



# Pengetahuan Bahan Pangan (Food Science)

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# Food Groups:

1. Cereals, starchy roots and other mainly carbohydrate foods
2. Legumes, nuts and oilseeds
3. Vegetables and fruits
4. Meat, fish, eggs, milk and their products
5. Oils and fats
6. Beverages and condiments

*(Latham, M.C., Human nutrition in the developing world, FAO, Rome: 1997)*

# I. Cereals, starchy roots and other mainly carbohydrate foods

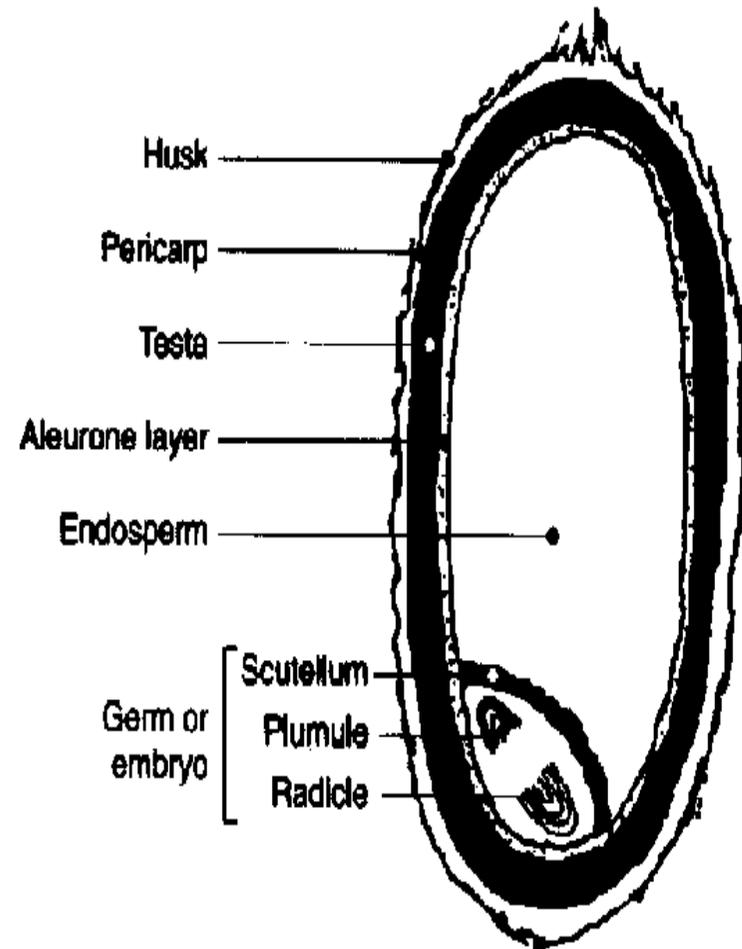
- the first crops to be planted and harvested were the cereal grains:
  - maize in the Americas before the arrival of Europeans;
  - rice in the great Asian civilizations;
  - barley in Ethiopia and northeast Africa.
- In the developing countries provide 70 percent or more of the energy intake of the population.
- In the United States and Europe often less than 40 percent of energy comes from carbohydrates.

# Cereals

- Include: maize, sorghum, millets, wheat, rice, barley, oats, teff and quinoa.
- A new cereal of considerable interest is *triticale*, a cross between wheat and rye.
- all cereal grains have a fairly similar structure and nutritive value:
  - whole grain provides energy, protein and useful amounts of calcium, iron (though phytic acid may hinder absorption) and the B vitamins
  - dry state cereal grains are completely lacking in vitamin C and, except for yellow maize, contain no carotene (provitamin A).
- For a balanced diet, cereals should be supplemented with foods rich in protein, minerals and vitamins A and C (Vitamin D can be obtained through exposure of the skin to sunlight.)

## The structure of all cereal grains consists of:

- the husk of cellulose, which has no nutritive value for humans;
- the pericarp and testa, two rather fibrous layers containing few nutrients;
- the aleurone layer, which is rich in protein, vitamins and minerals;
- the nutrient-rich embryo or germ, consisting of the plumule and radicle attached to the grain by the scutellum;
- the endosperm, comprising more than half of the grain and consisting mainly of starch.



## Content of certain nutrients in 100 g of selected cereals

<b>Food</b>	<b>Energy</b>	<b>Protein</b>	<b>Fat</b>	<b>Calcium</b>	<b>Iron</b>	<b>Thiamine</b>	<b>Riboflavin</b>	<b>Niacin</b>
	<i>(kcal)</i>	<i>(g)</i>	<i>(g)</i>	<i>(mg)</i>	<i>(mg)</i>	<i>(mg)</i>	<i>(mg)</i>	<i>(mg)</i>
Maize flour, whole	353	9.3	3.8	10	2.5	0.30	0.10	1.8
Maize flour, refined	368	9.4	1.0	3	1.3	0.26	0.08	1.0
Rice, polished	361	6.5	1.0	4	0.5	0.08	0.02	1.5
Rice, parboiled	364	6.7	1.0	7	1.2	0.20	0.08	2.6
Wheat, whole	323	12.6	1.8	36	4.0	0.30	0.07	5.0
Wheat flour, white	341	9.4	1.3	15	1.5	0.10	0.03	0.7
Millet, bulrush	341	10.4	4.0	22	3.0	0.30	0.22	1.7
Sorghum	345	10.7	3.2	26	4.5	0.34	0.15	3.3

