5

Nutritional requirements

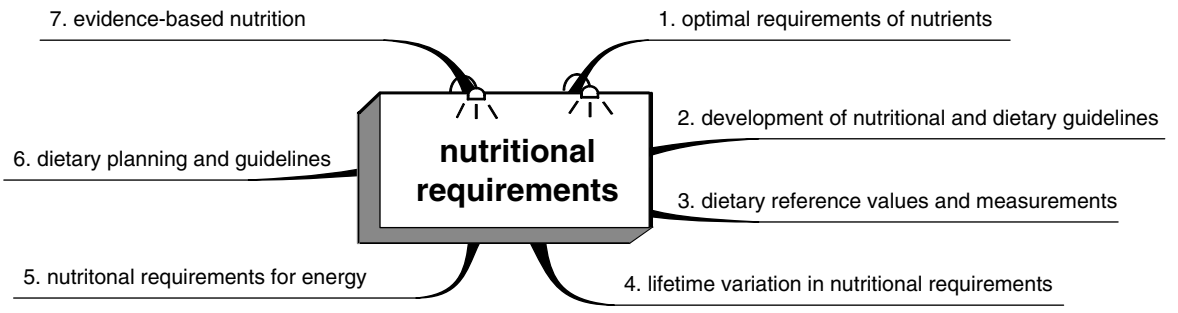

Fig. 5.1 Chapter outline.

OPTIMAL REQUIREMENTS OF NUTRIENTS

Individual nutritional requirements are determined by age, gender, environment, and genetic and isoenzyme constitution. The amount of intake for energy must be sufficient for childhood growth and adult work, leisure activities, pregnancy and lactation. The needs for a growing child who is physically active and laying down a wide range of tissue types, including neural, brain, muscle, enzyme systems, liver tissue, bone and connective tissue, are in contrast to those of the mature, exercising young adult in the physical prime of life. The pregnant or lactating woman's needs will be of a different qualitative and quantitative nature. The teenage mother who is growing as well as sustaining a growing infant has added needs. As the person ages the body requires much more care and maintenance as all activities reduce in intensity. The energy requirements of the elderly fall, but the nutrient requirement remains. The requirement for nutrients, i.e. essential constituents of the diet, may remain unchanged during these phases of life.

The concepts of an energy-dense and a nutrient-dense diet are important.

Requirements are also altered by stress, illness, smoking and trauma, and the extent to which these needs are met depend on the financial status of the person and the community. Adequate nutrition cannot be assumed, just because there are no obvious clinical features of deficiency disease. Indeed, some degree of malnutrition has been identified in a significant proportion of the hospital populations of affluent countries.

Optimal dietary requirements are those dietary intakes of nutrients that are most likely to ensure that the individual will attain optimum potential nutritional status for:

- successful development *in utero*
- growth
- learning potential

- quality of life
- body function
- successful pregnancies
- adequate milk production for a baby's needs
- expectation of a long and healthy life
- freedom from infection
- resistance to disease and response to diseases.

Appropriate nutrition requires that all nutrients, carbohydrates, lipids, proteins, minerals, vitamins and water are taken in adequate amounts and in the correct proportions. This is essential for normal organ development and function, reproduction, repair of body tissues, and combating stress and disease. Many nutrients require the presence of other nutrients if they are to fulfil their activity within the body.

Each nutrient is required at a certain level. The amount recommended will always exceed the precise needs because of the inefficiency of biological processes:

- **basal requirement**: that which is required to protect against clinical impairment of function due to insufficient intake
- **storage requirement** allows the body to maintain body tissue reserves. The reserve provides a supply of nutrient that can be mobilised without detectable impairment of function.
- the level required to **maximise health** and improve quality of life
- the level to required to **avoid chronic disease**.

Nutritional requirements meet:

- **fixed energy expenditure**, i.e. basal metabolic requirements, e.g. breathing, cardiac output, intestinal peristalsis
- **variable energy expenditure**, i.e. growth, movement (exercise, eating and drinking , exercise and work) on heat production, digestion, breathing, cardiac output , renal function, nervous system during active periods; also pregnancy and lactation

The variable energy output of the child and young mother is enormous, and therefore the ratio of fixed to variable energy expenditure is high. In contrast, the energy expenditure of the elderly person is much smaller and consequently the fixed to variable energy expenditure ratio is small.

