Dietary Guidelines for Older Australians

NHMRC
National Health and Medical Research Council
Dietary Guidelines for older Australians

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Edited for the NHMRC by Professor Colin Binns
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FOREWORD

The Commonwealth Department of Health and Aged Care funded the development of the *Dietary Guidelines for Older Australians* to mark the occasion of the International Year of Older Persons, in 1999. Development work involved extensive consultation with experts working in the field of nutrition and with members of the broader Australian community.

This document has been prepared for health care professionals. A practical consumers' guide has also been developed. Copies are available electronically through the NHMRC web site: http://www.nhmrc.health.gov.au.
The National Health and Medical Research Council has had a long involvement in developing public health guidelines providing dietary advice for Australians. It seeks to promote the potential benefits of healthy eating, not only to reduce the risk of development of diet-related diseases but also to improve the community’s health and wellbeing.

Based on the Dietary Guidelines for Australians, the Dietary Guidelines for Older Australians are designed to take account of the changes in nutritional needs that occur with ageing. The guidelines are aimed at healthy, independent Australians aged 65 and over. They may also be useful for health professionals who wish to develop suitable diets for older people in a range of health circumstances. The information presented focuses predominantly on healthy, independent older Australians, but additional advice is provided on how the guidelines apply to older Australians who receive assistance with meals or live in aged care accommodation.

The guidelines apply to the total diet: they should not be used to assess the ‘healthiness’ of individual food items, nor should individual guidelines be considered in isolation. The first four guidelines are ‘umbrella’ guidelines, dealing with general aspects of nutrition and lifestyle; the remainder deal with specific foods and nutrients and are ranked in approximate order of importance.

The NHMRC’s Dietary Guidelines for Australians and Dietary Guidelines for Children and Adolescents contain two additional guidelines on specific nutrients. The Dietary Guidelines for Older Australians retain the calcium guideline but not the iron guideline since iron deficiency is not considered a significant nutritional concern for the majority of healthy, independent older Australians.

Detailed information about requirements for specific nutrients in the Australian diet is contained in the NHMRC publication entitled Recommended Dietary Intakes for Use in Australia. The recommended dietary intakes and the dietary guidelines complement each other in providing comprehensive nutrition advice for the Australian community.

Development of these Dietary Guidelines for Older Australians involved extensive consultation with the Australian community and with experts working in the fields of nutrition and gerontology. Based on consensus, the guidelines are a distillation of current knowledge about the relationship between diet and disease, the nutrients available in the Australian food supply, and the pattern of morbidity and mortality among older Australians.

Each guideline is supported by background information prepared by members of the Working Party established to develop the guidelines. Professor Colin Binns, Head of the School of Public Health at Curtin University of Technology, chaired
the Working Party. In addition, Dr Trevor Beard, from the Menzies Centre in Hobart, provided the information supporting the salt guideline and Dr Janette Brand-Miller, from the University of Sydney, provided a background paper on the glycaemic index.
TERMS OF REFERENCE AND MEMBERS OF THE WORKING PARTY

TERMS OF REFERENCE

The National Health and Medical Research Council prepared the following terms of reference for the Working Party:

• to develop dietary guidelines for older Australians, with particular reference to how the Dietary Guidelines for Australians apply to older people;
• to prepare comprehensive scientific background papers explaining the rationale for each guideline; and
• to undertake widespread consultation during the development of the guidelines.

MEMBERS OF THE WORKING PARTY

Professor Colin Binns was contracted by NHMRC to develop the Dietary Guidelines for Older Australians.

Membership of the Working Party was as follows:

Prof. Colin Binns (Chair) Head, School of Public Health, Curtin University of Technology
Ms Jenny Bacon Dietitian, Bendigo Health Service
Ms Beryl Dawson Dietitian; Chairperson, Gerontology Special Interest Group, Dietitians Association of Australia
Dr Ivor Dreosti Chief Research Scientist, CSIRO Health Sciences & Nutrition
Ms Sue Jeffreson* Commonwealth Department of Health and Aged Care
Prof. AS Truswell Professor of Human Nutrition, University of Sydney
Dr Peter Williams Director, Scientific and Consumer Affairs, Kellogg (Aust) Pty Ltd
Ms Roslyn Giglia Research Dietitian, Curtin University of Technology
Ms Mi Kyung Lee Research Officer, Curtin University of Technology (multicultural issues)
Ms Jennifer Leong Research Officer, Curtin University of Technology (consumer issues)

*Ms Kathleen Graham, Nutritionist, Commonwealth Department of Health and Aged Care, replaced Ms Sue Jeffreson in 1999.
The Working Party acknowledges the contribution of the following people to the development of the *Dietary Guidelines for Older Australians*:

Dr Trevor Beard, from the Menzies Centre in Hobart, provided the information supporting the salt guideline.

Dr Janette Brand-Miller, from the University of Sydney, provided a background paper on the glycaemic index.

Dr Antigone Kouris-Blazos, from Monash University, provided information on food-based dietary guidelines.

Ms Leanne Lester helped with statistical analysis of the results of the 1995 National Nutrition Survey.

Ms Karina Desarmia, Project Manager for the Health Advisory Section, Office of NHMRC, provided secretariat support and coordination of the project.
1. Enjoy a wide variety of nutritious foods.
2. Keep active to maintain muscle strength and a healthy body weight.
3. Eat at least three meals every day.
4. Care for your food: prepare and store it correctly.
5. Eat plenty of vegetables (including legumes) and fruit.
6. Eat plenty of cereals, breads and pastas.
7. Eat a diet low in saturated fat.
8. Drink adequate amounts of water and/or other fluids.
9. If you drink alcohol, limit your intake.
10. Choose foods low in salt and use salt sparingly.
11. Include foods high in calcium.
12. Use added sugars in moderation.
In Australia a woman aged 65 years can expect to live on average another 19.6 years; for men the figure is 15.8 years. As our lifespan has increased, so has the proportion of older Australians in our community. It is expected that, by the year 2016, 16 per cent of the population will be aged over 65 years; 25 per cent of this group will be aged over 80 years. Good nutrition for older Australians is important—to minimise sickness and premature death and to maintain an independent lifestyle for as long as possible.

The nutritional wellbeing of older Australians can be affected by a number of factors other than those related to nutrition, among them poverty, the ability to shop for food, living alone, or even returning to earlier traditional food patterns. For many older people eating meals provides an opportunity for social contact as well as meeting the body’s need for food. Mealtimes should remain one of the pleasures of life. Good nutrition can be enjoyed.

In developing these guidelines the Working Party has been mindful of the changes in nutritional needs that occur with ageing. These guidelines apply to healthy Australians who are over 65 years old and able to live independently.

The guidelines are designed to be used as a whole. The first four are ‘umbrella’ guidelines, dealing with general aspects of nutrition and lifestyle. The remaining guidelines, which deal with specific foods and nutrients, are ranked in approximate order of importance.

1. **ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS**

The nutrients necessary for human life are found in varying amounts in many different foods. Eating a variety of nutritious foods increases the possibility of obtaining enough of the essential nutrients and of reducing exposure to small amounts of toxic substances found in some foods. Consuming a wide variety of foods in the diet also offers some protection against chronic diseases such as heart disease, high blood pressure and non-insulin dependent diabetes mellitus. Additionally, it may assist in reducing a person’s intake of foods that supply excessive amounts of fat, salt and alcohol.

‘Food variety’ can be defined as the consumption of foods that are nutritionally different from each other. In nutrition education the concept of food variety is incorporated in the ‘five food groups’. Australia is a multicultural society and we enjoy foods from many regions and countries. Foods such as rice, pasta and noodles have almost become staples. By trying these foods, older people can increase their enjoyment of foods and widen the variety of foods in their diets.
As people age their activity level often decreases, resulting in a decline in the amount of energy needed to carry out daily activities. A lowered energy output leads to a lowered energy intake: we eat less food. Because of this, older people need foods that are rich in nutrients—‘nutrient-dense’ foods—if they are to maintain their intake of essential nutrients.

