MODULE 2: UNIT #1

Milk and Milk Products

Definition of Milk

Biological Definition:

Milk is a nutrient rich liquid which is a secondary product of reproduction in female mammals. It is produced by the mammary glands, and its main function is to provide nutrients to the young mammals immediately after birth, and in the early period of their life. It is made up of water, protein, fat, lactose and ash. It also contains maternal antibodies which is passed to the young in the Colostrum or milk 12 to 24 hours ***post partum.*** The composition of the milk changes during the lactation and could also change with different feeding regimes.

Legal Definition:

For purposes of marketing and food and drug regulations, each country usually have in their food laws, a definition of the minimum quality standards and composition of milk.

Sources and Chemical Composition of different types of Milk
Table 12.2 from Payne (1990)

Milk products used by humans are: **Plain** and **Flavored Liquid Milk products**, **Powdered Milk**, **Butter** and **Ghee**, **Fermented Milk products** [**Cheese**, **Yogurt**] **Ice Cream** and **Creams.**

Forms of Milk Products

The form of milk products is dependent on the manner in which the milk is processed in the first instance. The whole milk can
(i) in the first instance be homogenized to produce whole milk or;
(ii) separated into cream and solids.

The cream can be left as cream or separated and made into butter and butter milk.

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The non cream part can be treated as low fat milk, reconstituted or fermented into yogurt, cheese and a variety of other products.

Liquid Milk

Collection and Grading

Milk is either collected in small (8 gallons) stainless steel containers from small farmers or in bulk stainless steel tanks.

It is usually graded based on its butterfat content. The grading system is usually dictated by the main buyer/ processor

Storage

Liquid milk can be kept as follows:

Raw:

Milk having undergone no treatment, other than the desired cooling may have an irregular chemical composition with butterfat content varying from < 3% to 4%.

Pasteurized Milk:

This is milk which is very often homogenized and in which pathogenic germs have been eliminated by heat treatment. Originally: Treatment 60-65°C for thirty minutes, now, high temperature short time [HTST], 72°C for 15 seconds.

Sterilized Milk:

Homogenized milk in which all revivable germs have been eliminated by heat treatment before packaging.

UHT Milk:

Homogenized milk heat treated at ultra high temperatures [UHT] and aseptically packaged.

150°C for 3 seconds followed by instantaneous cooling is the method used.

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Flavored sterilized or UHT milk:

Partially or totally skimmed milk with added sugar and flavoring. Can also contain a natural stabilizer and coloring agents.

Preparation, Processing and Packaging

[*Class discussion*]

Milk Production and Marketing in the Caribbean

[Read : Dairy Development in the Caribbean- Conclusions and Recommendations: CARDI-CTA-IDF (1993)]

Here are some points for consideration to be able to get a better understanding and appreciation of the Dairy Industry from a livestock products perspective.

- Role of Farmers

- Role of Import Wholesalers and Retailers

- Role of Nestle

- Role of the New Zealand Dairy Board

- Role of the Australian Dairy Board

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Powdered Milk

Powdered milk is produced by the removal of water from the liquid milk using the freeze drying technique. This is a very useful technique as the water content of whole milk ranges from 83 to 85 %.

Butter and Ghee

Description, Chemical Composition and Types of Butter

Butter is an emulsion of water and almost pure milk fat comprised of-83% Fat: 16% water: 1% other constituents (proteins, sugars, mineral salts). It is manufactured from cream containing 30 to 40% butterfat.

The Making of Butter

Activity: Reading

Please Read : Preparation of Dairy Products, by Pauline Ebing and Karin Rutgers (1991), AGRODOK 36, CTA, which describes the preparation of dairy products. Table 1 presents the composition of the various types of milk and Figure 6 gives a diagram of the preparation of the different types of milk products. This would also be useful reading for Module 2 : Unit 2.

