exceed the classic simple nutrients
- example: amino acids, sugars, fatty acids, etc.
Which compounds?

For example:

- Omegas 3
- Conjugated Linoleic Acids (CLA)
  (9cis – 11 trans)
Omega 3 Fatty Acids

They act in cardiovascular disease prevention.
CLA or Conjugated Linoleic Acids

CLA showed cholesterol-lowering, antiatherogenic, antidiabetic and anticarcinogenic effects demonstrated in experimental models.
• Conjugated linoleic acid (CLA) is a group of positional and geometric isomers of conjugated dienoic derivatives of linoleic acid.

• The major dietary source of CLA for humans is ruminant fat contained in meats, (beef and lamb), but meanly in dairy products, such as milk, butter and cheese.

• The major isomer of CLA in milk is cis-9, trans-11 (C18:2), also called rumenic acid.
Nutritional intake recommended:
- MUFA: 60% TFA
- PIFA: 15% TFA
- SFA: 25% TFA

The milk fat is a flexible component to transform dairy products into nutraceuticals foods.

MUFA: Monounsaturated fatty acids
PIFA: Polyunsaturated fatty acids
SFA: Saturated fatty acids.

Dairy products:
- 20 – 25% TFA
- 65 – 68% TFA
- 5% TFA
- 40% SFA

Persistence of conjugated linoleic and vaccenic acids in Argentine Tybo and Sardo cheese produced from natural high CLA milk.
Through cows feeding, we can . . .

- Increase the basal concentration of Omega 3 (EPA + DHA).
- Increase the basal concentration of CLA.
and...

- Decrease the atherogenicity index (AI) of dairy products (potential clogging of the arteries)
  
  $\frac{C_{12} + C_{14} + C_{16}}{\text{Sum of UFA}}$

- The nutrition allows modify, in a natural way, these parameters without requiring the addition of synthetic molecules that deteriorate sensorial properties and natural image of our food.
Background

- 2000. Experimental feeding to obtain “high CLA” milk in INTA-Balcarce.
- 2002. Preliminary results on transfers’ rate of CLA in yoghurt, soft-cream cheese and pasteurized milk production;
- 2009. We focused in hard and semi-hard cheeses to extend other possibilities for inclusion of CLA in the daily intake.
Objective

Determine if transformation of a natural milk containing high CLA and VA contents into Tybo and Sardo cheeses induces significant changes in the concentration of these bioactive molecules in the final product.

Dairy Functional Foods
The Beginning

- **INTI – LACTEOS.**
  National Institute of Industrial Technology

- **INTA – BALCARCE**
  National Institute of Agricultural Technology

- **PRODEEO SRL** 2008 award-winning "La Mirada Larga INTI" (looking in a log run) competition.

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**CONCURSO INTI "LA MIRADA LARGA"**

El Instituto Nacional de Tecnología Industrial (INTI) convoca a cátedras o departamentos universitarios, grupos de economía agraria o industrial, empresas, municipios o asociaciones sociales de cualquier tipo, con sede en municipios de cualquier provincia donde se cultive habitualmente soja, maíz o trigo, a presentar estudios de factibilidad para el aprovechamiento integral de los granos en su lugar de producción.

Para participar, los proyectos deben estar en cuarto año de ejecución.

- **Premio 1**: $5.000
- **Premio 2**: $3.000
- **Premio 3**: $2.000

Los proyectos deben presentar una propuesta de planificación integral y factibilidad técnica y económica, y deben ser enviados en un solo documento PDF.

**Inscripción**:

La inscripción al concurso se extenderá desde el día de la fecha hasta las 16 hs, del 30 de octubre de 2008, en el INTI en Retiro, sito en Leandro N. Alem 1960 – piso 7 – C1601LAF Capital Federal.

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Persistence of conjugated linoleic and vaccenic acids in argentine Tybo and Sardo cheese produced from natural high CLA milk.
High CLA and high VA Milk

- Transfer of bioactive molecules from high-CLA milk and high VA into cheeses with high CLA and VA

Healthier Cheeses:
with high content in beneficial fats and low AI
How?

Material and methods.

- The natural high CLA milk was obtained from 8 Holstein cows from middle lactation (109 ± 26 days postpartum), supplemented with sludge soybean oil (SSO), 55.5% of C18:2 n6 and fish oil (FO) as an inhibitor of ruminal biohydrogenation.

- In INTA BALCARCE
At day 25th after lipid feeding, milk was collected to be processed into cheese. An aliquot of milk was used to determine FA profile and the rest of the milk was pasteurized and transformed into Tybo and Sardo cheeses according to industrial processes.
Control of bioactive molecules

Material and methods.