As people age the amount of muscle in the body declines. This decline can, however, be slowed with an adequate intake of protein or amino acids and plenty of exercise.

Nutrient interactions can influence absorption, metabolism and the retention of other nutrients. When the diet is well balanced and nutrients are in good supply the interaction of nutrients poses little problem, but if a person’s intake of some nutrients is low, excesses of some other nutrients can have detrimental consequences.

In general, because they have more symptoms and more diseases, older people use more medications than younger people. Food consumed can affect a drug’s action; similarly, many commonly used medications can affect nutrient absorption, metabolism and retention.

2 KEEP ACTIVE TO MAINTAIN MUSCLE STRENGTH AND A HEALTHY BODYWEIGHT

The benefits of regular physical exercise, for men and women and for all age groups, are well recognised. Physical activity reduces the risk of many diseases—among them heart disease, high blood pressure, cancer of the bowel and non-insulin dependent diabetes mellitus—and premature death in general. It can also help to improve mental health and plays an important role in sustaining the health of muscles, bones and joints.

Many older people experience a decline in total muscle mass (sarcopenia) and strength as they age. This can lead to a decrease in performance (and a consequent decline in energy expenditure and intake), an increased risk of falling down, and greater susceptibility to injury and bone fractures. Aerobic exercise (30 minutes a day) and strength exercises are important to maintain muscle mass and energy expenditure. The decline in muscle mass and strength can also be retarded if a person has an adequate intake of protein and/or amino acids.

Being very obese is a problem at any age, although being moderately overweight in older age may be compatible with good health. On the other hand, if a person suddenly or unexpectedly loses weight they should consult a doctor.
DIETARY GUIDELINES FOR OLDER AUSTRALIANS

3 EAT AT LEAST THREE MEALS EVERY DAY

Good nutrition and appropriate eating habits are important throughout life for the maintenance of health. Eating a minimum of three nutritious meals each day will help maintain an older person’s nutritional status and ensure variety in the diet. As well as being a necessary functional activity, eating can be an enjoyable social experience. Much consideration has been given to the influence on diet of social isolation and living alone: eating can become more of an obligation than an opportunity for social interaction.

4 CARE FOR YOUR FOOD: PREPARE AND STORE IT CORRECTLY

Food safety is important because foodborne illnesses can have very serious health consequences, especially for older people. Despite having one of the world’s safest food-supply systems, there has nevertheless been an increase in the number of foodborne diseases in Australia. Correct handling of food, during all stages of preparation and storage, reduces the incidence of foodborne illnesses.

5 EAT PLENTY OF VEGETABLES (INCLUDING LEGUMES) AND FRUIT

There is a growing awareness of the health benefits associated with the regular consumption of a diet rich in fruits and vegetables; this is important throughout life, but particularly so in later life. Population studies have shown that people who regularly consume diets high in fruits and vegetables (including legumes) have lower risks of coronary heart disease, stroke, several major cancers, possibly high blood pressure, non-insulin dependent diabetes mellitus, and cataract. The term ‘phytochemicals’ has recently come into use to describe the many different substances that naturally occur in small amounts in plant foods, in addition to the well-known nutrients. Phytochemicals appear to contribute significantly to reducing the risk of degenerative diseases.

6 EAT PLENTY OF CEREALS, BREADS AND PASTAS

Prefer high-fibre foods and those with a lower glycaemic index.

The emphasis in this guideline is on high-fibre (both soluble and insoluble fibre) cereals, which are digested slowly within the body (and have a lower glycaemic index). The words ‘eat plenty’ are used to encourage people to choose these foods as the main basis of their daily dietary intake.

In terms of quantity, cereals, and the many foods made from them, constitute the most important food group: they form the basis of diets in most parts of the world. Whole cereal grains generally are excellent sources of carbohydrate and dietary fibre and are significant protein sources too. Cereals are generally low in fat and contain no cholesterol. They are good sources of B-group vitamins and vitamin E.
and of many minerals, notably iron, zinc, magnesium and phosphorus. They are also relatively inexpensive. Eating enough cereal foods helps ensure an adequate nutritional intake.

7 **EAT A DIET LOW IN SATURATED FAT**

Australians are eating less fat than in the past, and it is probably not important to reduce fat intake any further. It is now known, however, that what is important is the type of fat that is eaten. Although the increased relative risk of a raised cholesterol level for coronary heart disease tends to be less in older people than in younger adults, it is certainly significant in the 65–75 year age group. The absolute risk of coronary heart disease increases with age, so even a small change in risk can influence a large number of events.

8 **DRINK ADEQUATE AMOUNTS OF WATER AND/OR OTHER FLUIDS**

Fluids are essential to life and form a vital part of the diet of people in all age groups. Older people can, however, be at greater risk of dehydration than younger people because of inadequate fluid intake or increased fluid loss, or both.

As energy needs reduce with ageing due to decreased muscle mass, the average older person of healthy weight (55 to 75 kilograms) needs between 1650 and 2500 millilitres of fluid a day. Most of this fluid requirement will need to come from drinks of water and other fluids. Even older people who are very underweight need a minimum of about 1500 millilitres of water a day.

9 **IF YOU DRINK ALCOHOL, LIMIT YOUR INTAKE**

Alcohol provides about 5 per cent of the energy intake of Australian adults and 4.8 per cent of the energy intake of those over the age of 65 years. For many Australians an alcoholic drink is a regular and enjoyable part of some meals, and it is for this reason that advice on alcohol is included as a guideline. Consumption of alcoholic beverages (and of grams of alcohol per day) declines with age. With ageing, the body, especially the muscle mass, becomes smaller, so the volume in which absorbed alcohol is distributed is smaller and the concentration of alcohol that circulates in the body is higher. Moderate consumption of alcohol can, however, contribute to a healthy lifestyle.

10 **CHOOSE FOODS LOW IN SALT AND USE SALT SPARINGLY**

Salt, a chemical compound of sodium and chloride, is found naturally in many foods and is also added as salt or other sodium-containing substances. The relationship between salt intake and high blood pressure is now well recognised,
and many Australians choose to limit their salt intake in an effort to reduce the potentially harmful effects of a diet high in salt.

In the older population it may be too late for prevention, but established high blood pressure is responsive to a lower sodium intake, often without the use of drugs or with lower doses of drugs. Of all dietary improvements, reducing sodium intake has the most immediate effect on medication requirements, thus reducing the problem of multiple drug use. Among other benefits of restricting salt intake is a reduction in calcium excretion and osteoporosis at a time of impaired calcium absorption.

11 **INCLUDE FOODS HIGH IN CALCIUM**

Calcium is required for the normal development and maintenance of the skeleton. Adequate calcium status can delay the onset of osteoporosis and related fractures in the elderly. Peak bone mass achieved in early adulthood, genetics, hormonal status, exercise, and the subsequent rate of bone loss determine bone density in older people. A high calcium intake slows the rate of bone loss and reduces the risk of fractures. Recent studies have shown a reduction in fracture rates among subjects whose diet was supplemented with calcium.

The active form of vitamin D stimulates the absorption of calcium, which means that both calcium and vitamin D are essential to maintaining the skeleton. Vitamin D can be produced in the skin from exposure to sunlight; it is also available in foods such as supplemented margarine, fatty fish and eggs. Many age-related changes influence vitamin D status—decreased dietary intake, declining intestinal absorption, less efficient skin synthesis, and decreased exposure to sunlight are examples.

12 **USE ADDED SUGARS IN MODERATION**

Much of the sugar Australians eat is naturally occurring, in foods such as fruit and milk. Sugars, particularly sucrose, are also added to food products during processing, to increase their palatability and acceptability and sometimes to add bulk. Diets high in added sugar are associated with dental problems, and the presence of large amounts of sugar decreases the nutrient value of the diet. For older people, however, inclusion of a moderate amount of added sugar in the diet can increase variety and palatability without compromising the nutrient intake.
INTRODUCTION

by Professor Colin Binns and Ms Mi Kyung Lee

1999, the International Year of Older Persons, celebrates the contribution older citizens make to society. The Commonwealth Department of Health and Aged Care funded the development of these guidelines as a part of its contribution to this year of celebration and in recognition of older people’s unique needs.

