Sri Lakshmi Narayana Institute of Medical Sciences

Date: 04.05.2021

From
Dr Raji Sharma
Professor and Head,
Department of Anaesthesia
Sri Lakshmi Narayana Institute of Medical Sciences
Bharath Institute of Higher Education and Research
Puducherry

To
The Dean,
Sri Lakshmi Narayana Institute of Medical Sciences
Puducherry

Sub: Request for Permission to conduct value-added course: Clinical nutrition

Dear Sir,

With reference to the subject mentioned above, the department proposes to conduct a value-added course titled: **Clinical nutrition** for undergraduates from Jan -Jun 2021. We solicit your kind permission for the same.

Kind Regards

Dr. RAJI SHARMA

FOR THE USE OF DEANS OFFICE

Names of Committee members for evaluating the course:

The Dean: Dr RAJASEKAR

The HOD: Dr. RAJI SHARMA

The Expert: Dr K SELVARAJU

The committee has discussed about the course and is approved.

Dean Subject Expert HOD

DEAN
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, AGARAM VILLAGE,
KOCDAPAKKAM POST,
PUDUCHERRY - 605 502

DEPARTMENT OF ANAESTHESIOLOGY
SRI LAKSHMI NARAYANA INSTITUTE
OF MEDICAL SCIENCES
OSUDU, KUDAPAKKAM, PUDUCHERRY-605 502

Head of Dept. Anaesthesiology,
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry - 605 502.

OFFICE OF THE DEAN

Sri Lakshmi Narayana Institute of Medical Sciences

OSUDU, AGARAM VILLAGE, VILLIANUR COMMUNE, KUDAPAKKAM POST,
PUDUCHERRY - 605 502.
[Recognised by Medical Council of India, Ministry of Health letter No. U/12012/249/2005-ME (P -II) dt. 11/07/2011]
[Affliated to Bharath University, Chennai - TN]

Circular

05.06.2021

Sub: Organising Value-added Courses: Clinical Nutrition - reg

With reference to the above mentioned subject, it is to bring to your notice that Sri Lakshmi Narayana Institute of Medical Sciences, **Bharath Institute of Higher Education and Research**, is organizing **"_CLINICAL NUTRITION"** course in Jan –June 2021. The course content is enclosed below."

The application must reach the institution along with all the necessary documents as mentioned. The hard copy of the application should be sent to the institution by registered/ speed post only so as to reach on or before 15/06/2021. Applications received after the mentioned date shall not be entertained under any circumstances.

Dean

DEAN
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIEN
OSUDU, AGARAM VILLAGE,
KOODAPAKKAM POST,
PUDUCHERRY - 605 502

Encl: Copy of Course content

COURSE PROPOSAL

Course Title: **Clinical Nutrition**

Course Objective:

1.To enable the students to learn about nutritional needs and various disorders arising out of unmet nutritional needs and to know how to identify and treat them clinically.

2. To learn about nutritional requirements pertaining to special clinical situations

Course Outcome:

On successful completion of the course the students will have skill in assessing nutritional requirements of patients and managing malnutrition.

Course Audience: II year MBBS students

Course Coordinator: Dr **RAJI SHARMA**

Course Faculties with Qualification and Designation:

1. Dr SELVARAJU –ASSOCIATE
2. Dr.JALAKANDAN-ASSOCIATE

Course Curriculum/Topics with schedule (Min of 30 hours)

S.No	Date	TOPIC	Time	Hours	Faculty
1	02.01.2021	principles of healthy nutrition	2-4PM	2	Dr Selvaraju
2	09.01.2021	Nutritional assessment	2-4PM	2	Dr. Jalakandan
3	23.01.2021	malnutrition	2-4PM	2	Dr Selvaraju
4	30.01.2021	Weight management and eating disorders	2-4PM	2	Dr. Jalakandan
5	06.02.2021	Nutrition and anaemia	2-4PM	2	Dr Selvaraju
6	13.02.2021	Enteral nutrition	2-4PM	2	Dr. Jalakandan
7	20.02.2021	Parenteral nutrition	2-4PM	2	Dr Selvaraju
8	27.02.2021	Group discussion	2-4PM	2	Dr. Jalakandan
9	05.03.2021	Workshop on nutrition practices	2-4PM	2	Dr Selvaraju
10	12.03.2021	Metabolic stress	2-4PM	2	Dr. Jalakandan
11	19.03.2021	Life expectancy	2-4PM	2	Dr Selvaraju
12	26.03.2021	Nutrition in various disorders	2-4PM	2	Dr. Jalakandan
13	02.04.2021	HIV/ AIDS	2-4PM	2	Dr Selvaraju
14	09.04.2021	Nutrition in mental disorders	2-4PM	2	Dr. Jalakandan
15	16.04.2021	Final assessment	2-4PM	2	Dr Selvaraju

REFERENCES:

1) Understanding Normal and Clinical Nutrition, 8thEdition

2) Nutrition and Diagnosis –Related Care (Nutrition and Diagnosis –Related Care(Escott-Stump))

3) Manual of Clinical Nutrition Management

VALUE ADDED COURSE

1. Name of the program & Code

CLINICAL NUTRITION, ANAES 02

2. Duration & Period

30 hrs: January 2021 - June 2021

3. Information Brochure and Course Content of Value Added Courses

Enclosed as Annexure- I

4. List of students enrolled:

Enclosed as Annexure- II

5. Assessment procedures:

Multiple choice questions- *Enclosed as Annexure- III*

6. Certificate of Participation:

Enclosed as Annexure- IV

7. No. of times offered during the same year:

1 TIME JAN 2021-JUNE 2021

8. Year of discontinuation: 2021

9. Summary report of each program year-wise

Value Added Course- January 2021- June 2021					
Sl. No	**Course Code**	**Course Name**	**Resource Persons**	**Target Students**	**Strength & Year**
1	ANAES 02	CLINICAL NUTRITION	DR. SELVARAJU K	II MBBS	20

10. Course Feed Back

Enclosed as Annexure- V

RESOURCE PERSON

Dr K SELVARAJU

COORDINATOR

Dr RAJI SHARMA

Annexure I

CLINICAL NUTRITION

TOPICS

1. **Principles of Healthy Nutrition**
2. **Nutritional Assessment**
3. **Malnutrition**
4. **Weight Management and Eating Disorders**
5. **Nutrition and Anemia's**
6. **Enteral Nutrition**
7. **Parenteral Nutrition**
8. **Metabolic stress**
9. **life expectancy**
10. **HIV/AIDS**
11. **Nutrition in mental disorder**

Principles of Healthy Nutrition

Energy balance is the difference between energy intake, which can be metabolized, 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.
Thehumanbodyrequiresenergytoperformitsmanyfunctions, tofacilitate 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.

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 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 forest, inawarmroom,atleast12hoursafterlastfoodingestion. Sincethese strictconditionsarehardtoachieveinhospitalsettings,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.

Theothertwocomponentsofenergyexpenditureare

(1)theenergy spenton dailyactivitiesandphysicalexercise 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.

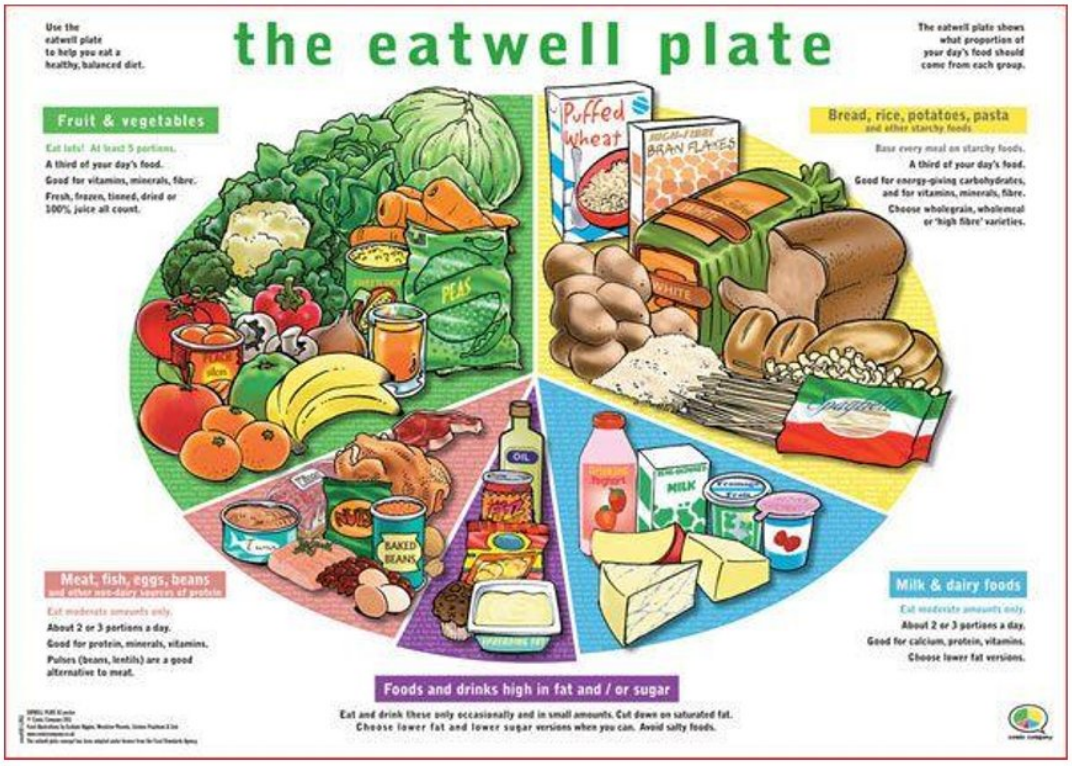
It has long been known that food consumption elicits an increase in energy expenditure, a phenomenon known as the 'thermic effect of food' (TEF). The intensity and duration of meal-induced TEF is determined primarily bythe amount and composition of the food consumed, mainly owing to the metaboliccostsincurredinhandlingandstoringingestednutrients.Activation 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.

Thefirstunitofenergyemployedinnutrition 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]. 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. 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 maltooligosaccharides and other oligosaccharides, and

(3) polysaccharides, which can be further subdivided into starch and non-starch polysaccharides. The commonest monosaccharaides are glucose and fructose, which occur in fruit and vegetables. The best-known disaccharides (consisting of two sugarunits) are lactose (which is found in milk), sucrose (common sugar) and maltose. Oligosaccharides, containing 3–10 sugar units, are often breakdown productsofpolysaccharides,whichcontainmorethan10sugar 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 classedas

(1)simplecarbohydrates(knownassimplesugars),whicharechemically 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).Thelatterwerelaterlargelyreplacedwiththeterm‘dietaryfibre’, although the two terms are not entirely synonymous.

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.

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 ona daily basis is 100g [380kcal (1590kJ)]. 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 themitochondriaoflivercells.Ketogenesisisthenaturalresponseofthebody 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 20–60g 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 400g. Excessive glucose intake may result in hyperglycaemia. The glycaemic index (GI) is a classification proposed to quantify the relative bloodglucoseresponsetofoodscontainingcarbohydrate.Itisdefinedasthe 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. 50g) 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.

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.. 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 (nonstarch 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, galactooligosaccharides, modified celluloses and synthesised carbohydrate polymers, such as polydextrose.

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

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

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 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.

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, theyinclude fatty acids and other lipids, such as phospholipids, sterols, such as cholesterol, and synthetic lipids. One gram of fat provides around 9kcal (37.7kJ) of energy.

Linoleicacid,anomega-6polyunsaturatedfattyacid,andalpha-linolenicacid, 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.

Dietary fatty acids can be classified into two large categories: saturated (with nodoublebonds)andunsaturated.

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.

Plant sources of omega-3 PUFA (alpha-linolenic acid) include soybean oil, canola oil, walnuts and flaxseed. Alpha-linolenic acid is the precursor for synthesisofEPAandDHA,whichareformedinvaryingamountsinanimaltissues, especially fatty fish (e.g. trout, mackerel, herrings, salmon), but not in plant cells.EPAistheprecursorofomega-3eicosanoids,whichhavebeenshownto 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.

According to epidemiological and clinical studies, trans fatty acids and to a lesser extent saturated fatty acids (mainly from animal products such as meat anddairy)ofthedietarepositivelyassociatedwithcoronaryheartdisease,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.

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)verylow-densitylipoproteins(VLDL)

,(3)low-densitylipoproteins(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.

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.

Fat provides more calories per gram than any other nutrient [i.e. 9kcal/g (37.7kJ/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%of total daily energy intake. In particular, the intake of linoleic acid (omega-6 PUFA) should provide 1% of total energy intake and the intake of linolenic acid (omega-3 PUFA) should provide at least 0.2% of total energy intake. Therefore, according to the Guidelines , total fat intake should be kept between 20 and 35% of total energy intake, mainly from MUFA and PUFA. SFA should not exceed 10% of total energy intake, dietary cholesterol should be limited to 300mg/day and

Proteinsfromanimals,suchasmilk,eggs,meatandfish,areconsidered tobeofhigherqualitythanproteinsderivedfromplantsources(e.g.legumes, grains and vegetables), because the latter lack various essential amino acids. Vegetarian diets are based on the principle of protein complementation,namely the consumption of plant protein sources complementing one another, for instance vegetables and legumes or bread and peanut butter.

The currently recommended daily protein intake is 0.8g/kg (0.37g/lb) body weight for adult men and women. Protein requirements are influenced by many factors, including growth, the need to replace losses and the need to respond to environmental stimuli. Another condition caused by the insufficient intake of proteins, calories and nutrients is marasmus, the main symptoms of which are muscle-wasting, depletion of fat, reduced growth, abnormal liver enlargement and skin problems. If protein deficiency is serious and lasts too long, it makes patients vulnerable to diseases and may even result in death.

Amino acids function as substrates for protein and nucleic acid synthesis, and are involved in protein turnover and enzyme activity regulation, nitrogen transport, oxidation-reduction reaction, etc.

Amino acids can be classified into essential, non-essential and conditionally essential amino acids. According to another nutritional classification amino acids are categorised into two groups: indispensable (essential) and dispensable (non-essential). The nine indispensable amino acids are those that have carbon skeletons that cannot be synthesised to meet the body's needs from simpler molecules in animals, and therefore must be provided in the diet. Dispensable amino acids can be further divided into two classes: truly dispensable and conditionally indispensable. Five of the amino acids are termed dispensable as they can be synthesised in the body from either other amino acids or other complex nitrogenous metabolites. In addition, six other amino acids, including cysteine and tyrosine, are conditionally indispensable as they are synthesised from other amino acids or their synthesis is limited under special pathophysiological conditions.