Nutritionists must make recommendations based on scientifically generated facts giving guidelines for groups and individuals in the community. The definition of dietary requirements is very exacting. The important question is: requirements for what? An example of the complexity facing scientific committees is giving recommendations for the daily requirements for folic acid (200 μg/day). There are two groups in which, the recommended intake at 400 μg/day, is double, the recommended intake for the population. One group is women contemplating pregnancy and who wish to minimise the risks of neural tube defects in the baby. Another group of adults needs to reduce the plasma homocysteine concentration to reduce the risk of coronary heart disease. An intake of 400 μg/day of folic acid is only achievable through fortified foods or supplementation in tablet form, and is not possible by eating unfortified foods alone.

The fulfilment of nutritional needs is dependent on agricultural economic effectiveness, particularly in developing countries. The recognition of this basic premise has been essential for the survival of every major civilisation. The development of farming as an industry means that the whole process of food production, which is central to the health of a community, requires supervision by agencies independent of but reporting to parliament or government. Examples are the Food Standards Agency (FSA) in the UK, Agence Française de Sécurité Sanitaire des Aliments in France, and the Food and Drug Administration (FDA) in the USA.

DEVELOPMENT OF NUTRITIONAL AND DIETARY GUIDELINES

Every parent endeavours to advise their children on what to eat. Throughout history, there has been literature offering dietary advice, e.g. in the Old Testament and the Koran there are important standards for clean food policies. W.O. Atwater was the first director of the Office of Experimental Stations in the US Department of Agriculture. In 1894, he published a table of food composition and dietary standards for the US population. Atwater's dietary standards were intended to indicate the average needs of humans for total calories, protein, fat and carbohydrate. Minerals and vitamins had yet to be

identified. At the beginning of the twentieth century Caroline Hunt further classified food into five groups: milk and meat, cereals, vegetables and fruit, fats and fatty foods, sugars and sugary foods. The amounts of foods were written as guides for the average family household units in familiar terms.

The recession and poverty of the 1930s changed the way in which these guides were required. Until then, ignorance was regarded as the basis of inadequate nutrition. With the recession poverty became an important factor, and cost-effective guidance became necessary. The food planners recognised that cereal foods, potatoes and dry beans supply energy and nutrients in a cheap form. Hazel Stiebeling, the writer of these new guides, drew attention to the importance of a balance between 'nutrient-dense, protective foods', e.g. calcium, vegetables and fruit, and 'high-energy and protein foods'.

The first recommended daily requirements or allowances/amounts (RDAs) were defined in the USA in 1941, and listed specific recommendations for calories and protein, iron, calcium, vitamins A and D, thiamin, riboflavin, niacin and ascorbic acid. It was essential to reinforce these with health education. In 1943 the 'basic seven' food guide was issued. Scientific RDAs were translated into ordinary foods, a format useful for the population at large. The foods that were to be eaten on a regular basis were green and yellow vegetables, oranges, tomatoes and grapefruit, potatoes and other vegetables, fruits, milk and milk products, meat, poultry, fish, eggs, dried peas and beans, bread, flour and cereals, butter and fortified margarine.

This guide also used exchanges, so that if fruit was scarce then vegetables could be an alternative. These recommendations were expanded in 1946 into a National Food Guide with recommended servings. By 1958 a simpler system was devised, with four basic food groups and a daily minimum of two helpings from four food groups: milk and milk products, meat, fish, poultry, eggs, dry beans and nuts, and four servings each of fruit and vegetables and grain products. This was a basic diet with the expectation that other foods would be eaten.

In Britain in 1940, Robert McCance and Elsie Widdowson published the Food Composition Tables, the first tables showing the chemical composition of food. They became a framework in the dietary treatment of disease and in any quantitative study of human nutrition. These tables included composition data for raw and cooked food, complete with the sources and description of the foods and recipes used in calculating the composition of the cooked dishes of the foods analysed. These tables revolutionised nutritional practice in Britain, not least in planning food rationing during the Second World War when Britain was dependent on home-grown food.