The Dietary Guidelines for Older Australians are for healthy older Australians who are able to live independently; they are written for health professionals who provide advice to and care for older Australians. They are similar in format to other sets of guidelines the National Health and Medical Research Council has published: the Australian Dietary Guidelines (for adults), the Dietary Guidelines for Children and Adolescents, and the Infant Feeding Guidelines. Further education materials based on these guidelines will be developed for wider distribution to non-health professionals, other people who care for older Australians, and the general public.

The guidelines take into account submissions to the Working Party—over 180 submissions were received in the first round and a further 51 commented on the draft guidelines—a review of relevant literature, and the results of several workshops. Additional consultations were held with representatives of industry, nutritionists and health professionals. Appendix A provides details of the report-development process.

As noted, the guidelines are for healthy older Australians who are able to live independently; they do not provide nutritional advice for people who are ill or have particular dietary needs (for example, vegetarians and people with lactose intolerance), although the principles on which they are based may be useful in formulating therapeutic diets. The guidelines are designed to be used as a whole, not individually. Similarly, they apply to the total diet: it is not appropriate to use them in evaluating specific foods. They should be used in conjunction with the recommended dietary intakes.¹

The Working Party was mindful of the fact that approximately 7 per cent of older Australians live in residential care and even more receive assistance with meal preparation, so it has provided additional information on each dietary guideline for meal-assisted older people and residents of aged care accommodation.

Older Australians’ nutritional status can be affected by many factors other than those related to scientific nutrition, among them poverty, the ability to access food supplies, living alone, even a reversion to earlier ethnic food patterns. For many, meals also provide an opportunity for social interaction. The Working Party took these factors into account in developing the guidelines: they are discussed throughout this document. The results of the National Nutrition Survey² were of considerable value because the Survey contained items related to many of these factors.
The question of when a person is considered to be an older Australian was canvassed during the consultation process: the great majority of respondents felt that 65 years was the most appropriate ‘starting age’ for the guidelines, although of course there is no physiological basis for this. In Australia a woman aged 65 years can expect to live on average another 19.6 years; for men the figure is 15.8 years. Good nutrition for older Australians is important—to minimise morbidity and premature death and to maintain an independent lifestyle for as long as possible.

Although it is preferable that good nutrition practices for older Australians build on well-established patterns of nutrition, it is never too late to improve. As documented in the National Nutrition Survey, the average nutrient intake of older Australians meets the levels of the recommended dietary intakes for almost all nutrients. In most cases, where dietary change is suggested it will be appropriate to optimise nutrition by marginal changes to people’s diets, rather than attempting a complete change away from long-established food habits. Age is also a factor: it is obviously less important, for example, to restrict salt intake among 85-year-olds than among 65-year-olds.

Health care costs increase sharply with age, and many of these costs are incurred in treating diet-related problems. Appropriate nutrition has the potential to reduce the number of hospital admissions, to shorten the length of hospital stays, and to improve outcomes from community-managed care. A reduced incidence of falls and fractures among older people with good muscle mass and reduced osteoporotic fractures are examples.

The proportion of Australians aged over 65 years is increasing.

- In 1976, 9 per cent of the Australian population, or 1.2 million people, were over 65 years old; of this group, 16 per cent were over 80 years old.
- In 1996, 12 per cent of the Australian population, or 2.2 million people, were over 65 years old; of this group, 20 per cent were over 80 years old.
- It is estimated that, in 2016, 16 per cent of the Australian population, or 3.5 million people, will be over 65 years old; of this group, 25 per cent will be over 80 years old.

Unless there is an improvement in health and a decline in the rates of morbidity and hospitalisation, this demographic change has serious implications for health care costs. The number of deaths and hospital admissions caused by diet-related factors increases with age (see Appendix B). Improved nutrition can improve health and reduce hospital and other health care costs.

The Dietary Guidelines for Older Australians are framed in a positive way—to reflect a nutritious diet’s positive influence on health. The first four guidelines are ‘umbrella’ guidelines, dealing with general aspects of nutrition and lifestyle. The remaining guidelines, which deal with specific foods and nutrients, are ranked in approximate order of importance.

The use of nutrition supplements for older people is the subject of much discussion, in Australia and overseas. It is difficult for older people, who usually
have reduced energy expenditure (and hence a reduced food intake), to maintain a sufficient intake of all nutrients without the use of supplements. If, however, energy expenditure is maintained at a high level, intake of sufficient nutrients to meet the recommended dietary intake is possible. Energy expenditure and the maintenance of muscle mass thus become very important and are emphasised in these guidelines. If sufficient energy expenditure is not possible nutritional supplementation may be needed.

The *Dietary Guidelines for Older Australians* are worded in a similar way to the *Dietary Guidelines for Australians*. The scientific literature has been reviewed and updated where necessary. For example, the guideline on fat intake has been changed to reflect more recent developments in lipid nutrition and changing nutrition patterns in Australia.

There has in recent years been debate about the use of food-based dietary guidelines; this was discussed in several submissions the Working Party received. But Australia, being home to people of many backgrounds, has a wide variety of cuisines, so we have retained a mixture of food-based, nutrient-based and behavioural guidelines. Guideline 2 is innovative in that is not directly concerned with nutrition; rather, it relates to a person’s muscle strength and body weight. It is included to emphasise how important physical and mental wellbeing are to optimal food intake and nutritional status. A guideline on food safety has also been added, to reflect the importance of preparing and storing food correctly.

Although the *Dietary Guidelines for Older Australians* are for healthy older people who are living independently, the Working Party gave careful consideration to the various settings in which older Australians live.

‘Meal-assisted’ older Australians means people living independently in their own home but receiving assistance with meal preparation—for example, meals on wheels, shopping deliveries, and meals prepared by relatives and friends. It is difficult to determine the proportion of meal-assisted older people living in the community because much of the assistance is provided informally, in the form of family and friends helping with meal preparation. The Australian Bureau of Statistics has estimated that less than 50 per cent of people aged 60 years and over and living in households require assistance with the activities of daily living. This assistance is related to all activities of daily living, though, and it is assumed that the number of people needing assistance with meal preparation would be considerably less.

‘Residents of aged care accommodation’ means people living in a residential care setting where all meals are provided. This group of older Australians make up approximately 7 per cent of people over 65 years, which gives the lie to the widespread belief that the majority of older people live in residential care. Although meal-assisted older Australians and residents of aged care accommodation are not the primary focus of these guidelines, their needs have been taken into consideration; some specific suggestions are offered in Appendix C. They are part of the population aged over 65 years and they too can benefit from improvements to their dietary intake.
The principles that underlie these guidelines are also generally applicable to Indigenous Australians aged over 65 years, although the needs of this group are not specifically discussed: the NHMRC is preparing a document on Indigenous Australians’ nutrition. The incidence of morbidity among older Indigenous Australians is high, and many of these people may require specific nutrition advice related to their health status.\(^4\)

Generally, the social, physical and mental health of the older Australian is well balanced, and a large number of older people are taking action to maintain their quality of life, as indicated by the results of the National Nutrition Survey\(^2\) and the Health Status of Older People project.\(^7\)

Although nutrition is one of the most important factors affecting the health of people in general, it is also important to recognise that quality of life is a multi-dimensional concept and that a person’s health can be influenced by their psychological wellbeing, just as it can be influenced by public health factors such as social conditions, living conditions, and other environmental factors.

Further, the social context of eating is important for all age groups, but probably more so for older people. For them, eating in company is often very important: it may be appropriate to change from delivering meals to lonely people to delivering lonely people to a sociable environment, where they can interact with others and be encouraged to talk and eat in ‘normal’ surroundings.