# (1). Maize

- very important food in the Americas and much of Africa
- contain about the same amount of protein as other cereals (8 to 10 percent)
- a poor-quality protein containing only small amounts of lysine and tryptophan
- The association noted between maize consumption and pellagra may be due in part to a deficiency of these amino acids.
- Whole-grain maize contains 2 mg niacin per 100 g, which is less than that in wheat or rice.
- The niacin in maize is in a bound form and not entirely available to humans.
- In Mexico and some other countries maize is treated with an alkaline solution of lime which releases the niacin and helps prevent pellagra;

# *Maize Processing*

- Maize is usually ground and made into flour → "Maizena"
- Milling reduces the nutritive value of maize just as it does that of other cereals.
- highly milled product is deficient in B vitamins
- The vitamin B constituents lost in milling may be replaced in maize meal, as in other cereal flours, by fortification.
- Enrichment of this kind has been effective in many countries.

<b>Level of processing of maize</b>	<b>Thiamine</b>	<b>Riboflavin</b>	<b>Niacin</b>
Whole grain	0.35	0.13	2.0
Lightly milled	0.30	0.13	1.5
Highly milled (65 percent extraction)	0.05	0.03	0.6

## (2). Rice

- wild varieties have existed for centuries in both Asia (*Oryza sativa*) and Africa (*Oryza glaberrima*).
- The outer layers and the germ together contain nearly 80 percent of the thiamine in the rice grain.
- The endosperm, though constituting 90 percent of the weight of the grain, contains less than 10 percent of the thiamine.
- Lysine and threonine are the limiting amino acids in rice.
- consisting mainly of starch: Amyloso vs. Amylopectin
- Waxy varieties (Beras Ketan) : >> Amylopectin

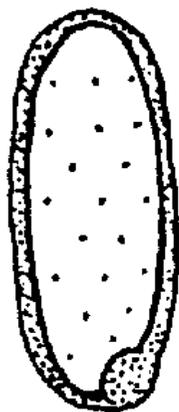
# *Rice Processing*

- The traditional home method of pounding rice in a wooden mortar and winnowing it in a shallow tray:
  - usually results in the loss of about half of the outer layers and germ, leaving a product containing about 0.25 mg thiamine per 100 g.
- The procedure of milling and subsequently polishing rice, removes nearly all the outer layers and germ, a product:
  - containing only about 0.06 mg thiamine per 100 g
  - grossly deficient
- In Asia, a person eating 500 g rice per day:
  - if use highly milled polished rice would get only 0.3 mg thiamine
  - if home-pounded or lightly milled rice would provide approximately 1.25 mg thiamine (normal requirement)

## *Important:*

- The solubility of the B vitamins has its disadvantages
- Parboiling is the way of providing highly milled rice that is reasonably white and yet contains adequate quantities of B vitamins:
  - The paddy, is usually steamed, so that water is absorbed by the whole grain, including the endosperm.
  - The B vitamins, which are water soluble, become evenly distributed throughout the whole grain
  - The paddy is dried and it is then ready for milling in the ordinary way.
  - Even if it is highly milled and polished, the parboiled grain still retains the major part of its thiamine and other B vitamins.
- Rice that is washed too thoroughly in water loses some of the B vitamins.
- If rice is boiled in excess water, a considerable proportion of the B vitamins is likely to be discarded with the water after cooking.

**Unmilled rice**



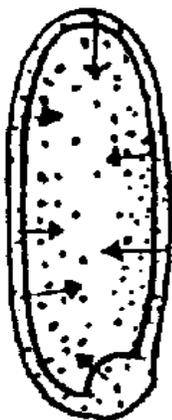
Thiamine is mainly in the outer layers and germ

**Milled rice**



Little thiamine is left

**Unmilled rice being parboiled**



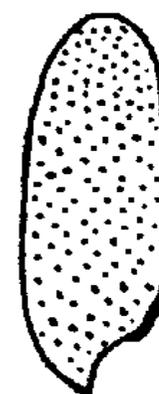
Thiamine is drawn into the endosperm during parboiling

**Unmilled parboiled rice**



More thiamine is now in the endosperm

**Milled parboiled rice**



Adequate quantities of thiamine are left in the grain

## **(3) Wheat**

- **Wheat (genus *Triticum*) is the most widely cultivated cereal in the world and its products are very important in human nutrition.**
- **Bread, usually made from wheat flour, is a popular convenience food.**
- ***Nutrient content:* provides a little more protein than does rice or maize, about 11 g per 100 g.**
- **The limiting amino acid is lysine.**
- **In many industrialized countries wheat flour is fortified with B vitamins and sometimes iron and other nutrients (folic acid)**

# *Wheat Processing*

- Usually ground and made into flour → "terigu"
- Gluten is the specific protein → flour quality
- The nutrient content depends on the degree of milling, i.e. the extraction rate.
- Low-extraction flours have lost much of their nutrients.
- In some developing countries where wheat is being increasingly used, the bakers have encouraged the trend towards highly refined products, because white wheat flour has better baking qualities.
- Traders also prefer the highly milled product because it stores better.
- Its low fat and vitamin content.

