

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 contain up 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 cooks 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 meet 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 choice 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.

Cereals are totally devoid of ascorbic acid and practically devoid of vitamin A activity. Yellow maize is the only cereal containing significant amounts of carotene.

Whole cereal grains also contain useful amounts of the water-soluble B group of vitamins.

To ensure adequate intakes of minerals and vitamins A and C, a diet based on cereals requires supplementation with milk, fruits and vegetables.

When cereal grains are consumed in their entirety an adequate supply of the B group of vitamins is ensured except in the case of maize, in which the niacin is not biologically available.

If, however, the grains are first milled and outer portions of the seed, including the germ and scutellum, discarded, there is a grave risk that there will be an insufficiency of the B group of vitamins.

Wheat and rice, however, are invariably subjected to some degree of milling. The extent to which the milling process removes the vitamins is of importance.

For a proper understanding of the nutritive value of the cereals and of the changes they undergo in preparing them as food for man it is necessary to consider the structure of the cereal grain and the composition of its parts.

Corn, rice, and wheat grains all have the basic structure made up of a germ, endosperm, and bran. Each portion contributes specific components and characteristics to the seed. It is useful to continue to remember that in these three grains, this is the reproductive mechanism for the plant. The bran is outer covering. This is primarily cellulose and would contribute fiber to the processed product. If the cellulose fibrils are present they will be abrasive in the product. Additionally, with some of these grains, the bran also is high in phenolics.

A second primary portion of the grain is the germ. The germ is of importance to us in discussing food quality as it has a high "oil" content. The fatty acid content of the germ oil is generally very susceptible to oxidative rancidity, particularly once the germ has been "cracked" with milling. The shorter shelf life of whole wheat flour, as opposed to all - purpose flour, is attributed to this portion of the grain.

The storage portion, or endosperm, of protein and starch in most typical grain is the primary part of most grains.

#### 5.2.5.1. GRAIN

##### 5.2.5.1.1. DISTRIBUTION OF THE NUTRIENTS IN THE GRAIN

This is not uniform. The germ is relatively rich in protein, fat and several of the B vitamins. So also is the scutellum, which contains about 50 times more thiamin than the whole grain, perhaps as much as half of the total thiamin in the grain. The outer layers of the endosperm and the aleurone layer contain a higher concentration of protein, vitamins (especially niacin) and phytic acid than the inner endosperm. The inner endosperm contains most of the starch and protein in the grain.

Wheat is usually ground into flour before being prepared as food.

The proportion of the whole grain that is utilised to make flour is known as the extraction rate. Thus an 85 percent extraction rate flour contains 85 percent by weight of the whole grain and 15 percent is discarded as bran. It is important to remember that the extraction rate refers to the proportion of the original grain in

the flour and not in the bran. Thus flour of a "high extraction rate" has lost little of the aleurone layer and outer endosperm.

#### **5.2.5.1.2. PROCESSING PROCEDURES TO PRODUCE CEREALS AND FLOUR FROM GRAINS**

Once milled the cereal may be left uncooked, partially cooked, or completely cooked. Other ingredients may be added.

Ready - to - cook cereals are generally cracked or crushed or maybe rolled or flaked grains. The finer the particle processed the shorter the cooking period required. If fine enough it may be a quick cooking cereal.

Milling itself is the step for preparing the various flours that we have available. Interestingly, milling itself has not changed substantially over the last two centuries.

The classification of wheat flours is obtained from the different "streams" off the mill. It used to be that the bran and red dog would go into cattle and pet feed. With the advent of the research indicating the advantages of bran in the diet, this product has made its way back into the "human market". For 100 grams of flour one could purchase flour varying considerable in quality depending upon the degree of extraction of the portion of extraction. We could have whole wheat flour or all - purpose flour, patent flour or cake flour from the same wheat with the same kernel composition. A good example of how the selection of the "stream" in milling can influence a product is the chocolate cake mixes.

Mixing of flour mixture products is dependent upon the role of mixing in developing the optimization of ingredients. Otherwise, mixing in flour mixtures is due to addition of water to gliadin and glutenin (wheat protein) to form gluten. Essentially, with the average hard wheat flour and the appropriate amount of water, the more mixing the greater the amount of gluten development.