Many of these factors that influence quality of life were assessed in the Health Status of Older People project, which involved a representative community survey of 1000 people aged 65 or more years. Seventy-nine per cent of respondents reported frequently feeling ‘happy’ and 80 per cent rarely felt symptoms of depression. Seventy-eight per cent were extremely satisfied with their neighbourhood and 81 per cent said it was conveniently close to grocery shops. Ninety-four per cent lived near public transport and 51 per cent and 37 per cent were ‘very satisfied’ and ‘fairly satisfied’, respectively, with this service.\(^7\)

The Australian Bureau of Statistics and the Department of Health and Family Services conducted the National Nutrition Survey, the most extensive survey of nutrition in Australia, between February 1995 and March 1996.\(^2\) Dietary intake and the social and behavioural factors affecting food intake were examined in terms of age group, gender, rural versus urban dwelling, and living with others or in isolation. Almost 14 000 Australians, including 1600 people aged 65 years and over, were interviewed.\(^8\) The survey results showed that older people were more likely than younger adults to have eaten a diet consistent with the Australian Dietary Guidelines and that the nutrient density of people’s diets actually increases with age.\(^2\)

Further, older Australians were most likely to eat breakfast on five or more days a week and, despite being the highest consumers of fruit and among the highest consumers of vegetables, they reported wanting to eat more fruit and vegetables.\(^9\) The survey results provide extensive information about purchasing and eating
habits. For example, in relation to food security the majority of respondents over 65 years old did not find the availability, cost or dislike of fruit and vegetables a barrier to changing the amount they ate. Only 1 per cent of respondents in this age group reported that they had ‘run out of food and had no money to buy food during the previous twelve months’. Such a low proportion probably has no statistical validity, but if it is correct it would represent 25 000 people.

In general, the results of the Health Status of Older People project and the National Nutrition Survey suggest that older people living in Australia often have a better diet than their younger counterparts.

The Dietary Guidelines for Older Australians are based on current living, social and health conditions, with a view to providing further public health support for the growing population of older people in Australia. Together with favourable health and living conditions, use of the guidelines will help to diminish the physical and financial burdens of old age and offer the potential for positive health as the rest of the population ages.

REFERENCES


DIETARY GUIDELINES FOR OLDER AUSTRALIANS


Background papers
The nutrients that are essential for human life are found in varying amounts in many different foods. Australians today enjoy a wide variety of foods, relatively independent of season and location, and can choose from a number of cuisines. Variety in the diet maximises the possibility of obtaining enough of the essential nutrients (known and not yet known), of increasing phytochemical consumption, and of minimising exposure to toxicants.

BACKGROUND

**The importance of food variety**

The benefits of eating a variety of foods are well documented; among them are protection against macrovascular disease, obesity, diabetes, and possibly even cancer. Consuming a wide variety of foods in the diet offers protection against non-communicable chronic diseases such as these by reducing the intake of foods that supply excessive amounts of fat, salt and alcohol. In addition, a diet with a large variety of foods limits the consumption of potentially toxic substances, which are usually naturally occurring and are found throughout the food supply. It also increases the possibility of receiving essential nutrients in adequate amounts.

Food variety can be defined as the consumption of foods that are biologically diverse or nutritionally distinct from each other. The five food groups comprise foods that differ in nutritional quality, although within each group foods can vary considerably as a result of processing. Plants contain various toxic substances that, although often useful for discouraging insects and other predators, have the potential to harm humans. Minimising the risk posed by naturally occurring toxicants is a useful goal of public health policy. Consuming a wide variety of nutritious foods minimises the intake of toxic components and not only protects against the accumulation of toxic substances and the development of nutrition-related diseases but also works to retard the processes responsible for the physiological decline associated with ageing.

**THE 1995 NATIONAL NUTRITION SURVEY**

The National Nutrition Survey was conducted between February 1995 and March 1996, as an adjunct to the 1995 National Health Survey. The dietary intakes of approximately 13,800 people aged 2 years or older, from urban and rural areas throughout all States and Territories, were recorded; additional information on physical measurements and eating habits and patterns was also collected.

1 ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

*by Professor Colin Binns and Ms Roslyn Giglia*
Data from the 1995 National Nutrition Survey show that during the 14 years since the previous survey food variety in Australia increased significantly, with a greater number of foods being recorded in 1995. The increase in the variety of foods available reflects the wide range of fresh, processed, mixed or prepared food forms that are now conveniently obtainable in Australia on a daily basis. Overall, the food supply is adequate to meet the nutritional needs of Australians, as assessed using the NHMRC's *Recommended Dietary Intakes for Use in Australia* and the Australian Bureau of Statistics apparent consumption of foodstuffs data. The Australian food supply is free of contaminants and pollutants, as shown by the NHMRC Market Basket Survey.

**AUSTRALIA'S ETHNIC DIVERSITY**

The expansion in the number of foods available in Australia is largely due to the ethnic diversity that now characterises our population. The influx of European immigrants after World War 2 and the emphasis on Asian migration in more recent decades have led to the development of an older Australian population consuming a wide variety of cuisines, in place of the ‘traditional’ Anglo-Celtic foods. Nevertheless, many older Australians are unfamiliar with these international foods: it is more common for young people to experiment with foods from different cultures.

On 30 June 1997 more than 704 000 overseas-born people aged 65 or more were living in Australia, constituting 31 per cent of the population in this age group. Thirty-seven per cent of overseas-born older people were originally from the United Kingdom and Ireland; 12 per cent were from Italy, 4 per cent were from Greece, and 3 per cent were from Germany. The number of immigrants from Asia is increasing: approximately 9.8 per cent of immigrants over 65 years now come from Southeast Asia, Northeast Asia and Southern Asia.

The majority of older Australians are therefore more familiar with the Anglo-Celtic food culture of earlier years. The ready availability of different cuisines does, however, enable most Australians to experiment with foods not common in the everyday diet, thus increasing the opportunity for expanding their food variety.

Mennell *et al.* refer to the varying cuisines of the world as ‘culinary culture’ and define this as ‘the ensemble of attitudes and tastes people bring to cooking and eating’. Research into Mediterranean diets is showing benefits in decreasing mortality from chronic diseases and an increased life expectancy in countries where these diets predominate. Traditional Mediterranean diets are based on plant foods, contain small amounts of animal foods, use olive oil as the principal fat, contain moderate amounts of alcohol, and balance energy intake with energy expenditure. They are low in saturated fat and high in the protective compounds found throughout a variety of foods. The traditional diet of older men and women living in Greece, for example, contains large amounts of protein of plant origin, large amounts of carbohydrates from bread, vegetables and fruits, and the majority of alcohol from wine rather than beer and spirits. People whose diets
deviated considerably from this pattern of intake were found to have higher levels of mortality from all causes.14

Continued examination of the health status of immigrants to Australia has shown mortality patterns that, with increasing length of residence, converge towards the mortality pattern of Australian-born residents. These trends in mortality are a result of exposure to the Australian environment: changes in diet, including alcohol consumption, and changes in living and working conditions.15

Food variety in the diet of Chinese immigrants living in Melbourne has been shown to increase with length of stay, independent of age, which suggests that food variety can be increased if there is continued exposure to new foods.1 This study is encouraging in the light of the common assumption that older people are not receptive to the introduction of new foods. In addition, the researchers found that when the diet failed to provide more than 40 per cent of the maximum achievable variety (over 12 months), study participants were far more likely to have at least one nutrient level fall below two-thirds of the Australian recommended dietary intakes. A high food variety is the key to sustaining the intake of essential nutrients. Appendix D outlines a recently developed method of assessing food variety.

