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Requirements in maturity and ageing

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OBJECTIVES

- To understand compression of morbidity and chronological versus biological age.
- To understand the relative importance of lifestyle factors (social activity, physical activity, food variety) in maintaining physiological and nutritional reserves and in the prevention of 'frailty'.
- To outline the food and nutrient intakes of older adults and identify groups of nutritionally vulnerable older adults at risk of protein energy dysnutrition and nutrient deficiencies.
- To appreciate how health problems in the aged may relate to nutritional status.
- To outline nutritional assessment in the aged.
- To outline strategies for healthy ageing.

THE SOCIO-DEMOGRAPHY

As a species, *Homo sapiens sapiens* are living longer than ever before with several population life expectancies at birth exceeding 80 years, and increasing by about 1 year every 3 years for the last 30 years, with part of this increased longevity occurring from ages 60 and 70 onwards. The elderly today are living almost 20 years more than their ancestors at the turn of the century. At the moment, although the proportion of centenarians is also increasing (upwards of 1 in 1000 of the population in economically advantaged countries), individuals do not appear to exceed a maximal lifespan of about 120 years. This may change as biotechnology, lifestyle and health care develop in favour of greater longevity. Like other nations, Australia is ageing. In 1861 older people aged 65 and over comprised just 1% of the Australian population; this increased to 4% at the beginning of the twentieth century, 8% in 1970 and about 12% in 1998. By 2052, it is predicted 6 million people (25% of the population) will be 65 and over. Many Australians are making it to their one-hundredth birthday, especially women (Jones 1993).

Our ability to live longer is, in part, attributable to better nutrition and to other lifestyle changes (such as reduced substance abuse, greater recreational opportunities), to improved health care (for example, reduced infant and maternal mortality, earlier diagnosis and

management of cancers and heart disease), to educational and economic improvements, and to better housing (especially less crowding) and social support systems. But as we live longer, our nutritional needs may change, either with 'healthy' ageing or because of the advent of disease. Keeping an elderly population well is of great importance for the individuals themselves, for the well-being of society in general (the transfer of knowledge and skills to younger people, especially descendants and a reduced burden on others), and for reasons of available resources to care for the aged. Remarkably, the numbers (as opposed to percentages) of elderly people in developing countries now approach and will exceed those in developed countries due to the much larger populations in the former (Grundy 1992) (Table 23.1) so that the problem is global.

COMPRESSION OF MORBIDITY, BIOLOGICAL AND CHRONOLOGICAL AGE

Ageing is not a disease. Nor are the so-called diseases of ageing—cancer, heart disease, arthritis and senility—the inevitable consequences of advancing years. If we live long enough, changes in body composition, physical function and performance will occur in all of us. Many of these changes, as well as health problems, which become more common in old age, have long been attributed to the 'normal ageing process'. This chapter, however, will highlight that these health problems can be delayed to the last few years of life (an outcome known as compression of morbidity).

Table 23.1 Proportion of the population aged 65 and over, selected countries 1985 and 2005

	% of population aged 65+	
	1985	2005
Europe		
France	12.4	14.8
Germany (FRG)	14.5	18.9
Greece	13.1	16.9
Hungary	12.5	15.0
Italy	13.0	16.9
Poland	9.4	12.3
Sweden	16.9	17.2
UK	15.1	15.3
North America		
Canada	10.4	12.5
USA	12.0	13.1
Other developed countries		
Australia	10.1	11.4
Japan	10.0	16.5
Less developed countries		
Brazil	4.3	5.8
China	5.1	7.4
India	4.3	6.1
Kenya	2.1*	2.1
Mexico	3.5	4.6

* 1988

Chronological and biological age

Ageing may be defined as chronological age (a person's age in years since birth) or biological age (the decline in function that occurs in every human being, given sufficient time). Some elderly people look and function as though they were older and others as though they were younger at the same chronological age. Prospective studies, where some assessment of biological age has been made during this century in Sweden, indicate that people are less biologically old than they used to be at the same chronological age and that this difference may be as much as ten years of biological age. This is a rather remarkable change and some of it is likely to be attributable to improved lifelong nutrition. It may well be that much of what we currently regard as ageing is preventable by nutritional means. In other words, even though genes have a strong influence on biological age, it is now believed that lifestyle factors also have a strong influence. You may be able to remain biologically younger if you look after yourself in your younger adult years. The question is, what aspects of ageing are biologically inevitable, having to do, for example, with the programmed death of cells (apoptosis) and how much is it age-related?

While the clock cannot be turned back in terms of chronological age, the search for prolonging youth continues to invoke much interest and research. Perhaps you have noticed that the older people become, the more dissimilar they become from their contemporaries of the same chronological age. By contrast, there is little biological heterogeneity amongst children. When we speak of a baby six months old or a two-year-old child, we have a fairly clear idea of what stage of growth and development has been achieved, unless there are identifiable limiting factors, like malnutrition. Some of the variability in older adults may reflect heterogeneity in true rates of ageing; however, other factors, which accompany ageing, seem to be of major importance. These include lifestyle factors such as:

- poor eating habits;
- a sedentary lifestyle;
- smoking, and the development of disease.

Each of these factors can contribute to deterioration in cardiovascular, lung or endocrine functions, thereby accelerating one's apparent 'rate of ageing'. For example, declining cardiovascular function has been observed in the Baltimore Longitudinal Study of Ageing. However, after careful exclusion of those with heart disease, no consistent declines in function with age remained. Thus the apparent declines in the study group members as they aged were due to inclusion of people with defined disease rather than to the ageing process per se. As you will read about later in this chapter, the accumulating effects of years of poor eating habits can increase the risk of many health conditions as one grows older. Yet, as you will also see, it is never too late to change (Khaw 1997; Horwath et al. 1999).

Compression of morbidity

The accumulating effects of years of poor eating habits can increase the risk of many health conditions, as one grows older. The good news is, however, that food habits may be amenable to modification. In other words, we can adopt lifestyle habits such as regular exercise and healthy eating that will slow functional declines and compositional changes within the limits set by genetics. It is possible to compress morbidity to the last few years of life (that is, increase health span potential) if we take care of lifestyle and environmental factors throughout life, even once we reach old age. For example, an exercise intervention study in mid-life has been shown to compress morbidity (measured with disability score) towards the end of life (Fries 1996). Several of the health problems and bodily changes experienced by older adults which have been attributed to the 'normal ageing process' are increasingly being recognised as linked to lifestyle or environmental factors. For example, declines in lean body mass and increases in body fat which tend to occur as people grow older cannot be entirely attributed to the ageing process per se. A major contributor to these changes is the increasingly sedentary nature of people's lifestyles as they grow older in Western countries. Social and physical activity and adequate nutrient and phytochemical intakes are now thought to be instrumental in the ability to compress morbidity towards the end of life and in maintaining or increasing physiological and nutritional reserves.

PHYSIOLOGICAL/NUTRITIONAL RESERVES AND FRAILTY

Many bodily functions remain relatively unaffected to about 75 years of age when, on average, they start to decrease more noticeably. Nutritionally related health problems are often compounded in later life by reduced physiological reserves of many organs and functions. This applies to both reduced metabolic tissues (for example, insulin resistance or reduced insulin response to a meal load or a greater glycaemic response to the same food) and organ tissues (for example, reduced cardiac reserve means that an added salt load may tip someone into heart failure whereas otherwise it would not). While a younger person will be able to consume an inadequate diet with no immediately foreseeable consequences, an elderly person is more likely to experience problems because of diminished physiological function and capacity to adjust to adverse events. Many studies have shown significant reductions in different body functions with age. These may not be inevitable, however. For example, what used to be regarded as a decline in brain function at about age 70 may not be seen until much later, raising the possibility that biological age in some body functions may be occurring at a later and later chronological age. Measures of physiological and nutritional reserves may be important indicators of health in older adults. Prevention of associated health problems may be possible if physiological and nutritional reserve levels are known. The major prevention strategies that elderly individuals can take to increase their physiological and nutritional reserves include (Wahlqvist et al. 2001):

1 engaging in physical activity, as this maintains lean muscle and bone mass, thus increasing nutritional and physiological reserves to prevent major health problems;
2 engaging in social activity;
3 avoiding substance abuse (includes alcohol, tobacco, excessive caffeine intake and unnecessary intake of medications);
4 consuming a wide variety of foods.

