- **Deficiency:** anemia, pale tongue, and intestinal problems.
- **Works with:** vitamin C, B_6, B12, and niacin.
- **Interactions:** sulfa drugs, oral contraceptives, alcohol, tabacco, stress.

➢ **VITAMIN C (ASCORBIC ACID)**
- **Sources:** citrus fruit, tomatoes, cabbage, and vegetables.
- **Dose:** 60 mg/day.
- **Benefits:**
- **Deficiency:** bruising, wound healing, tooth/gum defects, and aching joints.
- **Works with:** vitamin A, B_6, and pantothenic acid, zinc.
- **Interactions:** aspirin, cortisone, and antibiotics, stress.

➢ **VITAMIN P (BIOFLAVONOIDS)**
- **Sources:** skin and pulp of fruit.
- **Dose: -**
- **Benefits:** blood vessel wall maintenance, healthy capilaries and veins.
- **Deficiency:** eczema, colds, bleeding gums.
- **Works with:** vitamin C.
- **Interactions:** aspirin, antibiotics, cortisone, and tabacco.

5.1.5.2.3. GENERAL USES OF VITAMINS IN THE BODY

Although individual vitamins have special functions, as a group of body regulators they share in certain functions such as:

1. The promotion of growth;
2. The promotion of ability to produce healthy offspring;
3. The maintenance of health and vigor through promoting:
   - Normal functioning of the digestive tract;
   - Normal nutrition, especially utilization of mineral elements and metabolism of energy nutrients;
   - Nervous stability;
   - Health of tissues and resistence to bacterial infections.

5.2. THE FOODS

5.2.1. MILK AND MILK PRODUCTS

5.2.1.1. MILK AND CHEESE

Milk is the sole natural food for the human infant for the first few month of life. After about 3 to 6 month it is desirable to give supplementary foods and gradually wean the infant on to a good mixed diet.

In this process milk slowly loses its dominant place in the infant's diet, but for the first two years of life it is important that milk should remain the largest single item of food.

From the age of 2 years and until growth ceases, children grow rapidly and reach maturity sooner if given ample quantities of milk. Increased growth rates are generally associated with improved health and vitality and with relative freedom from disease. All nutritionists agree that a regular intake of milk is good for invalids, especially for patients with acute illnesses.

from disease. All nutritionists agree that a regular intake of milk is good for invalids, especially for patients with acute illnesses.

There is no evidence, however, that milk is a good source of the principal nutrients it can be recommended for those who like it.

5.2.1.1.1. CHEMICAL COMPOSITION OF MILK

The constituents of milk are dispersed as either:

- colloidal dispersion;
- solution;
- suspension.

The different dispersion systems may be listed as:

- True solution: sugars, salts, vitamins;
- Colloids: emulsified lipids, proteins as a colloidal sol;
- Suspension: fats.

The carbohydrate portion is present in solution, and the ash is likely also dispersed as a true solution. Calcium phosphate may form a large micelle and have characteristics of a colloidal dispersion. The fat may be present as globules in suspension or emulsified throughout the milk. Protein is colloidally dispersed.

Composition of cow's milk:

- 88% water;
- 3,3% protein;
- 3,3% fat;
- 4,7 % carbohydrate;
- 0,7% ash.

PROTEIN

Cow's milk contains much more protein than human milk. The two primary proteins in milk have characteristics that are very distinct from one another. About 80 percent of this protein are casein. Casein is particularly susceptible to denaturation by the enzyme rennin and by low pH. The resulting coagulation is the first step in most cheese production. The rest, whey proteins, broadly resemble that found in plasma and include lactalbumin and various immunoglobulins that have a role in defence mechanism in early life. Most whey products consist of the whey proteins, carbohydrate and minerals. Whey was considered to be a waste product of commercial manufacturing. Whey has been primarily the liquid portion left after cheese production. It contained the whey proteins, water, riboflavin, and the mineral salts.

FAT

The fat in freshly secreted milk is present in fine globules, many of which are as small as 0.5 μm in diameter.

Fat in this form is easily digested. When milk is left to stand these globules run together to form cream. The fat content of both human and cow's milk varies greatly.

CARBOHYDRATE

The carbohydrate in all milks is lactose. This sugar is much less sweet than sucrose. Human milk contains more lactose than cow's milk. Cow's milk is frequently "humanised" by diluting and then adding sucrose or glucose. The young infant thus becomes accustomed to un unnaturally sweet food at an early age.

MINERALS

Calcium is present in all milks in good quantities.