Further research that illustrates the health benefits of increasing food variety in a diet comes from the National Health and Nutrition Examination Survey Epidemiologic Follow-up Study.16 Using a dietary diversity score of 0 to 5, with 5 being the maximum possible score and indicating high food variety, increased risk of mortality was associated with a low dietary diversity score at nearly every level of age, income, education, race, smoking status and fibre intake. There was also an increased risk of mortality from all causes for both men and women in dietary patterns where a food group was omitted from the diet. In this study of 4160 men and 6264 women, less than 5 per cent reported omitting foods from the meat or grain groups on the survey day, whereas 46 per cent reported no fruit, 25 per cent reported no dairy products, and 17 per cent reported no vegetables. Not reporting consumption of fruits and vegetables was associated with low serum vitamin C, whereas reporting fruit and vegetable consumption was associated with a high vitamin C concentration.16

Recommending to older Australians that they ‘enjoy a wide variety of nutritious foods’ will help to ensure adequate dietary intake and protect against the adverse effects of consuming only a small number of foods. Older people are often willing to make changes to their diet if they know their health will benefit.17

**SCIENTIFIC BASIS**

**Nutrients important in ageing**

The rate and manner of ageing are the product of a multitude of factors—environmental, genetic, social, economic, and health-related—which interact in ways we do not completely understand (see Appendix E). Some 60-year-olds seem
frail and elderly, yet some 80-year-olds participate regularly in strenuous physical activity. Nutrition plays an important part in normal ageing and the disease process, although its precise contribution is difficult to quantify and qualify.\textsuperscript{18} Table 1.1 shows examples of age-related changes in body composition and physiological function that affect nutrient requirements and occur with advancing age.

Table 1.1 Examples of age-related changes in body composition and physiological function that influence nutrient requirements

<table>
<thead>
<tr>
<th>Change in body composition or physiologic function</th>
<th>Impact on nutrient requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreased muscle mass (sarcopenia)</td>
<td>Decreased need for energy</td>
</tr>
<tr>
<td>Decreased bone density (osteopenia)</td>
<td>Increased need for calcium, vitamin D</td>
</tr>
<tr>
<td>Decreased immune function</td>
<td>Increased need for vitamin B\textsubscript{6}, vitamin E, zinc</td>
</tr>
<tr>
<td>Decreased gastric acid (atrophic gastritis, Helicobacter pylori)</td>
<td>Increased need for vitamin B\textsubscript{12}</td>
</tr>
<tr>
<td>Decreased skin capacity for cholecalciferol synthesis</td>
<td>Increased need for vitamin D</td>
</tr>
<tr>
<td>Decreased calcium bioavailability</td>
<td>Increased need for calcium, vitamin D</td>
</tr>
<tr>
<td>Decreased hepatic uptake of retinol</td>
<td>Decreased need for vitamin A</td>
</tr>
<tr>
<td>Decreased efficiency in metabolic utilisation of pyridoxal</td>
<td>Increased need for vitamin B\textsubscript{6}</td>
</tr>
<tr>
<td>Increased oxidative stress status</td>
<td>Increased need for carotenoids, vitamin C, vitamin E</td>
</tr>
<tr>
<td>Increased levels of homocysteine</td>
<td>Increased need for folate, vitamin B\textsubscript{12}, vitamin B\textsubscript{6}</td>
</tr>
</tbody>
</table>

\textsuperscript{a.} Overall need may be increased because of decreased absorption.

**Energy**

The decline in basal metabolic rate associated with ageing is largely a result of the reduction in lean body mass.\textsuperscript{20} The decline in BMR can be related to a decline in energy needs, although energy needs may also change in response to differences in activity levels or energy expenditure. The decline in physical activity and subsequent energy intake is most often a result of disabilities that limit physical activity, and the decline in energy intake can be compounded by changes in socio-economic, pharmacological and psychological factors.\textsuperscript{21}

The most important factor influencing nutrient intake and nutritional status is the decline in energy expenditure and the subsequent decrease in food intake. For older people, maintaining nutrient intakes in the face of decreased energy requirements can be a challenge—it calls for increased nutrient density. The relationship between energy and protein is a critical and multi-factorial component of nutrition in ageing; it is discussed in greater detail in Chapter 2.
Protein

It might be assumed that protein requirements would decrease concurrently with the pool of body protein as a result of decreasing muscle mass. Researchers have, however, investigated the hypothesis that older people actually require a higher protein intake than do younger people. Although muscle mass generally decreases in older people, the formation of muscle protein can be stimulated by the increased availability of protein and/or amino acids. This response of protein synthesis to amino acid supply suggests that muscle wasting in the older population is not the result of a decreased ability to efficiently use amino acids; rather, it suggests that a decreased intake of dietary protein, amino acids and energy is responsible.

This hypothesis was investigated by applying the current WHO–FAO–UNU recommendation for protein of 0.75 grams per kilogram of body weight per day and using short-term nitrogen balance techniques to determine protein requirements in healthy older men and women. The recommendation of 0.75 grams per kilogram of body weight per day is the same as the current recommended dietary intake for Australian adults, although this recommendation will be reviewed by the RDI working party as party of the Australian RDI revision process. The results of these studies suggest that current protein recommendations might be inadequate and that a more appropriate intake for older people would be 1.00–1.25 grams of high-quality protein per kilogram per day. In practical terms these higher levels are already being achieved in Australia: the median protein intake among Australians aged more than 65 years is in excess of 1.0 gram per kilogram per day (see Table 1.2). It has been suggested that the higher requirement for dietary protein in older people, despite their decreased muscle mass, may be a result of impaired efficiency in the use of dietary protein.

Proteins are essential structural and functional elements within every cell and are extensively involved in the body’s metabolic processes. Older people are often at increased risk of injury from falls and from everyday activities that cause minor injury, since atrophic skin is readily damaged. Pressure sores in immobile older people can also result in severe wounds. Protein deficiency contributes to poor wound healing and, if prolonged, oedema secondary to hypoalbuminaemia can result. For these reasons it is imperative that an adequate protein intake is maintained. Protein requirements increase during times of sepsis, trauma and after surgery, whereas they may decrease in the case of renal or hepatic disease.

Meat is a good source of high-quality protein, which includes other readily available nutrients. The Australian diet contains a wide variety of other protein sources, among them fish, poultry, eggs, soybeans, nuts, nut pastes (such as peanut butter) and other legumes. The average protein intake of National Nutrition Survey respondents aged 65 years and over was adequate, as Table 1.2 shows.
Table 1.2  The protein intake of Australians over 65 years old

<table>
<thead>
<tr>
<th>Age group</th>
<th>Males</th>
<th></th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RDI</td>
<td>Protein</td>
<td>Proportion of</td>
<td>RDI</td>
<td>Protein</td>
<td>Proportion of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(g)</td>
<td>intake</td>
<td>energy intake</td>
<td>(g)</td>
<td>intake</td>
<td>energy intake</td>
<td></td>
</tr>
<tr>
<td>65–69</td>
<td>55</td>
<td>86</td>
<td>16.6</td>
<td>45</td>
<td>67</td>
<td>17.2</td>
<td></td>
</tr>
<tr>
<td>70–74</td>
<td>55</td>
<td>86</td>
<td>17.3</td>
<td>45</td>
<td>64</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>75–79</td>
<td>55</td>
<td>80</td>
<td>16.2</td>
<td>45</td>
<td>64</td>
<td>17.7</td>
<td></td>
</tr>
<tr>
<td>80+</td>
<td>55</td>
<td>79</td>
<td>16.8</td>
<td>45</td>
<td>61</td>
<td>16.3</td>
<td></td>
</tr>
</tbody>
</table>

Vitamins and minerals

A decrease in the older population’s energy intake is associated with a decrease in the need for some of the B vitamins, so the RDI for these vitamins is lower for this group compared with younger age groups.