Frailty

Avoidance of frailty is one of the major challenges facing older people and their carers. Frailty amongst older people has been defined as:

> a condition or syndrome which results from a multi-system reduction in reserve capacity to the extent that a number of physiological systems are close to, or past, the threshold of symptomatic clinical failure. As a consequence the frail person is at an increased risk of disability and death from minor external stresses. (Campbell and Buchner, 1997)

As the number of chronic conditions increases with age they contribute to disability and frailty, which in turn reduces a person's level of independence, sometimes resulting in institutionalisation. Falls, incontinence or confusion are regarded as clinical consequences of frailty and a number of risk factors are associated with each of these conditions. The risk of falling is increased as muscle strength and flexibility decline, and if balance and reaction time are impaired. Urinary incontinence is also a risk factor for falls among elderly people. Dehydration and/or protein energy malnutrition are two nutritional factors that can contribute to the confusion often experienced by elderly adults. Urinary incontinence often results in elderly people restricting their fluid intake in an effort to control their incontinence or reduce their frequency of urination. Studies are underway in relation to the prevention and management of urinary incontinence, and there is great interest in the extent to which it is reversible.

Physical activity

> Ageing as we know it in modern society is, in many ways, an exercise deficiency syndrome, implying that we may have far more control over the rate and extent of the ageing process than we previously thought. (Fiatarone 1995)

Some of the most dramatic changes that we see with age are changes in body composition. A decline in muscle mass and increases in body fat tend to occur as people grow older—due, as we have seen, to an increasing sedentary lifestyle as much as to the ageing process per se. Reduced physical activity leads to loss of muscle, and as a direct consequence basal metabolic rate falls. A lower metabolic rate means that an individual needs to eat less in order to maintain the same body weight. If one does indeed eat less in order to avoid weight gain, rather than remaining (or becoming) active, it becomes increasingly difficult to meet the needs for essential nutrients. Without doubt, it is preferable to keep physically active, maintain muscle mass, and continue to enjoy eating.

Several studies have shown that energy and total food intakes decline with age, making a nutritionally adequate diet more difficult to achieve. Older men consume about 800 kcal less than younger men and older women, and about 400 kcal less than younger women. A reduction in basal metabolic rate (BMR) is partly responsible for this decline, but physical inactivity appears to be the major cause (James 1989). Prospective studies show that increased energy intakes of the order of 300–500 kcal per day, which is balanced with increased physical activity to avoid fat gain, confer either decreased cardiovascular mortality or decreased total mortality, and improve life expectancy (Paffenburger et al. 1993). This results in a higher plane of energy nutrition and runs counter to the disturbing advocacy that energy restriction prolongs life. The studies on energy restriction were conducted on rats and have no direct application to humans (Weindruch 1996). To suggest that elderly people restrict their food intake to prolong life is absurd when this may contribute to frailty and loss of lean mass (Khaw 1997). The evidence is, however, that any extra energy intake must be from nutrient- (and phytochemical-) dense foods, without excessive abdominal fatness (defined as an abdominal hip ratio over 0.8 for women and 0.9 for men).

Social activity

Social activity is now thought to be one of the most important determinants of longevity. Participation in fewer social activities outside the home (Welin et al. 1985) and limited social networks (Olsen et al. 1991) have been linked with higher mortality in old age. The impact of social activity on longevity could be through its impact on psychological well-being and through nutrition. For example, elderly people who are socially isolated, lonely, institutionalised, recently bereaved and socially inactive have been found to have inadequate food intakes (Horwath 1989). Glass et al. (1999) examined associations between social (for example, church-going), productive (for example, shopping) and physical/fitness activities (for example, walking) at

baseline and thirteen-year survival in 3000 older people. Social and productive activities were found to be as effective as fitness activities in lowering the risk of death. Further studies of this kind indicate the importance of social activity in the health of older people and probably younger people as well.

Food variety

There is increasing evidence that food variety or diversity is predictive of less morbidity and greater longevity. Mortality follow-up studies of elderly people aged 70 and over in Australia, Greece, Spain and Denmark have found that more varied food patterns, even as late as 70 years and onwards, could reduce the risk of death by more than 50% (see Chapter 38). In order to obtain this mortality advantage, the elderly in these studies had to have varied food patterns consistent with the following food groups, giving a score ranging from 0–8:

1 high in vegetables (>300 g/day);
2 high in legumes (>50 g/day);
3 high in fruits (>200 g/day);
4 high in cereals (>250 g/day);
5 moderate in dairy products (<300 g of milk/day or equivalent in cheese/yoghurt);
6 moderate in meat and meat products (<100 g/day);
7 moderate in alcohol (<10 g/day);
8 high mono-unsaturated fat intake (mainly from olive oil) and a low intake of saturated fat (high mono-unsaturated: saturated fat ratio).

This food pattern is consistent with food patterns prevalent in Greece in the 1960s when Greeks enjoyed the longest life expectancy in the world. What was particularly interesting was that subjects achieved greater mortality advantage if they followed the entire food pattern (that is, had high dietary variety scores >=4) as opposed to just achieving the required amount for one or two of the food groups (see Figure 23.1). This suggests that there may be synergy between the food groups and that we need to follow dietary recommendations as a whole rather than focusing on just one food group or nutrient.

Table 23.2 Mean daily food (g/day) intake of older Australians compared to their middle-aged counterparts in 1995

	65 and over		25–44 years		Recommended intake g/day*
	M	F	M	F	
N	3337	2926	4189	3321	
cereals (e.g. rice, bread)	200	150	230	170	>210 g
fruit (not juice)	179	176	127	132	300 g
vegetables (not juice)	282	244	275	220	300–375 g
milk products	340	300	390	300	450 g
meat/poultry	146	95	212	121	85 g[b]
fish & seafood	26	20	28	20	40 g[a]
legumes (+tofu)	9	3.6	11	8.4	>30 g[a]
nuts/seeds (e.g. peanut butter)	3	2	7	4	>10 g[a]
egg products	14	10	16	12	30 g or 2–4 eggs/week
snack foods (e.g. crisps)	0.8	0.4	4	4.4	
sugar products (jam, sorbet)	28	17	22	14	
confectionery (e.g. chocolate)	4	4	11	10	
fats/oils	17	12	14	9	1–2 tablespoons (~30 g)
soup	77	69	40	53	
savoury sauces	25	20	37	27	
non-alcoholic beverages (e.g. tea, juice, water)	1644	1714	2162	2004	
alcohol (pure)	15	5	20	8	men 20 g; women 10 g