You could write to the CTA for these and many other books:
Publications Unit
CTA, P.O. Box. 380, 6700 AJ Wageningen, The Netherlands

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MODULE 2: UNIT #2

Fermented Milk Products

Introduction to fermented Milk: Chapter 2, Kosikowski (1982)

- Six major fermentation processes in Milk
  1. Lactic Acid Fermentation- Homo-fermentative
  2. Propionic Acid Fermentation
  3. Citric Acid Fermentation
  4. Alcohol Fermentation
  5. Butyric Acid Fermentation
  6. Coliform-Gassy Fermentation
- Cultures and Starters: Chapter 3, Kosikowski (1982)
- Fermented Milks: Chapter 4, Kosikowski (1982)

Cheese

Cheese is the product of curds. It is produced through the denaturing of the milk proteins through the acidification of the milk either by direct or indirect methods.

Description and Classification of Cheese

- pg 207 Montagne (1983)

Making and Processing Cheese

- Fundamentals of Cheese Making and Curing:
  Chapter 7, Kosikowski (1982)
- Mozzarella Cheese
  Chapter 11, Kosikowski (1982)

Cheese Quality

Storage of Cheese

Grading and Marketing of Cheese

New Readings:

Robinson, R. K. and Wilbey, R. A. (1998): *Cheesemaking Practice*, 3rd Edition; Aspen Publishers Inc., Gaithersberg, Maryland, USA

Fox, P.F.; Guinee, T.P.; Cogan, T.M.; and Mc Sweeney, P.L.H. (2000): *Fundamentals of Cheese Science*; Aspen Publishers Inc., Gaithersberg, Maryland, USA

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Yoghurt [*Laboratory Topic*]

Description, Composition and Types of Yogurt
Making and Processing of Yogurt
Plain and Flavoured

Other Fermented Milk Products

Reading Activity

Anon/FAO (1999)
Manual 1: Hygenic Milking and Milk Handling on Farms
Training Workshop on "Small scale Milk Processing" Trinidad and Tobago, September 1999
[Garcia's Collection in Main Library Special Reserve # Garcia 530]

Anon/FAO (1999)
Manual 2: Simple Quality Control for Milk Processing at the Farm Level.
Training Workshop on "Small scale Milk Processing" Trinidad and Tobago, September 1999
[Garcia's Collection in Main Library Special Reserve # Garcia 529]

Anon/FAO (1999)
Manual 3: Small Scale Milk Processing at the Farm Level
Training Workshop on "Small scale Milk Processing" Trinidad and Tobago, September 1999
[Garcia's Collection in Main Library Special Reserve # Garcia 532]

Anon/FAO (1999)
Manual 4: Marketing Milk Products
Training Workshop on "Small scale Milk Processing" Trinidad and Tobago, September 1999
[Garcia's Collection in Main Library Special Reserve # Garcia 531]