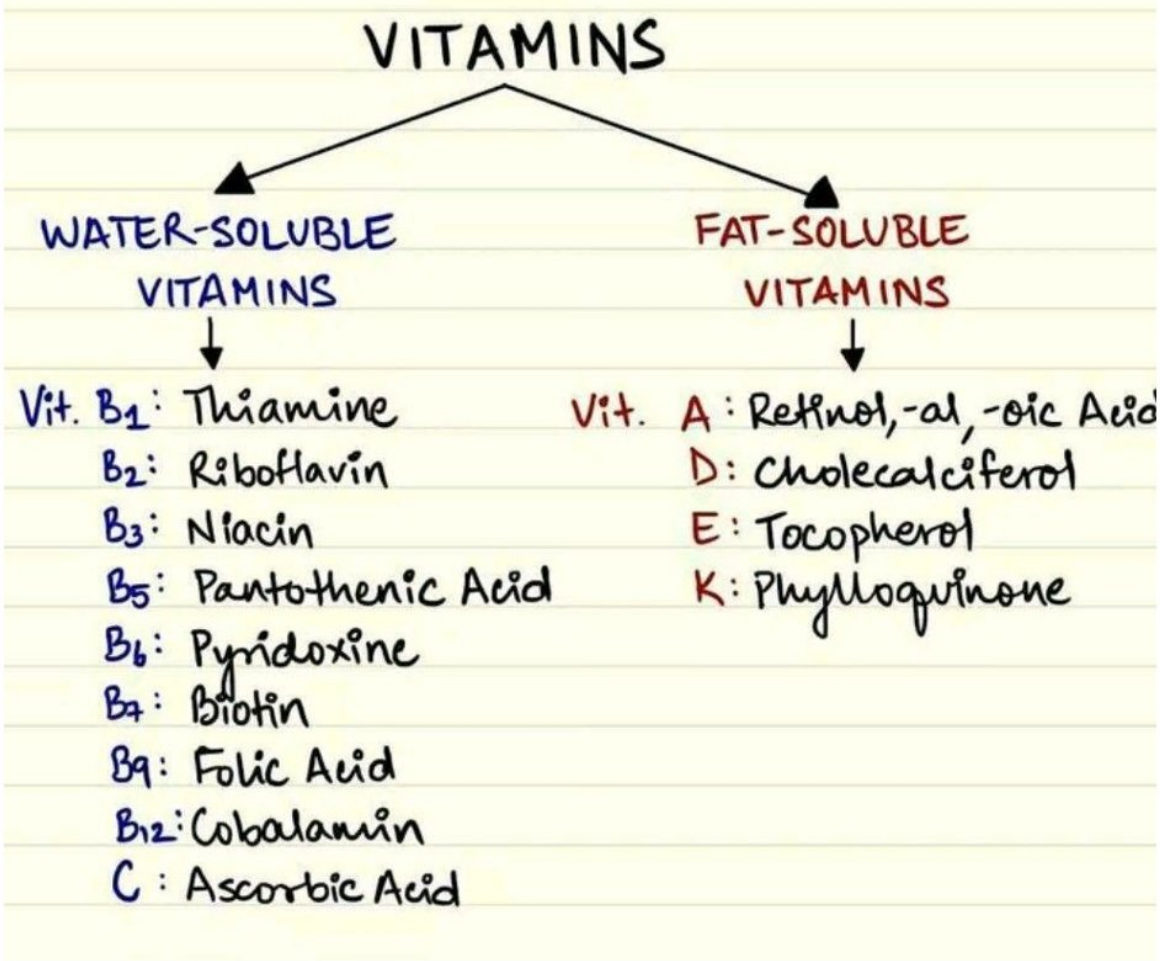
Precursors of conditionally indispensable Histidine Alanine Arginine Glutamine/glutamate, Isoleucine Aspartic acid Cysteine aspartate Leucine Asparagine Glutamine Methionine, serine Lysine Glutamic acid Glycine Glutamic acid/ammonia Methionine Serine Proline Serine, choline Phenylalanine Tyrosine Glutamate Threonine Phenylalanine Tryptophan Valine

a Conditionallyindispensableisdefinedasrequiringadietarysourcewhenendogenoussynthesis cannot meet metabolic need.

b Although histidine is considered indispensable, unlike the other eight indispensable amino acids,itdoesnotfulfilthecriteriausedinthisreportofreducingproteindepositionandinducing negative nitrogen balance promptly upon removal from the diet. glutamate, serine and probably asparagine are truly dispensable.

Aminoacidscanalsobeclassifiedaccordingtotheirstructureintoaromatic amino acids, which are precursors of neurotransmitters such as dopamine, epinephrine and serotonin, and branched-chain amino acids, which are selectively taken up by muscle cells rather than the liver. The former include phenylalanine, tryptophan and occasionally histidine, while the latter include isoleucine, leucine and valine.

Vitamins are micronutrients necessary for the maintenance of normal metabolic functions and blood cell formation. They are not synthesised in adequate amounts in the human body, so they have to be obtained through the diet, as vitamin deficiencies may lead to various dysfunctions. Water-soluble vitamins are rapidly depleted and must be regularly replenished, while fat-soluble (lipid-soluble) vitamins are better stored in the body. Vitamins can also be divided into natural and synthetic ones. Their action and kinetics are similar.



Many vitamins can have serious side effects or even prove to be toxic if taken in excess; this is why megadoses must be avoided. This applies especially to the fat-soluble vitamins, as they can accumulate in the body, reaching potentially dangerous levels. Vitamin A and D toxicity syndromes are well documented, while vitamin K may also be toxic in water-soluble form. Some examples of well-known side effects due to vitamin excess are:

headaches (vitamin A)

vomiting (vitamins A and D)

nausea (vitamins D, C, nicotinamide, vitamin B6)

spontaneous abortions and birth defects (vitamin A)

diarrhoea (vitamin C, pantothenic acid, choline, carnitine)

Hemolytic anaemia and kernicterus (vitamin K)

hepatomegaly (vitamin A, niacin).

Although it is preferable to follow a balanced diet that covers all the vitamin needs of the body, vitamin supplements are sometimes indicated for groups of people that may be at risk of developing certain deficiencies. Eligible candidates for vitamin supplementation may be:

the very young, and especially premature infants pregnant women the very old some categories of people suffering from chronic diseases, and especially chronically undernourished patients and chronic alcoholics, who commonly develop thiamin deficiency injured people, given the fact that vitamins (and especially ascorbic acid) play a role in wound healing strict vegetarians (vegans), who may be at increased risk of developing specific vitamin.

It must be stressed,however, thatsince the antioxidant action of the above mentioned vitamins has not been fully elucidated yet and more studies are evidently needed, vitamin supplements ideally should be taken on prescription and only after careful evaluation of each individual's nutritional status. In addition, patients should be warned of the dangers of the excessive intake of vitamins, and especially vitamins A, D, E and K.

Mostwater-solublevitaminsaregenerallyfoundinthesamegroupsoffoods, namely whole grains, leafy vegetables, legumes, meat and dairy products. Food sources of vitamin C (ascorbic acid) are fresh fruit (and especially citrus fruit) and vegetables. Vitamin B12 is synthesised by micro-organisms and then becomes incorporated in animal tissues. This is why vegans, who avoid animal products altogether, are at risk of developing B12 deficiency. As for the food sources of fat-soluble vitamins, they generally include leafy vegetables, seed oils, meat and full-fat dairy products. More specifically, as far as vitamin A is concerned, it should be noted that the term includes both retinol and provitamin A carotenoids. Liver, fortified margarine and full-fat milk products are good dietary sources of retinol and bright orange fruits and vegetables (e.g. carrots, pumpkins, sweet potatoes, apricots) and dark-green vegetables (e.g. peppers, spinach, broccoli) are the best sources of carotenes.

The dietary sources of vitamin D, which are not as important as its endogenous synthesis on the skin by the sunlight, however, are oily fish, eggs, liver, full-fat dairy products and fortified milk. Oily fish and green leafy vegetables are also rich in vitamin E. Other good sources of vitamin E are seeds, vegetable oils and beans. The main food sources of vitamin K are nuts and seeds, as well as nut oils and seed oils.

Minerals and trace elements are required in only small or even trace quantities, but are nonetheless essential for normal bodily function. They exhibit a variety of roles and are often necessary for tissue structure, enzyme system function, fluid balance, cellular function and neurotransmissionCalcium is the most abundant inorganic chemical in the human body – it accounts for 1.5–2% of our body weight – and is the main mineral of bones and teeth (approximately 90% of the calcium present in the human body can be found in bones and teeth).

Essential Potentially essential Chromium (Cr) Aluminium (Al) Cobalt (Co) Arsenic (As) Copper (Cu) Boron (B) Fluoride (F) Cadmium (Cd) Iodine (I) Nickel (Ni) Iron (Fe) Silicon (Si) Manganese (Mn) Vanadium (V) Molybdenum (Mo) Selenium (Se) Zinc (Zn)and muscular functions, the good hormonal functioning of the body, normal blood coagulation, effective digestion, etc. TheRNIforcalciumis400–1200mg.Women'sneedsarehigherthanmen's are, especially during lactation. Calcium supplements may be needed for the prevention of osteoporosis, a condition especially prevalent among older women. Foods rich in calcium are milk and dairy products, cruciferous vegetables (e.g. broccoli, cauliflower, Brussels sprouts), mineral waters, almonds and legumes.

Phosphorus is the second most abundant inorganic compound in the body after calcium. Most of the total phosphorus present in our body can be found in the bones, along with calcium. Phosphorus also plays an important role in carbohydrate, lipid and protein metabolism. Sodium,alongwithpotassiumandchloride,isinvolvedinbodyfluidosmolarity and plays the most decisive role in determining extracellular osmolarity.

Iron has multiple biochemical roles in the human body. It is necessary for the production of red blood cells and haemoglobin. As the major component of haemoglobin, it is necessary for the transport of oxygen to cells throughout the body. Iron also reinforces the defensive mechanisms of the body against illnesses.

Zinc is necessary for a broad range of biochemical processes that are important for growth and development and zinc deficiency results in poor healing and growth retardation. The RNI for zinc is 9.5mg for men and 7.0mg for women daily. Its best dietary sources are whole grains, nuts, meat, fish and poultry.

Its best dietary source is fish and seafood. The RNI for iodine is 140μg daily, with no increment during lactation and pregnancy.

Itseems that as an insulin cofactor it contributes to insulin binding to the cell membrane,whileitisalsoinvolvedinmaintainingnormalbloodglucoselevelsand in triglyceride level regulation. The estimated safe and adequate daily intake of chromium is 120μg or 0.5μmol/day for adults and 0.1 and 1.0μg/kg/day (2 and 19nmol/kg/day) for children and adolescents respectively. Doses larger than 200μg are toxic and may cause concentration problems and fainting. The best chromium food sources are yeast, liver, potatoes, bran, seafood, meat and poultry.

Fluoride is valuable for healthy bones and teeth and it has been shown to prevent dental caries. There is little evidence that there is any physiological requirement for fluoride and therefore no RNIs have been set; however, it has been suggested that the continuous fluoridation of water supplies to achieve levels of 1ppm (parts per million) is generally recommended. Water, therefore, is the best source of fluoride, although its content may vary fromone area to another. Fluoride is also found in several foods, which provide about 25% of total intake. Fluoride is considered as semi-essential since, although no physiological requirement can be shown to exist, it has known beneficial effects.

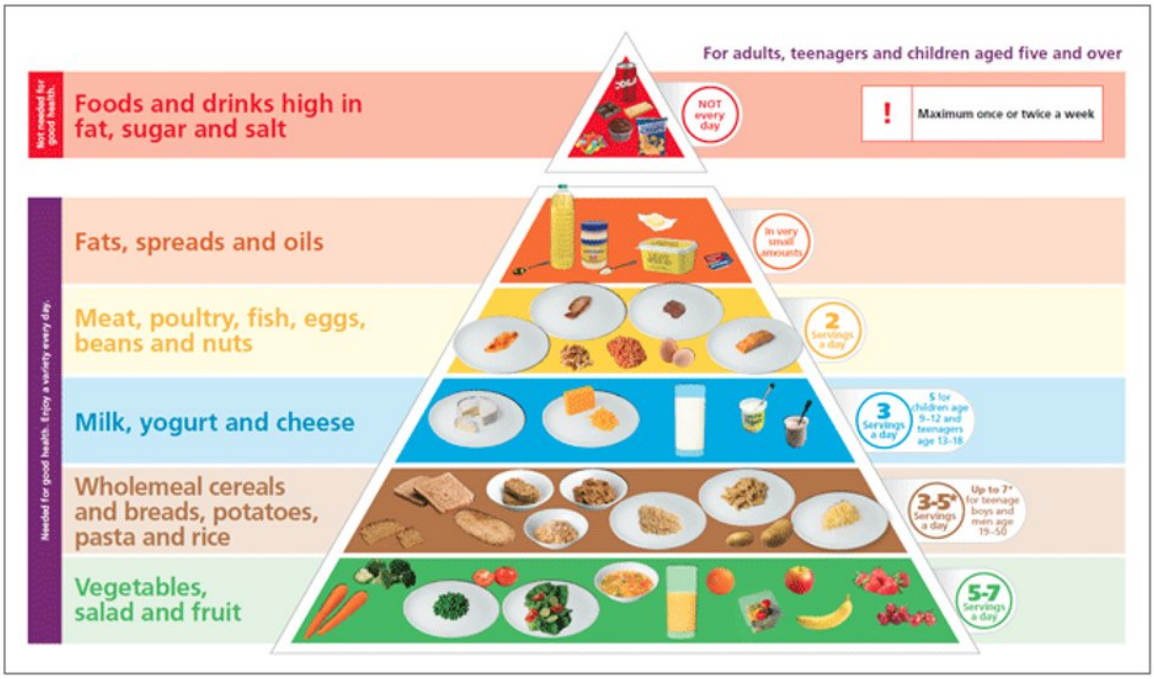
Food guide models are mainly teaching instruments that can be used in order to educate the general population on healthy eating and to visualise the frequency of consumption of the different food groups. They are most frequently in the form of a pyramid or a plate and are divided into sections, accordingtotheenumberoffoodgroups(e.g.fruits,cereals,fats,vegetables). The size of every section represents the frequency of food or food group consumption; although in some of the food models there are certain numeric suggestionsforfoodconsumptionandforportions.Insomeofthesemodels, there are suggestions for exercise, fluid consumption and alcohol.

The Food Guide Pyramid is a practical graphic developed by the US Department of Agriculture (USDA) in 1992.Concerns have been raised about the base of the pyramid, which recommends too many carbohydrates without any reference to the differences between good (complex) carbohydrates versus refined ones and sugars. In view ofnew scientificdata,many experts alsocriticisethe pyramid'smessage to avoid fat.

The Balance of Good Health plate was the food model suggested and most widely used in UK, which showed the types and proportions of foods needed

Food Pyramid, the vegetarian pyramid and many ethnic ones. A pyramid that does not limit guidance only to food choices and quantities is Willett's Healthy Eating Pyramid, a pyramid that gives emphasisto daily physical exercise and weight control, along with abundant consumption of whole grains, vegetables and plant oils. Most of these healthy diet models advise consuming plenty of fruit and vegetables and cutting down on sugar products and refined carbohydrates.

People should generally be encouraged to eat a balanced diet consisting of reasonable choices of all macronutrients, including fats and healthycarbohydrates, to maintain a normal body weight and to make physical activity an integral part of their everyday life.



Nutritional Assessment

Nutritional assessment is an extremely useful tool for the application of nutritional therapy. It is related to the individual's

(1) food and nutrient intake (diet history),

(2) lifestyle,

(3) medication intake

(4) social and medical history and

(5)anthropometric,bodycompositionandbiochemicalmeasurements.It includesboththescreeningandassessmentoftheperson'snutritionalstatus, the collection of data through the use of interviews, questionnaires and specially designed forms and the scientific analysis of the information obtained.

Thesedataareusedinordertoidentifythenutritionalstatusoftheindividual, to design the appropriate nutritional therapy and to investigate the need for greater nutritional support.

Taking a dietary history is a common method of evaluating food intake, and wasdevisedbyBurkein1947.Itcanbemadebytaking,throughaninterview, an informative dietary history of an individual or a group of people. Some of the most frequent and necessary information collected is: the usual dietary and meal plan, the number of meals, the usual meal size and the common amount of food, the usual location of eating, the consumption of ready-made meals, snacks and fast food, fluid intake, including the consumption of beverages and alcohol, possible food allergies, food preferences and the frequency of consumption.

A dietary history can give the dietitian an accurate picture not only of a person's normal food intake but also of the quality of that diet. However, the interview is a time-consuming process requiring well-educated interviewers being able to collaborate successfully with interviewees in order both to generate accurate data about a person's usual dietary intake and to be able to differentiate between the number and content of daily meals (daily meal plan).

The 24-hour recall is a simple method of direct nutritional assessment, which was first used by Wiehl in 1942. Using this method, it is easy to obtain the necessary information concerning the individual's total food and fluid intake, for the previous day or previous 24 hours. It is a quantitative method and is based on the assumption that the intake described is typical of the daily food and drink intake of the individual. The advantages of this method are that it is easy, quick, to a large extent representative and does not need special equipment (e.g. scales).

Themain disadvantages of this method are:

(1) it is dependent on the memory of the individual and thus it is not advisable for individuals with decreased memory skills (older people and young children);

(2) it is does not provide accurate information when there is a day-to-day variation of the food intake; and

(3) thereisusuallythetendencyfromtheinterviewеesaskedtodeclareincorrect food intake (either lower or higher than actual food intake), which may lead to statistical mistakes and unreal results (overestimation appears to be more frequent than underestimation for portion sizes). The role of a well-skilled dietitian or any other health professional involved in this method is essential in order to obtain the data accurately.

