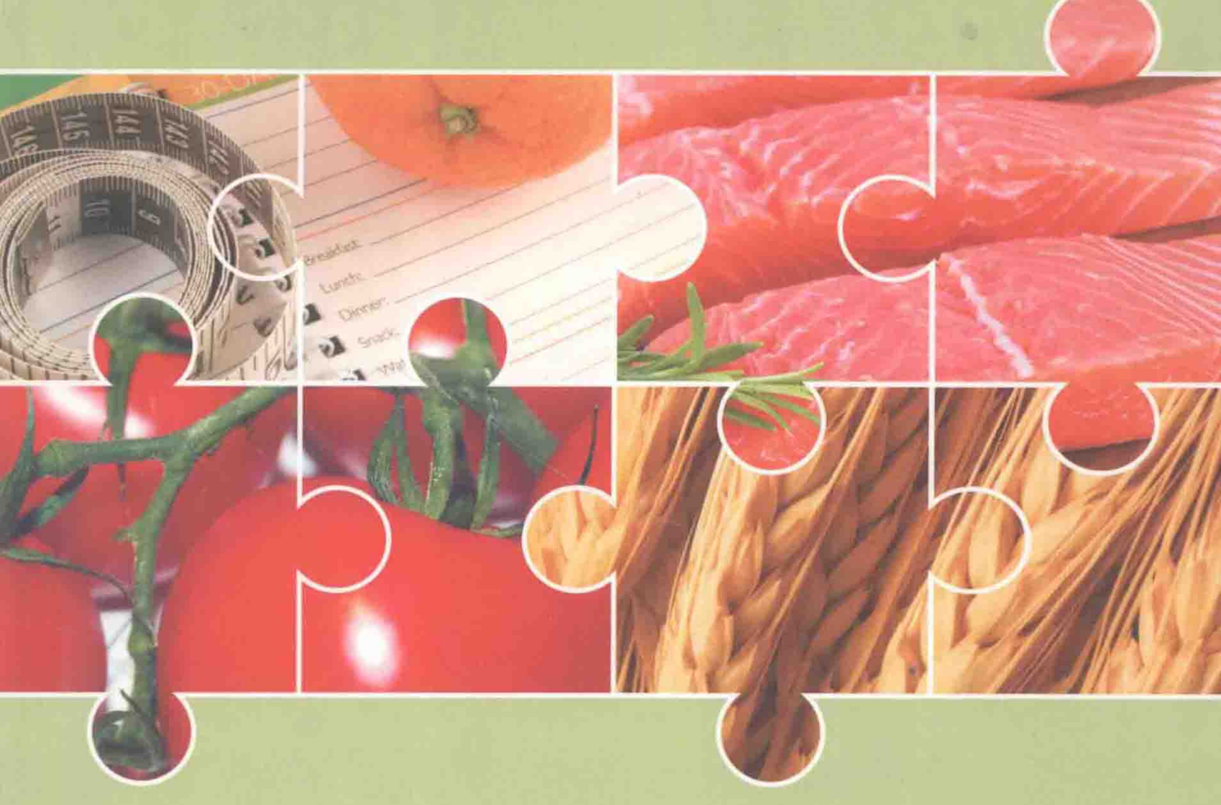
Clinical Nutrition in Practice



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Preface

Nutrition is of central importance to the treatment of various diseases and health conditions, just as malnourishment is largely responsible for their prevalence. In recent decades, great emphasis has been placed on the importance of nutrition and a healthy diet, especially in hospital settings, since malnutrition is a widely presented problem and an appropriate dietary plan can shorten the treatment period and hence the duration of a patient's hospitalisation.

Clinical Nutrition in Practice is aimed at health professionals who are involved in the general medical treatment of patients. The book is in the form of questions and answers, in order to be more interesting and practical for the reader. It contains short answers on topics related to different scientific fields of nutrition, based on the recent literature, and can be used as a scientific tool for all professionals in daily practice.

I would like to thank all the authors of the book, who are clinical dietitians and nutritionists with great experience in the clinical field, with whom I collaborated on a daily basis, in 'Laiko' General Hospital, Athens, Greece. I would like especially to thank Charilaos Dimosthenopoulos (RD) for his cooperation in the general organisation of the book.