Cooking of cereals and pasta products is interesting and unique for each one. However, in each instance, gelatinization of starch is an important phenomena which is taking place. That is cereals and their processed pasta products are made up of grains. The endosperm of the grain is composed primarily of starch with varying amounts and quality of protein. Heating of the cereal product in the presence of water will cause gelatinization to occur. Additionally, the heat will also cause denaturation of protein. If a whole grain is used, heat and water may soften the bran.

The change in the starch, the gelatinization, certainly takes away some the raw starch flavor; however, there are other changes. The swelling is evidenced by such generalizations as we have with rice. It is more or less understood that rice doubles in size when properly cooked. Proper cooking means adequate space in the saucepan and, as important, adequate liquid to take this into account. If rice doubles in size it is important to, minimally, for each cup of rice to cook to have 2 cups of water.

#### **5.2.5.1.3. NUTRITIVE VALUE OF FLOUR**

Whole wheat is devoid of vitamin A,D and C and contains very little fat and these have to be supplied by other items in the diet. There are many records of healthy communities who get up to 70 percent of their dietary energy from wheat.

The bread made from flour was a nutritious food, even if the extraction rate was as low as 70 percent as in most white bread.

The composition of selected grains are follows:

- Rice, brown raw - moisture (12%), protein (7,5%), lipid (1%), carbohydrates (77,4%);
- Rice, brown cooked - moisture (70,3%), protein (2,5%), lipid (0,6%), carbohydrates (25,5%);
- Wheat flour whole - moisture (12%), protein (13,3%), lipid (2%), carbohydrates (71,1%);

It is generally accepted that in baked products, when wheat is used the three major components (protein, starch and lipid) interact to produce the viscoelastic mass due to gluten.

**Protein** provides about 13 percent of the energy.

Osborn divided the proteins of the wheat kernel as follows:

- albumins soluble in water;
- globulins soluble in salt solutions but insoluble in water solutions;
- gliadins soluble in 70-90% alcohol;
- glutenins insoluble in neutral aqueous solutions, saline solutions or alcohol.

The proteins that are generally said to contribute to the elastic gluten structure are the gliadins and glutenins. These two categories have high concentration of proline, glutamine, glutamic acid and other hydrophobic amino acids.

The low lysine content is of interest since this nutritionally, is a limiting amino acid.

**Water-soluble vitamins.** When white bread made from 70 per cent extraction flour provides no more than 30 per cent of the dietary energy and the other foods are varied and of good quality, requirements of all the known in this group are likely to be met.

For this reason white flours are often fortified with thiamin and nicotinic acid and sometimes with riboflavin.

Nearly all the vitamin E present in whole wheat is removed by milling but other dietary sources usually produce adequate amounts.

**Dietary fibre.** Whole wheat flour contains three times as much dietary fibre as white flour.

This gives it a mild laxative effect, which a few people find disagreeable.

#### **Minerals**

Whole wheat flour contains amount of calcium, iron and zinc which would be nutritionally valuable if they were absorbed, but this is greatly impeded by binding to phytate. Low extraction flours have lost much of these minerals but what remains may be better absorbed because of the loss of phytate. All wheat flours are thus an unreliable source of minerals.

#### **5.2.5.1.4. SELECTION OF FLOUR**

In poor rural communities in which over 60 percent of dietary energy comes from wheat flour, the extraction rate should be high to ensure an adequate supply of B vitamins. Such flour is usually made into unleavened bread.

#### **5.2.5.1.5. BREAD**

Preparation of the "classic" loaf of white bread can be as simple as combining the basic ingredients: flour, water, and yeast, kneading, fermenting, proofing and baking. However, each ingredient's role and contributions of each step of these process preparing breads can be confusing and difficult.

Wheat bread are divided into four classifications:

- wheat breads with a minimum of 90 % wheat components;
- mixed-wheat breads with 51-89% wheat components;
- mixed-rye breads with 51-89% rye components;
- rye breads with a minimum of 90% rye components.

There is no doubt that the development of gluten in the dough system is critical. A dough system for yeast bread may be made by mixing flour with water. Other ingredients such as yeast, salt and sugar are added for leavening, flavor and other quality factors in bread.

Of the predominant wheat flour constituents, the gluten-forming proteins, both kind, quality and amount are of major importance. Gluten is formed from two wheat flour proteins, gliadin and glutenin, the presence of water and some mixing.

Standard white yeast bread:

- Flour-168 g;
- Milk - 118 ml;
- Sugar - 6g;
- Fat - 6g;
- Salt - 3g;
- Yeast - 7g.