Rationing in Britain during the Second World War was a triumph for applied nutrition. A precedent had been established in Britain during the First World War, when German submarine warfare had severely restricted the importation of food and rationing was necessary. Food was scarce, but no allowances were made for the needs of the elderly and children. In January 1918 sugar and butcher's meat were rationed, to ensure rather than to restrict supplies. During the 1930s, McCance and Widdowson had tested restricted but nutritionally complete diets under experimental conditions in normal day-to-day life. These diets met the nutritional standards of the time. In 1936, Boyd-Orr in Aberdeen published a report of a dietary survey, *Food, Health and Income*, which showed that half of the surveyed British population could not afford a diet supplying the basic nutrients, and 10% of the population was undernourished. When the war began it soon became apparent that imported foods such as tea and sugar would be in short supply. Equal shares for all were established in 1939 with the introduction of ration books. Rationing, which also included clothing, continued until 1954. This dietary regime proved to be healthy and practical, and particularly when supplemented by vegetables grown in the garden and allotments. (The government leased ground taken from parks and waste-ground.) The diets of babies, children and pregnant mothers were supplemented by additional rations. Infant mortality fell during the war, helped by higher employment and perhaps a greater social awareness in the national effort.

The success of these programmes was such that by the 1970s a new approach was needed for the affluent countries, where advances in agriculture were yielding a sufficiency and variety of food. Instead of the primary concern being whether the population was eating adequately and avoiding nutritional deficiencies, it became necessary to tackle the epidemics of diseases associated with

Food rations (weekly except where otherwise stated) for one person in Britain in 1942

• Bacon and ham	100 g
• Meat	Up to 6p worth (e.g. a pork chop and four sausages)
• Sugar	225 g
• Butter, margarine or lard	225 g
• Tea	50 g
• Cheese	50 g
• Milk	1800 ml
• Sweets	350 g every 4 weeks
• Jam	450 g every 2 months

incorrect balances in nutrient intake, excess energy, sugar and saturated fat, insufficient polyunsaturated fats and dietary fibre.

In 1977, *Dietary Goals for the USA* was prepared by a US Senate Select Committee. Quantitative goals were laid down for the dietary content of protein, carbohydrate, fat, fatty acids, cholesterol, sugars and sodium. RDAs were issued separately. These recommendations aroused controversy.

There continues to be a public demand for authoritative, consistent and achievable food guides. In 1990 the United States Department of Agriculture published seven principal statements intended to help the citizens of the USA to minimise the risk of chronic diseases in which diet was believed to have a causative role. The Swedish recommendations are similarly simplified into a helpful diagram, a pyramid giving the foods and the proportions of such foods in daily servings. This suggested a moderate diet, which was sufficient to meet nutritional needs and provided variety.

The US FDA recommends:

- **level 1**: bread, cereal, rice and pasta, 6–11 servings
- **level 2**: vegetable group, 3–5 servings; fruit group, 2–4 servings
- **level 3**: milk, yoghurt and cheese group, 2–3 servings; meat, poultry, fish, dry beans, eggs and nut group, 2–3 servings
- **level 4**: fats, oils and sugars to be used sparingly.

The British guidelines, *Balance of Good Health*, is a food selection guide that helps people to understand and enjoy healthy eating. The guide is in a pictorial format showing a plate with the proportion and type of foods needed for a balanced diet.

The five food groups are:

• Bread, cereals and potatoes	Eat lots
• Fruit and vegetables	Eat lots
• Milk and dairy foods	Eat moderate amounts and low-fat versions where possible
• Meat, fish and alternatives	Eat moderate amounts and low-fat versions where possible
• Foods containing fat and/or sugar	Eat sparingly

It is recommended that the health benefits of eating fruit and vegetables be formulated into advice to eat 400 g of fruit and vegetables a day (varieties not specified), which translates into five portions a day.

The diet should be reduced in salt, fat and saturated fat, and alcohol intake should be moderate. The guide recommended a substantial intake of vegetables, fruit and grain products.

DIETARY REFERENCE VALUES AND MEASUREMENTS

Current recommendations for a nutrient look at the needs of healthy, normal individuals and populations and regards the body as a biochemical machine. The nutrients listed meet the basic needs of human nutrition: protein, energy, vitamin A and carotene, vitamin D, vitamin E, vitamin K, thiamin, riboflavin, niacin, vitamin B_6, pantothenic acid, biotin, vitamin B_{12}, folate, vitamin C, calcium, iron, zinc, selenium, magnesium and iodine.