Human milk usually contains about 120 mg/dl. The calcium is present chiefly in combination with caseinogen and is more readily absorbed than that in other foods, probably because calcium salts of amino acids are soluble. Milk is thus a most valuable food fot the formation of bone.

Milk contains very little iron. All milks provide 0.1 to 0.2 mg/dl. Young mammals depend for their initial supply of iron on stores accumulated during intrauterine life. In the human infant these stores are sufficient for only four to six months, and if iron is not then provided in the diet anaemia is likely to follow.

Infants born prematurely have smaller reserves of iron in the liver, and so are more liable to develop anaemia.

VITAMINS

Cow's milk is a useful but not rich source of vitamins.

Its riboflavin may be especially valuable to children on poor diets and its nicotinic acid may help to prevent pellagra in maize-eaters. Cow's milk contains little vitamin D mostly as the aquesous-soluble sulphate and unless enriched cannot be relied on the prevent rickets.

The ascorbic acid content is also not high and it is destroyed by pasteurisation, boiling or alowing the milk to stand in sunlight.

5.2.1.1.2. DIGESTION OF MILK

Milk clots when it enters the stomach. This is due to the action of an enzyme-rennin. The clothing converts the caseinogen into insoluble casein. The clot contracts and is subsequently digested. Infants secrete little pepsin in the stomach; trypsin and other proteolytic ensymes in the small intestine digest the clot. The biological significance of this clotting is not known; it is reputed to make milk less easily digested. It can be partially prevented by diluting the milk with water, thus reducing the concentration of calcium, which is necessary for the formation of the clot. Clotting can also be prevented by the addition of sodium citrate. Both of these means have been much used, but whether they increase the digestibility of milk is doubtful. Milk is readily digested and absorbed by infants and growing children.

Cow's milk owing to its high protein content and its content of phosphate and citrate exerts a strong buffering action, thus lowering the acidity of the gastric juice. It is perhaps for this reason that milk is often so effective in reducing the disconfort caused by a peptic ulcer on the associated hyperacidity.

5.2.1.1.3. PROCESSING OF MILK

Pasteurisation and homogenization are the two main processing procedures used for fluid milk. Pasteurisation is heating milk to kill microorganisms that can cause illness in people. The *hold method* of pasteurization heats milk to 63 °C and holds it for 30 minutes before it is cooled to 7^0C. The *high - temperature short - time* pasteurization heats milk at 72 ^{0}C and holds it there at least 15 seconds before it is cooled to 10^0C. *Ultrahigh temperature* pasteurization heats milk rapidly to 138^0C and holds it for at least 2 seconds. It is then stored in a sterile container. The milk can be stored at room temperature until the sterile container is opened.

Homogenization of milk prevents creaming. There is a natural tendency for milk to "cream".

5.2.1.2. MILK PRODUCTS

5.2.1.2.1. SOURED AND FERMENTED MILKS

Milk is drunk sour or curdled. Various bacteria are used for this purpose - Lactobacilus acidophilus found in man. L. bifidus found in the alimentary tract of infant and L. bulgaricus found in cows. All these bacteria cause a breakdown of the lactose in the milk with the formation of lactic acid (up to 3 percent).

There are many traditional forms of sour milk, which are appreciated as national drinks.

5.2.1.2.2. CURDS (JUNKET)

Curds are the clotted proteins formed when fresh milk is artificially inoculated with rennet (a comercial preparation of rennin, prepared either from calves'stomachs or vegetable sources). Sweetened and flavoured forms are junket.

5.2.1.2.3. WHEY

Whey is the fluid that separates from the clot in making cheese. It contains most of the lactose in the original milk and a little lactalbumin, but almost no casein or fat. Whey proteins isolate will contribute with essential amino acids to a product. It can be added to beverages and clear sport drinks.

5.2.1.2.4. CREAM

Cream contains all the fat and usually from one-third to half of the proteine and lactose in milk.

5.2.1.2.5. EVAPORATED AND CONDENSED MILK

Evaporated milk is the liquid product obtained by the partial removal of water from milk or skimmed milk. Evaporated milk has approximately 60% of the water removed.

Condensed milk is the product obtained in the same way, but with the addition of sugar. Condensed milk not only has half the water removed from whole milk but also has approximately 44% refined can or corn sugar added. The milk is canned after heating and cooling.

5.2.1.2.6. SKIMMED MILK

This is milk from which the fat has been removed in the making of butter or cream.

5.2.1.2.7. CASEIN

Various preparations of casein are on the market. Casilan, a calcium caseinat is one that is well known.

