Milk and Dairy Products in the Mediterranean Diet

Effie TSAKALIDOU
- Introduction

- Milk and Dairy Products in the Mediterranean Basin

- Composition and Nutritional Value of Milk

- Challenges for the Future
Mediterranean Diet

- A dietary pattern
- A joint heritage
- A common language

Mediterranean Basin

- See deeps, mountains, plains, valleys, peninsulas, islands, bays
- Climate, flora and fauna diversity, food culture, cooking heritage
Mediterranean Pastoralism

- Very important part of the Mediterranean agricultural systems
- Particularly for sheep and goat
- Practices developed to valorize less favored highlands & pastures
- Long-time & diversified tradition of fermented milks & cheeses
- Structural conditions deeply changed since the end of the 1940s
- Introduction

- Milk and Dairy Products in the Mediterranean Basin

- Composition and Nutritional Value of Milk

- Challenges for the Future
## World Milk Production

<table>
<thead>
<tr>
<th>Worldwide</th>
<th>Cow milk</th>
<th>83%</th>
<th>EU28, US &amp; India</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Buffalo milk</td>
<td>13%</td>
<td>India &amp; Pakistan</td>
</tr>
<tr>
<td>Goat milk</td>
<td>2.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheep milk</td>
<td>1.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camel milk</td>
<td>0.4%</td>
<td>Africa &amp; Asia</td>
<td></td>
</tr>
</tbody>
</table>

| Goat Milk | Asia | 57% |
| Africa | 24% |
| Europe | 15% |

| Sheep milk | Asia | 47% |
| Europe | 30% |
### Small Ruminant Populations in EU Mediterranean Countries

<table>
<thead>
<tr>
<th>Females (X100)</th>
<th>Spain</th>
<th>France</th>
<th>Italy</th>
<th>Greece</th>
<th>Slovenia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk sheep</td>
<td>2900</td>
<td>1600</td>
<td>5700</td>
<td>6100</td>
<td>4</td>
</tr>
<tr>
<td>Meat sheep</td>
<td>14600</td>
<td>5200</td>
<td>1400</td>
<td>400</td>
<td>70</td>
</tr>
<tr>
<td>Goat</td>
<td>2200</td>
<td>1100</td>
<td>800</td>
<td>3900</td>
<td>20</td>
</tr>
</tbody>
</table>
Dairy Products Consumption in the Mediterranean Basin

Milk
- No detailed data concerning all Mediterranean countries
- The EU28 mean of 60 kg per capita annually
- In North European EU countries (e.g. Ireland, Finland) 90-140 kg
- Middle East and North Africa countries from 80.8 to 87.1 kg

Butter
- France, the top EU country with almost 8 kg per capita annually
- The EU28 mean of 3.5 Kg
- Middle East and North Africa countries from 1.9 to 2.1 Kg
- Low consumption in the Mediterranean countries linked to olive oil
Dairy Products Consumption in the Mediterranean Basin

Cheese

- Greece, France & Italy among the 5 EU28 countries with the highest per capita consumption annually
- Greece & France competing for the 1st place worldwide with an annual per capita consumption of 31 and 26 kg, respectively
- Middle East and North Africa countries from 3.3 to 3.4 kg
Cheese Production in the Mediterranean Basin

France

- First within the EU28 in goat milk production
- Efficiency & skill in turning milk into value in the form of cheeses
- Almost all goat milk into cheese with no addition of sheep or cow milk
- 30% of the total French PDO cheeses made with goat milk, e.g. Chevre
- Goat cheeses unique regarding composition, flavor & culinary applications
Cheese Production in the Mediterranean Basin

Greece

- First in the EU28 in the per capita goat milk production
- 60% of the milk from autochthonous breeds of sheep (37%) & goats (22%)
- World champion in the per capita cheese consumption per year
- 22 PDO Greek traditional cheeses, 20 of them from sheep and goat milk
- *Feta*, flagship of the Greek cheeses, 50% of the total cheese production
Cheese Production in the Mediterranean Basin

Italy

- Sheep and goat milk for cheese making, small amounts of goat milk consumed as UHT milk or yoghurt
- Sardinia first with about 70% and 40% of the total sheep and goat milk, respectively, followed by Tuscany, Lacio and Sicily
- Nearly 30% PDO cheeses produced by sheep and goat milk
  *e.g. Pecorino Romano, Pecorino Toscano, Pecorino Sardo*
- Mixed cheeses: sheep-goat, sheep-cow and goat-cow milk
Cheese Production in the Mediterranean Basin

Turkey

- Some cheeses originally produced using only sheep and/or goat milk
- Today, cow milk added due to limited production of small ruminants milk
- Significant decrease in the production of sheep and goat milk due to:
  - Migration of population from rural to urban areas
  - Unproductive pastures, low production and milking yields
  - Increasing prices in feeds and labor
  - Drawbacks in the agricultural policy and management
- Recent increased popularity of dairy products from small ruminants
- Introduction
- Milk and Dairy Products in the Mediterranean Basin
- Composition and Nutritional Value of Milk
- Challenges for the Future
### Gross Composition of Milk from Cow, Sheep, Goat & Human