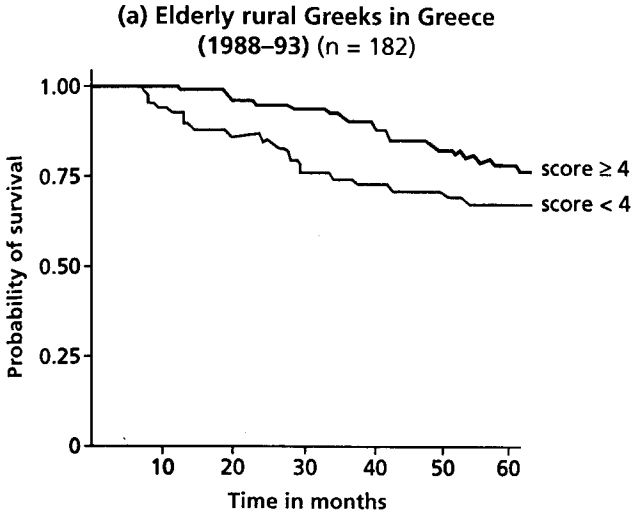
Source: ABS 1997; Horwath et al. 1999

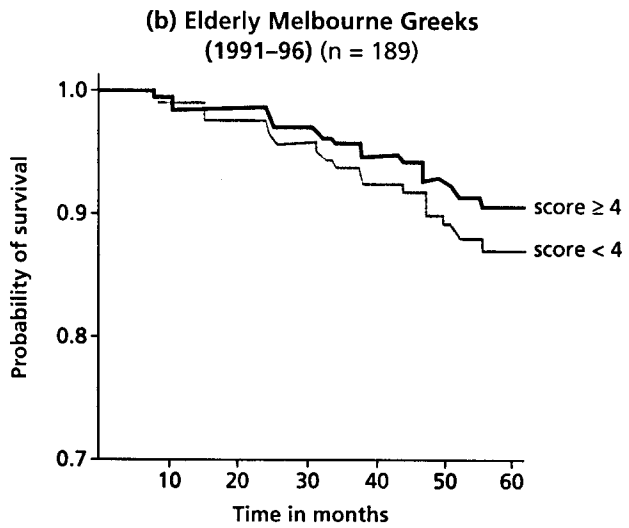
* Foods were converted to equivalents in core food groups as follows: 30 g bread is equivalent to 90 g cooked rice/pasta or 20 g breakfast cereal; 150 g fruit is equivalent to one medium fruit (apple, orange, banana, 2 apricots, 1 cup diced pieces, edible portion); 75 g cooked vegetables is equivalent to 1/2 cup or 1 cup salad vegetables; 250 ml milk is equivalent to 1/2 cup evaporated milk or 40 g cheese or small tub (200 g) yoghurt

a Based on epidemiological studies of long lived populations e.g. Greeks in Greece (Crete) in 1960s, Greek Australians, Japanese, vegetarians

b In core food groups 85 g/day of meat and meat equivalents is recommended which includes red and white meat, eggs and legumes e.g. 35 g cooked meat is equivalent to 40 g cooked fish fillet or 1/4 cup cooked beans or 1/3 cup nuts

N = number of people surveyed in the 1995 National Nutrition Survey





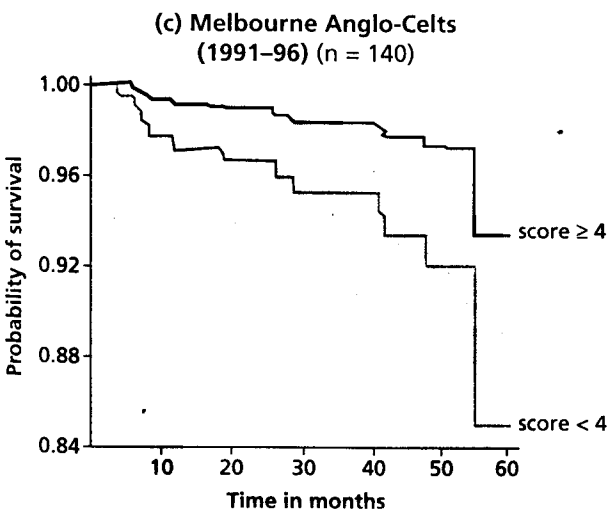


Figure 23.1 Survival by diet score (Kouris-Blazos et al. 1999, Trichopoulou et al. 1995)
(a) Reproduced with permission from BMJ publishing group. Trichopoulou et al., 1995, *BMJ* 311 : 1457–60.
(b) (c) Unpublished figures, adapted from Kouris-Blazos et al., 1999, *BJN* 82 : 57–61.

Table 23.3 Mean daily nutrient intake of older Australians compared to their middle-aged counterparts in 1995

	65 and over		25–44 years		Recommended intake	
	M	F	M	F	M, F	M, F
N	3337	2926	4189	3321	65+	19–64 yrs
Nutrients						
energy kJ	8510	6370	11725	7875		
kcal	2000	1500	2800	1900		
protein %E	17	17.6	17	17	10–15	
Total fat %E	32	32	33	33	30–35	
saturated %E	12	12	13	13	<10	
monounsaturated %E	11	11	12	12	>15	
polyunsaturated %E*						
omega-6 linoleic %E	5	5	5	5	3–5	
omega-3 linolenic %E[a]	<0.5	<0.5	<0.5	<0.5	1–2	
omega-3 EPA/DHA %E[a,b]	<0.1	<0.1	<0.1	<0.1	0.2–0.3	
carbohydrate %E	46	47	45	47	>55	
total sugars %E	21	22	19	20	<15%	
total starch %E	25	26	26	26	>40%	
dietary fibre g	24	20	26	20	>30g	
ethanol %E	5	2	5	3	<3	
vitamin A RE (mcg)	1310	1064	1334	1038	750	750
thiamin (mg)	1.6	1.2	2.1	1.4	0.9, 0.7	1.1, 0.8
riboflavin (mg)	2.0	1.6	2.5	1.8	1.3, 1.0	1.7, 1.2
niacin equivalents	39	29	54	35	16, 11	19, 13
folate (mg)	280	225	311	227	200	200
vitamin C (mg)	127	111	133	108	40, 30	40, 30
calcium (mg)	796	686	990	762	800, 1000	800
phosphorus (mg)	1420	1132	1867	1300	1000	1000
magnesium (mg)	334	268	392	284	320	320
iron (mg)	14	11	17	12	7, 5–7	7, 12–16
zinc (mg)	11	9	15	10	12	12
potassium (mg)	3232	2626	3818	2816	1950–5460	1950–5460

Source: ABS 1997; Horwath et al. 1999

a Sinclair et al. 1998

b EPA = eicosapentaenoic acid; DHA = docosahexaenoic acid

N = number of people surveyed in the 1995 National Nutrition Survey

E = energy

FOOD AND NUTRIENT INTAKES OF OLDER ADULTS

Contrary to the popular 'tea'n'toast' myth, it appears that many older adults outside institutions eat reasonably well (Horwath et al. 1999). The dietary patterns of older adults have generally been found to be similar to or healthier than those of their younger counterparts (see Tables 23.2 and 23.3). Nevertheless their intakes of cereals, fruit, vegetables and milk products are still below the recommended amounts. A newspoll conducted nationally in September 1998 reported that nine out of ten Australians over the age of 60 are not eating the recommended dietary intake of fruit and vegetables and that more than one in five (22%) women in this age group lack the motivation to prepare a meal, especially if living alone (Newspoll 1998).

Energy intakes fall with advancing age (from 2800 kcal to 2000 kcal for men and from 1900 kcal to 1500 kcal for women), but average intakes of protein, total fat, polyunsaturated omega-6 linoleic acid, vitamin A, thiamin, riboflavin, niacin, vitamin C, iron and phosphorus remain adequate in the 65-plus age group. Saturated fat and refined carbohydrates (high sugar content) continue to be consumed in excess of the recommended and mono-unsaturated fats, omega-3 fatty acids (from plants and fish), unrefined carbohydrates, fibre, folate, vitamin B-6, calcium, magnesium and zinc tend to be below the recommended intakes. These intakes may not result in the appearance of any

diagnostic features or symptoms of true deficiency, but may result in subtle or subclinical nutrient deficiencies. Mild vitamin and mineral deficiencies are common in older persons, particularly those in institutions, and have been associated with cognitive impairment, poor wound healing, anaemia, bruising, and an increased propensity for developing infections, neurological disorders, stroke and some cancers (for example, vitamin A deficiency is associated with lung cancer).