## (4) Millets and sorghum

- Millets and sorghum are cereal grains widely grown in Africa and in some countries in Asia and Latin America.
- can survive drought conditions better than maize and other cereals, so they are commonly grown in areas where rainfall is low or unpredictable.
- sorghum requires more moisture than millets but less than maize
- nearly all contain a higher percentage of protein than maize and the protein is also of better quality, with a fairly high content of tryptophan.
- also rich in calcium and iron.
- many varieties of sorghum have a higher protein content than other cereals.
- usually for making beer

# (5) Other cereals

## 1. Oats:

- Oats are not important in the diets of most developing countries.
- The crop is grown in a few cold highland areas
- ***Nutrient content:*** a good cereal containing rather more protein than maize, rice or wheat, but they also contain a considerable quantity of phytic acid which may hinder absorption of iron and calcium.
- Oatmeal is imported for use in porridge and is used in some manufactured infant foods.

## 2. Rye:

- Rye is little grown in Africa, Asia and Latin America, and even in Europe it is not an important item of the diet.
- ***Nutrient content:*** similar to those of other cereals and is sometimes added to bread.

### **3. Barley:**

- **grown in some of the wheat-growing districts of Africa and in highland areas of Asia and South America.**
- **it is usually consumed as a stiff porridge after home preparation.**
- **In Europe, used mainly for animal feeding and in the preparation of alcoholic beverages such as beer and whisky.**

### **4. Triticale:**

- **This new cereal is a cross between wheat and rye.**
- **It has promise of high yields and good nutritive value.**
- **It is particularly suited to temperate climates.**

### **5. Teff. Teff (*Eragrostis tef*):**

- **It is usually ground into a flour, cooked and eaten as *injera*.**
- **an important cereal in Ethiopia, where it is held in special regard although it gives a relatively low yield per unit area.**
- **The nutritive value of teff is similar to that of other cereal grains, except that it is richer in iron and calcium.**
- **The high consumption of teff in parts of Ethiopia may be an important reason why iron deficiency anaemia is rarely reported there.**

# Other mainly carbohydrate foods

- a. Starches and starchy roots
  - Cassava
  - Sweet potatoes (ubi manis)
  - Yams (ubi)
  - Taro or cocoyams (talas, keladi),
  - Potatoes (kentang)
  - Arrowroot (ararut)
- b. Other predominantly carbohydrate foods:
  - Bananas and plantains (pisang & pisang raja)
  - Sago
  - Sugar
  - Honey

# Starches and starchy roots

## 1. Cassava

- energy yields per hectare from cassava roots are often very high
- contains less than 1 percent protein (in maize and other cereals in maize and other cereals more than 10 percent )
- also has less iron and B vitamins than the cereal grains.
- kwashiorkor is much more common in young children weaned on to cassava than in those weaned on to millet or maize.
- Cassava, particularly bitter varieties, contains a cyanogenic glucoside
- Can make tapioca, which is mainly cassava starch
- Cassava leaves:
  - their nutritive value is similar to that of other dark green leaves.
  - source of carotene (vitamin A), vitamin C, iron and calcium.
  - also contain some protein.
  - to preserve the maximum quantity of vitamin C in the leaves, they should not be cooked for longer than about 20 minutes

## **2. Sweet potatoes**

- Sweet potatoes originated in the Americas**
- Usually from stem cuttings.**
- Contain little protein.**
- Contain some vitamin C, and**
- The coloured varieties, especially the yellow ones, provide useful quantities of carotene (provitamin A).**
- Sweet-potato leaves are often eaten and have properties very similar to those of cassava leaves.**
- However, the leaves should not be picked to excess since, as with other tuber crops, this may reduce the yield of tubers.**

## **3. Yams**

- There are innumerable varieties of yams (genus *Dioscorea*), some of which are indigenous to Africa, Asia and the Americas.**
- They vary in shape, colour and size as well as in cooking quality, leaf structure and palatability.**
- The many domesticated and wild varieties are eaten.**
- Usually contain about twice as much protein (2 percent) as cassava, although very much less than cereals.**

#### **4. Taro or cocoyams (*Colocasia sp.*)**

- originated in Asia**
- grown in areas where there is fairly high rainfall spread over much of the year.**
- Both the tubers and the leaves are eaten.**
- The nutritive value of taro is similar to that of cassava.**

#### **5. Potatoes**

- first taken to Europe from South America**
- became a cheap, useful, high-yielding alternative to the existing main staples**
- they are grown in higher cool areas**
- contain only about 2 percent protein, but the protein is of reasonably good quality.**
- provide small quantities of B vitamins and minerals.**
- contain about 15 mg vitamin C per 100 g, but this amount is reduced in storage.**
- the keeping quality of potatoes is not good, unless they are stored carefully.**