These preparations have little taste and provide a most convenient and effective means of enriching diets with protein in dietetic practice, as in the treatment of burns, prolonged fevers and in convalescens from severe illnesses. They can be added to soups, puddings, milk drinks, cocoa.

5.2.1.2.8. CHEESE

Milk production is inevitably subject to large seasonal variation. Cheese-making is an effective method of preserving some of this surplus (realised in the summer) and has been a traditional occupation of European farmer's wiver for generations. There are over 400 varieties.

The basic process in cheese - making is the clotting of the milk.

Cheese is the processed product from fluid milk. All cheese preparations follow these basic processes:

- adding lactic acid bacteria to milk;
- curdling the milk (with rennin, an animal enzime, or other coagulant);

- collecting and pressing the curd and draining off the whey, the watery part of milk;
- salting;
- Ripening/aging.

There are three steps of cheese production:

- proteolysis;
- coagulation;
- gelation.

Most cheeses contain 25 to 35 percent of protein and this protein is of high biological value. The fat content usually varies from 16 to 40 percent. Cheeses are also rich in calcium, vitamin A and riboflavin. There are also dietetic cheeses made from skimmed milk: cottage cheese contains 4 percent fat.

The cheese reaction. Many cheeses contain tyramine, the amine of the amino acid tyrosine. Tyramine stimulates the sympathetic system by inhibiting uptake of noradrenaline at the synaptic jonctions where its concentration increases, causing a big rise in blood pressure. The tyramine naturally present in foods is normally destroyed very quickly in the tissues by monoamine oxidases (MAO).

5.2.1.3. HEALTH RISKS FROM COW'S MILK AND MILK PRODUCTS

Health risks from milk consumption are greatest for infants less than one year of age, in whom whole cow's milk can contribute to deficiencies in several nutrients, including iron, essential fatty acids, and vitamin E.

Cow's milk products are very low in iron, containing only about one-tenth of a miligram over eight - ounce serving. Milk can also cause blood loss from the intestinal tract, which, over time, reduces the body's iron stores. Researchers speculate that the blood loss may be a reaction to proteins present in milk. Pasteurization does not eliminate the problem.

Although concerns are greatest for children in the first year of life, there are also health concerns related to milk use among older children and some problems associated with cow's milk formulas.

5.2.1.3.1. MILK PROTEINS AND DIABETES

Several reports link insulin-dependent diabetes to a specific protein in dairy products. This form of diabetes usually begins in childhood. It is a leading cause of blindness and contributes to heart disease, kidney damage, and amputations due to poor circulation. The cow's milk proteins stimulate the production of the antibodies, which, in turn, destroy the insulin-producing pancreatic cells.

Pancreatic cell destruction occurs gradually, especially after infections, which cause the cellular proteins to be exposed to the damage of antibodies.

Milk proteins are also among the most common causes of food allergies. Often, the cause of the symptoms is not recognized for substantial period of time.

5.2.1.3.2. MILK SUGAR AND HEALTH PROBLEMS

Many people, particularly of Asian and African ancestry, are unable to digest the milk sugar, lactose. The result is diarrhoea and gas. For those who can digest lactose, its breakdown products are two simple sugars: glucose and galactose. Galactose has been implicated in ovarian cancer and cataracts.

galactose. Galactose has been implicated in ovarian cancer and cataracts. Nursing children have active enzymes that break down galactose. As we age, many of us lose much of this capacity.

5.2.1.3.3. FAT CONTENT

Whole milk, cheese, cream, butter, ice cream, and all other dairy products aside from skim and non-fat products contain significant amounts of saturated fat, as well as cholesterol, contributing to cardiovascular diseases and certain form of cancer. White children do need a certain amount of fat in their diets; there is no nutritional requirement for cow's milk fat. On the contrary, cow's milk is high in saturated fats, but low in the essential fatty acid linoleic acid.

5.2.1.3.4. CONTAMINANTS

Milk contains frequent contaminants, from pesticides to drugs. About one-third of milk products is contaminated with antibiotic traces.

5.2.1.3.5. OSTEOPOROSIS

Dairy products offer a false sense of security to those concerned about osteoporosis. In countries where dairy products are not generally consumed, there is actually less osteoporosis. Indeed, those who drank three glasses of milk per day had more fractures than those who rarely drank milk did.

There are many good sources of calcium. Kale, broccoli, and other green leafy vegetables contain calcium that is readily absorbed by the body.