Bread has the same nutritive properties as the flour from which it was baked, but the nutrients are diluted by the water added to make the dough and the sodium content is increase from 300 to over 500 mg/100g. In the final product the water content should not be outside the range of 35 to 40 percent. The energy content of breads lies within the range 0.9 to 1.05 MJ (215 to 250Kcal)/100 g and the content of other nutrients is correspondingly reduced.

- **WHITE BREAD**

This is made from low extraction flours which may contain additives and additional nutrients as already described.

- **BROWN BREAD**

It is usually made from a mixture of whole wheat and white flours with a minimum of about 50 percent whole wheat, which corresponds to an extraction rate of 85 percent. Caramel may be added for colouring.

- **WHOLEMEAL BREAD**

This has to be made from whole wheat flour.

#### **5.2.5.1.6. BISCUITS**

These are made from flours which are baked with very little water.

#### **5.2.5.1.7. CAKES AND CONFECTIONERY**

These are made by baking wheaten flour with sugar and fat, to which eggs are sometimes added. Fruit and nuts may also be incorporated.

#### **5.2.5.1.8. OTHER PRODUCTS**

- **TOAST**

Toast is made by applying dry heat to bread.

- **MACARONI, SPAGHETTI AND VERMICELLI**

These and other forms of Italian 'pasta' are made from a very hard variety of wheat (*Triticum durum*), high in protein, which flourishes in the warm, dry Italian climate. Only the endosperm is used for making flour for "pasta", consequently it is

not rich in the B group of vitamins. Their very high gluten content enables the characteristic mouldings to be made.

- **CHAPATIS**

These are the common form in which wheat is eaten in India, Pakistan and Iran. They are made from wholemeal flour (atta). Coarse sieves remove some of the fibre and bran. This may amount to 5 to 7 percent of total weight so Indians usually eat 93 to 95 percent extraction flour.

#### **5.2.5.2. RICE**

Rice is second to wheat in global importance as a staple food for man.

It is possible to produce a refined white rice almost totally devoid of vitamins by home-pounding.

A field trial in the Philippines indicated that rice enriched with thiamin and other nutrients could prevent beriberi.

Most samples of milled rice contain 6,5 to 8,0g/100g of protein, providing 7,0 to 8,5 percent of the energy.

This is less than in other cereals, but no other protein is of such good quality. Lysine is the limiting amino acid. A variety has been bread with 14 g/100g of protein which was well utilised in nitrogen balance experiments on man.

Another cereals are: maize, millets, barley, rye (secale cercele) and triticale.

#### **5.2.5.3. HIGH PHENOLIC CEREALS**

The phenolics are a particular problem, especially for the sorghum, legumes, rapeseed and mustard. They bind up iron and so those consumers who eat high fenolic cereals may have anemia. The phenolics are intermediate in concentration in soybean, flax, peanut, and safflower flour and low in coconut, cottonseed and sesame flour.

### **5.2.6. FOOD FROM THE VEGETABLE KINGDOM**

Fruits, vegetables, and other plant tissues either directly or indirectly supply all of man's foods. There are a number of different types of vegetables. They are classified as bulbs, roots, and tubers. Vegetable fruits such as okra, or cucumbers, make up another category or classification of vegetables. There are also flowers, buds, stems and leafy vegetables. Vegetable seeds are those such as the legumes, coconut, or corn.

Plants are the source of many other types of food beside cereals. These are considered under the headings starchy roots, sugars and syrups, legumes, nuts, vegetables and fruits.

#### **5.2.6.1. STARCHY ROOTS**

Tuberus are generally higher in carbohydrates and lower in water content than stem, flower and leafy vegetables. Tuberus are an enlarged underground stems.

The potato is the most important food of this class in temperate climates.

**COMMON POTATO (SOLANUM TUBEROSUM)**

Potatoes contain 75 to 80 percent of water and yield from 290 to 380 KJ (70 to 90Kcal)/100g. Of the energy, 7.6 percent comes from protein, a negligible amount from fat and most from starch. The protein content is low, about 2 g/100g, but it has a biological value equal to that of egg proteins when fed as a sole source of protein, especially if large amount are eaten, and of dietary fibre.