## **6. Arrowroot**

- is grown in areas with adequate rainfall**
- the nutritive value of arrowroot is similar to that of potatoes.**
- the roots are eaten in a variety of ways, often roasted or boiled.**

# **Other predominantly carbohydrate foods**

## **1. Bananas and plantains**

### **– Plantains :**

- that are picked green and are cooked before eating,**
- frequently sun-dried and made into a flour.**
- contain more starch and less sugar than bananas, which are usually eaten raw like other fruits.**
- A 100-g portion of green bananas or plantains provides 32 g carbohydrate (mainly as starch), 1.2 g protein, 0.3 g fat and 135 kcal. Plantains also have a high water content.**
- Their very low protein content explains why kwashiorkor commonly occurs in young children weaned on to a mainly plantain diet.**

– **Bananas:**

- usually contain about 20 mg vitamin C and 120 mg vitamin A (as beta-carotene equivalent) per 100 g.
- low in their content of calcium, iron and B vitamins.
- bananas supply only 80 kcal per 100 g, about 2 kg must be eaten to provide 1 500 kcal.

**2. Sago (*Metroxylon sp.*)**

- almost pure starch and comes from the sago palm.
- Sago has low protein content.

### **3. Sugar**

- almost 100 percent sucrose and pure carbohydrate.**
- produced sugar comes from sugar cane or sugar beet.**
- sugar is often inexpensive source of energy and can be a valuable addition to bulky energy-deficient diets.**
- Contrary to popular belief, customary consumption of sugar is not related to obesity, diabetes, hypertension or any other non-communicable disease.**
- Frequent sugar consumption can be associated with dental caries when coupled with poor oral hygiene, but sucrose is no more cariogenic than other fermentable sugars.**
- White sugar contains no vitamins, protein, fat or minerals.**
- Many people find that its sweet taste adds to the enjoyment of eating.**
- The yields of energy per hectare of land are very high on productive sugar estates.**

## **4. Honey**

- From time immemorial honey has been extensively gathered in developing countries from wild hives.**
- Now more and more hives are being kept, often in hollowed and suspended pieces of tree-trunk or in other more managed ways.**
- The incentive to keep bees tends to be the high price of beeswax rather than just the honey.**
- Honey has gained the false reputation of being of special nutritive value.**
- In fact it contains only sugar (carbohydrate), water and minute traces of other nutrients.**
- Although merely a source of energy, it has sensory value as a pleasant food for humans.**

## II. Legumes, nuts and oilseeds

- These legumes (excluding soybean) all have a somewhat similar nutritive value.
- contain about 22 percent protein (as opposed to 1 percent in cassava roots and 10 percent in maize)
- good quantities of thiamine, riboflavin and niacin
- richer in iron and calcium than most of the cereals.

# (1) Soybean

- originated in Asia
- contain up to 40 percent protein, 18 percent fat and 20 percent carbohydrate.
- the protein is of a higher biological quality than that from other plant sources.
- used in a wide variety of ways:
  - made into a variety of tasty dishes which supplement the staple food of rice or other cereal.
  - Soy products such as tofu (soybean curd) and tempeh (a fermented product)
  - as an enrichment of cereal flours, as an infant food or for institutional and school-feeding purposes.

## (2). Groundnuts (peanuts)

- ***Nutrient content:***
  - groundnut (*Arachis hypogaea*) contain much more fat than other legumes, often 45 percent
  - also much more niacin (18 mg per 100 g) and thiamine,
  - but relatively little carbohydrate (12 percent).
  - The protein content is a little higher than that of most other pulses (27 percent).
  - Groundnuts are an unusually nutritious food with more protein than animal meat.
  - They are energy dense because of their oil, and they are rich in vitamins and minerals.
  - In predominantly maize diets, relatively small quantities of groundnuts, with their high content of niacin and also of protein (including the amino acid tryptophan), can prevent pellagra.
  - When groundnuts are added to children's diets, their high protein and energy content serves to prevent protein-energy malnutrition.

- Used in a wide variety of ways:
  - usually utilized for oil extraction, and the residue, groundnut cake, is used for animal feed.
  - consumed as peanut butter (in USA)
  - consumed roasted, boiled or cooked in other ways.
- Notice:
  - if damaged during harvesting or if poorly stored in damp conditions, groundnuts may be attacked by the mould *Aspergillus flavus*
  - *Aspergillus flavus* produces aflatoxin, which has been shown to cause liver damage in animals and to kill poultry fed on infected groundnuts.
  - aflatoxin may be toxic also for humans and a cause of liver cancer

# (3) Tree nuts

## 1. Coconut

- highly useful plant, a part from the food it provides for humans.
- When it is green, the nut contains about half a liter of water; this is a very refreshing and hygienic drink, but apart from a little calcium and carbohydrate, it has no nutritive value.
- The white flesh, however, is rich in fat.
- The flesh of the coconut is usually sun-dried into copra.
- The oil from copra is used both for cooking and for making soap.
- It is an important ingredient in a variety of cuisines from Thailand to Saudi Arabia.
- Coconut oil has the disadvantage of containing a relatively high proportion of saturated fatty acids.
- The coconut sap in many countries is fermented to yield alcoholic beverages.