I would also like to thank Wiley-Blackwell for publishing this book. It has been a great honour to work with them on it, and I hope that it will extend and deepen health professionals' knowledge and understanding of clinical nutrition.

Professor Nikolaos Katsilambros
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Chapter 1

Principles of Healthy Nutrition

Charilaos Dimosthenopoulos, Meropi Kontogianni and Evangelia Manglara

Energy balance

What is energy balance?

Energy balance is the difference between energy intake, which can be metabolised, and total energy expenditure. It could be said that the human body's energy state is balanced when its energy expenditure is equal to its energy intake.

The human body requires energy to perform its many functions, to facilitate muscle activity and developmental demands and to correct problems that may have been caused by disease or injury. Energy needs are met by the energy obtained from the body's diet, which derives from foods either of plant or of animal origin. Food energy is released in the body through the oxidation of carbohydrates, fats, proteins (which are called macronutrients) and alcohol.

If energy intake and expenditure are not equal, the result will be either a positive energy balance, in which body energy stores (and mainly fat) are increased, or a negative energy balance, in which the body falls back on using its energy stores (fat, protein and glycogen). Consequently, the body's energy balance (along with other factors) determines to a large extent its weight and general health status.

What factors influence how much energy the human body requires?

According to the definition given by the World Health Organization (WHO), energy requirement is 'the level of energy intake that will balance energy expenditure when we have a body size and composition, and a level of physical activity consistent with long-term good health'. Energy requirements are influenced by various factors, such as the developmental stage we are in (e.g. children's or adolescents' requirements are different from those of the adults), body size, the amount and intensity of physical activity (athletes and manual workers, for instance, obviously require more energy than people doing clerical work or leading sedentary lives), gender, illness, injury, pregnancy, lactation, etc.

What is the basal metabolic rate?

The basal metabolic rate (BMR) is one of the three components that energy expenditure consists of. It is the amount of energy spent for basal metabolism, which represents voluntary and involuntary vital bodily functions, such as respiration, renal, brain and cardiovascular functions, cell and protein turnover, blood circulation, the maintenance of body temperature, etc.

BMR is commonly extrapolated to 24 hours to be more meaningful, and it is then referred to as 'basal energy expenditure' (BEE), expressed as kcal/24 h (kJ/24 h). Resting metabolic rate (RMR), energy expenditure under resting conditions, tends to be somewhat higher (10–20%) than under basal conditions owing to increases in energy expenditure caused by recent food intake (i.e. by the thermic effect of food) or by the delayed effect of recently completed physical activity. Thus, it is important to distinguish between BMR and RMR and between BEE and resting energy expenditure (REE) (RMR extrapolated to 24 hours). BMR is measured under a specific set of circumstances: the subject must be awake, lying comfortably in a supine position, in a state of rest, in a warm room, at least 12 hours after last food ingestion. Since these strict conditions are hard to achieve in hospital settings, energy requirements are usually expressed as RMR. Basal, resting and sleeping energy expenditures are related to body size, being most closely correlated with the size of the fat-free mass (FFM), which is the weight of the body less the weight of its fat mass. The size of the FFM generally explains about 70–80% of the variance in RMR. However, RMR is also affected by age, gender, nutritional state, inherited variations and by differences in the endocrine state, notably (but rarely) by hypo- or hyperthyroidism.

What are the other two components of energy expenditure?

The other two components of energy expenditure are (1) the energy spent on daily activities and physical exercise (which depends on the kind, the intensity and the duration of the physical activity) and (2) the energy spent in response to a variety of thermogenic stimuli (thermogenesis), which include the food we consume, certain drugs, low temperatures, muscle tension, stress and similar psychological states.

What is the thermic effect of food?

It has long been known that food consumption elicits an increase in energy expenditure, a phenomenon known as the 'thermic effect of food' (TEF). The intensity and duration of meal-induced TEF is determined primarily by the amount and composition of the food consumed, mainly owing to the metabolic costs incurred in handling and storing ingested nutrients. Activation of the sympathetic nervous system, elicited by dietary carbohydrate and by sensory stimulation, causes an additional, but modest, increase in energy expenditure. The increments in energy expenditure during digestion above baseline rates, divided by the energy content of the food consumed, vary from 5 to 10% for carbohydrate, 0 to 5% for fat, and 20 to 30% for protein. The high TEF for protein reflects the relatively high metabolic cost involved in processing the amino acids yielded by the absorption of dietary protein, for protein synthesis or for the synthesis of urea and glucose. In general, consumption of the usual mixture of nutrients is generally considered to elicit increases in energy expenditure equivalent to 10% of the food's energy content.