Potatoes contain small but not very important amounts of minerals and the B group of vitamins. They are in good source of potassium. Potatoes are not quantities they often provide a considerable proportion of the ascorbic acid in the diet.

Potatoes are easily digested and well absorbed and are thus a good food for invalids.

The energy density of potatoes is only 26 percent that of beef steak, and 10 percent that of butter.

Potatoes contain an alkaloid solanine that is potentially toxic to man.

### 5.2.6.2. SUGARS AND SYRUPS

Color, texture, and flavor are all characteristics that sugar plays some role in most foods.

The sweetness that sugar presents makes an obvious approach to the study of sugars.

#### 5.2.6.2.1. TYPES OF SUGARS

Sugar in most recipes is understood to be granulated sucrose. This sugar usually come from a cane sugar and sugar beet.

The various sugar sources may have a number of the following sugars:

- monosaccharides - glucose and fructose (fruits, honey, corn syrup), galactose, mannose (does not occur in free form in foods);
- disaccharides - sucrose (beet and cane sugar), lactose (milk and milk products), maltose (malt products);
- polisaccharides - starch and glycogen, cellulose and hemicellulose.

As a cheap and easily digested form of energy, sugar is a valuable food; but as it lacks every nutrient save carbohydrate, its very attractiveness is a danger in that it tends to displace other more nutritious foods from the diet. With increased sugar consumption there is usually an increase in the incidence of dental disease.

Crystalline table sugar is one of the purest chemicals produced in large quantities by modern industry. It is practically 100 percent sucrose and contains no other nutrients, nor any potentially toxic compounds. "Brown sugar" is less highly refined sucrose containing traces of other sugar and minerals, and colouring matter; perhaps for this reason it has a better flavour and is esteemed for use in coffee.

**5.2.6.2.2. SYRUPS** are highly concentrated solutions in which the sugar is unable to crystallise out owing to the presence of small quantities of other substances.

**5.2.6.2.3. MAPLE SYRUPS.** It contains about 20 percent of water and the remainder carbohydrate.

**5.2.6.2.4. HONEY** is a pleasant attractive food. At many times and places it has acquired a special reputation either as a medicine or as a nutritious food. Most honeys consist of about 20 percent water and about 75 percent of sugars, mostly fructose and glucose, with only traces of other nutrients.

**5.2.6.2.5. JAMS** are made by boiling either fresh fruit or a pulp preserved with SO<sub>2</sub> (sulphited pulp) with sugar. Pectin may or may not be added, dependent on the amount present in the raw material.

The minimum fruit content varies from 30 to 40 percent for different fruits, but is only 20 percent for citrus fruits (marmalades).

Most jams contain about 65 percent of sugar.

#### **5.2.6.2.6. CONFECTIONERY (CANDY)**

The ingredients of most toffees (candy) are a mixture of sugar, a syrup and a little fat; they may contain up to 70 percent of carbohydrate. Boiled "sweeties" are often about 50 percent sucrose and 40 percent glucose. Plain chocolate consists of cocoa, other fats and sucrose. A typical analysis, with figures in g/100g, is cocoa butter 20, non-fat cocoa solids 15, other fats 25, sucrose 40, but there are wide variations. In milk chocolate, non-fat milk solids and butter may constitute about one-fifth of the ingredients.

#### **5.2.6.2.7. SWEETENERS**

In foods we meet and synthetic sweeteners which displace the sugar.

They are:

- saccharin
- aspartame
- acesulfame K
- alitame
- sucralose
- xylitol
- sorbitol
- malitol
- lactitol, etc.

#### **5.2.6.3. LEGUMES**

Peas, beans and lentils are the seeds of plants of the family Fabaceae, formerly known as Leguminosae.

##### **5.2.6.3.1. PROTEIN CONTENT**

The percentage of total energy provided by protein in pulses is higher than in meats and much higher than in cereals. The quality of the proteins may be judged by their content of three essential amino acids, methionine, lysine and tryptophan. Pulse proteins as a sole source of dietary nitrogen would be unsatisfactory because of their low content of methionine. Their lysine content is much higher than that of cereals and approaches that of meats.

Though pulses are not in general as rich in tryptophan as are cereals, they are richer than maize.

**5.2.6.3.2. VITAMINS**

Pulses as a class are good sources of the B group of vitamins (except riboflavin). Pulses have therefore a deserved reputation as a food which protects against beriberi.