## **2. Cashew nut (biji mete)**

- rich in fat (45 percent) and contain 20 percent protein and 26 percent carbohydrate.
- The edible swollen stalk of the nut contains good quantities of vitamin C
- Cashew nuts are a useful local food but too expensive for most people.

# **(4) Oilseeds**

## **1. Sesame (Wijen)**

- contain about 50 percent fat and 20 percent protein.
- also rich in calcium and contain useful quantities of carotene, iron and B vitamins.
- Sesame seeds can form a nutritious addition to the diet.

## **2. Sunflower seeds**

- some of the seeds and some of the oil are eaten.
- the oil has the advantage of being relatively high in polyunsaturated fatty acids.
- the seeds contain about 36 percent oil (less than sesame), 23 percent protein and some calcium, iron, carotene and B vitamins.

### 3. Other oilseeds

- A number of other oil-rich seeds are eaten or used for oil extraction, include:
  - pumpkin seeds (biji labu)
  - melon seeds (biji semangka)
  - Cottonseed (biji randu).
- The last is a major source of oil in the cotton-growing areas of Asia, Africa and Latin America.
- In West Africa and elsewhere, shea butter (*Butyrospermum parkii*), butternut and several other oilseeds are used in the diet.

# III. Vegetables and fruits

- Vegetables
  - The foods called vegetables include:
    - some fruits (e.g. tomatoes and pumpkins)
    - leaves (e.g. amaranth and cabbage)
    - roots (e.g. carrots and turnips)
    - even stalks (e.g. celery)
    - flowers (e.g. cauliflower).

# Vegetables

- nearly all types of vegetables are eaten soon after they are harvested; and they are rarely stored for long periods (with a few exceptions such as pumpkins and other gourds).
- nearly all rich in carotene and vitamin C and contain significant amounts of calcium, iron and other minerals.
- content of B vitamins is frequently small.
- provide only a little energy and very little protein.
- content consists of indigestible residue, which adds bulk or fibre to the faeces.
- the dark green leaves contain far more carotene and vitamin C, as well as more protein, calcium and iron, than pale green leaves and other vegetables.
- An increase in the consumption of green leaves and other vegetables could play a major part in reducing vitamin A deficiency, iron deficiency also supply additional calcium and vitamin C which would prevent the rare disease scurvy and perhaps also assist the healing of ulcers and wounds.
- Vitamin C from vegetables also enhances iron absorption.

# Fruits

- The main nutritive value of fruits is their content of:
  - vitamin C,
  - carotene.
  - very little fat or protein (except the avocado and a few others) and
  - usually no starch.
  - carbohydrate (present in the form of various sugars)
  - much unabsorbable residue, mainly cellulose.
- The citrus fruits, such as oranges, lemons, grapefruits, tangerines and limes, contain good quantities of vitamin C but little carotene.
- Papayas, mangoes and Cape gooseberries (*Physalis peruviana*) contain both carotene and vitamin C.
- The avocado is rich in fat
- Bananas contain fair quantities of carotene and vitamin C, and they are rich in potassium
- When bananas are ripe their starch is converted into other sugars.

## IV. Meat, fish, eggs, milk and their products

- Foods of animal origin are a useful complement to most diets, especially to those in developing countries that are based mainly on a carbohydrate-rich staple food such as a cereal or root crop.
- provide protein of high biological value, which is often a good complement to the limiting amino acids in plant foods consumed.
- relatively expensive
- increasing the risks of heart disease and obesity (especially saturated fat).
- Americans consume about 80 kg of meat per person per year - almost 0.25 kg per day

# (1) Meat and meat products

- Usually defined as:
  - the flesh (mainly muscles)
  - organs (for example, liver and kidneys)
- Sources:
  - animals (mammals, reptiles and amphibians)
  - birds (particularly poultry).
- Subdivided into:
  - red meat (from cattle, goats, sheep, pigs, etc.)
  - white meat (mainly from poultry).

- ***Nutrient content:***
  - contain protein of high biological value (about 19 percent protein of excellent quality)
  - iron that is well absorbed.
  - fat depends on the animal that the meat comes from and the cut.
  - energy value of meat rises with the fat content
  - fat in meat is fairly high in its content of saturated fatty acids and cholesterol.
  - provides useful amounts of riboflavin and niacin, a little thiamine and small quantities of iron, zinc and vitamins A and C.
  - Offal (the internal organs) and brain has a relatively high amount of cholesterol.
- Contaminated meat can lead to disease, so need:
  - hygienic practices are essential at all levels, from the farm, through the slaughterhouse, to the retailer and into the kitchen.

## (2) Fish and seafoods

- *Nutrient content:*
  - provide a good quantity (usually 17 percent or more) of protein of high biological value, particularly sulphur-containing amino acids.
  - varies in fat content but generally has less fat than meat.
  - provides thiamine, riboflavin, niacin, vitamin A, iron and calcium.
  - contains a small quantity of vitamin C if eaten fresh.
  - small fish from the sea and lakes such as sardines and sprats are consumed whole, bones and all, thus providing much calcium and fluorine.
  - fish liver and fish oils are very rich sources of the fat-soluble vitamins A and D.