How is energy expressed?

All forms of energy can be converted to heat and all the energy the body uses is lost as heat. For this reason, the energy that is consumed, stored and spent is expressed as its heat equivalent. The first unit of energy employed in nutrition was the calorie [the amount of energy needed to raise the temperature of 1 gram (g) of water from 14.5 to 15.5°C]. In the context of food and nutrition, the kilocalorie (1000 calories) has been traditionally used. However, in the International System of Units, the basic energy unit is the joule (J), which corresponds to the energy used when a mass of 1 kilogram (kg) is moved through 1 m by a force of 1 newton (N). One J = 0.239 calories, so that 1 kcal is equal to 4.186 kJ.

Carbohydrates and fibre

What are carbohydrates and how are they classified?

Carbohydrates, the most prevalent organic molecules, are a valuable source of energy in the human diet. It is estimated that in Western countries more than 40% of the energy intake in an average diet comes from carbohydrates. In developing countries, this amount is even higher. Therefore, carbohydrates can be seen as an important fuel for all living beings. As their name denotes, they are synthesised from carbon dioxide and water during plant photosynthesis.

Dietary carbohydrates may be classified by molecular size into (1) sugars, which can be further subdivided into monosaccharides and disaccharides, (2) oligosaccharides, which can be further subdivided into malto-oligosaccharides and other oligosaccharides, and (3) polysaccharides, which can be further subdivided into starch and non-starch polysaccharides.

The commonest monosaccharides are glucose and fructose, which occur in fruit and vegetables. The best-known disaccharides (consisting of two sugar units) are lactose (which is found in milk), sucrose (common sugar) and maltose. Oligosaccharides, containing 3–10 sugar units, are often breakdown products of polysaccharides, which contain more than 10 sugar units. Polysaccharides differ from sugars in that they are non-sweet and less soluble in water. Examples of polysaccharides include starch and glycogen, which are the storage forms of carbohydrates in plants and animals, respectively. Finally, sugar alcohols, such as sorbitol and mannitol, are alcohol forms of glucose and fructose, respectively.

According to an older broad categorisation, carbohydrates may also be classed as (1) simple carbohydrates (known as simple sugars), which are chemically made up of one or two sugar units and are digested quickly, and (2) complex carbohydrates (or starches), which are made of three or more linked sugar units and take longer to absorb. The latter lead to a slower and more stable release of glucose in the blood and are considered healthier.

In the 1920s, according to another categorisation, carbohydrates were divided into (1) available ones (digested and absorbed in the small intestine and providing carbohydrates for metabolism) and (2) unavailable ones (carbohydrates passing to the large intestine and offering substrate for intestinal microflora). The latter were later largely replaced with the term 'dietary fibre', although the two terms are not entirely synonymous.

What are the main functions of carbohydrates?

As mentioned above, carbohydrates have a very crucial role in our diet as an energy source indispensable for the body, and especially for the tissues of the central nervous system, given the fact that the brain has a limited ability to use other energy sources. Carbohydrate energy content is estimated to be 3.75 kcal/g (15.7 kJ/g). Apart from that, they also serve as a structural element in bacteria, plants and animals. Moreover, they help in vitamin and mineral absorption.

Another well-known function of carbohydrates is to impart sweetness to our food. In addition to that, starch, structural polysaccharides and many oligosaccharides have various other roles. For instance, polydextrose adds texture to certain food items. Thanks to their versatility, carbohydrates are widely used in the food industry, for example as thickeners, stabilisers, emulsifiers, crystallisation inhibitors, gelling agents, etc.

What are the minimum and maximum carbohydrate amounts required by humans?

The minimum intake of dietary carbohydrate which is compatible with life can be extremely low, provided that there is an adequate intake of protein and fat amounts, in order to promote *de novo* synthesis of glucose through the hydrolysis of endogenous or dietary protein or glycerol derived from fat. Generally, it is accepted that the minimum carbohydrate amount we need on a daily basis is 100 g [380 kcal (1590 kJ)]. If this minimum requirement is not covered, the result will be the extensive breakdown of body protein, as well as significant salt and water loss.