The selection of the appropriate method depends on the type of information to be collected. As there is no ideal method that could be used in all the cases and evaluations, each method addresses a different target group (e.g. different age, gender, social, educational group) or a different food or nutrient intake assessment. For the estimation of the actual nutrient intake of individuals or small groups of people for a certain period, food diaries or 24-hour recall are used. For the estimation of the mean dietary and nutrient intakeinalargepopulation,repeated24-hourrecallsorfooddiariesareused, while in the case of the estimation of the mean intake of a certain food item (e.g. specific type of fat, sweetener, fibre), by a small or larger population, a

Classification -BMI

Underweight <18.5

Normal weight 18.5–24.9

Overweight 25–29.9

Obesity Class 1 30–34.9

Obesity Class 2 35–39.9

Extreme Obesity Class 3 >40

Classification of overweight and obesity by BMI and waist circumference

Increased risk for obesity-related health problems, e.g. type 2 diabetes, hypertension and cardiovascular disease Waist circumference Women <88cm Men <102cm Waist circumference Women >88cm Men >102cm

Underweight (BMI <18.5)

Normal (BMI 18.5–24.9)

Eventually high (thin obese)

Overweight (BMI 25–29.9)

Increased High Obese Class I (BMI 30–34.9)

High Very high Obese Class II (BMI 35–39.9)

Very high Very high Extreme Obesity Class 3 (BMI >40)

It can be also calculated in US/Customary units: BMI = lb × 703 / in.2, where 'lb' is the subject's weight in pounds and 'in.' is the subject's height in inches. Values of BMI lower than 25 are considered of normal weight. Individuals with BMI of 25–30 are considered overweight, while values over 30 present obesity. Persons with a BMI <18.5 have an increased mortality rate. It should be mentioned, though, that BMI is not directly correlated with the accumulation of body fat, and for this reason there are exceptions (e.g. athletes, who have a very limited level of body fat and cannot be classified as overweight or obese like other adults).

The term 'anthropometric' refers to comparative measurements of the body, which are used in nutritional assessments in order to understand human physical variation.

The most useful measurements for infants, children and adolescents, which are used to assess growth and development, usually include:

length

height

head circumference (length is used in infants and toddlers, rather than height, because they areunable to stand).

The anthropometric measurements which are used for adults usually include:

Height

weight

BMI

waist/hip ratio

percentage of body fat.

weight

weight-for-length

The measurement of circumferences of the human body, for example the area of waist and hip, can be used in order to estimate the distribution of body fat and the danger of the development of certain diseases related to the central distribution of fat. The waist/hip ratio (WHR) is the ratio of the circumference of the waist to that of the hips and is calculated by measuring thewaistcircumference,justabovetheupperhipboneanddividingbythehip circumference at its widest part. In several, but not all observational studies, indexes of abdominal adiposity, such as the WHR and waist circumference (WC), predict coronary heart disease and strokes better than BMI, while an increased WHR is related with increased risk of stroke in women.

Wrist circumference is one of the measurements that have been proposed for the estimation of the size of the frame, which include the width of wrist and knee and are considered valuable. However, the quotient of the height tothewristcircumferenceandthemeasurementofwidthofelbowaretwoof the more often used measurements of the frame's size.

The size of the frame (r) is measured through the following

quotient:r=height(cm) wristcircumference(cm)

Many different biochemical markers can reveal nutritional depletion and play an essential role in nutritional evaluation. As far as concerns the evaluation of vitamins and minerals levels in the body, this can be realised by the measurement of these or their products of metabolism, in the blood, the urine and other biological materials. Serum proteins seem to be useful markers of nutritional status.

Serum albumin

The serum albumin level is an indicative marker, for the nutritional evaluation of a patient, although it has a relatively long half-life of 21 days. Patients with low serum albumin levels are in poor nutritional condition and at high risk of death.

Prealbumin

Malnourished patients, according to Subjective Global Assessment – a method of assessing nutritional status – have significantly lower levels of prealbumin. Thus, determining the levels of prealbumin can be a sensitive and cost-effective method of assessing the severity of illness, which can resultfrommalnutritioninpatientswhoarecriticallyillorhaveachronicdisease and may allow for earlier recognition and intervention for malnutrition.

Serum creatinine

This protein is used as a nutritional marker, because of its relation to muscle mass.Measuringserumcreatinineisasimpletestanditisthemostcommonly used indicator of renal function.

Serum transferrin

This is an iron-transport protein, which serves as a sensitive marker of total nutrition status and more specifically as a marker of iron deficiency. Serum transferrin receptor (sTfR) level is a new specific and sensitive indicator of tissue iron status and iron deficiency.

Nutritional requirements are determined by a wide variety of factors. In order to identify special nutritional requirements and determine the extent to which the individual's nutritional needs are covered, specific parameters and methodsareused,whichcanprovideallofthenecessarydata.

The nutritional requirements assessment includes:

clinical assessment

physical assessment

biochemical/haematological assessment

anthropometric and body composition assessment

current dietary assessment.

SGAclassificationisacomprehensiveassessmenttechnique and a valid screening tool for the prevention and treatment of, especially, malnutrition or undernutrition, in various patient populations.

Proteinisoneofthemainmacronutrientsthatareessentialforlifeandgrowth andvitalforthestructureandthemetabolismofthehumanbody.Itiscontinuously broken down and synthesised (the homeostatic mechanism generally known as protein turnover), but it cannot be stored and thus there is a daily minimum requirement intake to maintain the body's structure and function throughout life. In adults and on a daily basis, approximately 200–300g of protein or 3–4g protein/kg body weight is turned over. Protein contains nitrogen and the daily protein requirements are related to the total amount needed to maintain nitrogen equilibrium and cover losses. A general estimation of the protein requirements is based on the current RNIs and RDAs for protein, which are, for the average adult, 0.75–0.8g/kg of body weight per day, while a more accurate estimation can be made by measuring the nitrogen excretion and total losses (via urine, faeces, fistulae or other losses).

Carbohydrate is the main fuel for the human body and the most important dietary energy source, providing approximately 3.8kcal/g. The total carbohydraterequirements areusuallyexpressed asapercentage (e.g.45–60% for adults) of the total energy intake, according to the dietary reference values (DRVs) for the main nutrients, from which 39% should derive from starches, milksugarsandintrinsicsugarsandnotmorethan11%fromnon-milkextrinsic sugars. At the same time, there are general recommendations for carbohydrate intake, in grams. Thus, the minimum daily recommendation for carbohydrate is 100g, in order to provide enough energy and avoid protein breakdown, and the maximum intake is approximately 400g for the average adult.

Fluid requirements vary considerably between individuals and are influenced by various factors, related to the individual's age, gender, level of physical activity, type of diet, the environmental temperature and the climate, the individual's total fluid intake (from foods, water and beverages) and fluid output (kidney losses, respiratory, skin and gastrointestinal losses) and the general state of the individual's health. Individuals should take no less than the amount of fluids that cover the total losses and no more than the amount that can be excreted by the kidney function.

It is recommended that the fluid intake should be at least 500–750ml greater than urinary losses, but it should be even greater in cases of high temperatures or the presence of burn or pyrexia or in the case of any other reason of higher-than-normal losses.

Generally and under normal circumstances, the fluid requirements can be estimated:

children: 1.5ml/kg

adults: 1ml/kg or 30–35ml/kg body weight.

Dehydration is a fluid imbalance caused by inadequate intake or excessive losses. There are different biochemical markers that can identify and reveal the presence of dehydration.

These markers are:

urea/creatinine ration, which should be≥0.15

elevated levels of plasma sodium urine colour or specific urine gravity

serum osmolarity.

infants and young children, owing to poor intake or increased gastrointestinal losses

olderpeopleorpatients,owingtolowfluidintake,bluntedthirstresponse or poor food intake (anorexia, depression)

people with eating and/or swallowing difficulties

people with undiagnosed (or uncontrolled) diabetes mellitus and burns patients

patients receiving diuretic drugs and laxatives or people with the symptoms of diarrhoea and/or vomiting

patients suffering from pyrexia(mostly older) people with a physical immobility.

Malnutrition

'Malnutrition' is a general term for a medical condition caused by an improper or insufficient diet. The term usually refers to generally bad or faulty nutrition and is most often related to undernutrition. According to the World Health Organization (WHO), malnutrition is the 'cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions', and is the greatest risk factor for illness and death worldwide.

It can be associated with both undernutrition and overnutrition. Malnutrition and the state of deficiency or excess of energy, protein and other nutrients lead to measurable adverse effectsontissue,bodyfunctionandappearanceandclinicaloutcomes.There are different ways to classify malnutrition.

Anorexia, inadequate food intake or lack of food supplies and loss of appetite are probably the most common causes of malnutrition worldwide, especially in developing, but also in developed, countries. Anorexia can result from pathophysiological, psychological and general social problems. Different types of chronic and inflammatory diseases such as cystic fibrosis, chronic renal failure, stroke, Parkinson's disease, respiratory and orthopaedic problems, childhood malignancies, chronic inflammatory bowel diseases, fatigue, muscle weakness and difficulties with tasting, chewing and swallowing can lead to reduced food intake and malnutrition. Also, nausea and vomiting, which may result from certain diseases, and the use of certain drugs or specific treatments (chemotherapy, radiotherapy) may have a negative effect on appetite. Also, psychological factors such as anxiety and depression or the presence of dementia can cause malnutrition. Finally, malnutrition can have social causes, such as the institutionalisation of individuals (e.g. in hospitals, nursing homes), poverty and famine, poor food hygiene, inappropriate food supplies and the early cessation of breastfeeding.

The most common physical signs of protein and energy malnutrition (PEM) are:

weight loss and cachexia

decreased subcutaneous tissue and reduction in muscle and body tissue mass, which can be most often observed in the legs, arms, buttocks and face

oedemas

neurological problems and abnormalities

oral changes (red and usually swollen mouth, lips and gums)

muscle cramp and pain

skin changes (dry and peeling, frail, swollen, pale, loss of elasticity and poor healing)

hair changes (dry and discoloured).

'Malnutrition' is a general term that, although it encompasses overnutrition resulting from overeating or the excessive intake of nutrients (e.g. fat, simple sugars and carbohydrates),most often refers to undernutrition resulting from inadequate consumption, poor absorption or the excessive loss of nutrients and calories, regardless of whether any other specific nutrient is a limiting factor. On the other hand, malnutrition arises from deficiencies of specific nutrients or from diets based on inappropriate combinations or proportions of foods.

Cachexia is a wasting syndrome, regulated by cytokines, and a condition of general ill health, malnutrition, undesired weight loss and physical weakness. Cachexia is associated with various chronic and end-stage diseases and medical conditions (e.g. metabolic acidosis, infectious diseases, autoimmune disordersandmalignantconditions,suchasvariouscancers,infections,AIDS, congestiveheartfailure,cysticfibrosisandCrohn'sdisease).

Apart from infants and adolescents, who are very susceptible to malnutrition for various reasons, other categories of people at risk are:

older people, in nursing homes or hospitals, and especially those who are suffering from long-term illnesses or chronic metabolic disorders

poor people who are underfed or poorly fed

people living in less-developed or developing countries of the world

patients with neurological diseases such as dementia

pregnant women

peoplelivingindeprivedsocioeconomiccircumstances,withoutadequate sanitation, education or means of preparing food

individuals at risk of systemic infections.

Kwashiorkorand marasmusarethe twodifferentformsofproteinand energy malnutrition.. Kwashiorkor (from the West African word for 'displaced child') is a severe form of undernutrition, which develops in individuals on diets with a low protein/energy ratio. The main symptoms of Kwashiorkor are oedema, wasting, liver enlargement, hypoalbuminaemia, steatosis and the possible depigmentation of skin and hair.

Marasmus (PEM)	Kwashiorkor
Severe deficiency of all nutrients and inadequate caloric intake	Severe protein deficiency but normal caloric intake
Peripheral edema is absent	Peripheral edema is present
Hair changes absent	Hair changes common (sparse and easily pulled out)
Skin is dry and wrinkled but no dermatosis	Dermatosis, flaky paint appearance of skin
Voracious appetite	Poor appetite
Absent subcutaneous fat	Reduced subcutaneous fat
Fatty liver uncommon	Fatty liver common
Better prognosis	Worse prognosis

Marasmus	Kwashiorkor
	

Marasmus (from the Greek word for ‘to waste away’) is the other form of malnutrition, which is caused by the inadequate intake of both protein and energy.. The main symptoms of marasmus are severe wasting, with little or no oedema, minimal subcutaneous fat, severe muscle wasting and non-normal serum albumin levels.

Disease-related malnutrition is a common problem, which can be detected in nearly all health care settings. The prevalence of disease-related malnutrition is reported from various studies to range from 25–40% in hospital inpatients to 15–25% in home care units and 20–25% in nursing homes. Screening is essential, must be easy and fast and should be done as soon as patients are admitted, in order to define and validate whether they are at risk of malnutrition and what action should be taken. The introduction of a malnutrition screening tool for hospital outpatients can play a crucial role in improving the detection of disease-related malnutrition. Vitamins/Minerals

Clinical signs Calcium Numbness, muscle aches (in extreme cases), rickets, fractures, muscle spasms Magnesium Irregular heart rhythms (arrhythmias), seizures, dizziness, weakness Selenium Impaired thyroid function, impaired cardiac function, enlarged heart Zinc Loss of taste Vitamin D Rickets, risk of fractures, low bone density and weak bones Folic acid Increased risk of specific birth defect (neural tube defect), elevated homocysteine levels, anemia, fatigue Vitamin C Scurvy, poor appetite, digestion problems , bruising, slower healing of cuts Beta-carotene (Vitamin A) Eye damage (e.g. lack of night vision), dry skin Vitamin B-6 Low red blood cell count (anemia), low white blood cell count (neutropenia), poor appetite, trouble concentrating, reduced strength, hair loss, elevated homocysteine levels Vitamin B-12 Pernicious anemia, muscle weakness, confusion in older people, tingling in the hands/feet, elevated homocysteine levels Vitamin E Lack of coordination of malnutrition, improve patient outcomes (e.g. weight status) and compliance and, finally, promote early nutritional therapy. According to the latest European Society of Parenteral and Enteral Nutrition (ESPEN) guidelines for nutritionalscreening,MUST isthemostwidelyusedscreening toolforadults, mainly in the community, but also in hospitals settings, where NRS-2002 is the most appropriate tool for under nutrition detection, with an additional grading of severity of diseases. Both these tools have excellent reliability and a high level of validity. Apart from the above-mentioned tools, there is another one that concerns and is mainly used for older people. This tool is MNA, which includes physical and mental parameters and adietaryquestionnaire, for the detection of under nutrition among older people, even in the early stages. The ESPEN guidelines state that there is, as yet, no universally accepted screening tool for children. All these screening tools include the assessment of risk factors such as: difficulty in chewing and swallowing, presence of dysphasia, loss of appetite for more than three days, unintentional weight loss, levels of prealbumin and albumin, energy intake and the presence of pressure ulcers, multiple food allergies or intolerances, skin breakdown or intravenous nutrition (total parenteral nutrition or peripheral parenteral nutrition).

The main causes of hospital malnutrition are usually related to the lack of:

global interest in nutrition and/or poor recording of food intake in patient notes and inadequate referral to dietitians

nutritional support

practice guidelines and nationally agreed standards

clearly defined responsibilities in planning and managing nutritional care

sufficient educational level with regard to nutrition among all staff groups (medical and nursing)

patients' influence and knowledge

cooperation between different staff groups

involvement by the hospital management.

When the gastrointestinal tract does not function properly, the fortification of food intake with protein, fat or carbohydrate oral supplements, mainly in powder or liquid form, the use of oral sip supplements, enteral nutrition through nasogastric tube or gastrostomy and, finally, central or peripheral parenteral nutrition can provide all of the macro- and micronutrients the patient needs to retain their lost weight and to meet their nutritional needs.

Weight Management and Eating Disorders

Although,forthemajorityofpeople,theterms'overweight'and'obese'seem to be synonymous, there is a significant difference between them. Health professionals can determine whether a person is overweight or obese by combining their age and gender with the anthropometric parameters of their body weight, body mass index (BMI) and body fat mass. An adult who has a BMI of 25–29.9kg/m2 is said to be overweight, while an adult with a BMI in excessof30kg/m2 issaidtobeobese.Inthecaseofchildrenandadolescents, the various BMI and weight ranges are different from those of adults, and the fact that normal levels of fat in the body vary depending on gender and age must be taken into account. In the case of children or teenagers, the various BMI and weight ranges are different from those for adults and take into consideration the normal differences in body fat, according to gender (boys or girls) and age group.