## (3) Eggs

- *Nutrient content:*
  - Contain no carbohydrate.
  - contains high proportion of excellent protein
  - is rich in fat and contains good quantities of calcium, iron, vitamins A and D and also thiamine and riboflavin.
- Eggs do have a nutritional disadvantage: very high cholesterol content (in the yolk).
- They are also an easily prepared, easily digestible, protein-rich food suitable for children from the age of six months onward.
- Toddlers should be given priority in eating the eggs.

## (4) Milk and Milk Products

- The composition of milk varies according to the animal.
- Thus, for human infants, human milk is better than cows' milk or any other milk product.
- Caseinogen and lactalbumin, proteins of high biological value, are among the most important constituents of cows' milk.
- The fat has a rather high content of saturated fatty acids.
- The calcium content of cows' milk (120 mg per 100 ml) is four times that of human milk (30 mg per 100 ml), because calves grow much more quickly and have a larger skeleton than human babies and therefore need more calcium.
- When a human infant is fed entirely on cows' milk the excess calcium does no good.

- Milk is also a very good source of riboflavin and vitamin A.
- It is a fair source of thiamine and vitamin C, but it is a poor source of iron and niacin.
- Pasteurization of milk carried out efficiently in a large, well-run dairy greatly reduces the risk of pathological organisms spreading.
- Some people limit their milk consumption because of lactose intolerance, a condition resulting from low levels of the digestive enzyme lactase. Research shows that most lactose-intolerant persons can in fact consume milk in moderate quantities (perhaps three to five cups of milk per day) without developing symptoms.

# Kandungan Gizi berbagai Susu per 100 ml

Macam Zat gizi	ASI	Susu Sapi	Susu Kerbau
Protein	12,0 g	3,3 g	4,8 g
Lemak	3,8 g	3,8 g	7,8 g
Laktosa	7,0 g	4,8 g	5,0 g
Kalori	75 Kal	66 Kal	67 Kal
Kapur	30 mg	125 mg	180 mg
Besi	0,15 mg	0,10 mg	0,24 mg
Vit A	53 SI	34 SI	-
Vit B1	0,11 mg	0,42 mg	0,50 mg
Vit C	4,3 mg	1,8 mg	1,0 mg

Sumber: Jelliffe, Human Milk in the Modern Word, Oxford University Press,  
New York, 1978

# Milk Products

## 1. Skimmed milk and dried skimmed milk

- Skimmed milk is milk from which the fat has been removed, usually for making butter.
- In its dried form (DSM), it is a familiar product in many countries.
- It contains nearly all the protein of milk, as well as the carbohydrate, calcium and B vitamins.
- It is an excellent food, especially for those on predominantly carbohydrate diets and those who have extra needs for protein.
- In some places DSM is supplied to those with special needs through clinics and health centres.
- Skimmed milk is an excellent food to add to any diet, but it is particularly useful in the diets of children and pregnant and lactating women.
- It is not a suitable substitute for whole milk for infants.
- It is sometimes added to dietary supplements such as, for example, corn (maize)/soybean/milk mixture (CSM).

## 2. Whole powdered milk

- This product, as the name implies, is whole milk that has been dried.
- Unlike DSM, it contains fat.
- It is suitable for infants when no breastmilk is available.

### **3. Evaporated and condensed milks**

- These are milks that have had much of their water removed but that are still liquid.
- Condensed milk is sweetened by the addition of sugar
- Evaporated milk does not contain added sugar.
- Many brands of condensed milk have vitamins added.
- They are not suitable as breastmilk substitutes for infants.

### **4. Yoghurt and soured or fermented milks**

- Many different organisms are used in the process of making yoghurt and fermented milks
- These products are easy to prepare, are highly nutritious, have enhanced keeping quality and are a little pathogenic organisms.
- Their use should be encouraged.

### **5. Casein**

- Casein is the protein from milk.
- rather expensive.
- commonly mixed as part of a formula or mixture for treatment of children with PEM.

## **6. Cheese (keju)**

- Cheese-making is an excellent way of using any excess milk produced during the seasons when milk yields are high.
- Numerous processes are used, but essentially cheese is made by letting milk clot and subsequently removing some of the water.
- Salt and other flavourings may be added.

## **7. Butter (mentega)**

- Butter are milk products
- made from the milk fat

## **(5) Blood**

- cattle blood is highly nutritious.
- rich in protein, has high biological value and contains many other nutrients.
- It is a particularly valuable source of iron.
- also a good source of nutrients in its processed form, usually a type of sausage (sisis).

## V. Oils and fats

- In general adults should consume at least 15 percent of their energy intake from dietary fats and oils,
- women of childbearing age should consume at least 20 percent.
- Active individuals who are not obese may consume up to 35 percent
- sedentary individuals up to 30 percent of energy from fat as long as saturated fatty acids do not exceed 10 percent of the energy intake
- cholesterol intake is limited to 300 mg per day.
- levels of fat intake for low-income countries calculated according to the recommended range (15 to 35 percent) of dietary energy from fat.