<table>
<thead>
<tr>
<th></th>
<th>Cow</th>
<th>Sheep</th>
<th>Goat</th>
<th>Human</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total dry matter (g/l)</td>
<td>118-130</td>
<td>181-200</td>
<td>119-163</td>
<td>107-129</td>
</tr>
<tr>
<td>Proteins (g/l)</td>
<td>30-39</td>
<td>45-70</td>
<td>30-52</td>
<td>9-19</td>
</tr>
<tr>
<td>Casein: Whey ratio</td>
<td>4.7</td>
<td>3.1</td>
<td>3.5</td>
<td>0.4-0.5</td>
</tr>
<tr>
<td>Fat (g/l)</td>
<td>33-54</td>
<td>50-90</td>
<td>30-72</td>
<td>21-40</td>
</tr>
<tr>
<td>Lactose (g/l)</td>
<td>44-56</td>
<td>41-59</td>
<td>32-50</td>
<td>63-70</td>
</tr>
<tr>
<td>Ash (g/l)</td>
<td>7-8</td>
<td>8-10</td>
<td>7-9</td>
<td>2-3</td>
</tr>
<tr>
<td>Energy (kJ/l)</td>
<td>2709-2843</td>
<td>4030-4439</td>
<td>2802-2894</td>
<td>2843</td>
</tr>
</tbody>
</table>
Proteins

- Caseins (80%) & whey proteins (20%)
- Whey proteins of equal nutritional value with the egg proteins
- Immunoglobulins, protecting newborns against infections
  - High in colostrum, decreasing during lactation
- Goat milk against food allergies e.g. towards cow milk proteins
- Bioactive peptides
Bio-hydrogenation of ruminant feed fatty acids in the animal rumen

Vaccenic (C18:1 11t) to rumenic acid (C18:2 9c,11t) in the mammary gland

Rumenic acid (C18:2 9c,11t) isomer of the conjugated linoleic acid (CLA)

Positive health effects of CLA isomers
  * lowering the risk of cardiovascular diseases, cancer, diabetes, osteoporosis
  * modulating the immune system

MUFA and PUFA higher in goat than in cow milk
Carbohydrates

- Lactose, the main milk sugar
- Oligosaccharides composed of
  - galactose, fucose, N-acetyl-glucosamine, N-acetyl-neuramic acid
  - Functionality determined by their chemical structure
  - Influence on gastro-intestinal and inflammatory processes
  - Modulation of growth of intestinal flora, e.g. bifidobacteria
  - Protection against bacterial and viral infections
- Concentrations
  - Human milk 5-10 g/l
  - Goat milk 0.25-0.30 g/l
  - Buffalo milk >0.1 g/l
  - Cow milk 0.03-0.09 g/l
  - Sheep milk 0.02-0.04 g/l
Total content highly variable, depending on the vitamin status and the feeding regime of the mother

Water-soluble more influenced by the feed than fat-soluble vitamins

Vitamin A higher in sheep, goat and buffalo than in cow milk

Riboflavin (B2) higher in sheep than in cow milk

Niacin (B3) higher in sheep and goat than in cow milk

Heat, light and oxygen effect on vitamin content

- slightly differs among milk types
- rather minor from the nutrition point of view, since many vitamins in relatively low levels in milk
Minerals

- Calcium (Ca) and phosphorus (P)
- Higher in sheep and goat milk than in cow and human milk
- Ca:P ratio on a weight basis of human milk more favorable for Ca uptake
- No differences between raw cow milk and UHT or sterilized milk
- Bioavailability decrease due to high temperatures up to 90°C
  - reversible after cooling
- Lactose, lactulose, CLA, vitamin D, casein
  - potential enhancers of Ca absorption
Probiotics

- "Live microorganisms, which when administered in adequate amounts confer a health benefit on the host"
- Probiotic dairy products via fermentation mainly by lactic acid bacteria
- Probiotic foods = health promoting foods = functional foods
- Expanding commercial interest and growing market shares
- Introduction

- Milk and Dairy Products in the Mediterranean Basin

- Composition and Nutritional Value of Milk

- Challenges for the Future
Challenges for the Future

- Traditional Mediterranean Diet a heritage of millennia

- Update needed if taking into consideration
  - globalization of food production & consumption
  - new life-style, dietary, socio-cultural, environmental & health challenges

- According to this
  - dairy products in moderate amounts, i.e. 2 servings per day
  - preference for low-fat dairy products
  - preference for traditional products e.g. yoghurt, cheese, fermented milks
Challenges for the Future

- Small-scale cheese units together with strong industrial ones
  - mainly in the European countries of the Mediterranean basin

- Globalization of trade and economic competition
  - dynamic industrial dairy sector not always with real territorial base

- Local small-scale production
  - with comparative advantages on niche markets
  - chance for economic development in marginal and isolated rural areas
  - despite their structural present weakness
    - hope for a renewal of pastoralism & small-scale local cheese making
    - public authorities support with diverse projects & initiatives
Thank you for your attention!

Effie TSAKALIDOU
Department of Food Science and Human Nutrition
Agricultural University of Athens
Iera Odos 75, 11855 Athens, Greece
E-mail: et@aua.gr