Weight status category Percentile range Underweight Less than the 5th percentile Healthy weight 5th percentile to less than the 85th percentile At risk of overweight 85th to less than the 95th percentile Overweight Equal to or greater than the 95th percentile

BMI is a useful screening tool and the most widely used index for the identification of possible weight problems among children, although it is not usually considered a reliable indicator of body fatness in the individual as it fails to distinguish between lean body mass and fat.Certainly, from a public health and statistical perspective, BMI measurements of a population are still a very good indicator. Thus, the relationship between BMI and body fatness varies according to bodycompositionandproportions.TheCentersforDiseaseControlandPrevention (CDC) and the American Academy of Pediatrics (AAP) recommend the use of BMI for the screening of overweight or obese children above the age of 2 years old. BMI for children and teens is combined with age growth charts (for either girls or boys). The growth charts show the weight status categories (underweight, healthy weight, at risk of overweight, overweight) for children and teens. BMI for age weight status categories and the corresponding percentiles are shown in

The pathogenetic mechanism of obesity is still a big mystery, as there is still the question of the interaction between relevant environmental factors and genetic correlates in the development of the disease. In recent years, research into genetics has greatly increased our understanding of the mechanisms involved in the imbalance of the body weight and the body mass, and the features of genetic conditions such as Prader-Willi syndrome and Bardet-Biedl syndrome.. Scientific findings on genetic predisposition to the development of obesity come from various studies on animals, and humans. A large number of studies between twins, adopted children and their families have shown that genetic factors play a significant role in the pathogenesis of obesity, whilecertaingenesinvolvedinpathwayswhichregulatefoodintakeandenergyexpendituremayplayaroleinpredispositiontoobesity.

Obesityismoststronglyrelated with:

variations in the sequence of genes, e.g. in uncoupling proteins (UCPs), the adrenergic receptors, the peroxisome proliferator-activated receptor (PPRAs) and the leptin receptor (OBR) polymorphisms and mutations in various genes, which are responsible for the control of appetite by the hypothalamus; the metabolism; or the adipokine release predispose to obesity [e.g. the FTO gene, the TNF-or the gene related to the synthesis of the melanocortin receptor or the proopiomelanocortin (POMC) gene that impairs the synthesis or structure of POMC-derived peptides]. In conclusion, it could be said that the development of obesity is partially determined by genes and genetic factors, but the environment (diet, activity, way of life, stress, etc.) influences its phenotypic expression.

The increase in fat intake of the modern diet and reduced physical activity are the two main causes of the development of obesity in industrialised countries. Fat is the most energy-dense nutrient in our diet, producing nine calories per gram, which is more than twice the calories derived from other macronutrientssuchascarbohydratesandproteins.Atthesametime,dietary fat is more efficiently metabolised and stored in body fat than carbohydrates are. Finally, although very fatty foods provide a high amount of calories, in parallel with an intense feeling of enjoyment and pleasure, they do not produce a strong feeling of satiety.

For this reason they are usually overconsumed, which encourages the passive over-consumption of calories and the development of obesity by affecting the body's total energy balance. Over-consumption and the extra amount of dietary fat intake can lead to its storage in fat tissue (in percentage terms sometimes as high as 96%). Thus, an initial recommendation to lower dietary fat intake to initiate significant weight loss is reasonable and supported by scientific literature, experiments on animals and clinical studies in humans. An increase in dietary fat intake leads to obesity in animals and has been associated with a higher prevalence of overweight and obesity in many human population studies. One of the main mechanisms through which dietary fat can contribute to the development of obesity is the regulation of leptin levels. Experiments have shown that an increased dietary fat intake results in central leptin resistance, whereas the restriction of dietary fat can lead to a partial improvement in leptin signalling, resulting in a spontaneous reduction in appetite and body weight. Of course, there is always the paradox of the modern diet, where the average fat content of the American diet is dropping (from 36% to 34%, according to the most recent National Health and Nutrition Examination Survey), but the weight of the average American continues to increase, mainly because the number of total calories continues to increase.

Carbohydrates represent the most essential energy fuel for the organism and play a very important role in our diet. They produce greater satiety, especially when they are in the form of complex high-fibre types, a better control of pre- and postprandial blood glucose levels and a higher dietary-induced thermogenesis, with a lower energy density (3.75kcal/g (15.7kJ/g), than fats (9kcal/g, 37.68kJ/g).

The association between the intake of carbohydrates and obesity is still debateable. This relationship depends on the total amount consumed and energy requirements, as well as the type of carbohydrate and how refined or complex it is.

These simple sugars, especially sucrose in refreshments and fructose in juices, have a direct effect on decreasing insulin resistance,increasinglipidlevelsandincreasingbodyweightwhenconsumed in large amounts. On the other hand, a diet that is high in complex carbohydrates from fruits, vegetables, legumes and whole wheat and grain products provides a large amount of dietary fibre, which may play an important role in producing greater satiety and weight loss, while the parallel lowering of total-fat intake in the diet can also result in a spontaneous reduction in total energy (caloric) intake and weight loss in overweight and obese persons. During the last few decades, the low-carbohydrate and high-protein diets have become very popular, suggesting severe carbohydrate restriction as the absolute solution totheobesityproblem.Itisknownthatthisrestrictionofcarbohydrateintake initially mobilises glycogen stores in the liver and induces the production of ketone bodies (ketogenesis) through the use of free fatty acids instead of glucose, as energy fuel, and increased diuresis.

There are different causes for the development of obesity, which are related to genetics, human biology, hormones and environmental factors. An imbalance between energy intake and energy expenditure is consider the most important. When we consume more calories than we expend for our daily needs (basal metabolic rate, thermogenic processes and activity), this extra energy is stored in the body, mainly as fat stored in fat tissue, in order to be used later as an energy fuel. Therefore, apart from the quality of the diet and the proportion of fat, protein and carbohydrates, the total quantity of energy intake and energy consumed is most important for the energy balance of the body.

An ideal dietary weight-reducing programme must contain all the food groups, without excluding any of them (e.g. low-carbohydrate diets). It is a programme that includes daily servings of fruits and vegetables (raw or cooked), fat-free or low-fat milk and milk products and servings from starchy foods (e.g. bread, rice, pasta, cereals) and potatoes, legumes, adequate protein sources such as lean meat, poultry, fish, beans, eggs and nuts, with a certain amount of fat, mainly in the form of monounsaturated olive oil. For this reason, alcohol in a hypocaloric diet would provide unneeded calories, displacing more nutritious foods. At the same time, an ideal dietary programme should be characterised by variety, proportionality, flexibility and personalisation and should cover the nutritional and energy needs of the dieter, according to their age, gender, resting metabolic rate, health status, level of physical activity and their lifestyle. The total reduction in calories should not exceed 500–1000kcal/day (2093–4189kJ/day), in order to achieve a weight loss of 0.5–1kg/week (1.1–2.2lb/week). Finally, during weight loss, attention should be given to maintaining an adequate intake of vitamins and minerals (e.g. iron and calcium).

These diets are advised for a short period (no more than three months) and only under medical supervision. They can be dangerous, as they are not nutritionally balanced diets and they may produce certain nutritional and electrolyte deficiencies, lean body mass loss or development of medical problems(e.g.gallstones).Forthisreason,theseprogrammesarenotsuitable foralloverweightorobesepeople,butonlytoobesepatientsthatcannotlose weightthroughconventionalmethodsanddietsofmodestcaloricrestriction, and to patients with certain medical problems, in whom a rapid weight loss is indicated. They are often prescribed to the morbidly obese patient, under medical supervision, prior to their undergoing bariatric surgery, and during and post-surgery, in order to reduce complications.

High-protein diets are the most popular type of exclusion diets used in the weight-control industry. The higher intake of protein and the severe restriction of carbohydrates in the diet, through the exclusion of fruits, starchy foods and legumes, had been considered the best solution for obesity. It is true that protein provides specific benefits in the diet that are useful during a weight-reducing diet programme.

Moreover, meals containing protein (meat products, poultry, cheese, egg whites, etc.) induce satiety, prolong the feeling of fullness and depress hunger. Protein metabolism produces higher diuresis, which contributes to a larger initial weight loss.

In the cases of stricter programmes, when the caloric level is lower than 1200kcal (5024kJ), or in the presence of specific groups of people (e.g. adolescents, lactating women), a supplement is usually necessary since the food intake may be insufficient. The most commonly used supplements are those of iron, sodium, potassium, magnesium, phosphorus and calcium. Apart from the known supplements, a wide variety of other nutritional supplements are usually proposed during the diet. Fish oils (good sources of omega 3, which improve glucose-insulin metabolism and cholesterol levels), conjugated linoleic acid (CLA), chitosan, L-carnitine, but also herbs, such as the dangerous ephedra (also known as ma huang, which has been withdrawn recently because it has been linked with fatal complications such as liver failure), psyllium (a soluble fibre), green tea (Camellia sinensis), capsaicin (Capsicum frutescens) and others are some of the 'natural' supplements that are suggested as promoting weight reduction. All of these should only be administrated with medical approval and should be a part of a balanced weight-reducing dietary programme.

Exercise is considered a cornerstone of weight loss and weight maintenance. It represents the second component of energy balance, which is the output or the energy expenditure that is necessary to achieve a positive energy balance and weight loss. Body weight is determined by the balance betweenenergy intake and energy expenditure, and weight loss can only be achieved by decreasing energy intake and/or increasing physical activity. Exercise contributes to the suppression of the appetite, improves the psychological status of the dieter and is extremely important for the maintenance of any weight loss. The American Heart Association recommends at least 30–45 minutes of moderate/intense physical activity (e.g. walking) as many days as possible in the week, while other foundations, such as the Institute of Medicine, recommend an even greater frequency of moderate/intense exercise, which should last approximately 60 minutes per day (which can be as intermittent activity throughout the day, rather than a single period of exercise). The type of exercise, its the frequency and intensity are strongly related to the severity and morbidity of obesity, the mobility of the obese patient and their motivation and so its type and level of intensity should be specific to the individual patient's needs and physical ability.

It is widely accepted that in order to achieve the best weight reduction, a reduction in calorie intake of 500–1000kcal (2093–4187kJ) per day will help to achieve a healthy and gradual, weekly weight loss.

Although many popular diets suggest a very drastic decrease in energy intake, according to theliterature,theenergyallowanceshouldbelowerthan1000–1200kcal/day (4187–5024J/day) for women and 1200–1600kcal/day (5024–6699J/day) for men.

According to their function, these supplements have been organized by the Food & Drug Administration into the following categories:

increased energy consumption: supplements such as ephedra, bitter orange, guarana, caffeine, country mallow, yarbe mate

increased satiety: guar gum, psyllium, glucomannan

increasedlipidoxidation:L-carnitine,hydroxycitricacid,greentea,vitamin B5, liquorice, pyruvate, CLA (conjugated linoleic acid – naturally occurring fatty acid, which is found in meat, cheese and dairy products)

decreased lipid absorption: chitosan

various ways of function: laminaria, spirulina, apple cider vinegar, etc.

Ring insertion (also known as gastric band insertion) is one of the most populartypesoftreatmentformorbidobesity.Thefirstphaseofthepostoperative diet is the clear liquids phase (apple juice, orange juice, water, flat diet soft drinks, sugar-free jelly, low-fat soup, etc.). When these liquids are well tolerated, the patients pass to the second phase, which includes semi-liquid foods and drinks and lasts for one to two weeks. The patient receives all the foods in a similar consistency to that of thinned mashed potatoes. During this phase, the patient is fed with skimmed or semi-skimmed milk, blended soups (made with skimmed milk instead of water, to increase the protein content), blended fruit, shakes made with skimmed milk and light/non-fat yogurt and blendedmeat,creamysoups,mashedpotatoesmadewithskimmedmilkand sugar-free yogurt. This phase lasts for approximately two weeks, accordingto the degree of tolerance. Immediately afterwards comes the third phase, of the semi-solid diet. This diet consists of low-fat cottage cheese, cooked, peeled vegetables, boiled or canned fruits in natural juice, boiled eggs, chopped lean meat, skimmed or semi-skimmed milk, unsweetened instant breakfast (e.g. porridge oats), sugar-free, low-fat yogurt and boiled chicken. The last phase is the low-fat solids diet. This is low in fat and sugar, avoids carbonated and caffeinated drinks but includes plenty of other, non-alcoholic, fluids [as much as 1500–1800ml (52.5–63floz) according to the patient's tolerance]. The patient must add one new food at a time, must chew all food very well and sip only limited amounts of liquids with their meal, and if necessary must take a vitamin/mineral supplement to cover any nutritional needs.

The Roux-en-Y gastric bypass is a process which involves the creation of a small stomach pouch and the bypass of the distal stomach and the proximal small bowel, and is a very drastic way for weight reduction for morbidly obese patients. This operation can often lead to long-term iron, calcium, vitamin B12 and vitamin D deficiencies. The postoperative diet is liquidbased for the first week.

On day one post-surgery the patient must drink in small sips and wait in-between sips for some minutes and avoid taking more that 100ml (3.5floz) at once, while the total fluid intake should be at least 2000ml (70floz) per day. For days 2–6 they must be on a liquid diet, with sugar-free fruit juice, skimmed milk, clear soups and vegetable juices, and if necessary on protein drinks and supplements. For the second week (days 7–13), they should be on a pur´eed diet, which has a thicker consistency. This diet includes yoghurt, porridge, skimmed or semi-skimmed milk, soups, scrambled egg, pureed meat and blended vegetables, fruits and vegetable juices. The most frequent nutritional problems that appear after bariatric surgery are dehydration, protein malnutrition and vitamin/mineral deficiency.

Fluids

Dehydration is often present after almost all types of surgery, mostly owing to limited fluid intake. Especially in cases of gastric bypass, patients have difficulty in getting the appropriate amount of fluid because of the limited content of the stomach. The symptoms of sweating, diarrhoea and vomiting, in parallel with greater faecal production, enhance fluid loss. There are no specific recommendations for fluid intake, but patients are advised to drink plentyoffluid,usingthesenseofthirstandthequantityandcolourofurineas markers of sufficient hydration. Nutritional fluids (e.g. juices, low-fat milk) are preferable,sincetheyprovideenergyandproteinapartfromhydration,while non-nutritionalfluidsarebestavoidedoratleastrestrictedtobetweenmeals.

Protein

Accordingtorecentresearch,themostimportantmacronutrienttotakeafter bariatric surgery (e.g. gastric bypass surgery) is protein. Protein, in contrast to fat or carbohydrate, does not change gastric transit time significantly, while at the same time it is essential for tissue repair and growth after a major surgicalprocedure.Inthesecases,ahigh-proteindietcontributestothefaster healing of the trauma, the maintenance of an increased basal metabolic rate and the stimulation of the protein synthesis. A protein intake of 60–90g/day is recommended for the postoperative period through the consumption of high-protein foods or the use of sugar-free fluid protein supplements, which provideallteadequateessentialaminoacids,butalsovitaminsandminerals, which were malabsorbed in the postoperative period. Protein is important even after recovery, as it continues to provide adequate thermogenic action, in order to lose weight or to sustain previous weight loss.

When we say ‘fad diets’ we are usually referring to a wide variety of popular diets that mainly promote energy- or nutrient-restricted eating plans that exclude certain nutrients (e.g. low-carbohydrate diets). Therefore, fad diets are usuallybothunhealthyandinsufficient,especiallyforchildren,andforthemajority of adults. Diets such as the Cabbage Soup Diet, the South Beach Diet,the Hollywood Diet or the Grapefruit Diet are well promoted and commercialised, through books, magazines and TV series.

Almost all of them are not based on scientific evidence and studies but on pseudo-scientific claims and are considered non-clinical dietary programmes that can even be harmful. They promote rapid weight loss by increasing diuresis and use of fat stores as energy fuel, through ketosis, and finally they overemphasise one food or type of food, banning a specific food or food group or suggesting that a specific food or product can increase the body's chemistry. They usually lack sufficientenergy,proteinandcertainfat-solublevitaminsandminerals,which are essential for the maintenance of the total health status of the obese or overweight patient.

Nutritionalintervention,by a scientificgroup ofspecialists,is essentialfor the total health management of an anorexic patient. The restoration of normal nutrition, the prevention of muscle and bone loss, the increased energy intake level, the gradual weight gain and the normalised hormonal function are the main nutritional interventions needed, in the case of anorexia nervosa, in parallel with psychotherapeutic treatment. For all the above, it is necessary to provide nutritional support to these people, who are considered patients. In cases of patients who weigh less than 45kg (99lb) and are severely malnourished, an initial calorie intake of 1400–1500kcal/day (5862–6280kJ/day) is considered a starting level of refeeding, in order to reduce the chances of stomach pain, bloating, fluid retention or heart failure and to reduce the patient's anxiety of becoming 'overweight', which is the main cause of the disorder. In certain cases, when either extreme weight loss, a critical medical condition of the anorexic patient or refusal of feeding is present, tube or enteral feeding, preferably through a nasogastric tube, may be required. In these cases, in order to avoid fluid or electrolyte disturbances, tube feeding should have a slow flow (i.e. the rate of fluid going through the tube should be a low one), while the total fluid chart, electrolyte levels and blood glucose concentration must be carefully monitored. In the case of life-threatening situations, a patient can be fed intravenously for a short period, until oral or nasogastric feeding become possible.