- Fats derived from land animals (e.g. butter and lard) usually contain a high proportion of saturated fatty acids and are solid at room temperature.
- Fats derived from vegetable products and marine animals (e.g. groundnut and cod-liver oils) contain more unsaturated fatty acids and usually liquid at room temperature and are termed oils.
- Coconut oil is an exception in that it contains mainly saturated fatty acids.
- A high intake of saturated fatty acids may contribute to raised serum cholesterol levels, which in turn may increase the risk of coronary heart disease.

# Sources of Oils and fats:

## 1. Butter (mentega)

- Butter consists mainly of the fat from milk.
- It usually contains about 82 percent fat, with a trace of protein and carbohydrate; the rest is water.
- Butter is rich in vitamin A and has a small amount of vitamin D, but the content varies with the time of year and the diet of the cow from which it was derived.
- Usually about 800 mg of retinol and 50 IU of vitamin D are present in 100 g of butter.
- Butter and margarine are increasingly used in diets in developing countries as the use of bread increases.

## 2. Margarine

- Developed as a substitute for butter, margarine is made from various vegetable oils that are partially hydrogenated to give a product with a consistency similar to that of butter.
- In most countries vitamins A and D are added so that the final product is nutritionally very similar to butter.
- If these vitamins have been added, they will usually be mentioned on the margarine container.

### 3. Vegetable oils

- Vegetable oils are the cooking fats most commonly used in Africa, Asia and Latin America, and there are many different kinds.
- Except for red palm oil, they have the disadvantage of containing no vitamins except vitamin E.
- They are mainly low in saturated fatty acids.
- Commonly used vegetable oils are soybean, olive, maize, groundnut, sunflower, sesame, cottonseed and coconut oils.
- In their pure form, they are 100 percent fat and contain no water or other nutrients.
- Red palm oil is widely produced in West Africa and in certain Asian countries (e.g. Malaysia). In West Africa it is important in human diets, but elsewhere it is exported for soap production and not much consumed locally.
- The oil contains large quantities of carotene, the precursor of vitamin A, commonly 12 000 µg per 100 g (with a range from 600 to 60 000 µg per 100 g).
- It is therefore a very valuable food wherever a shortage of vitamin A occurs in the diet.
- Vitamin A deficiency will not be a problem in areas where all members of the family consume even small quantities of red palm oil.
- Encouragement should be given to its wider cultivation and consumption

#### **4. Ghee**

- Ghee is made by heating butter to precipitate the protein, which is then removed.
- Ghee contains 99 percent fat, no protein or carbohydrate, about 2 000 IU of vitamin A per 100 g and some vitamin D.
- It has good keeping qualities and is much used in tropical countries in place of butter, because butter soon goes rancid if kept unrefrigerated in warm temperatures.

#### **5. Lard (lemak babi)**

- Lard is collected during the heating of pork.
- it consists of 99 percent fat and contains no carbohydrate, proteins, vitamins or minerals.

# VI. Beverages and condiments

- Minuman (Beverages)
- Bumbu (Condiments)

# (1) Beverages

- These include: beer, wine, spirits, fruit juices, tea, coffee, cocoa, synthetic sweetened soft drinks and aerated waters.
- Some of these beverages contain:
  - small amounts of drugs such as caffeine (tea, coffee and some colas) or
  - alcohol in varying amounts (beer, wine and spirits), and
  - some are sources of minerals and vitamins.
- traditional beverages: sake/tuak, cendol, bandrek
- aerated soft drinks: called "sodas", provide no significant nutrients other than carbohydrates.
- In contrast, fruit juices, either purchased or home-made from fresh fruit, usually contain useful amounts of vitamin C, and some provide carotene.
- Another major group of beverages comprises those usually consumed hot: tea, coffee, cocoa

## (2) Condiments

- Consists of :
  - salt
  - artificial chemical agents (for example, monosodium glutamate) and some are based on traditional spices (garlic, cloves, ginger, etc.).
  - Other spices and flavourings
- Salt consists mainly of sodium chloride
- A high intake of salt may contribute to the development of hypertension or high blood pressure in some individuals.
- Adults usually consume about 10 g of salt a day,
- Other spices and flavourings are of less physiological or nutritive importance.

# Penyimpanan Bahan Makanan

- **Adalah proses kegiatan yang meliputi pemasukkan, penyimpanan dan penyaluran bahan makanan**
- **Langkah-langkah:**
  - **penyiapan ruangan, tempat/alat yang bersih utk penempatan bahan**
  - **bahan makanan kering disimpan pada suhu kamar**
  - **bahan makanan segar seperti daging, ikan, ayam disimpan dalam suhu 0 - 5° C**
  - **bahan sayur dan buah disimpan pada suhu sekitar 10°C**
  - **bahan yang diterima dicatat dalam kartu yg disediakan**
  - **bahan yang datang lebih dahulu disalurkan terlebih dahulu (sesuai bon permintaan bahan)/FIFO dan dicatat**
  - **dilakukan pemeriksaan periodik dibandingkan jumlah yang tertulis dengan jumlah fisik**
  - **dilakukan stock opname tiap 3 bulan & tiap akhir tahun, serta dibuat laporan**