Calcium is only one of many factors that affect the bone. Others factors include hormones, phosphorus, boron, exercise, smoking, alcohol, and drugs. Protein is also important in calcium balance. Diets that are rich in protein, particularly animal proteins, increase calcium loss.

5.2.1.3.6. RECOMMENDATIONS

There is no nutritional requirement for dairy products, and there are serious problems that can result from the proteins, sugar, fat, and contaminants in milk products. Therefore, the following recommendations are offered:

1. Breast - feeding is the preferred method of infant feeding. Whole cow's milk should not be given to infants under one year of age.
2. Parents should be alerted to the potential risks to their children from cow's milk use.
3. Cow's milk should not be required or recommended in government guidelines.
4. Government programs, such as school lunch programs, should be consistent with these recommendations.

5.2.2. MEAT AND MEAT PRODUCTS

Meat was an important part of the hunter-gatherer's diet. Protein of animal origin is not essential for man as has been amply demonstrated by many vegetarians who have led full and active lives. Yet as soon as the income of a family or community rises, there is nearly always an increase in the amount of meat they consume.

5.2.2.1. MEAT PRODUCTION

Man eats the flesh of more than 100 species of animals. Production of beef and mutton is the responsibility of stockmen and butchers who over the generations have developed a mystère of what determines the quality of meat.

5.2.2.2. QUALITY OF MEAT

Meat is appreciated for its digestibility, tenderness and flavour.

Meat involves four different components: the muscle, the fat, the connective tissue, and the bones. All these components integrate together to give the meat quality that a person tastes when eat it, however, individually they do react differently and do give different characteristics to the ultimate meat quality.

DIGESTIBILITY

The muscle proteins are more rapidly and easily digested than the connective tissue proteins, mostly colagen, and fat. As an animal ages there is relatively more connective tissue and the meat of an old ewe is tougher than of a young lamb. The collagen content varies with cut. Thus it may be as low as 2.5 percent in a fillet of beef and as high as 23.6 percent in skin meat.

Fat delays the emptying of the stomach and the proportion of fat in a helping of meat may vary from 8 to 50 percent and more for bacon. Cuts of pork often contained large amounts of fat and this probably explains why pork acquired the reputation of being indigestible.

TENDERNESS

We like our meats to be tender and perceive its tenderness though three sensory components: first, the ease of initial penetration by the teeth; next, the ease with which the meat breaks into fragments; and, lastly, the amount of unchewable residue. The ultimate measurement must be semiquantitative rating of tenderness given by a reliable taste panel but several workers have devised tests to try and express this by physical laboratory methods. Tenderness varies with species, breed and age of the animal.

Coarse muscle fibres are less tender and connective tissue especially elastin, is associated with toughness. Marbled meat with fat between the muscle fibres is usually more tender. After slaughter the proportions of these structures do not change but there can be large variation in tenderness, depending on how the meat is handled.

Cooking make meat more tender; slow cooking hydrolyses collagen to gelatin.

FLAVOUR

The flavour of meat is a complex sensation. Much of it is due to water-soluble substances such as inosinic acid; hypoxanthine derived from ATP, glycopeptides and amino acids such as glutamic acid. Meat with very little fat tastes insipid.

There is a gradual loss of flavour during storage, even frozen, due to evaporation of volatile substances. The flesh of full-grown male pigs contains trace of un unpleasant "boar odor". Substances in animals' feed can sometimes give undesirable flavors in the meat and volatile taints can be absorbed during frozen storage.

5.2.2.3. NUTRITIVE PROPERTIES

The energy value of meat depends on its fat content, which as already stated varies greatly. For this reason, the use of food tables to calculate the energy content of diets containing much meat is subject to large errors.

The muscle itself contains anywhere from 70 to 75 percent water.

However, meat is a good source of energy as lean muscle contains about 20 (approximately 17 to 22) percent of protein and 5 (approximately 2 to 8) percent of fat.

The protein of meat is of high biological value, but this may be somewhat reduced when the proportion of connective tissue protein is high. Cooking denatures the natural proteins and makes them more susceptible to digestive enzymes.

There are a number of minerals, which cannot be disregarded in their importance; however, they are of fewer amounts in total muscle composition.

Meats are usually rich in iron and also in zinc, but contain little calcium. They are an important source of nicotinic acid in muscle meats but they provide moderate amounts of vitamin B_{12}.

The fat in beef and mutton contains little polyunsaturated fatty acids. This is because these acids are hydrogenated in the rumen of cattle and sheep. The fat in chicken and turkey meat contains much more, depending on the amount of these acids in the poultry food.