Recommended nutritional or dietary allowances or intakes define the differing nutritional needs, established by physiological and metabolic studies, for defined population groups, e.g. babies, toddlers, and pregnant and lactating women, in a healthy

Table 5.1 References terms relating to energy and nutrient intake

AI	Adequate intake: if the scientific evidence is insufficient to establish a requirement, then a figure for AI is obtained from the best available information
Basal requirement	The dietary requirement of a nutrient to prevent any clinically demonstrable impairment of function (defined by FAO/WHO)
DRI (USA, Canada, 2000)	Daily reference intakes: a collective name referring to four nutrient-based reference values, EAR, RDA, AI and UL
DRV (UK, 1991)	Dietary reference value; a term used to cover LRNI, EAR, RNI and safe intake
DV (USA)	Daily values: single figures created by the US FDA. A term used in USA nutrition labelling for a reference intake level. Two types of reference intake are defined, RDI (reference dietary intake) for minerals and vitamins, and DRV (daily reference value) for certain other nutrients)
EAR	Estimated average requirement for a group of people for energy, protein, vitamins or minerals.
LRNI	Lower reference nutrient intake for protein, vitamins or minerals. An amount of the nutrient that is enough for only a few people in a group who have low needs
Normative storage requirements	The dietary requirement of a nutrient to maintain a reserve in body tissues
RDA (USA,1941)	Recommended daily allowances: the level of intake of essential nutrients considered to meet the functional needs of practically all healthy persons. Statistically, this intake would prevent deficiency disorders in 97% of the population. The term was devised to allow modification with changing knowledge and was not intended to imply a minimum or an optimal requirement. Superseded by dietary values
RDA (UK, 1979)	Recommended daily amount: the average amount of a nutrient that should be provided in a group of people if the needs of practically all members of the group were to be met. These are averages for the group, not amounts that individuals must eat. Superseded by RNI in the UK, but European RDAs are used in food labelling
RDI (UK, 1969)	Recommended daily intake of nutrients. The recommendation applies to food as actually eaten
RNI (UK, 1991)	Reference nutrient intake for protein, vitamins or minerals. An amount of the nutrient that is enough or more than enough for about 97% in a group. If the average intake of a group is the RNI, then the risk of a deficiency in the group is extremely small. The value is equivalent to RDA or RDI
Reference values for nutrient intake (German-speaking countries, 2000)	Nutrient intakes which meet the demands of 97.5% of a population group, and for evaluation of the nutrient supply of the population
Safe intake	Indicates intake or range of intakes of a nutrient for which there is not enough information to estimate RNI, EAR or LRNI. It is an amount that is enough for almost everyone, but not so large as to cause undesirable effects. An upper limit of safe intake is not, however, implied by this recommendation
UL (USA)	Tolerable upper limit: the highest amount of nutrient intake unlikely to pose any risk of adverse health effects to almost all individuals in the general population
USRDA (USA, 1968)	Recommended daily allowances: a selection of the highest values for 20 nutrients from the RDAs and used as standards for labelling

For each dietary recommendation, consideration is given to:

- function
- metabolism
- dietary intake patterns
- requirement levels for different categories of people
- toxicity
- basal requirements
- safe intake levels and intakes
- tolerable upper intake levels
- variations between individuals within a population

population. Nutritional and dietary guidelines also define intakes of individual categories of food.

It is important to distinguish requirement (for individuals) from recommendation (for populations). There is a movement towards a nutritive rather than a preventive approach. A person may meet a requirement for a specific nutrient but eat less than the recommendation for the entire population.

A requirement for a nutrient is the amount that an individual must consume to avoid deficiency as defined by clinical, physiological and biochemical criteria, and varies from individual to individual.

Various terms are used by different national authorities to prescribe or recommend values for food energy and nutrient intakes (Table 5.1). The terms reflect evolving views about guidance and prescribing recommendations for a population that is becoming more educated. The terms are gradually becoming less prescriptive and indicate best practice rather than absolute values. The original RDA values in the USA were written primarily to indicate nutrient intakes that would prevent clinical deficiency. The new approach is to maximise health and improve quality of life, including the avoidance of chronic disease, and to suggest guidelines for groups and individuals.

No single value defines the requirements of each nutrient for the whole range of people who make up a population. The notional mean requirement is the estimated average requirement (EAR) (Figure 5.2).