## **Syarat Penyimpanan Bahan Makanan Kering**

- **bangunan gudang dirancang bebas kelembabab, mudah dibersihkan, bebas serangga dan binatang pengerat**
- **bahan makanan diletakkan secara teratur dan sistematis menurut jenis, golongan dan frekuensi pemakaian**
- **pembersihan dilakukan setiap hari**
- **bahan makanan disusun berseling, tidak langsung terkena lantai dan dinding**
- **letak meja penerimaan dekat dengan pintu**

## **Syarat Penyimpanan Bahan Makanan Segar**

- **suhu harus sesuai dengan suhu makanan**
- **pengecekan suhu sebaiknya 2 kali sehari, sedang pembersihan lemari es setiap hari**
- **semua bahan makanan yang akan disimpan harus dibersihkan dan dibungkus dalam plastik/kertas timah**

# Mikroorganisme menurut Suhu Pertumbuhan

<b>Golongan</b>	<b>Suhu optimum (<sup>0</sup>C)</b>	<b>Suhu minimum (<sup>0</sup>C)</b>	<b>Suhu maksimum (<sup>0</sup>C)</b>
<b>Psychrophilic</b>	<b>15,0</b>	<b>0,0</b>	<b>31,7</b>
<b>Mesophilic</b>	<b>37,0</b>	<b>15,0</b>	<b>45,0</b>
<b>thermophilic</b>	<b>55,0</b>	<b>45,0</b>	<b>86,6</b>

## Anjuran Suhu Penyimpanan

- Daging 0°C
- Ikan segar 0°C
- Ikan kering 1,7 – 4,4 °C
- Mentega 1,1°C
- Susu Segar 1,7 – 4,4 °C
- Susu Kental Manis 1,7 – 4,4 °C
- Susu tidak Kental Manis 2,2 – 4,4 °C
- Telur 1,7– 0,6 °C
- Sayur dan buah 10 – 11 °C

## Spesifikasi Bahan Makanan yang baik

- yaitu standar mutu yang ditetapkan terhadap bhn makanan yg akan diadakan utk memenuhi kebth
- kriteria untuk menentukan spesifikasi bahan al:
  - nama bahan makanan
  - warna bahan makanan
  - bentuk bahan makanan
  - kualitas bahan makanan
  - jumlah produk (dalam 1 kg = .. buah)
  - ukuran
  - keterangan khusus (levering)
  - identitas pabrik/produsen
- karena BM banyak jumlahnya, maka dilakukan penggolongan spesifikasi bahan makanan, ada sekitar 16 kelompok pangan.

# Spesifikasi Bahan Makanan yang baik

## 1. Sayur-sayuran:

- daunnya segar, muda, utuh dan bersih
- tidak rusak kulit (sayur buah)
- tidak terdapat bekas gigitan serangga atau hewan lainnya

## 2. Buah-buahan:

- fisik bersih, isi penuh, tidak rusak kulit dan isi tertutup
- tdk berbau busuk/bau asam/terdapat cairan selain getah
- warna sesuai buah, tidak terdapat warna asing/tambahan

## 3. Serialia dan kacang-kacangan:

- bijinya tua, mengkilat dan utuh, tidak berjamur
- bersih dari benda asing (pasir, tanah dan biji lain)

## 4. Umbi-umbian:

- segar, muda dan kulit utuh, bersih dari tanah
- umbi berwarna putih atau sesuai warna aslinya

## 5. Tepung-tepungan:

- warna putih, baru dan tidak apek, tidak menggumpal

## **6. Tahu:**

- warna putih, tidak berbau busuk**
- tidak berlendir/berjamur**
- tekstur liat/tidak mudah hancur**

## **7. Susu Cair:**

- warna putih bersih, tdk berlendir, tdk kental & tdk terlalu encer, tidak berbau asing**

## **8. Susu Bubuk:**

- warnanya putih bersih dan kering**
- tidak berbau asing**

## **9. Telur ayam:**

- baru dan kulit bersih dari kotoran**
- 1 kg berisi 16 butir**

## **10. Daging Sapi :**

- warnanya cerah, tektur tidak lembik atau berlendir**
- tidak berbau busuk dan tidak berurat**
- ada izin resmi pemotongan daging (RPH)**

**11. Ikan :**

- sisik mengkilat dan melekat erat, baunya masih segar
- matanya masih menonjol dan jernih
- insangnya berwarna merah, tekstur tidak lembik/berlendir

**12. Dendeng sapi:**

- tdk terlalu banyak mengandung gula dan bumbu
- warnanya tdk kemerahan, tdk berjamur dan tdk berbau busuk

**13. Ikan Asap:**

- tdk berbau terbakar, pengasapan merata dan tekstur tidak keras
- kadar air rendah, tidak berjamur dan tidak berbau busuk

**14. Makanan Kemasan:**

- kemasannya utuh (tdk penyok/tergores/berkarat)
- tidak kedaluwarsa, tidak mengandung bahan yang berbahaya.