Although pulses, except peas and garden beans, like cereal grains are devoid of any vitamin C activity, large amounts of ascorbic acid are formed on germination; sprouted pulses are an excellent preventive against scurvy.

**5.2.6.3.3. DIGESTIBILITY**

Pulses have a reputation for being indigestible. In health, the digestion of pulses and the absorption of their principal nutrients is practically complete and about as effective as in the assimilation of cereals. However, even in minor gastrointestinal disorders their digestion may be incomplete. Flatulence may be assessed objectively by measuring flatus volume or breath hydrogen.

**5.2.6.3.4. TOXINS**

Some pulses may sometimes contain toxic substances. The effects of those associated with the lathyrus pea, with groundnuts contaminated by a fungus and favism from broad beans.

**5.2.6.3.5. THE LEGUMES IN HUMAN DIET****• PEAS**

They were usually eaten dry. The best canned and frozen peas are as good nutritionally as fresh peas.

**• BEANS**

It is now grown extensively and is an important component of diets in the Mediterranean region, where it is associated with favism, in also in high - lands in Africa, Asia and Central and South America. A variety, sometimes known as the Windsor bean, is a crop popular with European gardeners.

**• LENTILS AND SIMILAR PULSES**

Its special value was that it was very resistant to drought. However, it was found that if large amounts of khesari dhal were eaten, paralysis of the lower limbs commonly followed.

**• SOYA BEANS**

The whole dry grain contains about 40 percent of protein (twice as much as in most other pulses) and also up to 20 percent of fat. Soya form the basis with which Chinese cooks garnish their food.

Soya bean oil is a major raw material of moderne margarine.

Soya bean cake is used in animal husbandry as a good source of protein, and is fed to cattle, pigs and poultry.

Soya flour is being increasingly used in human foods.

Human consumption of soya protein is increasing with the development of textured vegetable proteins and other artificial meat. Soya protein is an important constituent in some infant foods and milk substitutes.

**• GROUNDNUTS**

Groundnuts are in fact the seeds of a leguminous plant.

The cultivation of groundnuts is seldom intended as a primary source of human food. The chief product is the oil, which can be used either as cooking oil or for making margarine and soap. The secondary product is making margarine

and soap. The secondary product is the residue or cake left after the expression of the oil.

- **NUTS**

Most nuts have a high content of fat and protein, but as they are eaten in such small amounts their nutritive value is generally insignificant, compared with their flavouring properties.

- **COCONUTS (COCOS NUCIFERA)**

Coconuts palms grow on low-lying land often near the sea, and their graceful leaves and the curves of their trunk give great charm to many tropical landscapes. To the hot and thirsty traveler there is no more refreshing drink than the water inside a green coconut and it is also hygienic.

To white flesh inside the nut, when dried, is known as "copra". It has a high content of oil, and coconut oil is the most valued product of the palm.

The residual cake after the oil has been extracted is known as "ponnac" and is used as a cattle food.

Dried coconut is imported into temperate countries and used by confectioners and cake makers, who value its flavour.

The fresh sap of the palm (sweet toddy) is a pleasant drink but it contains few nutrients.

#### **5.2.6.4. VEGETABLES**

Some vegetables, like spinach, cabbage and lettuce are leaves; others - onions, turnips and radishes - are roots; egg-plants (brinjals or aubergines), gourds and marrows are fruits; celery is a stalk and cauliflower and globe artichokes are flowers.

Leafy vegetables (spinach, lettuce, mustard green, cabbage) are generally high in water and low in carbohydrates, proteins and fats. They frequently contain the mechanism for photosynthesis.

Bulbs (onion, garlic) are generally higher in carbohydrates and lower in water than stems, flowers and leafy vegetables. Bulb are enlargements above the roots. Roots (carrot) are generally higher in carbohydrates and lower in water content than stem, flower or leafy vegetables. Roots are the part of a plant which grows downward into the soil and furnishes nourishment by absorbing nutrients.

Fruits (cantaloup, eggplant, Squash, snow-peas) are the fleshy part of the plant which surrounds the seed. It may be eaten either, botanically or culturally, as a fruit or as a vegetable.

Stems (asparagus) are the plant portions high in water and fiber. They have relatively little other nutritive value.

Flowers (broccoli, cauliflower and artichokes) are generally high in water and low in carbohydrates.

Nevertheless, despite the great variety of botanical structure, vegetables all possess the same general nutritive properties.