A diet low in carbohydrates may also lead to bone mineral loss, hypercholesterolaemia, and mainly in ketogenesis and ketone-body production in the mitochondria of liver cells. Ketogenesis is the natural response of the body to a low-carbohydrate diet, owing to the exhaustion of cellular carbohydrate stores, such as glycogen and energy production through fatty acids.

For this reason, professional associations such as the British and the American Dietetic Association do not recommend low-carbohydrate diets, which usually are especially high in fat and protein. Low-carbohydrate diets restrict caloric intake by reducing the consumption of carbohydrates to 20–60 g per day (typically less than 20% of the recommended daily caloric intake).

The maximum daily amount of glucose tolerated by an average person is about 400 g. Excessive glucose intake may result in hyperglycaemia. It is generally recognised that the high consumption of sugars – and especially sucrose – has adverse effects on health as it is related to dental caries and chronic diseases, such as diabetes mellitus, obesity, heart disease, etc. Therefore, plasma concentrations of glucose must be carefully regulated.

What is the glycaemic index?

The glycaemic index (GI) is a classification proposed to quantify the relative blood glucose response to foods containing carbohydrate. It is defined as the area under the curve for the increase in blood glucose after the ingestion of a set amount of carbohydrate in an individual food (e.g. 50 g) in the two-hour post-ingestion period as compared with ingestion of the same amount of carbohydrate from a reference food (white bread or glucose) tested in the same individual, under the same conditions, using the initial blood glucose concentration as a baseline. The consumption of foods that have a low GI is beneficial for health as it contributes to good glycaemic control and to the reduction of chronic disease risk factors. Carbohydrates with a high GI cause higher insulin secretion; this is why the GI of dietary carbohydrates, along with the insulinaemic response to them, is of utmost importance for diabetes control.

What is the definition of dietary fibre?

The concept of dietary fibre has changed considerably in recent years. It is now recognised that dietary fibre encompasses a much broader range of substances than was acknowledged previously and that it has greater physiological significance than previously thought. There is no generally accepted definition of dietary fibre worldwide. However, there is a consensus that a physiologically based definition is necessary. The most recent definitions of dietary fibre emanate from the American Association of Cereal Chemists, the US Institute of Medicine, the Agence Française de Sécurité Sanitaire des

Aliments, the Codex Alimentarius Commission and the Health Council of The Netherlands. These definitions all take into account the physiological characteristics of dietary fibre, but with a varying emphasis, and are summarised in Table 1.1.

Early chemistry of non-starch polysaccharides extracted different fibre fractions by controlling the pH of solutions; in this context the terms 'soluble' and 'insoluble' fibre evolved. They provided a useful simple categorisation of dietary fibre with different physiological properties, as understood at the time. Historically, soluble fibres principally affected glucose and fat absorption, because many of them were viscous and formed gels in the small intestine (e.g. pectins and ß-glucans). In contrast, types of dietary fibre with a greater influence on bowel function were referred to as 'insoluble' (including cellulose and lignin). It is now apparent that this simple physiological distinction is inappropriate because some insoluble fibres are rapidly fermented and some soluble fibres do not affect glucose and fat absorption. As the terms 'soluble' and 'insoluble' may be misleading, in 1998 the WHO and the Food and Agricultural Organization recommended that they should no longer be used.

In general, dietary fibres consist primarily of carbohydrate polymers (non-starch polysaccharides) that are components of plant cell walls, including cellulose, hemicellulose and pectins, as well as other polysaccharides of plant or algal origin, such as gums and mucilages and oligosaccharides such as inulin. Analogous non-digestible carbohydrates that pass through the small intestine unchanged but are fermented in the large intestine should also be included, for example resistant starch, fructo-oligosaccharides, galacto-oligosaccharides, modified celluloses and synthesised carbohydrate polymers, such as polydextrose. Associated substances, principally lignin, and minor compounds including waxes, cutin, saponins, polyphenols, phytates and phytosterols, are also included, insofar as they are extracted with the polysaccharides and oligosaccharides in various fibre analytical methods. However, with the exception of lignin, these associated substances when isolated could not be described as dietary fibre. Table 1.2 summarises the most common natural sources of various components of dietary fibre.