NUTRITIONALLY VULNERABLE OLDER ADULTS

In developed countries 30–50% of older adults have been reported to be at high risk of developing health problems as a result of an inadequate food and nutrient intake. There are some sub-groups within older populations who appear more likely to be consuming inadequate diets (for example, less regular consumption of cooked meals). In Australia in 1998, 50% of older people lived with their partner and 63% lived with at least one relative; 28% lived alone and 6% in cared-for accommodation. An elderly person may eat less food for several reasons (see Table 23.4). Medications, depression, dementia, chronic illness, disability, loneliness and diminished senses of smell and taste may decrease the pleasure of eating. Changes in taste are variable and are often associated with lifelong cigarette smoking, poor dental hygiene, and disease. This phenomenon partly explains why older people tend to increase salt intake and use caffeinated beverages (caffeine also increases their appetite) (Schiffman 1987). Ageing is associated with a decrease in the opioid (dynorphin) feeding drive and an increase in the satiety effect of cholecystokinin, which is a peptide hormone produced in the gut with eating. Recent studies suggest that the early satiety in older persons may be caused by a nitric oxide deficiency, which decreases the adaptive relaxation of the fundus of the stomach in response to food. Food beliefs in relation to health can be strongly held among elderly people and lead to both food faddism and undesirable food avoidance. There may be a significant association between food beliefs and food habits as evidenced in studies of various elderly communities around the world (Kouris et al. 1991; Wahlqvist et al. 1995). Nutrients at greater risk of inadequate intakes in 'at risk' elderly groups are listed in Table 23.5. Low intakes of these nutrients have important implications for bone health (calcium), wound healing (zinc, protein, energy), impaired immune response (zinc, vitamin B-6, protein, energy) and vascular disease via elevated homocysteine levels (folate, vitamin B-6).

Table 23.4 Nutritionally vulnerable 'at risk' groups within older populations who are more likely to consume inadequate diets (e.g. less regular consumption of cooked meals) and to be at risk of protein energy dysnutrition

- institutionalised
- older men living alone
- low socioeconomic status groups
- socially isolated, the lonely
- recently bereaved
- depressed/cognitively impaired
- physically and socially inactive
- physically handicapped, impaired motor performance and mobility
- presence of chronic diseases e.g. arthritis, diabetes, hypertension, heart disease, cancer
- polypharmacy (unnecessary intake of medications, drug-nutrient interactions, some drugs affect appetite/mood and cause nausea)
- sensory impaired—taste/smell (reduction in taste), eyesight (cataract)
- reduced sense of thirst (hypodypsia)
- problems with chewing (loss of teeth and poorly fitting dentures)
- limited food storage, shopping difficulties, inadequate cooking skills
- erroneous beliefs and food faddism, food preferences

Protein energy dysnutrition

It is usual to speak about protein energy malnutrition (PEM), otherwise known as protein calorie malnutrition (PCM), but in the aged, the body compositional disorder may be rather more complex. The most common nutritional scenario in the aged is a decrease in lean mass (comprising water and protein-

Table 23.5 Nutrients at greater risk of inadequate intakes in 'at risk' elderly groups

- energy
- protein
- calcium
- zinc
- magnesium
- vitamin B-6
- folate
- vitamin B-12
- water

Source: SENECA 1991; Horwath et al. 1999

dominant tissues such as muscle and organs such as the liver, and also bone) and an increase in abdominal fat. This disorder could not be described as PEM, but can be described as protein energy dysnutrition (PED). Illness or inadequate food intake may result in PED, a condition more common among elderly adults, especially in institutional care. It is associated with impaired immune responses, infections, poor wound healing, osteoporosis/hip fracture, decreased muscle strength (frailty), and is a risk factor for falls in the elderly. About 16% of elders living in the community consume <1000 kcal/day, an amount that cannot maintain adequate nutrition. Undernutrition also occurs in 3% to 12% of older outpatients, 17% to 65% of older persons in acute care hospitals, and 26% to 59% of older persons living in long-term care institutions.

Studies show that being underweight in middle age and later places a person at greater risk of death than being overweight (see Figure 23.2). Marasmus is a condition of borderline nutritional compensation in which there is marked depletion of muscle mass and fat stores but normal visceral protein and organ function. Because there is a depletion of nutritional reserves, any additional metabolic stress (such as surgery, infection, burn) may rapidly lead to kwashiorkor (hypoalbuminemic protein energy malnutrition). Characteristically, elderly people deteriorate to this state more rapidly than younger people; even relatively minor stress may be the cause. Usually, susceptible elderly people are underweight, but even those who appear to have ample fat and muscle mass are susceptible if they have a recent history of rapid weight loss.

Inadequate intake of vitamins and minerals

Folate

Folate is a common vitamin deficiency due to low intake and can result in macrocytic anaemia and increased risk of cardiovascular disease through elevated homocysteine levels.

Although food fortification and supplementation may reduce problems, these approaches may also unmask vitamin B-12 deficiency and the adverse effects of this on the central nervous system. This is a particular problem among the aged due to atrophic gastritis. It is possible, however, to overcome this problem by a substantial increase of B-12 beyond the RDI, to about 50–100 μg per day of hydroxocobalamin.

Vitamin B-6

During the course of life, plasma vitamin B-6 falls by approximately 3.6 nmol/l per decade. A number of studies suggest age-related changes occur in both the absorption and metabolism of this vitamin and as a consequence aged adults may have a higher requirement. Supplementation in healthy elderly people has been found to improve immune function and long-term memory.

Vitamin B-12

The prevalence of pernicious anaemia increases with age as does atrophic gastritis and the absorption of vitamin B-12 is reduced in individuals with either condition. Probably the most important change in the digestive system as we grow older is the reduction in stomach acid production in a sub-group of older people who have atrophic gastritis. This atrophy of the stomach mucosa becomes more common with ageing and appears to affect about one-third of those over 60 years. This can reduce the availability for absorption of vitamin B-12, calcium, iron and folate and result in elevated homocysteine levels. The prevalence of *Helicobacter pylori* also increases with age and has been shown to be associated with vitamin B-12 malabsorption, possibly because it contributes to gastric atrophy. As the likelihood of vitamin B-12 deficiency is more common among older adults, this not only increases the risk of irreversible neurological damage but is likely also to contribute to megaloblastic anaemia and homocysteine concentrations associated with vascular disease.

Zinc

Zinc plays an important role in wound healing, taste acuity and normal immune function and may affect albumin status in older adults. It is a crucial element in numerous metalloenzymes, and its intake is dependent on foods such as meat and to a leaser extent from plant foods, in which it is found bound to phytic acid, oxalate and dietary fibre. It is more bioavailable in cereals that are leavened because of the presence of phytase in yeast. Low zinc intakes are associated with low energy and meat intakes. Zinc deficiency in older people is likely to be an important contributor to proneness to infection and proneness to respiratory infection, especially pneumonia.

Calcium

Postmenopausal women not on hormone replacement therapy have higher calcium needs. Many women do not meet the current Australian recommended calcium intake for postmenopausal women (1000 mg/day). Recent studies suggest that postmenopausal women need 1500 mg calcium per day to attenuate bone loss and reduce the risk of fractures, at least in Western food cultures (this may not be the case where the food culture has other bone protection components, such as soy).

Fluids and dehydration

As we age we have a blunted ability to defend ourselves against dehydration. This occurs because of the reduced sensation to thirst and a decline in kidney function (Wahlqvist et al. 1995). To avoid dehydration (and constipation) it is advisable to consume at least four large cups of water or other fluids like tea (which has the added benefit of containing antioxidant phytochemicals) irrespective of thirst. Consuming food with high water content such as fruit will also help hydration status (see Chapter 18).

NUTRITION RELATED HEALTH PROBLEMS WITH AGE

There is growing awareness that the major health problems, and even mortality, in the aged do have nutritional contributors and can be (in part) prevented with food intake. These health problems do not necessarily need to occur with ageing and death can be delayed. As the number of chronic conditions increases with age they contribute to disability and frailty, which in turn reduces a person's level of independence, sometimes resulting in institutionalisation. The primary nutritional problems affecting the elderly are:

- protein energy dysnutrition
- subclinical/mild vitamin deficiencies, trace mineral deficiencies
- obesity

all of which can contribute to the development of chronic conditions seen with ageing. Some common nutrition-related problems in the aged are outlined below (Wahlqvist et al. 1999).