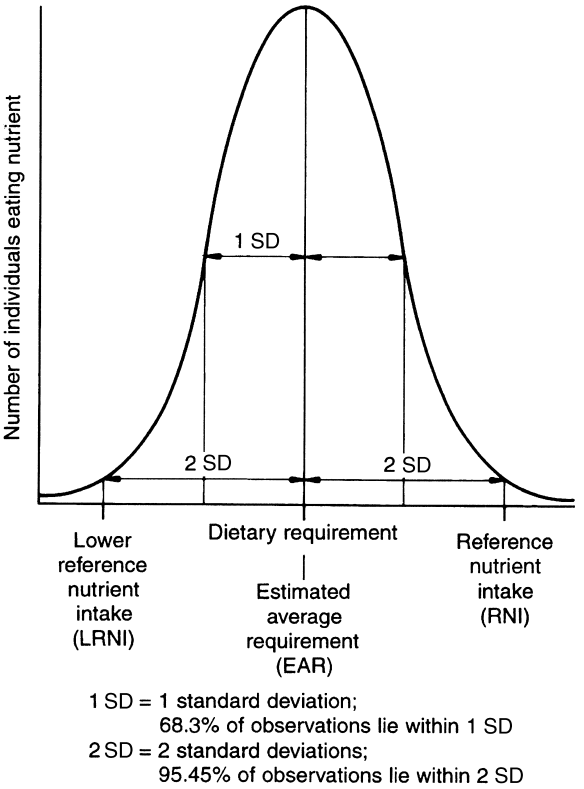

Fig. 5.2 Estimated average requirements (EAR), lower reference nutrient intake (LRNI) and reference nutrient intake (RNI). LRNI and RNI are two standard deviations below and above the EAR, respectively.

Dietary reference value (DRV) is a term used to cover LRNI, EAR, RNI and safe intake, introduced in 1991 by COMA (the UK Committee on Medical Aspects of Food and Nutrition Policy). When no DRV has been defined for a nutrient, a 'safe level' is useful for evaluating diets and for defining and reversing unsatisfactory low intake.

The UK DRVs are estimates of reference values and have moved away from the more prescriptive recommendations for intakes (e.g. RNI or RDA), although the values are similar. They are standards by which nutrients in the food eaten by different sections of the community can be defined. However, it is difficult to establish DRV with great confidence for every nutrient. There are different DRVs according to age and gender and during

pregnancy. For most nutrients no increment for pregnancy is necessary in the mature Western mother; however, the growing teenage mother or marginally sustained mother does have extra and very real needs to increase dietary intake. DRVs have been set only for infants fed with artificial feed as it is assumed that human breast milk will automatically provide all of the baby's requirements.

Expert committees in many countries have used similar principles to establish their own values, e.g. daily reference value (USA and Canada), reference values for nutrient intake (German-speaking countries) and dietary reference intakes (The Netherlands).

Every year the British National Food Survey examines the diets of the population by region and family size and income. In addition, the National Diet and Nutrition Survey has a rolling programme examining the diets of individuals within certain population groups. In this way shortcomings in the diet can be identified.

When planning diets for groups in institutions, e.g. old people's homes, prisons and the armed forces, it is important that the overall diet meets the DRVs. In planning food supplies, international agencies use reference values to plan long-term aid for developing regions and to calculate food supplies for famine relief. There are different RDAs for most countries, reflecting their respective diets.

The USA has adopted dietary reference intakes, as part of the move from avoidance of deficiency to maximising health and improving quality of life. This again is a collective term, to include estimated average requirements, recommended dietary allowance, adequate intake and tolerable upper intake level. Thresholds differ among different members of the general population and will depend on genomic constitution, age, possibly gender and the overall diet.

Many countries rely on the Food and Agriculture Organisation (FAO) and the World Health Organisation (WHO) to establish and disseminate dietary allowances. Others use their reports as the basis of their standards. The public health and clinical significance of too little and too much intake must be revised every 10–15 years as knowledge expands, and this information is specific to each country.

LIFETIME VARIATION IN NUTRITIONAL REQUIREMENTS

The requirement for a nutrient varies from one person to another, and may alter with the composition and nature of the diet as a whole. There is no absolute requirement for fat, sugars or starches, although there are for essential fatty acids, vitamins and minerals. Estimates of requirements may be made from:

- the intake of a nutrient by individuals or by groups which is associated with the absence of any signs of deficiency disease
- the intake of a nutrient to maintain a given circulating concentration or degree of enzyme saturation or tissue concentration
- the intake of a nutrient needed to maintain balance, noting that the period over which such balance needs to be measured differs for different nutrients and between individuals
- the intake of a nutrient needed to cure clinical signs of deficiency
- the intake of a nutrient associated with an appropriate biological marker of functional nutritional adequacy.