Anorexics, owing to their decreased food intake and extreme weight loss, are at increased risk of vitamin and mineral deficiency.

Nutrient deficiencies

(e.g. vitamin abnormalities) may contribute to muscle mass catabolism, tissue damage (hair loss, bone density) and various cognitive difficulties (such as poor judgement, memory loss, other psychiatric conditions) and should be corrected through dietary intervention and supplementation. Planning the diet of a person with anorexia nervosa should consider the following macroand micronutrients and ensure an adequate intake of:

protein, to prevent and treat muscle mass loss

carbohydrates, to avoid erratic weight changes

fat and essential fatty acids

nutrients necessary to support bone mineral density (calcium, vitamin D, magnesium)

other minerals such as iron and zinc (zinc deficiency may cause altered taste as well as a variety of neuropsychiatric symptoms)

fat-soluble vitamins (A, E, D, K).

A very important phase in the treatment of an anorexic is the refeeding period, especially for patients with a very low BMI, when a number of serious complications may occur, and dietary and medical monitoring is highly recommended. During this phase, a wide range of electrolyte disturbances (e.g. hypokalaemia, hypocalcaemia and hypomagnesaemia), referred to as 'refeeding syndrome', and renal or hepatic impairment, may occur.

The consequencesofthisprocedurecanbeminimisedbyavoidinganinitialexcessive protein intake, by giving the patient relatively small amounts of food and by increasing the quantities of all the nutrients progressively.

Bulimia nervosa is a serious, even life-threatening, and difficult-to-overcome eating disorder, in which patients are preoccupied with their weight, body fat and body shape. Bulimics usually judge themselves severely and produce episodes of bingeing and purging. Physical complications and dangers of bulimia nervosa often include imbalance in electrolytes (sodium, chloride and potassium abnormalities), gastrointestinal problems and oesophagus inflammation, constipation, bloating or nausea, anaemia, heart problems, tooth decay and gum problems, absence of a period and finally, in the most severe cases, death.

The dietitian is one of the professionals who can contribute, as part of a scientific team, to the treatment of people with eating disorders. Eating disorders, such as anorexia and bulimia nervosa, have physiological, but mostly psychological, causes and require professional management and knowledge of the nutritional and health aspects of the illness.

Anorexia nervosa involves extreme dietary behaviour, weight loss, electrolyte imbalance and increasednutritional requirements.

The role of a clinical dietitian in the treatment of anorexia nervosa is crucial, for it is they who: collect the nutritional and behavioural information

assess the level of undernutrition and of nutrient deficiencies, providing these data to the other members of the team

try to establish a normal food intake

incorporate a wider variety of food items in the daily dietary intake of the patient

discuss and educate the anorexic on the adoption of a healthy and wellbalanced meal plan.

Nutrition and Anaemias

Iron-deficiency anaemia is a condition characterised by inadequate iron deposits in the body. Iron deficiency is the commonest nutritional deficiency and it occurs when body iron stores are insufficient to support the necessary rate of red blood cell production and haem synthesis in the bone marrow, to maintain a normal circulating red cell mass and haemoglobin concentration. It can be caused by an inadequate dietary daily intake, increased demands due to pregnancy or growth and/or by increased blood losses (menstrual losses, haemorrhage or trauma). The main symptoms of iron deficiency include fatigue, shortness of breath and vertigo. Periods of life with increased vulnerability of iron-deficiency anaemia include adolescence (particularly among girls after the onset of menstruation), women during pregnancy or of childbearing age, infants and older people.

Haemoglobin and serum ferritin are the most common ways to detect anaemia. The World Health Organization (WHO) criteria for the detection ofanaemia,establishedin1975, arethe mostwidely accepted.Haemoglobin concentrationsbelow13g/dlforadultmales,12g/dlformenstruatingwomen and11g/dlinpregnancyareconsideredindicativeofanaemia

Aim of the test Laboratory test Confirm the presence of anaemia Haemoglobin Haematocrit Evaluate iron status Iron stores Bone marrow iron Serum ferritin Iron supply Serum transferrin receptor concentration Transferrin saturation Free erythrocyte protoporphyrin Red blood cells indices Serum iron

There are two types of iron in the diet:

Haem iron derived from haemoglobin and myoglobin, which represents a small fraction of total iron in the diet and is highly absorbed. Haem iron is provided by animal-origin foods (i.e. red meat and meat products, liver, kidneys, egg yolk, fish, chicken, etc.).

Non-haem iron, which is inorganic iron, very abundant in vegetable foods and in fortified foods (i.e. dried fruits and vegetables, wholegrain cereals, legumes and fortified bread and cereals).

The bioavailability of non-haem iron is much lower than haem iron and it dependsonseveraldietaryandphysiologicalfactors.Theabsorptionofhaem iron can range from 8 to 40%, while non-haem iron is absorbed by 0.5–6%. The average iron content of a typical Western diet is about 10–15mg, of which only 10–15% is absorbed.

Haem iron, principally provided by meat, fish and blood-derived foods, as mentioned before, is better absorbed than non-haem iron is. Haem iron absorption can be altered only by meat

presence and to a smaller degree by the presence of calcium. Haem iron absorption is higher in the presence of meat, by a mechanism still under investigation. Moreover, as meat is the best dietary source of iron, it enhances its absorption and significantly increases the dietary content of iron. It should also be stressed that heat treatment and storage can transform haem iron into non-haem iron, resulting in the lower absorption of iron from certain foods.

With respect to calcium, some studies have shown that calcium chloride inhibits haem iron absorption in the same extension as non-haem iron. Calcium seems to have a direct effect on haem iron absorption, counteracting the enhancing effect of meat. It has also been demonstrated that this inhibitory effect is dose-related, as a dose below 40mg does not have an inhibitory effect, while maximum inhibition is reached with intakes around 300mg, where the inhibition of iron absorption is almost complete. The availability of non-haem iron further depends on dietetic factors and is generally considered lower. Its absorption is inhibited by the presence of phytic acid and polyphenols.

According to recent scientific data, phenolic compounds found in spices and herbs (i.e. chilli, garlic, pepper, shallot and turmeric) are potent inhibitors of iron availability, reducing iron availability from 20 to 90% in a dose-dependent manner. The aim of dietary advice in patients with iron-deficiency anaemia is to enhance the iron absorptionof their food and to restoreironstores in the body.

Patients should be advised to:

include food items with high iron content in their daily diet

consume sources of vitamin C in every meal, to enhance iron absorption

consume food items with haem iron in every meal if possible

avoidtheconsumptionoflargeamountsoftea and coffee,especiallywith meals, as they could inhibit iron absorption

consume up to three cups of milk or yogurt per day, as generally advised, but not with items rich in iron.

Haemochromatosis is an inherited or secondary condition that alters iron metabolism.Itisthemostcommonformofironoverloadduetoexcessiveiron absorption from the intestine. Physiologically, the only available mechanism in humans to prevent iron overload is the regulation of iron absorption in the intestine.

Hereditaryhaemochromatosisiscausedbyadefectinagenecalled HFE, which interferes with the regulation of dietary iron absorption from the small intestine. Haemochromatosis can also be due to repeated blood transfusions Even though haemochromatosis may be asymptomatic, it can be

accompanied by symptoms such as chronic fatigue, abdominal pain, irregular heart rhythm, hair loss and changes in skin colour – not attributed to sun exposure. Haemochromatosis can cause serious health problems, mainly owing to iron accumulation in the organs, i.e. hepatic disorders (cirrhosis, hematoma – with or without alcohol use), arthritis, gallstones, diabetes and heart disorders (heart failure, heart attack). It can be diagnosed by the measurement of elevated transferrin saturation (>50% for women and >60% for men), elevated ferritin levels and genetic tests to certify HFE gene mutations. The main therapy for haemochromatosis is iron removal, either by blood donation (phlebotomy) or by pharmacological removal by chelation therapy. Dietary advice consists of ways to impair iron absorption from foods. Increasing fibre intake, avoiding the intake of vitamin C at mealtimes and the increased intake of dietary items with either low iron content or of low iron bioavailabilityisoftenrecommended.VitaminCandironsupplementsshould be avoided in these patients. Moreover, alcohol intake should be restricted as it can worsen the hepatic damage.

Megaloblastic anaemia is characterised by the formation of abnormally large erythrocytes in the bone marrow and by abnormally large (macrocytic) erythrocytes and hyper-segmented neutrophils in the blood. Megaloblastic anaemia is caused by a reduction in the rate of DNA biosynthesis, resulting in abnormal nuclear maturation and ineffective erythropoiesis. The most commonaetiologyformegaloblasticanaemiaisfolateandB12 deficiencies.Other lesscommonfactorsaretheuseofdrugsthatinterruptDNAbiosynthesisand inherited conditions presenting defective enzymes of DNA biosynthesis.

In Western countries, B12 deficiency is mainly caused by pernicious anaemia. Pernicious anaemia is characterised by the insufficient production of the

The dietary management of B12 deficiency includes a high-protein diet (1.5g/kg body weight), a higher consumption of green leafy vegetables and inclusion of food items rich in B12, i.e. meat, eggs and dairy products.

Pregnancy is characterisedbyanincreasedneedoffolicacid,whilemedicationforepilepsy and barbiturates can cause folate deficiency. Moreover, alcohol consumption can alter folate metabolism and absorption. Foods with a high folate content include green leafy vegetables, fruits, breakfastcerealsanddairyproducts.Folateissensitivetohightemperatures, and cooking can destroy 50–95% of folate in the foods. Therefore, patients should be advised to consume fresh fruit and vegetables in order to increase their dietary intake of this vitamin.

Enteral Nutrition:

Thetwomaincategoriesofenteralnutritionareenteraltubefeedingandoral nutritional supplements. Before deciding to provide nutritional support to a patient enterally, it is important to take into account:

the predicted duration of the provision of the nutritional support

the danger of aspiration or tube misplacement

the presence or absence of digestion and absorption, i.e. the level of gastrointestinal (GI) functionality

whether a surgical operation is programmed

the texture and the volume of the feed that should be provided in order to meet the patient's needs.

Enteral tube feeding (ETF) is the provision of nutrients by a tube through the GI tract in patients who cannot attain sufficient oral intake from food and/or oral nutritional supplements or who cannot nourish themselves safely for periods of more than five days (e.g. dysphagic patients). It aims to maintain a patient's nutritional status and to improve their nutritional intake.

Oral supplements are usually pre-packed drinks, pills or powder-like substances, with a significant nutrient content, prescribed to improve the nutritional status of patients who fail to meet their nutritional requirements through food intake alone.

Oral nutritional supplements can be categorised as follows:

Complete oral supplements, which contain macro- and micronutrients. Usually they are prescribed as a supplement to the daily intake of foods, but the majority of them can be provided as exclusive nutrition. The content of these feeds in macronutrients varies and there are supplements for general use or for specific clinical conditions.

Oral supplements with modified nutrient content, i.e. hydrolysed or partially hydrolysed, elemental or semi-elemental feeds, fat-free, etc.

Supplements of one or more macronutrients, i.e. carbohydrate, fat or protein. Multivitamin supplements.

Oral nutritional support should be considered for malnourished patients or those in danger of insufficient nutrient intake through food, presupposing that they can swallow safely and they have an adequately functioning GI.

Most enteral feeds are ready-to-use fluids, in microbial-free containers that provide macronutrients, micronutrients, fluids and, in some cases, soluble or insoluble fibre. They are

usually nutritionally complete within a specific volume, providing the necessary nutrients to support the dietary needs of the patient.

Elemental and semi-elemental feeds facilitate digestion and absorption in patients with a problematic GI function. They are indicated for patients with inflammatory bowel disease, pancreatic insufficiency, malabsorption, short bowel syndrome, radiation enteritis, early enteral feeding or intolerance to polymeric feeds.

Renal feeds

They usually contain limited amounts of sodium, potassium and phosphorus. Their protein content varies: there are low-protein feeds for the early stages of chronic kidney disease (CKD) and higher-protein feeds for end-stage CKD patients (i.e. patients undergoing hemodialysis or peritoneal dialysis). The feeds for end-stage CKD patients are usually energy-dense, facilitating the fluid restriction that is needed for them.

Pulmonary feeds

They usually contain a higher percentage of their total energy in the form of fat to reduce the carbon dioxide that is produced by the feed metabolism.

Hepatic feeds

These are commonly low in aromatic amino acids (AAA) and methionine and high in branched-chain amino acids (BCAA). They usually have a high calorie/nitrogen ratio, are hypercaloric, low in sodium and contain dietary fibre to promote gut motility. They are usually low in copper, iron and manganese and are supplemented with fat-soluble vitamins, folic acid and B-complex vitamins.

Diabetic feeds

They usually have a lower carbohydrate content and a type of carbohydrate that is different from the standard formulas. They usually contain oligosaccharides, fructose and cornstarch, and in combination with their higher fibre content they aim at better glycaemic control as a result of delayed gastric emptying and a reduced intestinal transit.

Enteral feeds with dietary fibre contain both soluble and insoluble fibre. Soluble fibres, such as guar, pectin and FOS, are used as prebiotics. These substances are fermented by the colonic bacteria and short-chain fatty acids (SFAs) are produced. SFAs provide energy to colonocytes, improve mucosal growth and improve water and sodium absorption. Insoluble fibre increasesfaecalvolume, enteral peristalsisand thereby decreases faecaltransit time.

Enteral feeds with dietary fibre are recommended for patients with longterm enteral nutrition as they promote mucosal growth and gut peristalsis.

The use of enteral nutrition presupposes a sufficient functionality of the GI tract. Therefore, its use is contraindicated in specific clinical conditions that are characterised by compromised GI functionality, i.e. complete intestinal obstruction, intractable vomiting, paralytic ileus, circulatory shock, GI haemorrhage, short bowel, severe diarrhoea, GI ischemia and high output (>500ml/day) enterocutaneous fistula.

Following the initiation of enteral nutritional support, frequent monitoring of thepatientisessential,inordertoensuretheearlydetectionandtreatmentof possible complications, to check the tolerability of the feed and to make sure that the goals of the nutritional support are fulfilled.

Parameter Frequency Weight At least three times/week Signs of oedema Daily Signs of dehydration Daily Fluid balance Daily Adequacy of provided nutritional support At least twice/week Nitrogen balance Weekly Gastric residues Every four hours Electrolytes; blood, urine, nitrogen (BUN); creatinine 2–3 times/week Blood glucose, Ca, Mg, P Weekly Frequency and consistency of defecation Daily

It should be stressed that refeeding syndrome has no specific clinical features and therefore may easily go unrecognised. Its predominant biochemical sign is hypophoshataemia, while other features can be observed, such as rapid decreases of potassium, magnesium or sodium levels and water retention. These fluid and electrolyte abnormalities can lead to dehydration, cardiac or respiratory failure, rhabdomyolysis, seizures, coma, hypotension and sudden death. In order to prevent refeeding syndrome in patients receiving artificial nutritional support, it is vital to closely monitor their fluid balance and electrolyte status.Patientsathighriskofdevelopingrefeedingsyndromewhoneedartificialnutritionalsupportshoul dbeidentified. Inthesepatients,theinitiationof feedingshouldbeverygradual,withareducedcalorierateoftheirestimated dietary requirements (approximately 20kcal/kg/day) to prevent the development of refeeding syndrome. Moreover, measurements of electrolytes and biochemical parameters (creatinine, urea, potassium, magnesium, phosphorus) should be performed daily for at least four days after the initiation of the provision of enteral feeding.

Enteral feeding and TPN

Parenteral Nutrition

Parenteral nutrition (PN) is the intravenous provision of nutrients, without using the gastrointestinal (GI) system. It should be considered for patients with: malnutrition or inadequate or unsafe oral and/or enteral nutritional intake GI functionality insufficient to support an adequate degree of digestion and absorption of nutrients, due to ileus, dysmotility, fistulae, surgical resection, etc. prolonged GI system failure (>5 days) or intestinal failure which is predicted to last for >5 days. PN may also be chosen in patients who cannot tolerate enteral feeding (EF) or when EF is unsafe or impractical.

PN can be provided via catheter in: A peripheral vein dedicated solely to PN. As peripheral veins cannot support the infusion of hypertonic parenteral solutions, peripheral parenteral nutrition (PPN) should be chosen for short-term nutritional support (<14 days), as it can only partially cover the patient's nutritional needs. A central vein with high blood flow, either by a dedicated centrally placed central venous catheter or by a free dedicated lumen in a multilumen centrally placed catheter. Central parenteral nutrition or total parenteral nutrition (TPN) should be provided through tunnelling subclavian lines for long-term use (>30 days), while other central veins can also be used (cephalic vein or internal jugular vein). For TPN of shorter duration, nontunnelling lines can be used.