Sarcopenia

There are numerous elderly persons who appear to experience prematurely the ravages of final ageing and develop a level of wasting that is now called sarcopenia. The prevalence, incidence and cause of sarcopenia require further study. Factors contributing to sarcopenia are poor nutrition (especially inadequate energy and protein intake), inactivity, disease and 'ageing'. The condition or state of sarcopenia, literally deficiency of flesh or muscle that occurs with age, is more marked in women and it has been shown that reduced muscle mass is a direct cause of the age-related decrease seen in muscle strength. Furthermore, this decline in muscle strength is responsible for much of the disability observed in older adults and, in the old elderly, muscle strength is a crucial component of walking ability. There is a general acceptance that it might have something to do with nutritional status. Nutritional factors that contribute to sarcopenia include an inadequate intake of energy or protein that may be due to poor food intake and or disease. Protein requirements of elderly people may be higher than that currently recommended (0.91 as opposed to 0.75 g protein/kg/d). Physical activity appears to be important as inactivity or immobilisation leads to muscle wasting.

Obesity

Overweight and obesity are common problems in the aged—not because they are an inevitable part of growing older, but because of sedentary lifestyles. The consequences of obesity may differ in elderly people compared with younger adults. Weight change, and especially weight loss, are of greater concern than over-fatness. The prevalence of people becoming under-weight has been shown to rise with age. Lower body weight has been more strongly linked with morbidity in the elderly than mild to moderate excess weight, and the problem is often insidious. Though a less serious problem in older persons than protein energy dysnutrition, obesity can impair functional status, increase the risk of pulmonary embolus and pressure sores, and aggravate chronic diseases such as diabetes mellitus and hypertension. On average, the basal metabolic rate drops by 10% and spontaneous physical activity drops by about 15%. The drop in energy expenditure with age means that in order to maintain body weight, the average 50-year-old needs to eat around 25% less than

they ate at age eighteen. An alternative would be to increase the amount of movement during the day by 25%. This would mean an extra hour of moderate intensity activity like walking, or half an hour of more intense exercise like jogging. The health implications of being overweight in old age are controversial. To reach later life successfully, one needs to be in the preferred BMI range of 20–25 kg/m^2, and with a favourable abdominal (waist) hip ratio. Survival rates in Finnish elderly (85+ years) over a five-year period showed the highest mortality to be in those elderly with a body mass index (BMI; in kg/m^2) less than 20 kg/m^2. The lowest mortality was in the group with a BMI of 30 or more (Mattila et al. 1986). Other studies have shown that the elderly with BMIs below 27 kg/m^2 lived shorter lives than those with higher BMIs. Greater body fatness, especially if centrally distributed, still increases the risk of insulin resistance, hypertension and hypercholesterolaemia in the aged. On the other hand, heavier women have a lower risk of hip fracture. This is partly due to 'padding' and better muscles, but may also be due to maintenance of higher oestrogen levels from the conversion of precursor steroids to oestrogen in adipose tissue. Abdominal obesity is defined as abdominal circumference >102 cm for men, >88 cm for women. Interestingly, in some older adults there may be an inappropriate sense of need for weight change and this could lead to disordered eating behaviour. This type of behaviour might include: prolongation of a minor eating disorder from earlier life, preoccupation with the major morbidities and mortalities associated with later life, social isolation, physical handicaps, emotional difficulties and impaired cognitive function.

Diabetes

Ageing is associated with an increased prevalence of non-insulin dependent diabetes and glucose intolerance. Two risk factors associated with the development of both these conditions include obesity and physical inactivity. In older adults, weight reduction, including modest reductions, can contribute to improvements in diabetic control in older people. This is important as retrospective studies indicate good blood glucose control reduces the likelihood and severity of stroke, CVD, visual impairment, nephropathy, infections, as well as cognitive dysfunction.

Cardiovascular disease (CVD)

CVD is the most common cause of death and disability in the developed world. Cholesterol is one risk factor for coronary heart disease; however, not everyone with a high level of cholesterol will develop premature heart disease and having a low blood level of cholesterol is not necessarily protective. Furthermore, the relationship between cholesterol and heart disease in older adults has not been investigated fully especially in adults over 70 years of age. There are a number of dietary factors that are likely to be protective and these include limiting saturated fat as well as including a variety of fats from different food sources, such as nuts and fish. For instance, fish (a good source of omega-3 fats) appears to be protective against coronary heart disease and its regular consumption (more than once a week) has been associated with a reduced incidence of stroke and coronary heart disease mortality. Vitamin E, an antioxidant found predominantly in vegetable oils and nuts, may also play a protective role in coronary heart disease. Three vitamins that may be important in the prevention of coronary heart disease and stroke include folate, vitamin B-6 and vitamin B-12. Low intakes of these vitamins can lead to a buildup of an amino acid known as homocysteine, which is toxic to blood vessels. High blood levels of homocysteine appear to increase the risk of coronary heart disease and have been associated with narrowing of the carotid artery.

Immune dysfunction

The decline observed in immune function with ageing may be prevented with nutrient intakes greater than that currently recommended for 'normal' health. Nutrients found to be important in immune function include: protein, zinc, vitamin C, vitamin B-6 and tocopherols. Other components of food not considered to be essential for health may become so with age. For example, glutamine, a non-essential amino acid stored primarily in skeletal muscle, is utilised by intestinal cells, lymphocytes and macrophages, and is required for the synthesis of DNA and RNA. The rate of glutamine formation and availability may be compromised in older people as a consequence of the reduced contribution of skeletal muscle to whole body protein metabolism. This in turn may adversely affect immune function resulting in a less favorable response to infection or trauma. Glutamine can be synthesised from glutamic acid. Glutamic acid is

found in wheat, soy beans, lean meat and eggs. Glutathione, and phytochemicals such as flavonoids and carotenoids, also appear to play a role in immune function. Meat is a good source of glutathione with moderate amounts being found in fruits and vegetables. Whey proteins, although low in glutathione, are capable of stimulating endogenous glutathione production.

Cancer

Specific dietary patterns that protect against cancer remain unclear. However, certain food groups are associated with a reduced risk of cancer, for instance a high intake of fruit and vegetables appears to be associated with a reduced risk of cancer at many sites (see Chapter 32). Fruit and vegetables are excellent sources of antioxidants, phytochemicals and dietary fibre. Particular foods that may protect against prostate cancer include soy products, tomatoes and pumpkin seeds. Foods high in resistant starch, dietary fibre and salicylates may protect against colorectal cancer. Foods that appear to increase risk of cancer at specific sites include salt and smoked/cured foods (stomach cancer) and alcohol (oesophageal cancer). Factors that occur early in life may affect the risk of breast cancer in later life. For instance, rapid early growth, greater adult height and starting menstruation at a younger age are associated with an increased risk of breast cancer. Although it is unlikely appropriate interventions could be undertaken to avoid these, there are other nutritional and lifestyle factors that are amenable to change and may reduce the risk of breast cancer. These include consuming diets high in vegetables and fruits, avoiding alcohol, maintaining a healthy body weight and remaining physically active throughout life. There is some evidence that phytoestrogens (compounds found in plants that possess mild oestrogenic properties) may reduce the risk of breast cancer.

Soy and linseed are two excellent sources of phytoestrogens and recently Australian food manufacturers have been adding soy and linseed to a variety of breads and cereals. The increase in prevalence of nutritionally related immunodeficiency with ageing is likely to contribute to the development of neoplastic disease.

Osteoporosis and fractures

Women are more prone to osteoporosis than men for two reasons. First, bone loss is accelerated after menopause and women have a lower bone mineral density compared to men. A large study of elderly men and women conducted in Australia found that after the age of 60 years about 60% of women and 30% of men would sustain an osteoporotic fracture. In post-menopausal women, a high intake of calcium appears to prevent or reduce bone loss. While adequate intakes of calcium appear to be protective against osteoporosis, other potentially protective factors include vitamins C, D and K, boron, copper and possibly phytoestrogens. A vitamin D supplement from fish liver oil has been shown to reduce fracture rates in later life. To some extent this may be the effects on muscle strength and risk of fall in the presence of secondary hyperparathyroidism.