The composition of the meat will depend not only on the animal and its growing environment but will depend on whether it's a rib steak or a flak steak. Individually, meat varies in characteristics not only because of composition, but ultimately, because of the muscle fiber.

The muscle fibre itself is not the ultimate unit of the muscle. The muscle fiber does have an organizational network within the sarcolema. In the sarcoplasm are the myofibril proteins. The miofibril proteins consisting of actin and myozin are organized into myofibrils and myofilaments.

5.2.2.4. MEAT PRODUCTS

5.2.2.4.1. OFFAL

This curious word - a corruption of off-fall- is defined by the Meat Inspection Regulations 1963 as any part of a dead animal removed from the carcase in the process of dressing it, but does not include the hide or skin.

Some offal, e.g. liver, kidney, heart and tongue, are foods of repute found on the menus of the best restaurants.

Liver contains more vitamins and absorbable iron than muscle and so is a valuable food.

Liver, kidneys and pancreas, being rich in cells, contain more nucleic acids than muscle. For this reason patients with gout have been advised to avoid them.

5.2.2.4.2. SAUSAGES

This has been used throughout historical times as a convenient form in which meat can be preserved and transported. In the absence of any precise knowledge of the composition, protein 12 g, fat 20 g, carbohydrate 12 g and energy 1.2 MJ (280 Kcal)/100g is a reasonable estimate.

5.2.2.4.3. MEAT EXTRACTIVES, BEEF TEA, SOUPS

Meat extracts like Bovril have been used for generations.

They contain the freely water-soluble substances of muscle-potassium, phosphates, peptides, nucleotides, creatine, vitamin B_{12} and other vitamins. When reconstituted with hot water, "beef teas' have a very low concentration of solids and do not supply significant amounts either of energy or protein, but commercial preparations usually contain large amounts of sodium. However, they stimulate appetite and hence may be useful in the feeding of convalescents.

5.2.2.4.4. SLUGS AND SNAIS AND PUPPY-DOGS' TAILS' OR CHACUN A SON GOÛT

Those of us who have been brought up as members of one of the great religions of the world-particularly caste Hindus, but to a lesser extent all Mohammedans; Jews and Christians -seldom realise that extent to which our daily diet is artificially restricted.

Religious taboos are partly responsible, but custom and tradition are much more important.

Wild animals are a large potential source of food in some countries. The yield of meat from game such as blesbok, eland, wildebeest and springbok, if properly pretected and culled, is likely to be greater than that obtained from domestic animals grazed on the same-land.

5.2.2.5. VEGETARIANISM

Vegetarianism excludes partial or total the meat consumes.

Vegetarian diets have become more prevalent and popular. Most dietary and medical experts agree that a properly structured vegetarian diet is healthy. Younger vegetarians are usually parted of family that eat vegetarian meals for health or religious reasons. Experts in nutrition also say that if parents offer their children a vegetarian diet, they should follow the same diet.

Some of the major vegetarian categories include:

- Ovo vegetarian - eats eggs, no meat.
- Lacto-ovo-vegetarian - eats dairy and egg products, no meat.
- Lacto-vegetarian - eats dairy products, no eggs or meat.
- Vegan - eats only food from plant sources.
- Pesco-vegetarian - eats fish but no other meat.
- Pollo-vegetarian - eats poultry but no other meat.

5.2.2.6. FISH AND OTHER FOODS

Fish are an important source of animal protein for some people. Lean or white fish contains less than 1 per cent of fat and about 10 percent of protein with energy values ranging from 220 to 330 KJ (50 to 80 Kcal)/100 g.

Oily fish contain 8 to 15 percent of fat and so have a higher energy value - 330 to 660 KJ (80 to 160 Kcal)/100g.

Fish proteins have a high biological value similar to the protein of land animals. Yet although many fish are delicious, on the whole fish are less tasty than meat and a fish diet tends to be monotonous.

The content of protein in fish is somewhat less than in meat and there is often a large waste in the scales and bones.

The only fish offal commonly eaten is the roe, both the hard roe and the soft roe or milts. Cod roe and hering roe contain 20 to 25 percent of protein and are rich in nucleic acids.

True caviar is the roe of the sturgeon; coloring other fish roes produces many imitations. This rich and tasty food contains about 30 percent of protein and 20 percent of fat.

Fish oils are rich sources of the fat-soluble vitamins A and D.

Marine fish are the richest source of iodine in the diet and a good source of fluoride. Small fish-such as sprats and sardines-may be a useful source of calcium when eaten whole, together with the bones.