Theparenteralsolutionshouldnotexceed800–900mOsm/kgtopreventthrombophlebitis,the main complication of PPN. As peripheral veins cannot tolerate concentrated solutions, nutritional

needs can be met with larger volumes of solutions, or can be covered only partially, especially if there is a fluid restriction for the patient (e.g. patients with renal, cardiopulmonary or hepatic failure). Therefore, PPN should be used for short-term parenteral nutritional support (<14 days), while it is also suggested that PPN should be used as a supplementary nutritional support or during the transitional phase from parenteral to enteral or oral feeding. TPN is the provision of nutrients through a central vein. In TPN hypertonic solutions can be safely used, resulting in the provision of solutions with a higher calorie content but with lower volumes.

What should the monitoring of critically ill patients receiving PN include and how often should these values be obtained?

TheprovisionofPNpresupposes–justliketheprovisionofenteralnutritional support – regular monitoring, in order to ensure the safety of the patient and the achievement of the goals of their nutritional support.

The assessment of a patient's nutritional needs is essential in order to ensure the sufficient provision of nutrients through nutritional support.

Energy

Usually, the energy needs of the patient can be estimated by the calculation of their basal metabolic rate, ideally by indirect calorimetry. Owing to the high cost of the equipment for indirect calorimetry, in the clinical setting the use of appropriate equations taking account of the age, sex, body weight and additional increments depending on the metabolic stress of the patients are a more common means of assessment. For the majority of patients, the provisionof 20–30kcal/kg seems to be adequate, while for severely malnourished patients or those at risk of refeeding syndrome lower levels of energy intake should be chosen.

Protein

Protein needs are estimated according to the body weight of the patient, with relevant variations due to metabolic stress or illness. Typically, the provision of 1.0g/kg of protein (corresponding in 0.15g nitrogen from amino acids) is sufficient for most patients. In situations of severe metabolic stress requirements could be higher (i.e. 1.0–1.5g/kg), while in patients with renal or hepatic failure lower protein intakes are advised.

Fluids

Fluids should be about 30–35ml/kg per day, adding possible fluid losses owing to drains fistulae, etc. All sources of fluids should be calculated to avoid the excessive provision of fluid.

Micronutrients and electrolytes

As the parenteral provision of micronutrients does not go through digestion and absorption, the recommended daily allowances are lower than those for oral nutrition. The majority of pre-prepared PN feeds contain variable amounts of electrolytes, while there are others which are electrolyte-free for patients with renal or hepatic failure. Regarding micronutrients, most feeds contain insignificant amounts of vitamins and minerals and therefore should beaddedtothefeed.

These complications can be reduced if the personnel applying the PN are trained and use full aseptic techniques. The possibility of catheter occlusion can be minimised if PN solutions are given from dedicated intravenous catheters and the danger of infection or sepsis can be reduced if changes in catheters and PN bags are performed with strict aseptic techniques. Apart from the complications associated with intravenous access, PN is associated with metabolic and fluid-related complications. Acute and serious biochemical alterations may be caused by the provision of a large osmolar load to the circulation, resulting in refeeding syndrome. Hyperglycaemia due to diabetes or stress-induced insulin resistance is rather common and should be treated with insulin. PN can also cause fluid imbalances and hepatic disturbances, but the latter are mainly caused by the presence of sepsis or side effects from other drugs rather than by PN itself.

In the past, in order to reverse catabolism and to maintain the nutritional status of patients, deliberate overfeeding, or hyperalimentation, was initiated. Laterresearchonhyperalimentation,though,cametotheconclusionthatthe provision of PN that exceeds the patient's needs increases the risk of several complications. It can cause uraemia, hyperglycaemia, hyperlipidaemia, fatty liver (hepatic steatosis), hypercapnia (especially with the provision of excessive amounts of carbohydrates) and fluid overload. Overfeeding can be prevented by not exceeding the patients' nutritional needs and by measuring their basal metabolic rate by indirect calorimetry. Hyperglycaemia is a rather common complication in critically ill patients. It can be caused by hyperalimentation or by insulin resistance to the stress response. A proportion of all hospitalised patients either has diabetes orimpaired glucose tolerance (pre-diabetic state). Hyperglycaemia may lead to glycosuria (an excessive excretion of water by the kidney), resulting in hyperosmolar dehydration, which may be fatal for the patient if it remains untreated. Apart from micronutrient and vitamin additions to the parenteral solutions, some medications can be added. The medications most commonly added to the feed are insulin, in order to avoid hyperglycaemia, and antacids, to avoid gastroduodenal stress ulceration. In order to avoid incompatibilities with the components of the feed, caution must be exercised when adding other medications. More specifically, diuretics, vasopressors, antibiotics and narcotics can be added to the feed, provided that they are compatible with the solution's contents.

Pre-operatively, PN may improve the surgical outcome in several malnourished patients. In well-nourished or moderately malnourished patients, it has not been shown to have beneficial effects, as the risk of complication outweighs any potential benefit. Postoperatively, PN should be initiated in malnourished patients when enteral nutrition cannot be initiated for a period of 5–7 days. In well-nourished patients, PN should be considered only if the oral or enteral nutrition will not be possible for an extended period.

In patients with mild acute pancreatitis, nutritional support has a minimal benefit as most of them are usually well nourished and can tolerate the necessary period of 5–7 days for pancreatic rest without oral or enteral feeding.

Moreover, even in severe cases of pancreatitis, enteral feeding through a nasoenteric or jejunal tube has been shown to be effective and safe.

Moreover, TPN may be needed in necrotic pancreatitis, pancreatic abscesses and pancreatic pseudocysts.

Ready-to-use bags for PN, containing protein, glucose and lipid in a bag with separate sterile champers, which are perforated and mixed before hanging, are called ‘three-in-one solutions’. These bags of PN are usually more easy to use for the nursing staff, lower in cost and are preferred to making up individual parenteral solutions. However, these solutions are not flexible and cannot cover the needs of individual patients.

Metabolic Stress

Head injury is a trauma of the head, with or without injury to the brain. Head injury is a condition that increases the metabolic responses and the nutritional needs of the whole body. The initial systemic response after injury is the condition of hyper metabolism and hyper catabolism. In the acute phase, headinjurydecreasestheimmunologicalandgastrointestinalfunctions,leads to hyperglycaemia and increases ventricular fluid and the levels of serum cytokines. The provision of an adequate supply of nutrients is associated with an improved patient outcome. Early and adequate nutrition, whether enteral or parenteral, is believed to be essential for the patient's health and for improving the outcome of their injury. The best route of nutritional administration (parenteral or enterally) and the best timing of administration (e.g. early versus late) should be established. Most of the related studies propose early feeding in order to achieve better outcomes related to the patient's survival and disability. A significant benefit of glutamine supplementation on thesafetyandefficacyofthetreatment,decreasedmortality,durationofstay and infectious morbidity in critical illness has been demonstrated by recent data of head-injured patients.

As mentioned above, head injury increases the body's metabolic responses anditsnutritionaldemandsandthereforetheprovisionofanadequatesupply of nutrients is associated with improved treatment outcomes. The two different routes for the administration of nutrition are total parenteral nutrition (TPN) or enteral nutrition (EN). TPN is used in severely head-injured patients, when there is no gastric function or after an extended period, when a patient is nil by mouth. There are studies that propose this mode of feeding in order to achieve a better treatment outcome following head injury.
ENispreferredwhenthereisgastricfunction,becauseofthelowerriskof hyperglycaemia, infection and total cost. The route of administration can be through a percutaneous gastrostomy or jejunostomy tube or through percutaneous gastrojejunostomy. Recent studies suggest that an enteral formula containing glutamine and probiotics may decrease the infection rateand shorten the patient's staying the intensive careunit. The presence of increased intracranial pressure and the position and the severity of the brain injury may determine the beginning of EN. Most of the current studies have proved that when either parenteral or enteral feeding covers energy expenditure and nitrogen excretion, through equivalent quantities of feeding, almost the same outcome in the patient's treatment is achieved.

When the skin is exposed to excessive heat (from fire), electricity or corrosive chemicals, the resulting tissue damage is known as a 'burn'. The estimation of the severity of burn is based on its depth and the percentage body surface that is burnt. Burns are generally categorised according to the severity of tissue damage, as follows:

First-degreeburns:Theyaffectonlytheouterlayeroftheskin(epidermis) (e.g. mild sunburn). They are characterised by pain and redness and will heal within 5–10 days.

Second-degreeburns:Theyaffectboththeepidermisandthelayerbelow it (the dermis). They are characterised by pain, redness and blisters and will heal in 10–14 days (for milder burns) or 25–35 days (when the depth of burn is greater). They require hospitalisation. Third-degree burns: They destroy the epidermis and dermis, and can involve all layers of the skin and subcutaneous fat, and even underlying bones, muscles and tendons. They are characterised by a white burn site, lack of sensation due to the destruction of the nerve endings, disturbed temperature control and a higher danger of infections. They require immediate hospitalisation.

Severe burn patients present an extreme state of physiological stress and an overwhelming systemic metabolic response. They require specialised nutritionalsupport,whichisanintegralpartofmultidisciplinarymanagement.The main nutritional goals in the treatment of the burn patient are: Monitor nutritional status and provide specialised immune-enhancing nutrition. Estimate energy requirements and provide adequate calories to prevent weight loss of greater than 10% usual body weight. Provide adequate protein for positive nitrogen balance and maintenance or repletion of circulating proteins. The goal of nutritional therapy is to prevent rather than treat already established malnutrition, but protein degradation in burn patients proceeds despite adequate protein supplementation. Provide vitamin and mineral supplementation as indicated. Take into account the hormonal and metabolic changes resulting from a burn injury.

Protein requirements are also increased in burn patients because of the increased catabolism of skeletal muscle, leading to average losses of 260mg protein/kg/hr. Protein intake should vary between 1.5–2.0g/kg of ideal body weight on a daily basis. Nitrogen balance should be assessed on a daily or weekly basis, using the Waxman equation. The rate of protein breakdown into amino acids and the reincorporation of these amino acids are important for collagen synthesis in wound healing as well as for the maintenance of visceral proteins for optimal organ function, especially the immune system. Maintenance of diaphragm and intercostal muscle mass is also important for survival to avoid the reduction of vital capacity and respiratory efficiency. In addition to the urinary losses from the degradation of muscle mass, nitrogen is lost from wound exudate, excision of burns and blood loss during surgery, leading to an extraordinarily negative nitrogen balance.

Burninjuryincreasesthebody'smetabolicdemands,andthereforenutritional requirements. Provision of an adequate supply of nutrients is believed to lower the incidence of metabolic abnormalities, thus reducing septic morbidity, and improving survival rates. The purpose of the nutritional assessment is tocharacterisethepatient'snutritionalstatusandrecognisepre-existingmalnutrition. This is essential for developing an appropriate nutritional regimen to treat specific nutritional disorders (e.g. thiamin replacement for alcoholic patients).

Toprovide optimalrepletionduringthemetabolicinsultoftheburn and multiple surgeries, to reduce morbidity and mortality, and to minimise any loss of muscle strength. Nutritional status is assessed in most patients by a variety of methods, such as anthropometric measurement, biochemical data,clinicalsignsanddiethistory(Thetraditionalparameters of anthropometric, biochemical and clinical data will not be accurate in burn patients because the results are distorted by fluid resuscitation, surgeries and systemic inflammatory responses. For example, body weight, mid-arm circumference, blood count and visceral protein status are affected by fluid resuscitation and transfusion, and nitrogen balance is affected by burn exudate and immobility.

Therefore, diet history becomes more important to nutritional assessments than usual.

Critically ill burn patients present an increased free radical production, which isproportionaltotheseverityoftheburn,whilemicronutrientdeficienciesare frequent after major burns. Burn patients have a high risk of negative trace element balances, which contribute to the imbalance in endogenous antioxidant capacity and the extension of primary lesions. As far as concerns the routeofadministration,theintravenousroutehasbeenproposedasmoreefficient than the enteral. The clinical evidence shows that several factors may determine the efficacy of antioxidant supplementation in burn patients. In severe burns, high doses of vitamin C contribute to a reduction of resuscitationfluid requirements byendothelialantioxidantmechanismsand shouldbe administered to the burn patient in quantities equal to 5–10% of the recommended daily allowance (RDA). B-complex vitamins should be administered in quantities equal to 2–3 times of the RDA, vitamins A and D in quantities equal to twice the RDA and vitamins B12 and K once a week.

It is of primary importance in the care and treatment of burn patients to monitor the electrolyte–fluid balance and to contribute to an accurate fluid resuscitation. Lactated Ringer's solution without dextrose is the fluid of choice, except in children under two, who should receive 5% dextrose in lactated Ringer's solution. The initial rate can be estimated by multiplying the estimated total body surface area (TBSA) burnt, using the appropriate graphs, by the weight in kilograms, which is divided by 4.. The restoration of sodium losses in burn patients is essential, as mild or severehyponatraemia(<135mEq/l)canbepresent,mainlyowingtoextracellular sodium depletion, which follows all the changes that occur in cellular permeability. Hyperkalaemia is another characteristic of massive tissue necrosis.

Pressure sores are primarily developed by unrelieved pressure. There are numerous risk factors responsible for the development of pressure sores, which can be categorised as extrinsic or intrinsic. Sustained pressure, shearing forces, friction and moisture, mechanical loads on the skin and the soft tissues and body weight, age, sex, limitation in activity, dehydration and bowel and bladder incontinence, anaemia, poor nutritional status, medication and infection are some the most important risk factors involved in the aetiology and development of pressure sores.

Pressure ulcers are areas of damage to the skin and underlying tissue that usually occur over bony protrusions such as elbows, heels and hips. Pressure ulcers are caused most frequently by pressure, shear and friction. While unrelieved pressure, shearing forces and friction account for the mechanical aetiology of pressure ulcers, many other conditions can also predispose an individual to pressure ulcers. Pressure sores and malnutrition usually coexist, and the role of diet is vital. Eating a nutritionally rich diet with adequate calories and protein and a full range of vitamins and minerals – especially vitamin C and zinc – has been shown to improve wound healing. Being well nourished also protects the integrity of your skin and guards against breakdown. If you're at risk of or recovering from a pressure sore, your doctor may prescribe vitamin C and zinc supplements, which you can find at health food stores and most pharmacies. Patients with pressure ulcers may require higher protein diets and more energy than other bedridden patients do. Zinc supplementation is often promoted as aiding in wound healing, yet evidence for its efficacy is far from conclusive.

Systemic inflammatory response syndrome (SIRS) is an inflammatory state of the body, without a proven source of infection, which occurs when inflammatory mediators are released into the systemic circulation. Sepsis, SIRSand multiple organ dysfunction syndrome (MODS) represent the progressive stages of the same illnesses. The causes of SIRS are categorised as being either infectious or non-infectious. Although infection can be a common cause of SIRS, it is not the only one. There are also different non-infectious causes, such as severe trauma and complications of surgery, acute pancreatitis, burns, haematoma and venous thrombosis, pulmonary and myocardial infarction, acute adrenal insufficiency, increased cytokine release, neuroleptic malignant syndrome, lymphoma, hypernephroma, tumour lysis syndrome, drug overdose and immunodeficiency (e.g. AIDS).

The role of diet and especially of immunonutrition in critically ill patients is vital, though still controversial. Enteral feedings with arginine, glutamine and omega-3 fatty acids and supplementation with nucleotides have been shown to be beneficial for these patients. Thus, a diet enriched with eicosapentaenoic acid (EPA), gamma-linolenic acid (GLA) and elevated antioxidants may contribute to better hospital outcomes and is associated with lower mortality rates. The appropriate provision of these nutrients has been shown to decrease infectious complications, the duration of hospitalisation and of mechanicalventilation.Thetypeoffeedingformulaandtherouteofnutrition vary, according mainly to the aetiology of SIRS.

MODS, also known as multiple organ failure (MOF), is a condition characterisedbyseveresystemicinflammationandcausedbyalteredorganfunction in acutely ill patients. The major causes of MODS are trauma, burns, haemorrhage, autoimmune disease and over-dosage of drugs and toxic chemicals. Nosocomial infections – related to decreased immune function and gut-barrier malfunction, increased catabolism, morbidity and high rates of mortality–arethemostcommonproblemsincriticallyillpatientswithMODS. MOF is the leading cause of mortality (50–80% of all deaths) in surgical ICUs.