Arthritis

This is most commonly osteoarthritis, but elderly people also sometimes have rheumatoid arthritis or gout (deposition of uric acid crystals in joints). Degenerative osteoarthritis is commonly seen in weight-bearing joints like hips and knees and in the high usage small joints of the hands. Obesity is generally regarded as a risk factor for osteoarthritis in weight-bearing joints. In rheumatoid arthritis the immune system mistakenly attacks the bone coverings as if they were made of foreign tissue. Rheumatoid arthritis has a possible link to diet through the immune system, that is, a poor diet may worsen this type of arthritis. Marine long-chain omega-3 fatty acids may help reduce the inflammation in the joints that makes arthritis so painful.

Cognitive impairment, Alzheimer's disease and depression

Prevention of cognitive loss or dementia poses a particular challenge in older people. Some deterioration can be attributed to atherosclerotic disease, and thus interventions such as aspirin or particular dietary patterns that reduce cardiovascular risk may also prevent dementia. High educational status early in life and continued mental stimulation also may be protective. It is generally accepted that dementing illnesses and depression have a strong genetic background. The genetic susceptibility to a certain disease is strongly influenced by environmental factors. Thus, nutrients may have a disease accelerating or protective effect.

Long-term moderate (subclinical) nutrient deficiencies are now believed to produce memory impairments and declining immunity in older adults. Certain nutrients or toxic substances may directly affect brain development (alcohol, folic acid deficiency) or brain function (alcohol, vitamins B-1, B-2, B-6, B-12, C, E and Zn deficiencies). Brain ageing is associated with oxidative stress; thus, antioxidants and prooxidants (Fe) are of particular interest. There is some epidemiological evidence that the antioxidants carotene and carotenoids, ascorbic acid and alpha-tocopherol may delay brain ageing and iron may accelerate it. Vitamin K may also be protective against cognitive decline and Alzheimer's dementia. Depression in the elderly is a very common symptom. There is a growing body of evidence to suggest omega-3 polyunsaturated fatty acids may play an important role in the aetiology of depression. Caffeine ingested as either tea or coffee has been shown to improve mood and reduce anxiety. Evidence is now strong for a role of a lipid transport protein, apo E4 (one of 3 isoforms and 3 alleles, E2, E3 and E4), which predisposes to Alzheimer's disease (Polvikoski et al. 1995). This is involved in the transport of an amyloid protein which contributes to the development of plaques in the brain in Alzheimer's disease. Interestingly, people with the apo E4 allele, especially E4/E4 (one gene from each parent), are most sensitive to dietary fat as far as their blood fats are concerned. They are also likely to die prematurely, but if they survive will very likely get Alzheimer's disease. Thus there is a strong possibility that dietary fat may in some way contribute to Alzheimer's disease. Furthermore an important antioxidant in part obtained from food, glutathione, is operative in the brain and may protect against lipid (polyunsaturated) mediated brain damage.

NUTRITIONAL ASSESSMENT OF THE AGED

One of the greatest difficulties in making any assessment of the aged is biological heterogeneity ('biological age'). There are clearly many health problems seen in the aged in some communities which are not seen in others, making them more age related than ageing. Nutritional assessment of the aged should also consider a number of socio-demographic variables and the food culture in which the elderly person has lived. Another challenge for nutritional assessment in the aged is the question as to when nutritional factors will have operated during the lifespan to have had consequences on health in later life. With these considerations taken into account, the areas of nutritional assessment are:

1 food and nutrient intake;
2 anthropometry and body composition;
3 laboratory investigations by way of biochemistry, haematology and immunology;
4 nutritionally related risk factors for various health problems in the aged (see Table 23.4); and
5 retrospective assessment of nutritional status earlier in life (although this has difficulties).

Food and nutrient intake

Assessment of food and nutrient intake is an important tool in health assessment in the aged. Because of a possible decline in memory by participants, instruments used for food intake assessment should be as simple and practical as possible and should involve corroboration from other observers, such as family or friends. Knowing about appetite, the special senses for smell and taste and the overall food patterns, facilitates an understanding of the various factors which may affect food intake (Table 23.4). Food and nutrient intake can alert to possible nutritionally related disease, for example, osteoporosis, by asking 'What do you have in the way of dairy products, fish, sesame based foods?' as sources of calcium. A systematic enquiry about food intake usually requires asking about each episode of eating during the day, the main meals and the snacks (see Chapter 36). In Australia a tool has been developed which identifies the warning signs in older adults at risk of poor nutritional health (see Table 23.6).

Anthropometry and body composition

Anthropometry is a simple, non-invasive, quick and reliable form of obtaining objective information about a person's nutritional status.

Weight

Ambulatory elderly persons are weighed on an upright balance beam scale or microprocessor controlled digital scale. A movable wheelchair balance beam scale can also be used for those elderly who can only sit. A bed scale should be available in geriatric hospitals for measuring

the weight of bed-bound elderly patients. Weights less than 20% of the recommended weight for height indicate a significant loss of total body protein, requiring immediate investigation and action. They are associated with reduced tolerance to trauma and an increased risk of morbidity, infection and mortality. Low body weight and/or unintended weight loss are significant risk factors as the ageing process progresses and require careful intervention and monitoring. Weight loss is the single best factor for predicting persons at risk of protein energy dysnutrition. General guidelines requiring action would be:

1 2% decrease of body weight in one week;
2 5% decrease of body weight in one month (3.5 kg in a 70 kg man);
3 7% decrease of body weight in three months;
4 10% decrease of body weight in six months.

Interpretation of the weight of elderly people should be done with circumspection. Increases in body weight may indicate overweight/obesity or oedema. On the other hand, decreases in body weight can signify the correction of oedema, development of dehydration or emergence of nutritional disorder.

Height

For the elderly who are agile and without stooped posture, height should be measured in an upright position. When this cannot be measured, *knee height* (by using a knee height calliper) in a recumbent position can be used to estimate stature. The following formulae are used to compute stature from knee height:

Stature for men
$$= (2.02 \times \text{knee height}) - (0.04 \times \text{age}) + 64.19$$
Stature for women
$$= (1.83 \times \text{knee height}) - (0.24 \times \text{age}) + 84.88$$

Table 23.6 Example of a checklist to identify older persons at risk of poor nutritional health

DETERMINE YOUR NUTRITIONAL HEALTH

The warning signs of poor nutritional health in the older person are often overlooked. Use this checklist to find out if you or someone you know is at nutritional risk.

Read the statements below. Circle the number in the column that applies to you or the person you know. For each answer, score the number. Total your nutritional score.

	YES	NO
I have an illness or condition that made me change the kind and/or amount of food I eat.	2	0
I eat at least three meals per day.	0	3
I eat fruit or vegetables most days.	0	2
I eat dairy products most days.	0	2
I have three or more glasses of beer, wine or spirits almost every day.	3	0
I have six to eight cups of fluids (e.g. water, juice, tea or coffee) most days.	0	1
I have teeth, mouth or swallowing problems that make it hard for me to eat.	4	0
I always have enough money to buy food.	0	3
I eat alone most of the time.	2	0
I take three or more different prescribed or over-the-counter medicines every day.	3	0
Without wanting to, I have lost or gained 5 kg in the last six months.	2	0
I am always able to shop, cook and/or feed myself.	0	2
TOTAL		

Add up all the numbers you have circled. If your nutritional score is ...

0–3 **Good!**
Recheck your nutritional score in six months.

4–5 **You are at moderate nutritional risk.**
See what can be done to improve your eating habits and lifestyle. Your Council on Ageing or health care professional can help. Recheck your nutritional score in three months.