In what way is dietary fibre beneficial for health?

Although more studies are certainly needed, it has been suggested that an insufficient consumption of dietary fibre contributes to a plethora of chronic disorders such as constipation, diverticulitis, haemorrhoids, appendicitis, varicose veins, diabetes, obesity, cardiovascular disease, cancer of the large bowel and various other cancers.

What are the recommended fibre intakes through the life cycle?

Recommendations for adult dietary fibre intake generally fall in the range of 20–35 g/day. Others have recommended dietary fibre intakes based on energy intake, 10–13 g of dietary fibre per 1000 kcal. Nutrition fact labels use

Table 1.1 Recent definitions of dietary fibre.

American Association of Cereal Chemists (AACC, 2001)
The edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine, with complete or partial fermentation in the large intestine. Dietary fibre includes polysaccharides, oligosaccharides, lignin and associated plant substances. Dietary fibres promote beneficial physiological effects, including laxation and/or blood cholesterol attenuation and/or blood glucose attenuation.

Dietary Reference Intakes for Energy, Carbohydrates, Fibre, Fat, Protein and Amino Acids (Macronutrients), Institute of Medicine (2002)
Dietary fibre consists of non-digestible carbohydrates and lignin that are intrinsic and intact in plants.
Functional fibre consists of isolated, non-digestible carbohydrates that have beneficial physiological effects in humans.
Total fibre is the sum of dietary fibre and functional fibre.

Agence Française de Sécurité Sanitaire des Aliments (AFSSA, 2002)
Dietary fibre consists of:

- carbohydrate polymers (degree of polymerisation $\geq$3) of plant origin with lignin or other non-carbohydrate components (e.g. polyphenols, waxes, saponins, cutin, phytates, phytosterols) AND
- carbohydrate polymers (degree of polymerisation $\geq$3), processed (by physical, enzymatic or chemical means) or synthetic.

In addition, dietary fibre is neither digested nor absorbed in the small intestine. It has at least one of the following properties:

- stimulates colonic fermentation
- reduces pre-prandial cholesterol levels
- reduces postprandial blood sugar and/or insulin levels.

Codex Alimentarius Commission (CAC, 2006)
Dietary fibre means carbohydrate polymers[a] with a degree of polymerisation not lower than 3, which are neither digested nor absorbed in the small intestine. A degree of polymerisation not lower than 3 is intended to exclude mono- and disaccharides. It is not intended to reflect the average degree of polymerisation of a mixture.
Dietary fibre consists of one or more of:

- edible carbohydrate polymers naturally occurring in the food as consumed
- carbohydrate polymers, which have been obtained from food raw material by physical, enzymatic, or chemical means
- synthetic carbohydrate polymers.

Dietary fibre generally has properties that:

- decrease intestinal transit time and increase stool bulk
- are fermentable by colonic microflora
- reduce blood total and/or low-density lipoprotein cholesterol levels
- reduce postprandial blood glucose and/or insulin levels.

Health Council of the Netherlands (2006)
Dietary fibre is the collective term for substances that are not digested or absorbed in the human small intestine, and which have the chemical structure of carbohydrates, compounds analogous to carbohydrates, and lignin and related substances.

[a] When from plant origin, dietary fibre may include fractions of lignin and/or other compounds when associated with polysaccharides in plant cell walls. Fractions of lignin and/or other compounds (e.g. proteic fractions, phenolic compounds, waxes, saponins, phytates, cutin, phytosterols) intimately associated with plant polysaccharides are included in the definition of fibre insofar as they are actually associated with the poly- or oligosaccharidic fraction of fibre.

Table 1.2 Natural sources of various components of dietary fibre.

Fibre component	Main food source
Cellulose	Vegetables, woody plants, cereal brans
Hemicellulose	Cereal grains
Lignin	Cereal brans, rice and legume hulls, woody plants
Beta-glucans	Grains (oats, barley, rye, wheat)
Pectins	Fruits, vegetables, legumes, sugar beet, potato
Gums	Legumes, seaweed, micro-organisms (guar, locust bean, carrageenan, xanthan, Arabic gum)
Inulin and oligofructose/ fructo-oligosaccharides	Chicory, Jerusalem artichoke, onions
Oligosaccharides	Human milk, grain legumes
Resistance starches:	
Type 1 (RS1)	Starch that is physically inaccessible (e.g. enclosed within intact cell structures in foods such as leguminous seeds and partly milled cereal grains and seeds).
Type 2 (RS2)	Native starch granules (e.g. in maize rich in amylose, raw potatoes, green bananas).