##### **5.2.6.4.1. NUTRITIVE PROPERTIES**

The value of vegetables as a source of energy is very small. To obtain 1000 Kcal it would be necessary to eat 2 to 3 Kg of vegetables. The large bulk of vegetables helps to promote satiety and this, with their low-energy value, makes them useful in the prevention and treatment of obesity. Vegetables are also of little value as a source of proteins and essential amino acids. All vegetables contain

dietary fibre. This increases the bulk of the faeces. In this way vegetables, by increasing the size of the stool, have a mild laxative effect.

Most vegetables contain amounts of calcium and iron that are probably physiologically significant. The mineral content of different samples of the same vegetable may vary greatly.

Oxalic acid in some leafy vegetable may interfere with calcium absorption. Even though much of the iron present in vegetables may not be absorbed, the ascorbic acid which they also contain may aid its absorption.

All vegetables contain small amounts of the B group of vitamins, but their contribution to the total intake is seldom great.

The  $\beta$ -carotene content of vegetables is vary variable.

The great majority have good vitamin A activity.

There is a rough relation between colour and  $\beta$ -carotene content. All green leafy vegetables are rich and , some, such as kale, very rich. Cucumber, cauliflower, some of the gourds and other pale vegetables may contain very little.

All vegetables contain valuable amount of ascorbic acid, but the quantities are variable and losses in cooking and preparation may be great.

#### 5.2.6.4.2. VEGETABLE FLAVOR

The cabbage and onion family give flavors and odors due to a variety of sulfur compounds. In addition to contributing to flavor, one of the sulfur-containing compounds in the cabbage family, sulfo raphane, is thought to protect against cancer.

The cabbage family includes broccoli, brussel sprouts, cabbage, cauliflower, kale, kohlrabi, mustard, rutabaga, and turnips is sometimes known as Cruciferae family.

Although relatively mild when raw, cooking will develop strong flavors due to hydrogen sulfide and other volatile sulfur compounds. A portion of this strong flavor development during cooking is due to the breakdown of S-methyl-L-cysteine sulfoxide into dimethyl disulfide. Unfortunately, the natural plant acids may accelerate this process. For this reason, the recommended cooking method is to cook similarly to green vegetables.

Onion, garlic and leek has its typical flavor primarily due to the degradation of alliin or a derivative by the enzyme, allinase to allicin and pyruvic acid and ammonia. The cutting across the cytoplasm of the cell release the enzyme and bring about the reaction. During cooking, the onion flavor mildness is maintained by cooking in a large amount of water.

Sweetness of vegetables has been the one taste perception that is constantly searched for. Some plants, such as sugar cane and sugar beet are grown fir their sweet component, sucrose, but the types of sugar in others plants vary considerable.

#### 5.2.6.5. FUNGI

Fungi are for the most part delicious food and are eaten for their flavour. As they only contain up to 3 percent protein, less than 1 percent fat and about 2 percent carbohydrate, their nutritive value is small.

#### 5.2.6.6. FRUITS

The nutritive value of fruits is much less important.

The only essential nutrient in which fruits are rich is ascorbic acid. Almost all fruits contain physiologically significant amount of this vitamin and some are very rich.

Fruits, of course, like vegetables contain dietary fibre and add bulk to the stools; they are thus mild natural laxatives. A few people with sensitive colons can take fruit only in small quantities; if larger amounts are taken diarrhoea follows. Prunes contain derivatives of hydroxyphenylisatin, which stimulates the smooth muscle of the colon.

Most fruits contain small quantities of carotene and the B group of vitamins.

The amounts present are not usually great enough to increase significantly the intake of these nutrients.

Fruits contain little or no protein or fat. Most contain 5 to 20 percent of carbohydrate. Apples and pears contain much more fructose, while apricots and peaches contain sucrose.

Fruits contain a great variety of organic acids. As already described, the body readily disposes of these acids; most are easily oxidised, some excreted in the urine and a few are not absorbed from the gut. They do not give rise to acidosis.

##### 5.2.6.6.1. BANANAS are a fruit which requires special mention.

They contain much larger amounts of carbohydrate than most fruits and so can act as a useful source of energy.

In small quantities bananas are a pleasant and attractive food and have acquired a well merited reputation in temperate climates. They are very easily digested. In ripe bananas 15 to 20 percent of the pulp consists of sucrose, fructose or glucose and 1 to 2 percent is starch. It is important that bananas given to children be fully ripe. They can be digested by babies as early as their value in caeliac disease. They are also a food for convalescence.