5.2.2.6.1. SHELLFISH

Lobsters, crayfish, crabs, shrimps and other crustaceans have little fat and an energy value of about 200 KJ (50 Kcal)/100 g. They are very tasty and have become an expensive "prestige" food.

Oysters, mussels and other molluscs contain rather more protein (15 percent) than most fish. They also contain about 5 percent of carbohydrate glycogen, but little fat.

Oysters are the richest food source of zinc. They accumulate this and related metals from their water environment and can contain up to 100 mg/100 g.

Unfortunately they may harbour bacteria, particularly those of the Salmonella group.

5.2.2.6.2. FISH-MEAL AND FISH-FLOUR

These two products of the fishing industry are used as feeds for dairy animals and poultry and so add to the world's supply of protein-rich foods. But they can be used with greater nutritional efficiency directly as food for man.

They can be incorporated in stews and staple starches or scattered on cooked foods such as porridge.

5.2.3. EGGS

Since the egg forms a complete food for the embryo chick, it is naturally rich in essential nutrients.

The diverse roles of egg in the recipes occur due to particularly high water solubility, excellent foaming and emulsification capacities, heat coagulability, and high nutritive values. They contribute structure to a product that contains egg.

The quality of eggs is dependent upon the egg itself. In hard cooked eggs the size of the air cell will impact whether it is oval egg or has an identation on the end, "a less than perfect" egg for "hard boiled", and deviled eggs. In custard sauces, the true chef, to improve the quality of the product thinks the chalaza removal. It is important to know the egg and factor that impact the quality of the egg and resulting products.

5.2.3.1. THE BASIC EGG STRUCTURE

It is made up of approximately 11% shell and 89% interior. The composition of the shell is important from the viewpoint of food safety, sanitation, and esthetics. It contains calcium carbonate (94%), magnesium carbonate (1%), calcium phosphate (1%), and 4% organic matter. It is important to recognize that there has

been considerable information that the hen's diet can impact the composition of the egg.

The composition of the egg yolk and white is of primary importance and their chief factor affecting the ways that egg function in a baked product.

Composition (%) of whole egg consist in:

- 65,5% water;
- 11,8% protein;
- 11% fat;
- 11,7% ash.

Eggs and eggs whites have been used as a clarifier.

An average hen's egg, weighing about 60 g, contains 6 g of protein and 6 g of fat and yields about 330 KJ (80 kcal).

The proteins - most of which are albumins in the white of the egg - have the highest biological value for human adults of all food proteins.

A hen's egg contains about 30 mg of calcium and 1,5 mg of iron; however, the iron is bound, possibly to the protein conalbumin, and poorly absorbed in man.

The yolk is a fair source of vitamin A and also contains significant amounts of thiamin, nicotinic acid and riboflavin; most of the yellow colour of yolks is xanthophyll (lutein) which is a carotenoid but not a vitamin A precursor. There is no ascorbic acid.

Eggs from free-range hens contained more folate and vitamin B_{12}.

Eggs have been described as nature's "convenience food" since they come in a hygienic pack, are easily stored and readily opened and cooked. For this reason and also because of their nutritive value they are well suited to the needs of old people who usually like them.

An egg contains about 250 mg of cholesterol and when eaten in large numbers may raise the plasma cholesterol.

The eggs of many other species of birds are eaten in various parts of the world and all have approximately the same nutritive value as eggs of domestic hens.

5.2.3.2. EGG QUALITY

Certainly the grade of the egg impacts its "quality"; however, there are many other conditions. Eggs are graded as a freshly laid egg. This freshly laid egg may be an AA or even a C graded egg to start with. However, all eggs will begin to deteriorate upon storage. The question and problem is to minimize storage losses. Storage in a room where temperature is maintained slightly above the freezing point (-2^0C) of eggs and humidity of 90% will maintain quality of eggs for several weeks. As temperature and / or humidity increases, the storage time will decrease.

The following table indicates changes with storage and possible reasons for the change.

- Increase in pH - Carbon dioxide difuses out of the egg. This may cause a rise from the fresh egg pH of 7,9 to as much as 9,3 in the white. The pH of the yolk is initially around 6,2 with little rise in pH. The carbon dioxide, a product of the metabolic pathways in the chicken, form

carbonic acid and bicarbonate buffers. These no longer exist when it diffuses out.