25 g dietary fibre per day for a 2000 kcal/day (8374 kJ/day) diet or 30 g/day for a 2500 kcal/day (10467 kJ/day) diet as goals for American intake. Attempts have been made to define recommended dietary fibre intakes for children and adolescents. Although based on limited clinical data, the recommendation for children older than 2 years is to increase dietary fibre intake to an amount equal to or greater than their age plus 5 g/day and to achieve intakes of 25–35 g/day after age 20 years. No published studies have defined desirable fibre intakes for infants and children younger than 2 years. Until there is more information about the effects of dietary fibre in the very young, a rational approach would be to introduce a variety of fruits, vegetables and easily digested cereals as solid foods are brought into the diet. Specific recommendations for older people have not been published, although a safe recommendation would encourage intakes of 10–13 g dietary fibre per 1000 kcal (4186 kJ). All recommendations need to recognise the importance of adequate fluid intake, and caution should be used when recommending fibre to those with gastrointestinal diseases, including constipation.

Fats and lipids

What are fats and what are lipids?

Lipids form a broad category comprising fats, oils, waxes and various other compounds like lipoproteins, phospholipids and cholesterol. They are all water-insoluble and very useful for living organisms. Fats are food components insoluble in water that represent a condensed source of energy. From a chemical aspect, they are fatty acids, and from a nutritional aspect, they include fatty acids and other lipids, such as phospholipids, sterols, such as cholesterol, and synthetic lipids. One gram of fat provides around 9 kcal (37.7 kJ) of energy.

What are the main functions of fats?

Fats, thanks to their high energy density, are used by the organism as a long-term fuel reserve. Additionally, they act as solvents in the absorption of fat-soluble vitamins and they are the precursors for hormone synthesis, while they also form an integral structural part of cell membranes, in which they play various specific roles (e.g. acting as a pulmonary surfactant, participating in cell signalling, etc.).

In what ways are essential fatty acids important?

Linoleic acid, an omega-6 polyunsaturated fatty acid, and alpha-linolenic acid, an omega-3 polyunsaturated fatty acid, are called 'essential fatty acids' because they are indispensable for our health and they cannot be synthesised by our body, so they have to be obtained through the diet. Linoleic acid is the precursor to arachidonic acid, which is the substrate for eicosanoid production in tissues, is a component of membrane structural lipids and is important in cell signalling pathways. Lack of linoleic acid may lead to various problems, such as skin rash, dermatitis and hair loss. Moreover, lack of alpha-linolenic acid results in adverse clinical symptoms, including neurological abnormalities and poor growth. Clinical and epidemiological studies have addressed the omega-6/omega-3 fatty acid ratio, focusing on the beneficial effects on risk of certain diseases associated with higher intakes of the omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). A linoleic/alpha-linolenic acid ratio of 5:1 to 10:1 has been recommended for adults.

How are dietary fatty acids classified, and which of them are known to be especially beneficial for health?

Dietary fatty acids can be classified into two large categories: saturated (with no double bonds) and unsaturated. The latter are subdivided into monounsaturated fatty acids (MUFA), which have one double bond, and polyunsaturated fatty acids (PUFA), which have more than one double bond. Animal fats tend to be richer in saturated fatty acids compared to vegetable fats.

MUFA are also known as 'omega-9 fatty acids' and the commonest of them is oleic acid. They can be found in olive oil and peanut oil and they are believed to protect against coronary heart disease and some types of cancer. MUFA are a potential fuel source for the body and are critical structural fatty acids for cell membranes and other functions. MUFA are undoubtedly required for many body functions. Nevertheless, MUFA can be biosynthesised from other fuel sources and therefore are not essential in the diet.

PUFA are further divided into the omega-3 family and the omega-6 family, both of which are known to have positive effects on human health. The primary omega-6 PUFA are:

- 18:2 linoleic acid
- 18:3 gamma-linolenic acid
- 20:3 dihomo-gamma-linolenic acid
- 20:4 arachidonic acid
- 22:4 adrenic acid
- 22:5 docosapentaenoic acid.