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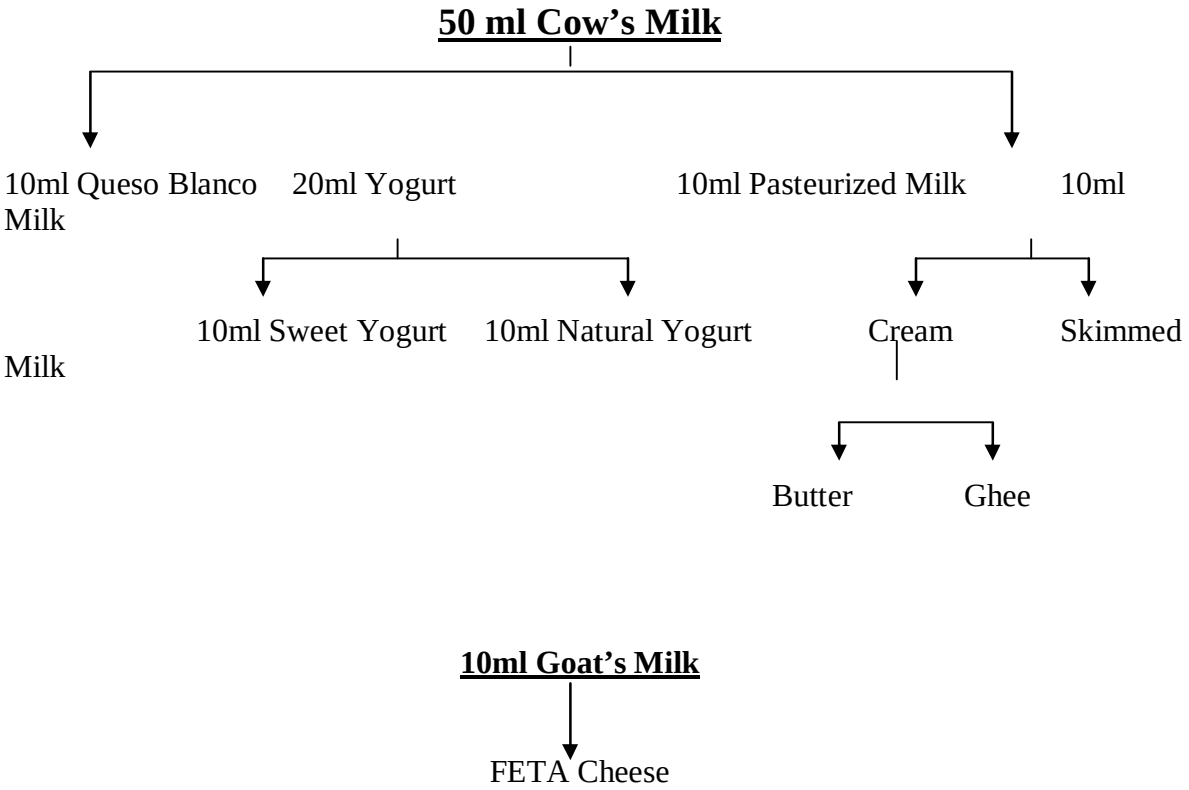
FAO/Ministry of Agriculture Milk Preservation and Cheese-making Course: 13-15th September 99, 5-6th and 12th October, 1999.

Report by Gail Young



Milk Reception

Steps:

(a) Test the milk via:-
Sensory (sight and smell) Test: for souring, presence of flies or other particles. If a sour smell is obtained, the milk should not be pasteurized, but can be used to make yogurt and cheese. Stir milk before performing this test, since some separation would have occurred as milking was done 2-3 hours before.

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:-Alcohol Test: mix 2ml milk and 2ml of 70% or 68% Ethanol together and check for coagulation

:-Clot-on-Boiling Test: put milk in test-tube and boil; if there is coagulation, its not possible to pasturise it

:-Density (Lactometer) Test: put the lactodensometer into a long measuring cylinder, and allow it to settle. Take the reading on the lacotmeter to obtain the 2nd and 3rd decimal points after the already given "1.0" of the gradation. Note the temperature of the surroundings. For every reading above the 15ºC to which the lactometer is calibrated, multiply by 0.2 and add the result back to the reading taken. This gives the density reading for the particular temperature, e.g. the density reading at 26ºC is:

26-15 = 11 11 x 0.2 = 2.2;
25 (2nd and 3rd decimal point readings taken from lactometer at 26ºC) + 2.2 = 27.2
and the initial 'given' reading is 1.0, so density reading at 26ºC is 1.0272

:-Acidity Test

(b) Filter the milk to be used through a strainer placed above a filter into a sterile container and the milk is ready for testing.

Pasturisation of Milk

The process is based on the High Temperature at Slow Time (HTST) concept. The combinations of 72°C/15 seconds (in order to kill *M. tuberculosis*), and 63°C/30 minutes are the minimum which are useful. To be on the safe side therefore, one can use 80°C/15 seconds.

Then you cool the milk down (possible in local T&T conditions to 32°C) essentially to 4°C by bottling.