Fatty Acid Composition in milk and cheese were analyzed by gas-liquid chromatography using an Agilent GC 6890 Serie Plus fitted with a FID Detector and autosampler.
Results

After supplementation the milk CLA content increased from a basal value of 1.42 to 3.58 g/100g and Vaccenic Acid from 2.56 to 3.58 g/100g FA.
# Results

Main fatty acid composition in milk “high CLA” and its transfer to Tybo and Sardo cheese.

<table>
<thead>
<tr>
<th>Fatty acids (g/100 g total FA)</th>
<th>Milk hCLA</th>
<th>Sardo Cheese hCLA</th>
<th>Transfer %</th>
<th>Milk hCLA</th>
<th>Tybo Cheese hCLA</th>
<th>Transfer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12:0</td>
<td>2,38</td>
<td>2,33</td>
<td>98</td>
<td>2,2</td>
<td>2,54</td>
<td>115</td>
</tr>
<tr>
<td>C14:0</td>
<td>9,04</td>
<td>9,27</td>
<td>103</td>
<td>8,88</td>
<td>9,73</td>
<td>110</td>
</tr>
<tr>
<td>C16:0</td>
<td>24,27</td>
<td>24,95</td>
<td>103</td>
<td>25,87</td>
<td>25,9</td>
<td>100</td>
</tr>
<tr>
<td>C18:1t10</td>
<td>4,22</td>
<td>5,95</td>
<td>141</td>
<td>5</td>
<td>3,89</td>
<td>78</td>
</tr>
<tr>
<td>C18:1t11 (VA)</td>
<td>5,43</td>
<td>5,89</td>
<td>109</td>
<td>3,55</td>
<td>4,48</td>
<td>126</td>
</tr>
<tr>
<td>CLA c9t11</td>
<td>3,58</td>
<td>3,51</td>
<td>98</td>
<td>2,86</td>
<td>2,72</td>
<td>95</td>
</tr>
<tr>
<td>CLA c12t10</td>
<td>0,02</td>
<td>0,03</td>
<td>144</td>
<td>0,04</td>
<td>0,05</td>
<td>115</td>
</tr>
<tr>
<td>C20:5 n3 (EPA)</td>
<td>0,05</td>
<td>0,04</td>
<td>77</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>C22:6 n3 (DHA)</td>
<td>0,03</td>
<td>0,03</td>
<td>100</td>
<td>0,04</td>
<td>0,04</td>
<td>100</td>
</tr>
<tr>
<td>AI</td>
<td>1,16</td>
<td>1,22</td>
<td></td>
<td>1,16</td>
<td>1,29</td>
<td></td>
</tr>
</tbody>
</table>
Results

- Atherogenicity Index of milk decrease after supplementation from basal value of 2.06 to 1.16, decreasing the concentration of atherogenics fatty acids (C12:0; C14:0; and C16:0).

- The atherogenicity index of high CLA Sardo and Tybo cheeses were 1.22 and 1.29 respectively.
Persistency of conjugated linoleic and vaccenic acids in Argentine Tybo and Sardo cheese produced from natural high CLA milk.

Fig. 1: Atherogenicity Index from high CLA cheeses

<table>
<thead>
<tr>
<th>Samples</th>
<th>Pre-supplementation Milk</th>
<th>High CLA Milk</th>
<th>Tybo cheese CLA</th>
<th>Sardo Cheese CLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atherogenicity Index</td>
<td>2.06</td>
<td>1.46</td>
<td>1.29</td>
<td>1.22</td>
</tr>
</tbody>
</table>
Conclusions

- There are a high transference rate of CLA 9cis 11 trans: 98% for Sardo cheese and 95% for Tybo cheese.

- Assuming that the fat of cheeses are 26.7 and 21.7%, an intake of 90 g/day of Sardo “high CLA” or 143 g/day of Tybo “high CLA”, may allow to achieve cardiovascular protection (800 mg/day) to the consumer of CLA.
Conclusions

- The beneficial effect of functional foods may be effective only within a comprehensive nutrition and healthy lifestyle.

- Successful transfer and support to small farm/cheese-factory to develop more healthy cheeses.
The presence of CLA in milk products would be guaranteed if we start with a natural high CLA milk.
Remarks

Nowadays, these healthy cheeses are being commercialized in the Argentine market.
Persistency of conjugated linoleic and vaccenic acids in Argentine Tybo and Sardo cheese produced from natural high CLA milk.

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