Sources of omega-6 PUFA are liquid vegetable oils, including soybean oil, corn oil and sunflower oil. Omega-3 PUFA tend to be highly unsaturated with one of the double bonds located at three carbon atoms from the methyl end. This group includes:

- 18:3 alpha-linolenic acid
- 20:5 eicosapentaenoic acid
- 22:5 docosapentaenoic acid
- 22:6 docosahexaenoic acid.

Plant sources of omega-3 PUFA (alpha-linolenic acid) include soybean oil, canola oil, walnuts and flaxseed. Alpha-linolenic acid is the precursor for synthesis of EPA and DHA, which are formed in varying amounts in animal tissues, especially fatty fish (e.g. trout, mackerel, herrings, salmon), but not in plant cells. EPA is the precursor of omega-3 eicosanoids, which have been shown to have beneficial effects in preventing coronary heart disease, arrhythmia and thrombosis, as well as to growth and neural development. Omega-3 fatty acids are considered good both for physical and mental health and to function preventively against heart disease and certain cancers. They also seem to have a beneficial effect on rheumatoid arthritis and atopic dermatitis.

Which fatty acids are considered 'bad' for health?

According to epidemiological and clinical studies, trans fatty acids and to a lesser extent saturated fatty acids (mainly from animal products such as meat and dairy) of the diet are positively associated with coronary heart disease, hypertension and insulin resistance. Dairy fats and meat naturally contain trans fatty acids; however, the majority of dietary trans fatty acids are derived from partially hydrogenated oils. Hydrogenation (a process used to manufacture margarine, for instance) converts PUFA to more saturated fat, thus counteracting the effectiveness of linolenic acid. Bakery foods, shortenings and fried foods, such as potato chips, French fries, etc., are rich in trans fatty acids and their consumption should be avoided.

What are lipoproteins and what is their function in the human body?

Lipoproteins are specialised compounds whose function is to transport through blood circulation lipids to tissues where they are needed. They consist of triacylglycerols and cholesterol esters, phospholipids and free cholesterol, as well as specific proteins, called 'apoproteins', which are important for lipoprotein structure, solubility and metabolism.

Lipoprotein density depends on their lipid/protein ratio. According to the density then, lipoproteins can be divided into four classes: (1) chylomicrons, (2) very low-density lipoproteins (VLDL), (3) low-density lipoproteins (LDL) and high-density lipoproteins (HDL).

Chylomicrons, which are low-density particles formed in the gut, transport dietary lipids to the liver and elsewhere in the body. In the liver, chylomicrons are converted into VLDL, which are the least dense lipoproteins. VLDL and LDL, which are derived from VLDL metabolism, transport fat to the cells. LDL and HDL are responsible for cholesterol transport. LDL transport cholesterol to the cells, while HDL remove excess cholesterol from the cells and carry it back to the liver for breakdown and elimination (reverse cholesterol transport).

A chief dietary goal for arteriosclerotic cardiovascular disease prevention is the reduction of LDL and the increase of HDL. It has been found that a high proportion of individuals who have a myocardial infarction have low HDL.

What is cholesterol and what is its main role in the human body?

Although it is often classified as a lipid, cholesterol belongs in effect to the class of sterols and consists of carbon, hydrogen and oxygen bound in ring structures. It has a vital role as a precursor for the synthesis of bile acids, vitamin D and the steroid hormones, including cortisol, aldosterone and sex hormones. It also has a central role in cell membrane synthesis.

Cholesterol is very susceptible to oxidation. Oxidised cholesterol is involved in the lesions that are responsible for atherosclerosis; therefore, it is implicated in the pathogenesis of heart disease. The main dietary sources of cholesterol are foods of animal origin like eggs, meat and dairy products, as well as certain sea foods, such as lobster, shrimps, etc.

What is the dietary allowance for fat and to what extent should different types of fatty acids be consumed?

Fat provides more calories per gram than any other nutrient [i.e. 9 kcal/g (37.7 kJ/g)] and its addition to food or diet increases their energy density. According to the dietary reference value (DRV) for fat intake, saturated fatty acid (SFA) should provide an average of 10% of total daily energy intake, MUFA (predominately oleic acid) should contribute 12% of total daily energy intake for the population, while the intake for PUFA should not exceed 10%