You can take the same 10L at 4ºC, and place it into a separator to get skimmed milk and cream. Then pasturise the skimmed milk.

The cream can be used as is or to make butter.

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ALL PLASTICS/BOTTLES used for packaging MUST BE WRAPPED to ensure that their STERILISED NATURE REMAINS IN TACT.

NATURAL YOGURT

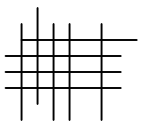
- The process here entails the milk being PASTURISED for 90°C/30 minutes
- Then COOL it down to 45°C
- Add YOGURT CULTURE at 1-2%
- FILL in CUPS of 100-200ml capacity
- INCUBATE at 42-45°C for approximately 4 hours. Observe for solidification
- Then COOL DOWN to 4°C

STIRRED/SWEETENED YOGHURT

- ADD 3-5% sugar before pasteurization
- Instead of putting yogurt into small cups, put the entire mixture into a 10ml container in the refrigerator for the same time indicated in the one above
- After incubation, then at the same time STIR/MIX it, add fruits
- Honey (at 7-8%) can be used instead of 5% sugar. This yogurt can be kept for 21 days

FETA CHEESE

- PASTURISE MILK at approximately 68-72°C/15-20 seconds not higher, otherwise the Rennet is in effective.
- COOL DOWN to 35-37°C
- ADD zero-culture (these are only lactic acid-forming bacteria), and yogurt culture mesophilic bacteria (1-2%)
- WAIT 30 minutes
- ADD RENNET at 1%; 2-3ml of Rennet
- WAIT 30 minutes
- CUT CURD into 2cm strips to for a grid-like effect, e.g.



- WAIT 20-30 minutes

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- REMOVE whey by scooping and draining off GENTLY and CAREFULLY
- ADD salt (approx. 5%); 70-80g
- FILL IN CHEESE MOLDS after covering with cheese-cloths, and apply pressure for 12-28 hours
- REMOVE cheese-cloths next morning, and re-salt cheese with 1% brine solution

QUESO BLANCO

QUESO BLANCO, which is made in many of the Latin American countries, follows a similar procedure to the one producing **FETA CHEESE**. Butter culture is an additional culture that can be used.

Dairy Culture Preparation

Thermophilic Dairy Culture (D.C.)

Yoghurt culture:

Lactobacillus bulgaris (50%)
Streptococcus thermophilis (50%)

They need a 35-45°C incubating temperature.

Commercial Yogurt culture:

This is freeze-dried culture in granules (most common form obtainable). Keep at <18°C. It can be kept this way for a maximum of 6 months.

In this granular form, the culture bacteria are 'asleep'. To 'wake' them up therefore, the following process can be used:

- Use UHT Skimmed Milk a5 43-45°C
- OPEN and POUR OUT 50ml of the milk
- TAKE STERILISED (with hot water) teaspoon, and put in ½ teaspoon of granules
- MIX well
- INCUBATE at 43-45°C for 4-5 hours

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- KEEP under REFRIDGERATED conditions at 4°C
- From this initial culture made, you can use ½ teaspoon to make fresh culture over time
- This culture will last for approximately 1 week, so test first before using it to make fresh culture in a new skimmed milk pack

CHEESE CULTURES

- possible to use yogurt culture for cheese culture. This is used for making Feta and Mozarella cheeses and Pasta Filata
- Mesophilic cultures (common cultures used for making cheese, have an optimum temperature of approximately 25°C)
- Mesophilic zero-culture:- only produce lactic acid. Used for FETA Cheese
- Butter culture; producing lactic acid plus aromas, e.g. Diacetyl
- All of the above cultures are also useful for making QUESO BLANCO

Procedure here is similar to the one for making yogurt cultures, BUT INCUBATE at 25°C. So it is possibly better to make them in the evening to night-time.

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MODULE 2: UNIT #3

Ice Cream [Laboratory Topic]

Description and Composition

Preparation and Processing

Storage and Packaging

Grading

Marketing

Creams

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