Atrophic gastritis, and the subsequent decrease in acid and intrinsic factor secretion, is a cause of vitamin B₁₂ deficiency in older people. Liberation of the bound form of B₁₂ in foods is also impaired, compounding the problem. A vitamin B₁₂ deficiency can result in any one of the following conditions: megaloblastic anaemia, peripheral neuropathy, ataxia or cognitive impairment. Because of large liver stores of vitamin B₁₂ and its long half-life, it takes six to 12 years to develop vitamin B₁₂ deficiency, so classic pernicious anaemia is rare in older people: it appears only in the presence of complete atrophy of the gastric mucosa.²⁶,²⁷ The National Nutrition Survey did not collect data on vitamin B₁₂ intake, but an Adelaide study²⁸ of 338 people aged 70 years or more showed that all age groups consumed more than 2 micrograms of vitamin B₁₂ a day, which is the NHMRC’s recommended dietary intake. Atrophic gastritis and ulcers are caused by a number of factors in the gastric mucosa, the most important being infection with Helicobacter pylori: if control of chronic H. pylori infection improves the prevalence of atrophic gastritis will be reduced.²⁹

A deficiency of vitamin B₁₂ or folate, or both, has been shown to be associated with elevated homocysteine concentrations in older people.³⁰ The decreased production of stomach acid that is common in older people can also lead to decreased folate absorption and thus to elevated homocysteine concentrations as age increases.³⁰ Folate lowers plasma homocysteine levels, and even a mild to moderate rise in homocysteine levels has been shown to be a strong risk factor for arteriosclerosis.³¹ Although the precise mechanism by which homocysteine exerts a cytotoxic effect on endothelial cells is unknown, 35 retrospective case-control studies and two recent prospective studies have consistently identified mild to moderate elevation of homocysteine as an independent risk factor for peripheral vascular disease, cerebrovascular disease and coronary artery disease.³²
A low intake of folate has also been associated with dementia, mild confusion, irritability, depression, apathy, and depressed memory function. Reports of dementia in patients with low serum folate levels that cleared with folate treatment provide further support for a diet rich in sources of this nutrient. In Australia a low folate intake is becoming less common as the fortification of foods with folate expands: results from the 1995 National Nutrition Survey indicated that people over 65 years old are not at risk of folate deficiency when compared with the current recommended dietary intake (see Tables 1.3 and 1.4).

Calcium bioavailability is also affected by atrophic gastritis: the decrease in acid can decrease the dissociation of calcium from food complexes. A greater influence on absorption is the effect of 1,25(OH)₂D, the active form of vitamin D. Calcium and vitamin D are interactive in their role in bone health. Produced in the kidney, 1,25(OH)₂D is necessary for calcium absorption. The age-related decrease in renal function is thought to be responsible for a decrease in the level of circulating active vitamin D and thus a decrease in calcium absorption. An inadequate vitamin D intake can also result from lack of exposure to sunlight, decreased consumption of dairy products, lactose intolerance, and malabsorption of fat-soluble vitamins.

In Australia the recommended dietary intake for calcium is 800 milligrams a day for men over 64 years and 1000 milligrams a day for women over 54 years. Mean calcium intakes for women over 65 years in the National Nutrition Survey were only 68 per cent of the RDI. Lack of calcium has been strongly implicated in the aetiology of osteoporosis; the maintenance of optimal calcium and vitamin D intake can minimise bone demineralisation and reduce the incidence of fractures in older people (see Guideline 11).
Table 1.3  Mean nutrient intakes of males aged over 65 years:
National Nutrition Survey, 1995–96

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>RDI for males</th>
<th>65–69</th>
<th>70–74</th>
<th>75–79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>–</td>
<td>8 823</td>
<td>8 439</td>
<td>8 420</td>
<td>8 001</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>55</td>
<td>86</td>
<td>86</td>
<td>80</td>
<td>79</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>–</td>
<td>77</td>
<td>72</td>
<td>76</td>
<td>70</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>–</td>
<td>240</td>
<td>234</td>
<td>231</td>
<td>230</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>30</td>
<td>25</td>
<td>24</td>
<td>23</td>
<td>24</td>
</tr>
<tr>
<td>Alcohol (g)</td>
<td>–</td>
<td>18</td>
<td>14</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Vitamin A–retinol equivalent (mcg)</td>
<td>750</td>
<td>1 208</td>
<td>1 483</td>
<td>1 243</td>
<td>1 198</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.9</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Niacin equivalent (mg)</td>
<td>14–17</td>
<td>40</td>
<td>39</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>200</td>
<td>289</td>
<td>275</td>
<td>259</td>
<td>270</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>40</td>
<td>131</td>
<td>130</td>
<td>115</td>
<td>126</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>800</td>
<td>825</td>
<td>794</td>
<td>767</td>
<td>761</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>1 000</td>
<td>1 467</td>
<td>1 419</td>
<td>1 398</td>
<td>1 327</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>320</td>
<td>349</td>
<td>332</td>
<td>326</td>
<td>312</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>7</td>
<td>14</td>
<td>15</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>12</td>
<td>11</td>
<td>12</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>1 950–5 460</td>
<td>3 389</td>
<td>3 229</td>
<td>3 052</td>
<td>3 068</td>
</tr>
</tbody>
</table>
Table 1.4 Mean nutrient intakes of females aged over 65 years: National Nutrition Survey, 1995–96

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>RDI for females</th>
<th>65–69</th>
<th>70–74</th>
<th>75–79</th>
<th>80+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>– 6 619</td>
<td>6 276</td>
<td>6 153</td>
<td>6 363</td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td>55 67</td>
<td>64</td>
<td>64</td>
<td>61</td>
<td></td>
</tr>
<tr>
<td>Fat (g)</td>
<td>– 59</td>
<td>56</td>
<td>54</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>– 186</td>
<td>179</td>
<td>177</td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>30 20</td>
<td>20</td>
<td>21</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Alcohol (g)</td>
<td>– 6</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Vitamin A—retinol equivalent (mcg)</td>
<td>750 1 130</td>
<td>1 021</td>
<td>969</td>
<td>1 108</td>
<td></td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.9 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Niacin equivalent (mg)</td>
<td>14–17 30</td>
<td>29</td>
<td>29</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Folate (mcg)</td>
<td>200 232</td>
<td>223</td>
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<td>Calcium (mg)</td>
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<td>672</td>
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<td>Phosphorus (mg)</td>
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<td>1 131</td>
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<tr>
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Zinc is an important mineral in the diet of older people because of its role in wound healing and immune function. Zinc deficiency leads to a slower rate of wound healing by retarding epithelialisation and decreases wound strength and collagen synthesis; it also diminishes taste acuity. As Tables 1.3 and 1.4 show, the National Nutrition Survey found that mean zinc intake in older Australian males was in keeping with the RDI, but for women it was not.

People with low energy consumption are at risk of zinc deficiency. An Australian study of 24 community residents and 66 nursing home residents aged 60 or more measured dietary zinc intake. Twenty-one per cent, or five, of the community residents and 85 per cent, or 56, of the nursing home residents had zinc intakes less than two-thirds of the then current US recommended dietary allowance for zinc (15 milligrams a day). There was a significant correlation between protein and zinc intakes for the study population.
PRACTICAL ASPECTS OF THIS GUIDELINE

Nutrient interactions

One of the fundamentals of nutrition is the interaction of foods and nutrients, which mutually influences the absorption, metabolism and retention of other nutrients. When the diet is well balanced and nutrients are in adequate supply, such interactions pose few problems, but when the intake of some nutrients is habitually low, excesses of others can have detrimental consequences. A common interaction is that between sodium, protein and calcium. Sodium and calcium compete for the same transport mechanism in the kidney, and an excess of one will cause excretion of the other. Protein has a similar effect on urine calcium levels. This interaction is important in the older population because factors that affect urinary calcium loss are likely to affect bone health: recognition of this interaction allows for the prevention of calcium losses related to high protein intakes. Table 1.4 shows borderline calcium intakes and high protein intakes among older Australian females. When diets are high in protein, a reduction in sodium intake can reduce the physiological need for calcium and so improve calcium nutrition (see Guideline 10). Other inhibitors of calcium absorption are phosphates in cow’s milk, phytic acid from the husks of cereals, and oxalic acid in spinach and rhubarb, which form insoluble complexes with calcium.

Iron is also susceptible to nutrient interactions. Non-haem iron absorption is inhibited by phytates, polyphenols (for example, tannins) and calcium. Consuming animal sources of iron, such as meat, which is also high in protein, will promote iron absorption, as will consuming a source of vitamin C with foods containing non-haem iron—for example, drinking a glass of orange juice with an iron-fortified breakfast cereal. Iron requirements appear to be lowest in old age, so iron deficiency appears to be less prevalent in this age group than in the younger population. There are, however, some subgroups of older people—for example, residents of aged care accommodation, people on marginal diets, and people with chronic illness—that may be at greater risk.