6 or more **You are at high nutritional risk.**
Bring this checklist the next time you see your doctor, dietitian or other qualified health or social service professional. Talk with them about any problems you may have. Ask for help to improve your nutritional health.

Source: Australian Nutrition Screening Initiative, a project of RACGP, Council on the Ageing, Dietitian's Association of Australia; Self Care Pharmacy, a joint program of the Pharmaceutical Society of Pharmacy Guild of Australia; and Lipiski, P.S. *Australian Journal on Ageing* 199b; 15(1): 14–15.

The knee height measurement in these equations is in centimetres, and the age is rounded to the nearest whole year. The estimated stature derived from the equation is in centimetres. These equations are derived from observations which presume elderly people will have lost some height, an inevitability which may not always continue as health care improves.

Arm span

Arm span is another substitute for height and happens to be the same as maximal height achieved. It is sometimes necessary to ask for maximum adult height to be recalled by the subject or by a carer. Gradual reduction in height may be an indicator of vertebral crush fractures due to osteoporosis, or it may be due to loss of vertebral disc space.

Mid-arm circumference (MAC)

Combined with triceps skinfold (TSF), MAC (taken at the mid-point between acromion and olecranon) can be used to calculate *mid-arm muscle area (MAMA)*, which is an index of total body protein mass. The equation to estimate MAMA is:

$$\text{MAMA} = \{\text{MAC} - (3.14 \times \text{TSF}/10)\}^2/12.56$$

The MAC measurement in this equation is in centimetres and the TSF is in millimetres. The calculated MAMA derived from the equation is in centimetres squared. MAMA of less than 44 cm^2 for men and less than 30 cm^2 for women may indicate protein malnutrition (Gibson 1990).

Calf circumference

Calf circumference (taken at the largest circumference by using inelastic flexible measuring tape), in the absence of lower limb oedema, can be used to calculate weight in a bed-bound patient. Several anthropometric measurements, apart from calf circumference itself (Calf C), are required to compute weight. They are knee height (Knee H), MAC, and subscapular skinfold thickness (Subsc SF) (taken at posterior, in a line from the inferior angle of the left scapula to the left elbow). There are separate equations for men and women:

Body weight for men =
(0.98 × Calf C) + (1.16 × Knee H) + (1.73 × MAC) + (0.36 × Subsc SF) – 81.69
Body weight for women =
(1.27 × Calf C) + (0.87 × Knee H) + (0.98 × MAC) + (0.4 × Subsc SF) – 62.35

All measurements should be in centimetres and the resulting computed weight is in kilograms. Calf circumference is expected to have increasing application for assessment of lean mass (Chumlea et al. 1985). It can also be used as a measure of physical activity in the aged.

Anthropometric indices

Body mass index (BMI) has been used widely to estimate total body fatness. BMI can be obtained by using the formula:

$$\text{BMI} = \text{weight (kg)}/\text{height (m)}^2$$

BMI can be calculated to help classify whether the subject is in the reference range; an acceptable BMI range for older adults is higher than for younger adults at 23–25. A BMI below 20 suggests inadequate nutrition and a BMI below 18.5 is indicative of malnutrition in older adults (see Figure 23.2). Inter-observer errors are possible. Height and weight that have coefficient of variations (CVs) of the order of less than 1% may be altered by kyphosis in the aged and make interpretation of BMI invalid (see also Chapter 26). The *abdominal* (taken at the midpoint between lower rib cage and iliac crest) and *hip* (taken at the maximal gluteal protrusion) *circumferences ratio (AHR)* is another anthropometric index to estimate fat distribution and the one now recommended by the World Health Organization. It is fat distribution reflected in abdominal fatness, which may account for a number of chronic non-communicable diseases in the elderly if the ratio is above 0.9 for men and 0.8 for women. A number of studies are now showing that abdominal measurements alone can be used to safely decide if weight loss is necessary to reduce the risk from diseases such as heart disease and diabetes. Statistical analyses of abdominal circumferences of Caucasian men and women aged 25–74 indicated that the ideal circumference for men is less than 102 cm and for women less than 88 cm

(Lean et al. 1995) (see Figure 23.2). These conclusions are drawn from Caucasian subjects and thus may not apply in ethnic groups where the build is slight, such as in many Asian countries, and where a lesser degree of abdominal fatness may still put the person at risk of developing chronic diseases.

Laboratory investigations by way of biochemistry, haematology and immunology

Biochemical, haematological and immunological assessments are useful to confirm nutritional disorders and to identify specific complications which accompany them in the elderly (see also Chapter 35).

Various nutritionally related risk factors for health problems in the aged

Elderly people tend to have different degrees of risk factors, many of which are social (see Table 23.4).

THE ELDERLY AS REPOSITORIES OF FOOD KNOWLEDGE, SKILLS AND BELIEFS

A gerontophobic society no longer venerates or values old age. The elderly, once precious repositories of lore and knowledge, have become disposable. The turnover of knowledge has become so rapid that the experience, knowledge and skills possessed by today's 65-year-olds are soon obsolescent. Today's knowledge is available from databases at the touch of a computer key, and telecommunications are supplanting personal communication. Diminishing personal contact has caused young people to lose respect for the aged, as reflected in an increasing rate of predatory and violent crime by the young against the old. These trends are peculiar to Western culture. It is hoped that in the future, changes in attitude will enable the true worth of the older members in 'developed' societies to be recognised and valued. Society is missing out through its neglect and devaluing of the old, which stems from its stereotyped view of their capabilities. It is false to generalise that a person's mental faculties decline with age. More than 80% of people over 80 have normal mental function; most of the remainder suffer from Alzheimer's disease. The wisdom of life experience cannot be gained from education. The older generation has a wealth of such experience that affords a lifetime perspective to current problems. Where the aged are accorded respect, their well-being is more assured. But, additionally, they then provide an opportunity for the transmission to younger generations of knowledge and wisdom, including that about food and health. While transmission of adverse beliefs may also occur, where the aged are well connected to the young, a culturally dynamic society can modulate the belief system in a critical way. At the present time, the potential for a young person to interact with all four of their grandparents has never been greater. At a time of considerable pressure on young people to conform to a global fast food culture, the championing of food cultural roots by grandparents may be invaluable—a contribution to self-respect and its favourable impact on behaviour.

Body mass index (weight [kg]/height [m]^2)	
Acceptable BMI range for older adults	23.0–28.0
Currently accepted healthy weight range for younger adults	20.0–25.0
Grade 1 malnutrition or PED*	17.0–18.5
Grade 2 malnutrition or PED*	16.0–17.0
Grade 3 malnutrition or PED*	<16.0

Abdominal circumference (measured midway between lower bony rib cage and iliac crest in standing position)
<88 cm (women)
<102 cm (men)

* Protein energy dysnutrition

Figure 23.2 Appropriate body weights and abdominal circumferences for older adults

STRATEGIES FOR HEALTHY AGEING

Sometimes the assumption is made that, after we turn 65 or 70 years, perhaps lifestyle changes will no longer confer significant benefits. Are the remaining years sufficient to reap the benefits of modifications to food choice or exercise patterns? In fact, several recent intervention and survival studies reveal that improvements in nutrition and regular exercise can benefit health even in advanced old age. For example, older muscles are just as responsive to strength training exercises as are young muscles. Nonagenarians have shown impressive increases in muscle mass, muscle strength, and walking speed with weight training programs. Chronological age is, in itself, clearly no justification for deciding whether it is worthwhile to pursue lifestyle change. Behavioural risk factors (such as not regularly eating breakfast, lack of regular physical activity, overweight, smoking) have been

shown to remain predictors of seventeen-year mortality even in people aged over 70 (Horwath et al. 1999). If elderly people pay attention to those aspects of their lifestyle (physical and social activity) other than eating, they may be able to make nutritional errors with less consequence.