Enteral feeding in MODS patients is the preferred route of nutrition, while the addition of nutritional substrates, such as glutamine, seems to preserve intestinal mucosal integrity and lymphoid tissue in the gastrointestinal tract, decreasing intestinal permeability and bacterial translocation.

Life Expectancy

In 1935, it was first reported that calorie restriction extended lifespan in rats. Subsequent data have shown that calorie intake reduction without malnutrition slows ageing and prolongs maximum lifespan in other species as well. Maximum lifespan in rodents is also prolonged by intermittent fasting.

The five main possible mechanisms are:

reduced production of reactive oxygen species

decreased circulating T3 levels and sympathetic nervous system activity

decreased plasma inflammatory cytokine concentrations

protection against ageing-associated immune function deterioration

increased expression of protein chaperones and neurotrophic factors.

Although there are no validated biomarkers of ageing and it is impracticable toconductrandomised,diet-controlled,long-termsurvivalstudiesinhumans, epidemiologic data show that energy restriction may positively affect factors involved in the pathogenesis of ageing and life expectancy in humans. Coronary heart disease mortality rates, which had declined during World War II food shortages in Europe, rose again after the end of the war. In addition, Okinawa inhabitants, who ate fewer calories than Japanese, had lower cardiovascular disease and cancer rates. The causal association between energy restriction and longevity, however, has not been definitely proven.

There are several changes:

low percentage of body fat

low systolic and diastolic blood pressures

markedly improved lipid profile

increased insulin sensitivity

low plasma concentrations of inflammatory markers

low levels of circulating growth factors

low serum concentrations of T3.

Moreover, left ventricular diastolic function in calorie-restricted persons was similar to that of persons 16 years younger.

Calorie restriction leading to weight loss improves numerous obesityassociatedriskfactors.Recentstudieshavealsoshownthatlong-termweight loss caused by bariatric-surgery-induced calorie restriction reduces mortality in extremely obese individuals.

The optimal calorie intake for life prolongation is not known. However, the available data suggest that calorie restriction with adequate nutrient intake in humans is as beneficial as in animal models. It can increase life expectancy and enhance late-life quality by lessening chronic disease burden.Some people are genetically predisposed to live longer. Studies show that familial longevity is inherited, the mortality of centenarian siblings is almost half throughout life and their relative risk to reach 100 is higher than in the general population. Certainly, there are clear indications of thatInaccordancewiththeaboveresultsarethedataofanItalianstudyshowing that in older subjects the 'olive oil and salad' dietary pattern (which included the high intake of olive oil, raw vegetables, soups and poultry) was inversely associated with overall mortality, whereas the 'pasta and meat' pattern (including pasta, tomato sauce, red meat, processed meat, animal fat, white bread and wine) was associated with increased overall mortality. It is also worth noting that the Greek study mentioned above showed that adherence to a Mediterranean diet was essentially unrelated to body mass index (BMI), with small variations depending on model choice and with no practical consequences. A recent report from Finland clearly showed that the long-term change in population diets (mainly a reduction of saturated fat and an increase of unsaturated fat intake) resulted in a major increase in life expectancy and in an 80% reduction in annual cardiovascular disease mortality rates.

The association between the degree of adherence to the Mediterranean diet and survival of patients with diagnosed coronary heart disease (CHD) at enrolment was examined in a population-based prospective study of 1302 Greek men and women. The results showed that a greater adherence to the Mediterranean diet was associated with a significantly lower mortality rate among patients with prevalent CHD at enrolment. In addition, similar results were shown in a French study, the so-called Lyon Diet Heart Study, a randomised secondary prevention trial designed to test whether a Mediterranean diet may lower recurrence rates after a firstmyocardial infarction. The conclusion was that the cardioprotective effect of the Mediterranean diet pattern was maintained up to four years after the initial infarction. There are indirect indications that:

calorie restriction in adults may prolong lifespan

a greater adherence to the Mediterranean type of diet is associated with increased survival.

HIV/AIDS

Acquired immunodeficiency syndrome (AIDS) is a disorder resulting from the infection with the human immunodeficiency virus (HIV), which leads to a profound immunosuppression and high susceptibility to life-threatening opportunistic infections and malignancies. It was first reported in 1981. HIV infection can be transmitted by:

unprotected vaginal and anal sexual intercourse

receiptofinfectedbloodandbloodproducts(sharinginjectingequipment between drug users, occupational accidents with needle stick injuries, infusion of contaminated blood products)

from the infected mother to the child during pregnancy, birth or breastfeeding (vertical transmission).

Since malnutrition is one of the most common problems in patients with HIV/AIDS, nutritional care aims predominately at the efficient provision of nutrients and the maintenance of body weight and lean body mass within normal levels. Moreover, the delay of wasting syndrome and the early detection and treatment of the metabolic disturbances due to the disease orSymptoms

CD4 lymphocytes count

A. Asymptomatic disease, acute retroviral syndrome, generalised lymphadenopathy

B .Symptoms of AIDS-related complex

C .AIDS-defining conditions >500/μL A1 B1 C1 200–499/μL A2 B2 C2 <200/μL A3 B3 C3

All patients in categories C1, B2, C2, A3, B3 and C3 are characterised as patients with AIDS.the antiretroviral therapy are of main concern. Finally, patients with HIV/AIDS should be provided with nutritional advice tailored to their specific needs, the possible side effects of their medications and their lifestyles.

The most common nutritional problem in symptomatic HIV disease is weight loss or wasting. Although its severity and frequency appear to be reduced by the use of antiretroviral therapy, it remains a problem. Since malnutrition can reduce the quality of life and increase morbidity and mortality in these patients, the early detection and treatment of the underlying cause of insufficient nutrient intake is of vital importance.

Malnutrition in HIV patients can often be attributed to:

reducedfoodintake,duetopsychologicalanneurologicalproblems,sore mouth or side effects of their medication (i.e. anorexia, vomiting, nausea)

altered metabolic needs due to the progression of the disease

malabsorption, especially in patients with chronic diarrhoea caused by gastrointestinal pathogens, by medication or by the HIV disease itself.

The main goal for asymptomatic or weight stable HIV-positive patients is to optimise food intake and to ensure the adequate intake of nutrients. Unintentional weight loss should be avoided by the sufficient provision of energy and protein. Although the micronutrient requirements of HIV-positive patients are unknown, a multivitamin and mineral supplement, providing no more than 100% of dietary reference intake (DRI) or reference nutrient intake (RNI)couldbeprescribedinordertoavoiddeficiencies,especiallywhenfood intake is compromised.

The main goals of the nutritional management of symptomatic patients with HIV infection are:

the preservation or increase of lean body mass

adequate provision of macro- and micronutrients

achievement and/or maintenance of a body weight within the normal values for body mass index (BMI)

provision of symptomatic relief, according to the patient's needs.

The energy needs of these patients vary greatly, according to the state of the disease, the presence of problems that could compromise absorption and the utilisation of nutrients. Ideally, energy needs should be calculated by indirect calorimetry. However, in the clinical setting, energy needs could be calculated, with limited accuracy though, by the use of equations such as the Harris-Benedict or Schofield equations, taking into account the relative stress factors according to the overall health status of the patient. Energy requirements are likely to increase by 10% to maintain body weight and physical activity in asymptomatic HIV-infected adults. During symptomatic HIV, and subsequently during AIDS, energy requirements increase by approximately 20–30% to maintain adult body weight. Protein needs in HIV-positive patients are considered relatively high. A dietaryproteinintakeof1.5–2g/kgisconsideredadequateforthemajorityof patients.Likewise, providing 20% of a patient's dailyenergy intake as protein seems to cover the needs of HIV-infected patients, given the fact that their energy needs are high. These recommendations may differentiate in patients with kidney or hepatic disease. In these cases, the relevant recommendations for non-HIV patients should be followed.

Accordingtotheavailabledata,HIV-positivepatientsseemtohavelower levels of vitamin A, B6, C and E in the bloodstream. These data possiblysuggest that HIV-positive patients may need these vitamins more than the healthy population does.

'Highly active antiretroviral therapy' (HAART) is a term used to describe the use of a combination of antiretroviral drugs for the treatment of HIV infection. The main antiretroviral drugs that are used for HIV-positive subjects are categorised according to the phase of the retrovirus life cycle that the drugs inhibit, as follows:

nucleosideandnon-nucleosidereversetranscriptaseinhibitors(NRTIsand nNRTIs respectively) inhibit reverse transcription of the virus.

protease inhibitors (PIs) inhibit the activity of protease (an enzyme used by HIV to cleave nascent proteins for the final assembly of new virons).

integrase inhibitors inhibit integrase, the enzyme that is responsible for the integration of viral DNA into the DNA of the host cell.

fusion inhibitors interfere with the binding, fusion and entry of the HIV virus to the host cell. maturation inhibitors inhibit the last step of virus production, by blocking the formation of the capsid protein of the virus.

The use of HAART has transformed HIV infection from an acute illness to a manageablechroniccondition.However,thesignificantdecreaseinmortality of HIV patients and the increase in their life expectancy have been accompanied by several clinical and metabolic complications. Nutrition-related side effects have been shown to correlate negatively with quality-of-life measures in people infected with HIV. The most common gastrointestinal adverse effects include nausea, vomiting, dyspepsia, anorexia, abdominal pain, chewing/swallowing difficulties and taste alterations. Usually, these effects lose their intensity after the first month of treatment. If they persist, they may compromise dietary intake, and a change in the drug regimen should be considered. Providing specific strategies to support patients through these challenges is an important part of nutritional therapy.

The main metabolic complication is described as 'HAART-induced lipodystrophy syndrome', which includes:

lipoatrophy (face, extremities and buttocks)

fataccumulation(abdomen,dorsocervicalorsupraclavicularfatpad–buffalo hump)

dyslipidaemia [hypertriglyceridaemia, hypercholesterolaemia and low high-density lipoprotein (HDL) cholesterol]

insulin resistance and glucose intolerance and lactic acidosis.

In the absence of results from randomised, controlled clinical trials evaluating specific dietary interventions in HIV-infected patients with lipid disorders, the current recommendations for the management of dyslipidaemia in HIVinfected patients receiving HAART do not differ from the recommendations forthenon-HIV-infectedpopulation.ItissuggestedthatHIV-infectedpatients withdyslipidaemiashouldfollowtheNationalCholesterolEducationProgram Adult Treatment Panel III (NCEP ATP III) recommendations, which include dietary restriction of total fat to 25–35% of total energy intake, saturated fat to less than 7% of total calories, dietary cholesterol to less than 200mg per day, use of plant sterols (2g/d) and attainment of a prudent diet increased with a high intake of dietary fibre (10–25g/d 'Wasting syndrome' is a term used to describe unintentional weight loss (>10% of the usual body weight) in combination with diarrhoea, fatigue and/or fever for a period of more than 30 days. The weight loss concerns mainly the loss of lean body mass and, secondarily, fat mass. Wasting can contribute to the deterioration of a patient's immune system and is connected with high rates of mortality and usually signals that the HIV-infection is progressing to AIDS. Detailed dietary assessment should be performed regularly in HIV-infected patients to ensure the early detection of wasting syndrome. When and if it is identified, certain actions should take place in order to maximise dietary intake of the patient and halt their weight loss. Dietary advice should focus on energy- and nutrient-dense foods, while meal planning should be the first priority for these patients. Food enrichment and food fortification could also improve the nutrient intake. If the patient's dietary intake remains compromised, oral supplements could be used. If the patient fails to attain a sufficient dietary intake, the use of artificial nutritionshouldbeconsidered.Enteralandparenteralnutritioncouldbeused in order to preserve the patient's nutritional status.

Omega-3 fatty acids – namely eicosapentaenoic and docosahexaenoic acid – have been shown to be effective for lowering triglycerides in patients with

HIV-associated dyslipidaemia. A 16-week randomised study in patients with HAART-associated hypertriglyceridaemia showed that fish oil supplementation reduced plasma triglyceride by 20%. Other studies have demonstrated thebenefitsofomega-3fattyacidsaswell.Omega-3fattyacidsmayalsohave secondary benefits in decreasing bone resorption and decreasing markers of systemic inflammation.

HIV-infected patients, owing to their compromised immune system, are usually more vulnerable to food-borne illness than the non-infected population. Special care should be taken for the education of HIV-infected patients in the safe handling of food in order to minimise the danger of a food-borne illness. Strict hygiene measures should be taken during food preparation, and foods easily spoilt or of a high microbial load should be avoided (raw or semi-raw meat and fish, raw eggs, non-pasteurised milk and milk products, soft cheese and cheese with moulds, i.e. Roquefort or blue cheese).

Moreover, attention shouldbepaidtotheexpirydatesoffoodproductsandtothecarefulstoring of food. In the developed world, tap water is usually safe. If water comes from wells or rivers, it should be boiled before it is consumed. Ice cubes and cold drinksshouldalsobeprepared fromsafewaterinordertoavoidwater-borne illnesses.

Neurological and Mental Disorders

Dysphagia, or difficulty in swallowing, is a common problem in patients with neurological diseases, often resulting in aspiration pneumonia, compromised nutrient intake, dehydration and malnutrition. The main signs and symptoms of dysphagia include:

excessive saliva excretion, choking and coughing during or after meals poor control of tongue, excessive tongue movement and spitting food out of the mouth inability to drink liquids through a straw pocketing of food in cheek or under tongue wet 'gurly' voice after eating or frequent throat clearing delayed or absent laryngeal elevation prolonged chewing or eating time chronic or recurrent upper respiratory problems.

The main goals for the nutritional management of a dysphagic patient are:

the determination of the safest route for the provision of food, to prevent aspiration and choking.

the evaluation of the problem and the assessment of the texture of the foods that the patient can tolerate.

the provision of sufficient energy and nutrient intake, to ensure the best possible nutritional status of the patient.

the intake of sufficient liquid to prevent dehydration.

Consistency Description Foods Pur´eed Pudding-like consistency, thick, homogenous textures Ground or minced Easily mashed foods, no coarse textures, raw fruits or vegetables (except for raw banana) Soft or easy to chew Soft foods prepared without use of blender; meats minced or cut in small pieces, no tough skins, nuts or raw crispy or stingy foods Modified, general Soft textures prepared without grinding or chopping; no nuts or crispy foods Fluids Thin Regular fluids Nectar-like Fluids thin enough to be sipped through a straw or a cup, but thick enough to fall off a tipped spoon slowly (e.g. buttermilk, milkshake) Honey-like Thick fluids eaten with a spoon, too thick for a straw and unable to hold their shape (e.g. thick yogurt, honey) Spoon-thick Pudding-like fluids that must be eaten with a spoon, that can hold their shape on a spoon (e.g. milk pudding, jelly)

Dysphagia diets must be highly individualised, depending on the patient's chewing and swallowing ability. Foods' texture and viscosity may be altered in order to be tolerated. Fluids and liquids are categorised in four groups, progressing form the easiest to most difficult to swallow. The description of food and fluid consistencies is included in Table 16.1.

Food items used in pur´eed preparations should be thoroughly cooked. This causes the loss of a significant amount of their vitamin and mineral content andoftentheprescriptionofamultivitaminisnecessaryinordertoensurethat the patient receives sufficient micronutrient intake. Moreover, constipation is very common among these patients, since texture manipulation through stirring and diluting the food items results in feeds relatively low in dietary fibre. Another problem that can also compromise the nutritional intake of dysphagic patients is the alteration in food appearance and smell following texture manipulation. The use of special equipment that can give special forms to the food and taste enhancers can be used in order to ensure food palatability and better patient compliance.

Perniciousanaemiawasfirstdescribedin1948.Itisamacrocytic,megaloblastic anaemia, caused by B12 deficiency or by secondary vitamin deficiency due to a lack in the intrinsic factor, which is excreted in the stomach and is necessary for the absorption of B12. The overt symptoms of pernicious anaemia includeparaesthesia,numbnessandtinglingoffeetandhands,poormuscular coordination, poor memory and diminution of the sensation of vibration and position. Its treatment consists of intramuscular or subcutaneous injections of B12. For the nutritional management of pernicious anaemia, food items such as meat, eggs and dairy foods are considered rich sources of vitamin B12 and should be included in the diet plan of the patient to ensure the sufficient dietary intake of this vitamin.

Nutritional neuropathies mainly affect the peripheral nervous system, and their symptoms include lean body mass depletion and progressive wasting. Early signs are anorexia, irritability, weight loss and abdominal discomfort, while in the long term paralysis, numbness and the disturbance of a patient's sense of hot and cold may be observed. The most common forms of nutritionalneuropathies–beriberiandalcoholicneuropathy–canbeattributedto thiamindeficiency,butotherdeficienciesinB-complexvitaminscannotbeexcluded. The nutritional management of these neuropathies is a balanced diet with supplementation of B-complex vitamins. Specifically in alcoholic neuropathy, thiamin supplements should be added, and abstinence from alcohol is essential for the recovery of the patient.