Zinc bioavailability is also affected by phytate found in cereal products. Zinc found in animal products, crustaceans and molluscs is more readily absorbed than zinc found in plant foods. Legumes and unrefined cereals contain phytates that reduce zinc absorption. The zinc content of refined cereals is lower than that of unrefined cereals but, because a large part of the phytic acid present in cereals is removed during the refining process, zinc bioavailability is increased. Phytate in the presence of calcium may also reduce zinc bioavailability. By including adequate amounts of wholegrain products and legumes, lacto-ovo vegetarians can meet their zinc requirements and maintain zinc balance. Meat is also a good source of zinc.
DRUG–NUTRIENT INTERACTIONS

Older people generally use more medications than younger people because they have more symptoms and more diseases. The number of medications a person uses is an important predictor of adverse drug reactions: the number of reactions will increase exponentially with the number of drugs used. Decreased endocrine function, prescriptive dietary restrictions, and the pathophysiological changes associated with ageing further increase the risk of nutrient–drug interactions in the older population.

The pharmacological response of drugs is strongly influenced by nutritional status, and in turn food consumed can affect a drug’s pharmacodynamics. Drug–nutrient interactions can be classified as follows.

- Foods can affect drugs.
- Nutrition can affect drugs.
- Drugs can affect nutrition.
- Drugs can affect foods.

Of course, drug–drug reactions must also be considered.

Foods can affect drugs

The most important nutrient–drug interactions involve the absorption process since most drugs are taken by mouth and need to be absorbed before their action begins. Food can either speed up or slow down the absorption process, which can alter the pharmacological effect of a drug. Prescribing drugs with a meal is a good way of helping older people remember to take their medication, but the interaction of food with drugs may not always make this the best time.

A number of mechanisms involved in drug–food and drug–fluid interactions affect absorption. Among the indirect mechanisms are

- drug-induced changes in gastrointestinal motility—for example, changes caused by anticholinergics;
- drug-induced malabsorption syndromes—for example, changes caused by neomycin.

Among the direct mechanisms are

- drug-induced pH changes in the gastrointestinal tract—for example, changes caused by antacids;
- drug-induced changes in bioavailability—for example, adsorption of drug-kaolin/pectin;
- drug-induced retardation of absorption—for example, retardation caused by charcoal;
- drug binding and chelation—for example, anionic exchange resins – cholestyramine; metal ions – iron, calcium.
Nutrition can affect drugs
The nutritional status of a person can affect their ability to metabolise some drugs. After absorption, most of a drug is transported in plasma attached to a plasma protein, most commonly albumin. The small amount of drug that remains unbound in the total plasma concentration is then free to act on target organs. In malnourished people the albumin can be considerably reduced, leaving a larger fraction of the drug in an unbound state in the plasma, free to act on target tissues. This results in a higher than expected dose of the drug in the plasma, particularly if metabolism or excretion of the drug is impaired by liver or kidney dysfunction. The body weight of a malnourished person should be taken into account when prescribing drugs.

Drugs can affect nutritional status
Certain drugs can affect nutritional status and lead to clinical under- or over-nutrition. Nutritional status can be altered by a decrease or increase in appetite, malabsorption of nutrients, stimulation of the basal metabolic rate, and changes in glycaemic level. Appendix F outlines some specific drug–vitamin reactions.

Drugs can affect foods
Monoamine oxidases constitute a class of drugs that can interact with foods and have the potential to cause serious problems. They are anti-depressants but also prevent the metabolism of amines such as tyramines found in fermented, protein-rich foods—for example, matured cheese, Vegemite and chocolate. The increase in amine concentration that can occur if these foods are eaten while taking monoamine oxidases can cause a dangerous rise in blood pressure.

Drug–drug reactions
Drug–drug interactions can result in modifications to pharmacological actions. It is important that polypharmacy in the older population is minimised—to prevent both drug–nutrient interactions and drug–drug interactions. The problem of polypharmacy is complex, involving patients, physicians, other health care providers, pharmacies and the pharmaceutical industry. Educating patients, educating medical practitioners and improving their prescribing habits, and monitoring medication numbers and use in older people all help to reduce polypharmacy and the related risks to nutritional status.

FOOD CONTAMINANTS
Eating a variety of foods dilutes the naturally occurring toxicants and any added contaminants. As noted, the Australian food supply is one of the safest and cleanest in the world, ensuring that a minimum of toxicants are ingested. In the 1996 Market Basket Survey, 76 commonly eaten foods were tested for 51 pesticide
residues, the metals arsenic, cadmium, lead and mercury, and a range of other contaminants. Dietary exposures were also tested for males and females aged 25 to 34 years, boys and girls aged 12 years, toddlers aged 2 years, and infants aged 9 months. The following contaminants were found to be within acceptable safety standards: arsenic, cadmium, lead, mercury, polychlorinated biphenyls, patulin and aflatoxins. Estimated dietary exposure to the following pesticide residues was also within acceptable levels: chlorinated, organic pesticides, organophosphorous pesticides, synthetic pyrethroid pesticides, fungicides, and the anti-sprouting agent chlorpropham.

**PHYTOCHEMICALS**

Variety in the diet is becoming increasingly important as the emphasis on non-nutrients increases. Foods have traditionally been classified according to their macronutrient and micronutrient value, but now their non-nutrient value is gaining recognition in terms of food’s role in chronic non-communicable diseases. Most non-nutrient factors are phytochemicals that are not directly associated with deficiency syndromes but do have some relationship to optimal health. Phytochemicals may be multi-functional; alternatively, a particular function may be provided by more than one class of phytochemicals. Interactions between compounds are likely to be complex and deep, causing a masking or synergy of effects.

Phytochemicals can fall into one of a number of chemical categories: carotenoids, flavonoids and isoflavonoids, polyphenols, isothiocyanates, indoles, sulphoraphane, monoterpenes, xanthin, and non-digestible oligosaccharides. Variety in the diet is recommended so that the protective benefits of nutrients and non-nutrients can be obtained: it is not known exactly which food constituents are responsible for the protective effect against chronic diseases. With the exception of breast milk in the first six months of life, no single nutritious food can provide a complete and healthy diet. A diet containing a wide range of foods from the different food groups is most likely to offer protection against non-communicable chronic diseases.

**TASTE PERCEPTION**

The senses of taste and smell have a strong influence on our perception of food flavour and thus affect our food choices and intake. Age-related sensory loss is common in the older population, and certain disease states, medications, surgical interventions and environmental exposure may compound the loss.

The sense of smell appears to be less sensitive than taste: older people require a smell threshold between two and 15 times higher than that of young adults and have less ability to differentiate food odours. A diminished sense of taste (hypogeusia) appears to be the result of a reduction in the number of taste buds and the turnover of taste cells in the taste buds. Similarly, a diminished sense of
smell (hyposmia) appears to be the result of a reduction in the number of glomeruli contained in the olfactory bulbs of olfactory cells. Taste and smell have an important role in preparing the body for digestion by triggering saliva and gastric, pancreatic and intestinal secretions.

In the older population impairment of taste (and smell) occurs at two thresholds:

- the detection threshold—the concentration for the absolute threshold for taste sensation;
- the recognition threshold—the lowest concentration at which a taste (tastant) is correctly identified.

Changes in these thresholds result in reduced taste sensitivity; the greatest losses occur for people who take a number of medications. In an older group taking an average of 3.4 medications the average detection thresholds were markedly higher than in a younger cohort: 11.6 times higher for sodium salts, 4.3 times higher for acids, 7.0 times higher for bitter, and 2.7 times higher for sweeteners. High concentrations of sucrose and sodium chloride in foods were rated as more pleasant by the older population.