Different groups have different nutritional needs:

- **Infants**: the baby's nutritional needs are adequately provided for by its mother's milk until 4 months. WHO recommends exclusive breast feeding for about six months. Iron and iodine provided in breast milk may be inadequate but do not require supplementation. Thereafter, the increasing nutritional demands of growth require the introduction of weaning to solid food.
- **Children 1–3 years**: essential nutrients and the great energy expenditure and growth needs of the toddler must be provided by the diet.
- **Children 4–10 years**: energy and protein, vitamin and mineral intake must meet the demands of activity and growth.
- **Children 11–18 years**: energy and protein needs continue to increase, particularly for boys, who require increased intakes of vitamins and minerals. In girls, once menstruation begins there are increased requirements for iron.
- **Adults 19–50 years**: growth is completed and the frenetic activity of youth is over. Energy

requirements are reduced, but the requirements for protein and most vitamins and minerals remain the same.
- **Pregnant women**: the most important requirement is for folic acid supplementation before and in early pregnancy. There is increased requirement for some but not all nutrients to provide for the energy needs associated with the growing foetus.
- **Lactating women**: the energy demands of milk production are reflected in increased dietary requirements of protein, minerals and vitamins if maternal good health is to be maintained.
- **Adults 50+ years**: the elderly are less energetic and protein requirement is less in men, although maintained in women. After the menopause the requirement for iron is the same in women and men. Vitamin and mineral demands are unchanged, except for increased vitamin D needs after the age of 65 years.

NUTRITIONAL REQUIREMENTS FOR ENERGY

The energy requirement of an individual is the energy intake of food that will support energy expenditure requirements in a person who requires economically and socially desirable physical activity consistent with body size, composition and long-term good health.

Energy is not a nutrient but is released from the carbohydrates, fat, protein and alcohol in food, and is therefore a composite term. Energy requirements are very individual and variable, and depend on metabolic processes, physiological functions, muscle activity, heat production, growth and synthesis of new tissue. It is needed for immediate use or, in industrial terms, just-in-time energy.

There are few methods available to measure energy status, although a constant weight or a body mass index (BMI) of 20–25 is a reasonable guide. The energy requirements in healthy people could be defined as the food energy needed to maintain a predetermined BMI and physical activity. In endurance athletes the glycogen content of muscle gives a clue to stamina.

Involuntary energy expenditure consists of different components:

- resting metabolism: the energy costs of the normal metabolic processes of the body
- adaptive involuntary energy expenditure to cope with cold conditions
- energy associated with absorbing and metabolising food

The Harris–Benedict equation is used to measure basal energy expenditure (BEE). It is important that the equation is used as originally designed in 1919. The temptation is to round off the long decimal places, which introduces errors of between 7 and 55%, depending on the particular figures rounded off.

For men,

$$\text{BEE} = 66.4730 + (13.7516 \times \text{weight in kg}) + (5.0033 \times \text{height in cm}) - (6.7750 \times \text{age in years})$$

For women,

$$\text{BEE} = 655.0955 + (9.5634 \times \text{weight in kg}) + (1.8496 \times \text{height in cm}) - (4.6756 \times \text{age in years})$$

Total caloric requirements = BEE × the sum of the stress and activity factors

The **metabolic energy** content of a foodstuff is a measure of the proportion of the ingested food that appears to be available for metabolism in the body. Only after absorption does the nutrient attain full value, with the exception of proteins.

Dietary energy is the EAR for different age and gender groups. EAR for energy reflects estimates based on total energy expenditure (TEE). TEE is calculated by multiplying the basal metabolic rate (BMR) by physical activity level (PAL):

$$\text{TEE} = \text{BMR} \times \text{PAL}$$

The BMR is the rate at which the body uses energy when the body is at complete rest. Values depend on age, gender and body weight. For a 65 kg man BMR is approximately 7.56 MJ/day. For a 55 kg woman, BMR is about 5.98 MJ/day.

The PAL is the ratio of overall daily energy expenditure to BMR. A PAL of 1.9 would reflect a very active work pattern. The physical activity level of 1.4 is a minimum of activity at work and leisure. A physical activity level of 1.5 should be used for individuals aged 60 years. Old people have low levels

of energy expenditure and dietary intake, with a consequent risk of nutritional deficiency.

In the 1985 report of the FAO/WHO/UNO Expert Consultation Committee, the maintenance energy needs were calculated as 1.4 × BMR for both men and women, while the other components were expressed as a function of BMR. The average daily requirements of an elderly person might be approximately 1.55 to 1.75 × BMR.