##### 5.2.6.6.2. FRUITY FLAVOR

Flavors and aromas in fruits are due to a variety of compounds working together to give unique and distinctive characteristics. Although each fruit tasted is unique, many of the compounds likely come from the aldehydes, alcohols, ketones, organic acids, esters, sulfur compounds, and a trace amounts of other chemical structures.

Astringency in fruits is primarily due to the flavonoid pigments classified as tannins or phenolics. These flavor components will make the mouth pucker.

Fruity flavour is extremely complex and can not be attributed to one specific compound. The fruity flavor can be generally attributable to a combination of esters, alcohols, aldehydes, ketones, and minor compounds. Some specific compounds attributable to fruity flavor in specific fruits will be described.

Acid flavor from fruits and vegetables is formed by many different acids. Although malic and citric acids, a number of others can be found in selected plant foods. Grapes has considerable tartaric acid and oxalic acid (rhubarb) and benzoic acid (plums, cranberries) is found in a number of fruits. These acids, in turn give a range of pH values.

## 5.2.7. BEVERAGES; HERBS AND SPICES

### 5.2.7.1. BEVERAGES

*Homo sapiens* is not very fond of plain water and prefers flavoured fluids such as beer; wine, spirits, tea, coffee, cocoa, fruit juice, or even synthetic "colas" and "lemonades". Americans encourage the consumption of plain water by serving it iced.

Beverages are appreciated for their flavour and for the pharmacological action of certain ingredients which many contain. Some are also a source of energy and a few provide small amounts of micronutrients.

#### 5.2.7.1.1. SOFT DRINKS

These include any fruit squash, crush and cordial (as distinct from fruit juice), colas, soda water, tonic water, sweetened artificially carbonated water that may or not may be flavoured, and ginger beer.

Soft drinks have little value in nutrition except that they encourage people to drink water. Some citrus squashes contain significant amounts of natural vitamin C or may be enriched with it. Most soft drinks are sweetened. If sugar is used, this may contribute to obesity and the drink is unsuitable for contribute to obesity and the drink is unsuitable for diabetics.

Cola drinks usually contain caffeine in concentrations from 50 to 200 mg/l.

#### • FRUIT JUICES

Fruit juices contain approximately the same nutrients as whole fruit but have lost most of the pectin. The most important nutrient is vitamin C. This varies greatly depending on the fruit juices may be expected to contain between 30 and 50 mg/dl and pineapple and tomato juices about half as much. Apple juices are also useful for patients on low sodium diets or receiving diuretic drugs for any reason, as their content of potassium is high and of sodium low. A reasonable assumption is that juice contain not more than 2.5 mmol/l of Na and not less than 30 mmol/l K and that K/Na ratio is at least 20:1.

#### • TEA, COFFEE AND COCOA

These beverages contain small amounts of three drugs, caffeine, theobromine and theophylline. These are methyl derivatives of xanthine. Caffeine is the most active; it is a stimulant to the nervous system and often prevents fatigue; many people find that caffeine appears to facilitate mental work.

An excessive intake of caffeine can cause sleeplessness and so may aggravate emotional instability and mental illness.

In some persons caffeine appears to sensitise the heart and increase the incidence of ventricular premature beats but this alone is not a reason to forbid its use.

Both contain tannin, which is a weak protein precipitant and astringent. Tea and coffee do not impair digestion when taken in moderate amounts and not excessively strong, whether by healthy people or patients.

Caffeine is a weak diuretic. It is of little medicinal value for this purpose, not are tea and coffee contraindicated for this reason.

#### TEA

The tannin content of a cup (150 ml) of infusion to vary from 60 to 280 mg. Caffeine contents varied from 50 to 80 mg.

Tea contains flavenols which after infusion polymerise to form tannins with an astringent flavour. This process is inhibited by acids as when lemon juice is added, and the polymers are absorbed by milk proteins.

#### **COFEE**

Coffee is a popular drink and in moderate amounts a mild cerebral stimulant and diuretic. People habituated to several cups of coffee during the day feel tired if this is stopped and may have head aches. But coffee is not inert. Too much can produce anxiety symptoms, cardiac arrhythmias, gastrointestinal discomfort or insomnia.