Compared with younger adults, older adults need to reach at least the same levels of intake (and in some cases, higher levels) of most vitamins, minerals and protein. Since this usually needs to be obtained in substantially lower overall food intakes, however, a nutrient/phytochemically dense diet becomes a high priority in later life.

In other words, given the tendency for activity levels to decline and total food intakes to fall with advancing years, there is less room for energy-dense foods (such as cakes, biscuits, pastries, crisps) which supply few of the essential nutrients which our bodies continue to need. Therefore, older adults need be selective about what they eat to avoid excessive fat gain and prefer foods that are nutrient-dense and high in protein, such as nuts, lean red meat, low fat dairy products, legumes, seeds. This principle also applies to younger adults who are sedentary.

The type of physical activity can play an important role in the health of older people. Resistance (or strength) training prevents lean muscle atrophy more effectively than aerobic activity, especially during weight loss, whereas aerobic exercise may be more involved in improving psychological functioning in older people (although group membership may also be a factor). Strength training in older adults seems particularly promising in reducing or preventing the

Table 23.7 Dietary guidelines for older Australians

- Enjoy a wide variety of nutritious foods.
- Keep active to maintain muscle strength and a healthy body weight.
- Eat plenty of vegetables (including legumes) and fruit.
- Eat plenty of cereals, breads and pastas.
- Eat a diet low in saturated fat.
- Drink adequate amounts of water and/or other fluids.
- If you drink alcohol, limit your intake.
- Choose foods low in salt and use salt sparingly.
- Include foods high in calcium.
- Use added sugars in moderation.
- Eat at least three meals every day.
- Care for your food; prepare and store it correctly.

Source: NH&MRC 1999

Table 23.8 Strategies for healthy ageing

Food

- Choose a variety of nutrient and phytochemically dense foods.

Health

- Maintain appropriate body weight.
- For people who smoke, quit; consume alcohol only moderately, if at all; use medications only as prescribed.
- Take care to prevent accidents.
- Expect good hearing and vision throughout life; obtain glasses and hearing aids if necessary.
- For women, see a physician about oestrogen replacement.
- Drink six to eight glasses of water every day.

Physical activity

- Include a variety of physical activities such as walking, running, dancing, swimming and especially activities which build muscle strength; change activities to suit changing ability and tastes.
- Go outside for sunshine and fresh air as often as possible.

Social activity and networks

- Try to maintain friendships and strong supportive networks.
- Include a variety of social activities—eat with or cook for friends, volunteer time to help others, play cards or other games.
- Stay interested in life—pursue a hobby, spend time with grandchildren, take a holiday, grow flowers, go to the movies.
- Make financial plans early to ensure security.

Mental activity

- Reduce stress.
- Try to develop good sleeping patterns—have a nap in the afternoon.
- Include a variety of activities that exercise the mind—for example, crosswords, cards, games, reading, writing, imagining, creating; be alert to cognitive changes and seek diagnosis—confusion is a disease symptom requiring treatment.
- Control depression through activities and friendships; accept change by working at recovering from losses and by making new friends.
- Laugh more by looking at the funny side of life.
- Cultivate spiritual health; cherish personal values and make life meaningful.

Sexual activity

- Learn new ways of enhancing sexual activity.
- Try other dimensions of sexuality (intimacy, showing affection through touching and kissing) to obtain sexual and spiritual fulfilment.

Adapted from Rolfes et al. 1998, Savige et al. 2001

decline in muscle mass observed with ageing. It can improve walking ability and balance and its associated risk for falls. Strength training also contributes to improved tendon and ligament strength, bone health and improvements in blood sugar levels. Additionally, the benefits of physical activity such as strength training should make activities of daily living easier for older people. Such activities might include climbing stairs, getting out of a chair, pushing a vacuum cleaner, carrying groceries and crossing a road with sufficient speed (Fiatarone 1995; Horwath et al. 1999). Both aerobic activity and strength training are recommended in the Dietary Guidelines for Older Australians, within a total minimum of 30 minutes a day. Activity does not have to be continuous but can be accrued during the day through short bursts of activity (NH&MRC 1999).

In late 1999, the Australian Government, guided by the National Health & Medical Research Council (NH&MRC 1999) report, released a set of dietary guidelines for older Australians (see Table 23.7). Food-based dietary guidelines for older adults are currently being developed by the World Health Organization (see Chapter 38). In apparently healthy older adults, the emphasis in the dietary guidelines relates to the prevention of premature deaths from the diseases of affluence. The nutritional factors involved in healthy ageing include food variety, nutrient and phytochemical density. A Mediterranean food pattern may also reduce the risk of death in older adults. In the frail elderly there should be more emphasis on the need for support and increased nourishment and the prevention of malnutrition. The best and main message for an older person at home is to be 'well nourished, to be as active as possible without overdoing it, to eat better—not less, to keep their weight up and to drink plenty of fluids every day' (NH&MRC1999).

Nevertheless, there is much people can do, besides obtaining adequate nutrition and physical activity, which will enable them to grow old gracefully and which will support a high quality of life in old age (see Table 23.8).

SUMMARY

- Chronological and biological age do not necessarily correlate because what we currently regard as the 'normal ageing process' may be altered, in part, through nutritional means.
- Healthy ageing requires compression of morbidity towards the end of life. This will be partly achieved by delaying the loss of organ function (or physiological reserve) and the onset of frailty, and by improving nutritional reserves in old age. It appears to be dependent on being socially active, achieving food variety with nutrient and phytochemically dense foods (probably within a Mediterranean or Oriental food pattern), having regular physical activity (endurance and strength) and avoiding substances abuse.
- Energy requirements generally decrease with age, however nutrient needs remain relatively high; animal studies suggest that energy restriction promotes longevity but human studies suggest that 'eating better not less' is desirable.
- Contrary to the popular 'tea'n'toast' myth, it appears that many older adults outside institutions have healthier diets than younger adults. Nevertheless, mild vitamin and mineral deficiencies are common in older adults and have been associated with several so-called 'diseases of ageing', such as cognitive impairment and poor wound healing.
- Nutritionally vulnerable 'at risk' groups within older populations who are more likely to consume inadequate diets (especially protein, calcium, zinc, magnesium, vitamins B-6, B-12 and folate) include older men living alone, the socially isolated or the lonely, those with low socioeconomic status and the recently bereaved.
- The primary nutrition-related health problems affecting the elderly are protein energy dysnutrition (PED), subclinical/mild vitamin and mineral deficiencies, and obesity. These, in turn, can contribute to the development of conditions seen with ageing such as sarcopenia, diabetes, cardiovascular disease, immune dysfunction, cancer, osteoporosis, arthritis and cognitive impairment.
- Nutritional assessment of the aged not only needs to take into account food and nutrient intake and 'warning signs' for poor nutritional health, but also anthropometry, laboratory investigations and nutritionally related risk factors for health problems (many of which are social factors).

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FOOD AND NUTRITION

Australasia, Asia and the Pacific

Second Edition

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Thanks to Antigone Kouris-Blazos for her editorial and technical assistance.

ALLEN&UNWIN

First published in 1997
Second edition published in 2002 by
Allen & Unwin Pty Ltd
83 Alexander Street, Crows Nest, NSW 1590 Australia
Phone: (61 2) 8425 0100
Fax: (61 2) 9906 2218
E-mail: info@allenandunwin.com
Web: www.allenandunwin.com

National Library of Australia
Cataloguing-in-Publication entry:

Food and nutrition: Australasia, Asia and the Pacific.

2nd ed.
Includes index.
ISBN 1 86508 692 4

1. Food. 2. Food analysis. 3. Food—Australian.
4. Food—New Zealand. 5. Nutrition.
6. Nutrition—Requirements. 7. Nutrition
Australia. 8. Nutrition—New Zealand.
I. Wahlqvist, Mark L.

641.3

Set in 10/12 Bembo by Asset Typesetting Pty Ltd
Index compiled by Russell Brooks
Printed by South Wind Productions, Singapore

10 9 8 7 6 5 4 3 2

Contents