- Thinning of "thick" membrane
- Increase in air cell size - This occurs between the two membranes at the shell interface. Part of this is due to the natural cooling of the egg, with concurrent shrinking of contents. Air is physically drawn in during this shrinkinage.
- Increase in yolk size
- Thinning of thick white
- Weakening of vitellenin membrane
- Deterioration of odor and flavor - This deterioration depends upon the storage and the reasons for storage changes. Storage does bring about slight changes in the protein and fat of the egg that may contribute in small part to the changes.

A high quality egg generally shows the same interior egg changes with storage as the decrease in grade reflects. These grades give an indication of the quality of eggs and, depending upon the product may reflect the final quality of the food product for which they are used. At this time, the grade is generally assigned by a method called candling. This can be done as an automated system where light is shined through the rotating egg to reveal condition of the shell, the size of the air cell, and size, distinctness, color and mobility of the yolk. Additionally abnormalities such as blood spots, embryonic development, and spoilage are identified. The importance of these conditions in a food product depends on the specific role and function of the egg in the food product.

The grades of eggs are AA, A, B, C.

Grade description:

AA - shell: clean; unbroken, practically normal
Air cell: 1/8 inch or less in depth; practically regular
White: clear, firm, "upright"
Yolk: well centered; outline slightly defined; free from defects

A - shell: clean; unbroken, practically normal
air cell: 2/8 inch or less in depth; practically regular
white: clear, may be reasonably firm
yolk: may be fairly well centered; outline fairly well defined; practically free from defects

B - shell: clean to slightly stain; unbroken, may be slightly abnormal
air cell: 3/8 **inch** or less in depth may be free but not bubbly
white: clear, may be slightly weak
yolk: may be off center, outline well defined, may be slightly enlarged and fattened, may show definite but no serious defects

C - shell: clean to moderately stain, unbroken, may be abnormal
air cell: may be over 3/8 inch on depth, may be free or bubbly
white: may be weak and watery, small blood clots or spots may be present
yolk: may be off center, enlarged and flattened, may show clearly visible germ development but no blood; may show other serious defects; outline may be plainly visible.

Most of the eggs on the market are AA, or A. The B and C eggs go in for pet foods and other egg products. During storage, the grade of the egg may deteriorate, although with the current knowledge of storage requirements, this is not necessarily an absolute. Actually, the major deterioration may be due to improper handling at home. It is important to know that not all eggs being laid are grade AA. Some chickens are failures and lay poor quality eggs to start with. This may be due to genetics or due to environment or feed.

The weight of the egg is important in that most recipes have been developed on the basis of a 48-gram egg. Certainly, in a fried egg, scrambled eggs or such, the size just means more. However, if one is looking at a product with a balanced formula, such as cream puffs, muffins, an angel food cake, the difference between a small egg versus a jumbo in the final product could be dynamic. As far as selection of grade, as with weight, in some products it makes a difference. In others there is none. Assuming a safe egg, it makes no difference whether an AA or a B is used in a scrambled egg. However, if being used in a sponge or angelfood cake one would have a different yield and foam stability with two grades. Certainly, with a fried egg, sunny side up, the egg would be more attractive if an AA or A egg was used.

5.2.4. OILS AND FATS

These are valuable foods as they provide a concentrated source of energy and they are essential to the art of good cooking in all civilised societies. Most plants bearing oil seeds are tropical.

The major fat structures within the fats and oils, are dominantly triglycerides; however, the other categories of types of lipids are important. Other lipids importance may be more subtle. The lipoprotein complex in gluten has a major role in the elasticity and strength of gluten; however, it is generally not extensively discussed as gliadin and glutenin are so important. The role of the lipid in the plastid of green and yellow vegetables is rarely mentioned; however, it functions to solubilize the pigment. The sterols in the vax of shiny apples is another compound lipids.

The use of fat in foods continues to expand as they become more healthy and as the industry learns to modify the natural product. The role of fat in a food product can be as varied as the product itself. In shortened cake it serves to tenderize, incorporate air, and possibly add flavour. In salad dressing it is part of the structure, the small droplets in a second liquid. These roles and other roles can be listed as:

- textual qualities
- emulsions
- shortening or tenderizers
- medium for transferirng heat
- aeration and leavening heat
- spray oils

These uses are impacted by the functionality of the particular fat or oil. These functionality's or role are: gives satiety; heat transfer; flavour; texture: body, mouthfeel; tenderizes: gluten, starch; decreases temperature shock in frosen desserts; "solubilizes" flavors and colors; dispersal; foaming; incorporation of air.

The differing roles of fat and oil can be seen in the following recipes:

Mayonnaise - The oil primarily serves the function of the dispersing phase.
Frosting - The butter fat to allow the creation of a foam.