#### **COCOA**

The chief xanthine derivative in cocoa is theobromine, but it also contains some caffeine and tannin.

#### **5.2.7.1.2. NATURAL WATERS**

Natural waters may contain too little iodine and too little or too much fluoride with effects on the health.

Soft waters contain little or no calcium, but very hard waters may contain 200 mg calcium per litre or more and so provide a useful proportion of the daily intake of this mineral.

Communities drinking water can sometimes become accidentally contaminated by industrial effluents such as cadmium and mercury and where the water is collected off heavily fertilised agricultural land its content of nitrate needs to be monitored because of the possibility of nitrosamine formation.

##### **• MINERAL WATERS**

Mineral waters contain small quantities of sodium chloride, sodium carbonate and bicarbonate, also salts of calcium and magnesium and sometimes iron or hydrogen sulphide. They are usually mildly alkaline. The total mineral content is seldom as high as 8g/l and is often much less. Many of these waters are naturally aerated with carbon dioxide.

"Soda water" is its traditional siphon in simply water from any wholesome source, with carbon dioxide forced into it under pressure. It has no medicinal properties.

#### **5.2.7.1.3. ALCOHOLIC DRINKS**

Alcohol is a drug which depresses the higher nerve centres. Its first effect is to reduce the sense of worry and so to promote a feeling of well-being. It also loosens the imagination. Men and women come out of themselves, are more sociable and generally less intolerant of their fellow beings. For these reasons alcohol promotes good fellowship.

Alcohol, even in small doses, impairs the judgment and inhibits the skills necessary for fine movements. Euphoria usually prevents the subject from appreciating this loss.

Ethanol is seldom the only product of fermentation when microorganisms grow in a carbohydrate medium; given a good supply of oxygen they generally yield acetic acid instead, with the production of vinegar.

The cellulose contained in wood pulp when fermented yield a high proportion of methyl alcohol which is highly toxic and can cause permanent blindness.

- **BEER, ALE AND STOUT**

Most beer ale and stout contain from 3 to 7 g ethanol /100 ml, though some "special brews" may contain much more. Their energy value is usually between 125 and 250 KJ (30 and 60 Kcal)/100ml -about the same as milk. But they differ from milk in that they contain no protein, fat or useful amounts of calcium. The only vitamins present in beer are small amounts of nicotinic acid and riboflavin.

- **VINES**

Two wine-growing countries, France and Italy, have the highest alcohol consumption in the world and also a high incidence of cirrhosis of the liver.

Natural wines contains 8 to 13 g of ethanol/100 ml and some unfermented sugars, but no other nutrients in significant amounts. One bottle (650 ml) of vin ordinaire provides about 1,9 MJ (450 Kcal). They may also contribute to iron overload.

French wines contain very variable amounts of histamine - from 0,1mg/l in the best champagnes to 30 mg/l in some burgundies. As little as 20 µg of histamine if injected intravenously produces headache and it is possible that histamine contributes to the after effects of too much cheap wine.

- **FORTIFIED WINES**, such as sherry, port and madeira have alcohol added to rise the concentration up to 20g/100 ml.

- **SPIRITS**

- **WHISKY**

A standard bottle of whisky containing 700 ml therefore provides about 230 g of ethanol, which at 30 KJ/g amounts to 6,9 MJ(1600 Kcal). But apart from its energy value, whisky has no other purely nutritional virtues.

- **OTHER DISTILLED SPIRITS** are Brandly (France), rum (West Indies), gin (Dutch), vodka (Russia), Calvados (Celts), slibovits(Yugoslavia), onzo (Greece), arak (North America), liqueurs (France), tsuica (Romania).

#### 5.2.7.2. HERBS AND SPICES

In all part of the world herbs and spices are used to flavour food and so make it more attractive and apetising. Large numbers of plants have been cultivated for this purpose. Their flavour resides in essential oils, or also resins, often in specialised parts of the plant.

They have little direct nutritional value. The energy value and protein content of this is negligible. Some condiments such as green chillies are rich in ascorbic acid (100 mg/100g); they may contribute significantly to the ascorbic acid content of the diet. Most herbs and spices contain the B group of vitamins and minerals such as calcium and iron in appreciable concentrations, but the quantities eaten are to small to be significant.

Some herbs contain substances which are poisonous to man. Most of these are well known locally and tradition assures that they are avoided.