Energy intake in excess of these requirements is stored as fat until needed. Thus, energy intake should meet just-in-time requirements.

DIETARY PLANNING AND GUIDELINES

No matter how carefully dietary guidelines are constructed, it is necessary to ensure that the population understands the thinking behind the scientific recommendations, and that the recommendations can be translated into recipes for delicious food and pleasurable meals.

Many agencies, at the local, national and EU level, along with the FAO and WHO, have made great efforts to define nutrient recommendations for their populations. The task of the FAO and WHO is particularly demanding because of the range of communities served, from the poverty-stricken in frozen, temperate and tropical countries, to the affluent and well-fed.

Dietary guidelines are also written by government agencies and associations interested in preventing and coping with specific diseases, e.g. heart disease or cancer. They aim to provide a diet that may, in their opinion, minimise the chance of acquiring such a disease.

Recommendations vary from country to country, but the general theme is as follows.

- Enjoy your food.
- Eat a nutritionally adequate diet drawn from a variety of foods.
- Reduce the consumption of fat, especially saturated fat (total fat should supply 30–35% of daily calories):
  - 8–10% of total calories from saturated fatty acids
  - up to 10% of total calories from polyunsaturated fatty acids
  - up to 15% of total calories from monounsaturated fatty acids.
- Achieve and maintain an appropriate body weigh.
- Increase the consumption of complex carbohydrates and dietary fibre.
- Reduce the intake of sodium (< 6 g/day).
- Consume alcohol in moderation (not more than 2 drinks/day). Children and pregnant women should abstain.
- Carbohydrates should provide 55–60% of the daily energy intake, a high proportion of which should be fruit, vegetables and wholewheat products. (This figure is for meat and fish eaters, and will be quite different for vegetarians.)

EVIDENCE-BASED NUTRITION

The health professions are moving towards evidence-based practice. The evidence base used in clinical decision making is supported by statistical methods that are sound and readily interpreted. Within the science of nutrition and dietetics, current thinking does not always fulfil these criteria. The statistical principles that have clinical and population consequences are different from laboratory experiments. The use of confidence limits, clinical significance curves and risk–benefit contours improves the evidence of statistical reporting and decreases the chance of results being misinterpreted.

KEY POINTS

1. Adequate nutrition requires that all nutrients, carbohydrates, lipids, proteins, minerals, vitamins and water are consumed in sufficient amounts for normal organ development and function, reproduction, repair of body tissues, and combating stress and disease. The nutrient energy intake should be appropriate for sustained activity and effective physical work.
2. Dietary reference values for food energy and nutrients include BMR (basal metabolic rate), PAL (physical activity level) and PAR (physical activity ratio). Terms relating to energy and

nutrient intakes include and have included the RDI (recommended daily intake) and RDA (recommended daily amounts) of food energy and nutrients, EAR (estimated average requirement) for a group of people, LRNI (lower reference nutrient intake) and RNI (reference nutrient intake) for protein, vitamins and minerals, safe intake and DRV (dietary reference value).
3. Dietary guidelines translate these values into practical statements, for real-life nutrition. Recommended nutrient and dietary allowances indicate the requirements of individual nutrients for defined population groups, e.g. babies, toddlers, and pregnant and lactating women. Nutritional and dietary guidelines recommend intakes of food, milk, meat and vegetables, etc.
4. The energy requirement of an individual is the level of energy uptake for food that will balance energy expenditure when the individual has a body size and composition and level of physical activity consistent with long-term good health, and allow for economically necessary and socially desirable physical activity. In women who are pregnant or lactating, the energy requirement includes the deposition of tissue or the secretion of milk at rates consistent with good health.

THINKING POINTS

1. The construction of recommendations for the intake of nutrients is a very important task for nutritionists.
2. Central to these recommendations is the science upon which the recommendations are based. How robust is the scientific background to these recommendations?
3. Also of importance are the eating habits of the populations that are to receive the recommendations.
4. What are the practicalities of food guidelines for a nutritionist?

NEED TO UNDERSTAND

1. The science of nutrition has practical objectives.
2. The guidelines must try to meet the goals and aspirations of the community being served.
3. Each generation of the community must feel well fed, and the nutritionist must also feel that that community is sufficiently fed for its needs and to allow best growth and maintenance of function.

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www.fao.org Food and Agriculture Organisation of the United Nations

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www.nas.edu US National Academy of Science, DRI updates and information

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