There are several classes of lipids. In food preparation, we are most concerned with simple lipids. There are triglyceride lipids, the major component of fat, butter, shortening, oil, etc. They have a simple formulas composed of glycerol and a variety of fatty acids.

5.2.4.1. PROCESSES USED IN PRODUCING FATS FOR THE CONSUMER

Fats and oils are extracted from either plants or animals. Extraction method vary. For example, the adipose tissue of the pig is heated, melts the fat and it is further processed. Butter is made by reversing the oil in water emulsion of cream into a water in oil emulsion. Plant extraction procedures involve a variety of different extraction methods.

Following are processed fats:

- buter;
- margarine;
- lard;
- hydrogenated shortening;
- refined oils: soybean oil, cottonseed oil, sunflower oil, peanut oil, olive oil, corn oil, canola oil, safflower oils, coconut oils, palm oil, palm kernel oils.

After removal of the plant fat from the seed, pod or grain, it is further refined.

5.2.4.2. NUTRITIONAL VALUE

Oils and fats consist predominantly of triglycerides and contain little water. Vegetable oils and animals fats have an energy value of about 3700 KJ (900 Kcal)/100g. Butter and margarines are a little lower, about 3000 KJ (730 Kcal)/100g, because they contain water. Diets containing little or no oils and fats or foods into which they had been incorporated are of low nutritional density and hence so bulky as to be unsuitable for active men and women needing more than 12,6 MJ (3000 Kcal) daily. They provide not only energy but essential fatty acids in varying amounts.

Those vegetable oils with a high content of polyunsaturated fatty acids, particularly corn oil and sunflower seed oil, are useful in diets for the treatment of patients with familial hypercholesterolaemia.

One vegetable oil, rape seed oil, contains erucic acid in amounts which may be toxic and regulations in EEC countries limit the level of erucic acid in edible oils and fats to 5 percent.

Oil and fats may be a source or potential source of fat-soluble vitamins. Most vegetable oils contain significant amounts of vitamin E; none contain vitamin D and most are devoid of vitamin A activity. Red palm oil is a rich source of β-carotene and children in Nigeria receiving red palm oil have been shown to be in better health than those that had none. Corn oil contains small amounts of carotene.

Animal fats contain small but nutritionally significant amounts of vitamin D and retinol.

Butter, however, is a good source of retinol and has some vitamin D. The amounts depend on the quality of the cow's diet.

Good summer butter may containup to 1300 µg of retinol/100g, but winter as little as 500 µg.

The enrichment of margarines with retinol and vitamin D was a major advance in public health. By law margarine must contain 700 µg of retinol and 8 µg of vitamin D/100g. This measure is an important part of the continuing campaign to prevent rickets.

In India, Pakistan and other eastern countries butter fats are clarified by heating and the resulting product is known as ghee. Good ghee may contain almost all the vitamins present in the original milk fat, but losses may be up to 50 percent.

5.2.4.3. ROLE IN DIETS

Separated oils and fats are essential for good kooks and food manufacturers to practise their arts.

They have been part of good living since the beginning of history. They are also expensive compared with cereals and cereal products. With increasing prosperity consumption rises and in many countries about 40 percent of the dietary energy comes from fat. In many individual proportion is higher. There is a consensus among nutritionists that this proportion is too high, except for the now small minority who are very active physically.

5.2.5. CEREALS

Over the last 2 million years humans have existed as hunters and gathers. Likely, grains and seeds played a role in their diets. During the last 10000 years these grains have been domesticated, and bioengineered into grains of differing characteristics. Additionally, alternate seeds and legumes have been developed into roles in the diet.

The basic commodity of most diets of the world are the grain seeds which are made into cereals, flours and "value added" products. The source of these foods is beyond the classic expected "wheat, the only grain used". But we meat as source rice at 11% and oats at 22% in the ready-to-eat cereals, too.

There are many types of grains and seeds used throughout the world. There has been use of soybean flour, rice flour, and corn flour, as well as seed flour.

Cereal grains are the seeds of domesticated grasses.

Wheat is the cereal of choise in temperate or dry climates and rice in damp tropical climates.

All cereals can be ground into flour for cakes or porridge, but only wheat and rye bake into bread.

The whole grains of all cereals have a similar chemical constitution and nutritive value.

They provide energy and protein, which is usually of good quality. They contain appreciable amounts of calcium and iron, but the value of these minerals is partly discounted by the presence of phytic acid which may interfere with their absorption.