When a patient with a recent stroke is being evaluated, it must be taken into account that:

A brain injury due to a stroke results in a hypercatabolic state for patients, raising their energy and protein needs significantly. Moreover, as insulin resistanceandelectrolyteimbalancesarerathercommoninthesepatients, they should also be co-estimated.

A stroke can severely modify the ability of the patient to receive food without help.

Neurological deficit Influence on nutritional parameters Perception Disturbed perception of time. Unable to identify meal times Visual perception/ hemianopsia Cannot define or recognise food items. In some cases only half of the plate is seen and therefore only half of the food is eaten Spatial deficits Unable to analyse position of the plate Behaviour Food thrown around and not eaten Apraxia Unable to use cutlery and self-feed Aphasia Forget to eat Memory Forget that he/she has already eaten Hemiplegia Able to use only one hand to self-feed Ataxia Unable to self-feed Psychological influences/ depression Limited appetite

Malnutrition is common in patients with stroke, caused either by their increased nutritional needs or by their compromised nutritional intake, and can prolong the recovery or increase comorbidities, such as pressure ulcers and infections.

Cognitive decline and dementia deeply affect the quality of life of older peopleandtheircaregivers.TherapeuticoptionsforthetreatmentofAlzheimer's diseaseanddementiahavebeenshowntobeoflimitedefficacy,andprevention strategies are mandatory. There is cumulative evidence of the possible protective role of lifestyle and diet-related factors for the prevention of cognitive decline. At present, in older subjects, balanced diets, the prevention of nutritional deficiencies of antioxidants by nutritional supplements and moderate physical activity could be considered the first line of defence against the onset or progression of dementia. Moderate alcohol consumption seems to be a protective factor against mild cognitive impairment, dementia and Alzheimer's disease. Apart from alcohol, dietary models based on complex carbohydrates, fruits and vegetables and low in animal fat appear to protect against cognitive decline that is degenerative or vascular in origin, owing mainlytothehighprovisionofantioxidants.FishconsumptionhasbeenassociatedwiththelowerriskofAlzheimer'sdiseaseinlongitudinalcohortstudies.
Conversely,vitamindeficienciescouldhaveanegativeimpactoncognition in older people, while the aluminium content of foods and water may also affect the risk of developing Alzheimer's disease.

maintain a state of ketosis and their beneficial effect may be attributed to the role of ketone bodies as inhibitory neurotransmitters, providing an anticonvulsant effect to the patient. There are two forms of ketogenic diets: the traditional one and the ketogenic diet based on medium-chain triglycerides (MCT). Both forms of these diets are calculated to provide 75% of the recommended dietary allowance (RDA) of energy for the child's ideal weight and height and a 4:1 ratio of kcal from fat to kcal from protein and carbohydrates respectively. But it must be borne in mind that the child receives sufficient protein provision to ensure growth (approximately 1g/kg body weight/day). Fluids are controlled (approximately 65ml/kg/day) and should not exceed 2l/day. The MCT approach provides 50–70% of kcals in the form of MCT oil. In the MCT approach, a greater amount of non-ketogenic food is allowed as ketosis can be more easily achieved with MCT oil, and fluid restriction is not necessary. It should be stressed that the ketogenic diet is a difficult diet to follow, and can be nutritionally incomplete. Therefore, a

multivitamin supplement is often needed to ensure the sufficient nutritional intake and growth of the child. Ketogenic diets are often discontinued after 2–3 years.

One of the main problems associated with multiple sclerosis is malnutrition due to the loss of interest in, or inadequate consumption of, food.

The aetiology of malnutrition in these patients is:

psychological factors, e.g. anorexia or depression, as a result of the diagnosis side effects of the medical treatment fatigue and disability in preparing meals.

Apartfromundernourishment,overweightandobesityduetolimitedphysical exercise and increased appetite mainly due to corticosteroid therapy can also be observed in this population. Moreover, binge eating and bulimic episodes can be seen as a result of depression in these patients.

It is also noteworthy that constipation is a common symptom, resulting from reduced mobility and physical exercise, restricted fluid intake due to problems in micturition or continence and reduced bowel movement due to the disease.

Parkinson's disease frequently affects patients' nutritional intake. The symptomsofthediseasecanvarybetweenpatientsandmayworsenasthedisease progresses. They can include:

tremor and rigidity, causing difficulties in preparing food and self-feeding slow movement, resulting in extended meal duration depression, limited appetite, apathy drug side effects (nausea, vomiting, anorexia) swallowing difficulties (dysphagia).

Patients with Parkinson's disease may also have increased energy requirements due to tremor and rigidity thus worsening the effects of an already inadequate intake.

Nutritional intervention should aim to promote an adequate dietary intake, taking intoaccountany difficultiesin feeding due to symptomsofParkinson's disease. Such interventions may include nutritional support (e.g. supplementation, tube feeding during the end stages of the disease and texture modification due to dysphagia). Table 16.3 proposes specific solutions for the problems that are usually seen in patients with Parkinson's disease.

Levodopa (or L-DOPA) is used in the treatment of Parkinson's and has been foundtobeaffectedbydietaryintake,particularlythatofneutralaminoacids, which compete with the levodopa and reduce its action. Recent interest has focused on the use of protein redistribution diets to optimise the action of Levodopa.Thismayinvolvelimitingproteinorredistributingitwithinthediet toreducetheproteinloadatbreakfastandlunchandmovingittotheevening meal. Interest has also arisen around the effects of antioxidant nutrients in the prevention of Parkinson's; however, there is no evidence to suggest that they have any effect on the progression of the disease.

The main types of mood disorders are depression, anxiety and mania. Its nutritional implications depend on the severity of the disorder, and some of the most common ones are summarised in Table 16.4. Severe depression can alter a patient's interest in food, either by increasing the amount of food consumed or by causing anorexia or food refusal. Moreover, mainly owing to neurotransmitterimbalance,depressioncancausecarbohydratecravings, resulting in weight gain. Depression can also diminish thirst sensation, resulting in a high risk of dehydration for these patients.

Mood disorder Influence on food intake Nutritional implication Depression Reduced interest in food, apathy, anorexia, food refusal Weight loss, malnutrition Loss of thirst sensation Dehydration, constipation Carbohydrate cravings Weight gain, dietary imbalances Anxiety Diarrhoea, abdominal pain or discomfort Selective avoidance of food groups, excessive nutrient losses Mania Xerostomia and altered taste due to drugs' side effects Difficulties in chewing and swallowing Increased appetite Weight gain, obesity Strange food habits Nutrient imbalances, weight gain

Anxiety can also have an effect on the nutritional status of the patient. It is often accompanied by diarrhoea and abdominal pain or discomfort, causing the selective avoidance of food groups and excessive nutrient losses. Finally, mania can be accompanied by unusual eating habits and increased appetite,causingweightgainandnutritionalimbalance.Moreover,drugside effects include taste alterations and xerostomia, resulting in difficulties in swallowing and chewing.

Lithium salts are used for the treatment of mania and have a very narrow range between therapeutic effectiveness and toxicity. Therefore, they should be used only for the period they are necessary, as their long-term use is connected with undesired effects on renal function. Moreover, there is an inverse relationship between sodium intake and serum lithium levels, and toxicity from lithium can be a result of sodium restriction. Patients receiving therapy with lithium should be encouraged to maintain sufficient fluid intake and avoid dietary modifications that could alter their sodium intake.

VALUE ADDED COURSE
CLINICAL NUTRITRION
Annexure II

STUDENT ENROLLMENT LIST

S.No.	University no	Name of the student	Year /	
1.	U14MB301	RENJITH. J	II nd	Renjith
2.	U14MB302	RESHMA. R.L.	II nd	Reshma
3.	U14MB303	RICHARD ROZARIO. C	II nd	
4.	U14MB304	RUBINA.S	II nd	Rubina
5.	U14MB305	SABARI KRISHNAN.N	II nd	Sabari Krishn
6.	U14MB306	SANDHYA.S	II nd	Sandhya
7.	U14MB307	SANTHOSH KUMAR. L	II nd	Santhosh Kuma
8.	U14MB308	SARAN. S	II nd	Saran
9.	U14MB309	SASIDHARAN. V	II nd	Sasidharan
10.	U14MB310	SENTAMIL SELVAN .P	II nd	Sentamil Selva
11.	U14MB311	SHALINI. T. C.	II nd	Shalini
12.	U14MB312	SHANMUGA RAJA. A	II nd	Shanmuga Raja
13.	U14MB313	SHANMUHA PRIYA. S	II nd	Shanmuga Priya
14.	U14MB314	SHAREEFA AKHTAR.S	II nd	Shareefa akhtar
15.	U14MB315	SHEMBIYAN. R.M.	II nd	Shembiyan
16.	U14MB316	SIKKANDAR. A	II nd	Sikkandar
17.	U14MB317	SINDHU. M	II nd	Sindhu
18.	U14MB318	SIVARAJ. S	II nd	Sivaraj
19.	U14MB319	SOUNDARYA. S	II nd	Soundarya
20.	U14MB320	SOWMYA DEVI. N	II nd	Sowmya devi

RESOURCE PERSON

Dr K SELVARAJU

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OSUDU, KUDAPAKKAM, PUDUCHERRY-605 502

COORDINATOR

Raji Sharma

Dr RAJI SHARMA

Head of Dept. Anaesthesiology.
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry - 605 502

Annexure III

MCQs: CLINICAL NUTRITION

1. When the food is directly given in the veins ,it is called ___ nutrition

    a. Parenteral

    b. Enteral

    c. Intravenous

    d. Saline

2. When food is given in the stomach /intestines directly then it is ___nutrition

    a. Intravenous

    b. Saline

    c. Enteral

    d. Parenteral

3. A person who has, had a renal transplant should regulate the intake of

    a. Carbohydrates

    b. Proteins

    c. Fat

    d. Vitamins

4. To overcome diabetes, a person can increase the intake of___and reduce the intake of ___

    a. Carbohydrates , proteins

    b. Proteins , fats

    c. Fats, carbohydrates

    d. Carbohydrates, fats

5. For a person suffering from problems like slow neural transmission eg: dementia ,they should be given

a. Increased sodium

b. Increased potassium

c. Increased calcium

d. Increased magnesium

6. A person who is suffering from high blood pressure should cut down on____

a. Sodium

b. Potassium

c. Calcium

d. Magnesium

7. Long period of parenteral nutrition is not recommended because of

a. It increase the toxicity of blood

b. It puts pressure on the kidney

c. It will put pressure on the heart

d. It causes the cell pack to degenerate

8. In case of muscle fatigue, which of the vitamin should be taken

a. A

b. D

c. E

d. K

9. Which vitamin in large amount harms the bone

a. A

b. B

c. C

d. D

10. In case of renal insufficiency what should be taken in place of protein

a. Glucose

b. Vit. K

c. Triglycerides

d. Essential amino acids

Renjith. J

Annexure III

MCQs: CLINICAL NUTRITION

8/10

1. When the food is directly given in the veins ,it is called ___ nutrition

   a. Parenteral

   b. Enteral

   c. Intravenous

   d. Saline

2. When food is given in the stomach /intestines directly then it is ___nutrition

   a. Intravenous

   b. Saline

   c. Enteral

   d. Parenteral

3. A person who has, had a renal transplant should regulate the intake of

   a. Carbohydrates

   b. Proteins

   c. Fat

   d. Vitamins

4. To overcome diabetes, a person can increase the intake of___and reduce the intake of ___

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10. In case of renal insufficiency what should be taken in place of protein

a. Glucose

b. Vit. K

c. Triglycerides

d. Essential amino acids

Gindho. H

Annexure III

MCQs: CLINICAL NUTRITION

7/10

1. When the food is directly given in the veins ,it is called ___ nutrition

   a. Parenteral

   b. Enteral

   c. Intravenous

   d. Saline

2. When food is given in the stomach /intestines directly then it is ___nutrition

   a. Intravenous

   b. Saline

   c. Enteral

   d. Parenteral

3. A person who has, had a renal transplant should regulate the intake of

   a. Carbohydrates

   b. Proteins

   c. Fat

   d. Vitamins

4. To overcome diabetes, a person can increase the intake of___and reduce the intake of ___

   a. Carbohydrates , proteins

   b. Proteins , fats

   c. Fats, carbohydrates

   d. Carbohydrates, fats

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d. D

10. In case of renal insufficiency what should be taken in place of protein

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b. Vit. K

c. Triglycerides

d. Essential amino acids

Annexure V

Student Feedback Form

Course Name: **CLINICAL NUTRITION**

Subject Code: **ANAES 02**

Name of Student: _____ Roll No.: _____

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear					
2	Course contents met with your expectations					
3	Lecturer sequence was well planned					
4	Lectures were clear and easy to understand					
5	Teaching aids were effective					
6	Instructors encourage interaction and were helpful					
7	The level of the course					
8	Overall rating of the course	1	2	3	4	5

**** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory***

Suggestions if any:

Annexure V

Student Feedback Form

Course Name: **CLINICAL NUTRITION**

Subject Code: **ANAES 02**

Name of Student: RUBINA.S Roll No.: U14MB304

We are constantly looking to improve our classes and deliver the best training to you.

Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear				✓	✓
2	Course contents met with your expectations					✓
3	Lecturer sequence was well planned				✓	
4	Lectures were clear and easy to understand			✓		
5	Teaching aids were effective		✓			
6	Instructors encourage interaction and were helpful					✓
7	The level of the course			✓		
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory*

Suggestions if any:

Need More course content

Annexure V

Student Feedback Form

Course Name: **CLINICAL NUTRITION**

Subject Code: **ANAES 02**

Name of Student: SARAN.B Roll No.: U14MB308

We are constantly looking to improve our classes and deliver the best training to you. Your evaluations, comments and suggestions will help us to improve our performance

Sl. NO	Particulars	1	2	3	4	5
1	Objective of the course is clear					✓
2	Course contents met with your expectations				✓	
3	Lecturer sequence was well planned					✓
4	Lectures were clear and easy to understand			✓		
5	Teaching aids were effective				✓	
6	Instructors encourage interaction and were helpful		✓			
7	The level of the course				✓	
8	Overall rating of the course	1	2	3	4	5

** Rating: 5 – Outstanding; 4 - Excellent; 3 – Good; 2– Satisfactory; 1 - Not-Satisfactory*

Suggestions if any:

NIL

Date: 15.05.2021

From
Dr. Nithianandam
Professor and Head,
Department of Anaesthesia
Sri Lakshmi Narayana Institute of Medical Sciences
Puducherry

To
The Dean,
Sri Lakshmi Narayana Institute of Medical Sciences
Puducherry

Sub: Completion of value-added course: Clinical nutrition

Dear Sir,

With reference to the subject mentioned above, the department has conducted the value-added course titled: Clinical Nutrition in January-June 2021 for 20 students. We solicit your kind action to send certificates for all the participants, whose name list is attached with this letter. Also, I am attaching the photographs captured during the conduct of the course.

Kind Regards,

Dr. S Nithianandam

Head of Dept. Anaesthesiology,
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry - 605 502.

Encl: Certificates

Photographs

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that _SHALINI T C____ has actively participated in the Value Added Course on Clinical Nutrition held during January - June 2021 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

DEPARTMENT OF ANAESTHESIOLOGY
SRI LAKSHMI NARAYANA INSTITUTE OF MEDICAL SCIENCES
OSUDU, KOOPAKKAM, PUDUCHERRY-605 502

Dr.SELVARAJU K

RESOURCE PERSON

Dr. NITHIANANDAM S

COORDINATOR

Head of Dept. of Anaesthesiology
Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry - 605 502.

Sri Lakshmi Narayana Institute of Medical Sciences

Affiliated to Bharath Institute of Higher Education & Research

(Deemed to be University under section 3 of the UGC Act 1956)

CERTIFICATE OF MERIT

This is to certify that __SANTOSH KUMAR L_____ has actively participated in the Value Added Course on Clinical Nutrition held during January - June 2021 Organized by Sri Lakshmi Narayana Institute of Medical Sciences, Pondicherry- 605 502, India.

Dr.SELVARAJU K

RESOURCE PERSON

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OSUDU, KUDAPAKKAM, PUDUCHERRY-605 502

Dr. NITHIANANDAM S

COORDINATOR

Sri Lakshmi Narayana Institute of Medical Sciences
Osudu, Kudapakkam, Puducherry - 605 502


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AI TRIPLE CAMERA