Altered taste perception may have serious implications for older people, who generally have a higher prevalence of hypertension and diabetes and who may find salty and very sweet foods more palatable. Losses in salt taste perception can make it difficult for hypertensive people to restrict their dietary salt intake because salt-reduced food may seem tasteless. One study of salt preferences in chicken broth by two age groups found, however, that the older group preferred less salt.

There has been little research into how perceptions of taste and preferences for certain foods and their flavours might vary between people from different cultures. Varying preferences for sweetness, sourness, saltiness and bitterness may be an important factor in the preparation of meals for older people in nursing homes or people receiving home-delivered meals. For example, a generalisation that the Japanese prefer their food to be quite salty may influence how a cook prepares food for people of Japanese background. Research in this area has mainly been done on Japanese and Australian subjects: panels of subjects gave ratings on intensity of and liking for the manipulated taste (such as citric acid in orange juice); the findings suggested a high level of cross-cultural agreement about the optimal amount of tastant for each food.

Alzheimer’s disease has a greater effect on olfactory senses than is the case for normal older people. The degree of olfactory impairment appears to be related to the degree of dementia. During ageing, reductions in olfactory cell numbers, damage to cells, and diminishing levels of neurotransmitters occur, but they are more pronounced in people with Alzheimer’s disease. It appears that olfactory dysfunction associated with Alzheimer’s disease is a neurologically mediated function of the disease and is not related to nasal dysfunction.
People who regularly prepare food for older Australians need to take into consideration this diminished sense of taste and smell. Foods, meals and menus that are designed to compensate for sensory losses may help enhance the perceived palatability of food, in addition to improving nutrient intakes. Over-flavouring meals using sugar- or sodium-based flavourings should, however, be minimised so that rises in blood pressure or blood glucose levels, or both, are avoided in older people susceptible to these conditions.

**RELATION TO OTHER GUIDELINES**

*Keep active to maintain muscle strength and a healthy body weight.* If older adults are aware of the need to eat a wide variety of foods they will be less likely to choose foods from only one source and more likely to eat many foods with varied energy contents.

*Eat at least three meals every day.* Every opportunity to eat is an opportunity to eat a new food or a food not eaten on a regular basis. Choosing different snacks can also increase food variety.

*Eat plenty of vegetables (including legumes) and fruit.* Adopting a varied diet means that a wide choice of vegetables and fruits can be enjoyed, in addition to those regularly eaten; for example, having stewed fruit on porridge and other breakfast cereals and adding fruit to salads instead of olives, which are high in salt.

*Eat plenty of cereals, breads and pastas.* Choose from a wide range of cereal-based products from different cuisines, including wholemeal, wholegrain and fibre-enriched products such as bagels, pita bread and pumpernickel.

*Eat a diet low in saturated fat.* A diet that is rich in variety will contain foods from many different sources and be less concentrated in sources of fat.

*Choose foods low in salt and use salt sparingly.* Inclusion in the diet of foods from a variety of sources will displace the number of foods that are high in salt. Experimenting with different types of foods will introduce new flavourings to the diet.

*Include foods high in calcium.* Increase dietary variety by using high-calcium foods from other countries; for example, parmesan cheese and some varieties of tofu.

*Use added sugars in moderation.* Foods that are naturally sweet are more likely to be consumed in a varied diet because many different foods types are chosen, not just those that are high in added sugars.
CONCLUSION

Enjoying a variety of nutritious foods remains an important message for all age groups, but particularly for older people, who have reduced energy requirements and need to ensure adequate nutrient density. Making mealtimes a social occasion, experimenting with other cuisines, and incorporating new and traditional foods will encourage variety in the diet and protect older people from chronic diseases.

REFERENCES


The Physical Activity Guidelines for Australians recommend that all Australians engage in at least 30 minutes of moderate-intensity exercise on most, if not all, days of the week. The 30 minutes’ exercise need not be continuous: short sessions of different activities, such as walking briskly or gardening, can make up the total. Any other incidental activity should also be encouraged and seen as an opportunity to improve health. People who exercise for longer than the minimum recommended, and at a higher intensity, will accrue greater benefits. Physical activity reduces the risk of coronary heart disease, hypertension, colon cancer, non-insulin dependent diabetes mellitus, and premature mortality in general. It can also help to improve mental health and plays an important role in the health of muscles, bones and joints.

BACKGROUND

Older people constitute a growing proportion of the Australian population. They are predominantly sedentary, and increasing their exercise level would reduce the extent of chronic illness among them, improve their sense of wellbeing, and retard any decline in functional capacity.

Common to the older population is a decrease in skeletal muscle mass (sarcopenia) and strength, which is the result of a decline in the production of muscle tissue. Changes in muscle function and mass lead to decreased performance, increased risk of falls, and increased susceptibility to injury and bone fracture. Eyesight deterioration and arthritis may also contribute to an increase in the incidence of injury and bone fracture. Reduced muscle strength is a major cause of the increased prevalence of disability among older people. Sarcopenia appears closely linked to age-related losses in bone mineral, basal metabolic rate and increased body fat content.

The decrease in muscle mass leads to a decline in physical activity and may be responsible for retarded metabolic rate, decreased bone density, obesity and impaired glucose tolerance. Results from the National Nutrition Survey show that daily energy expenditure declines throughout adult life and that most older Australians take little exercise (see Figures 2.1 and 2.2). For people with sedentary habits, energy expenditure is dependent on fat-free mass, which decreases by about 15 per cent between the third and eighth decades of life, contributing to the lowered metabolic rate in older people. The decrease in energy expenditure is generally accompanied by decreased appetite and a diminished food intake, and so may account for many nutritional problems seen in the older population.
Figure 2.1  Participation in exercise: males

Figure 2.2  Participation in exercise: females
SCIENTIFIC BASIS

Physical activity and body weight

Aerobic exercise involves using many muscle groups; the NHMRC’s Dietary Guidelines for Australians acknowledge aerobic exercise as important for the prevention and treatment of diet-related diseases such as diabetes, hypertension, heart disease and osteoporosis, all of which are chronic diseases associated with ageing.

There have been many studies investigating the outcomes of continued aerobic or endurance exercise among older people. The inverse relationship between the level of physical activity and the risk of premature death from any cause, even in older age groups, continues to be reaffirmed. More recently, resistance exercise, or strength training, has been investigated as a way of preserving muscle and bone mass in older people. Strength (or resistance) training is generally defined as ‘training in which the resistance against which a muscle generates force is progressively increased over time’. Progressive strength training involves lifting a heavy load in rapid succession, to strengthen muscle and reduce muscle loss. Strength training has received less emphasis than aerobic exercise in health promotion programs, but recent studies conducted in older people have demonstrated that among its benefits are a decline in the progression of sarcopenia and a decline in associated problems such as non–insulin dependent diabetes mellitus, coronary artery disease, hypertension, osteoporosis and obesity.

Strength training’s effect on muscle strength, peak cycling output, treadmill walking, stair climbing, and bone mineral density and content was studied in healthy males and females aged 60 to 80 years for 42 weeks. Strength continued to increase over the training period, without plateauing—regardless of age—and there were improvements in all of the activities tested. Nursing home residents taking part in a resistance training study gained benefits not only in terms of muscle strength and mass but also in gait speed, stair-climbing ability, balance, and the amount of spontaneous activity they engaged in.

Any decline in energy expenditure with ageing must be balanced by adjusting energy intake, to maintain body weight within the healthy range and to prevent an increase in body fat. The NHMRC has documented the role of abdominal adiposity in the development of dyslipidaemia, hypertension and non–insulin dependent diabetes mellitus. Increasing muscle mass and function through resistance training can produce benefits for older people who are trying to lose weight. In general, older people’s low fitness level means they do not expend a great deal of energy during endurance exercise, and a 30- to 40-minute walk may increase energy expenditure by only 420 to 840 kilojoules, with little continued effect on metabolic rate. Aerobic exercise is not as effective at preserving lean body mass during weight loss; strength training does preserve muscle mass during weight loss and produces a continued rise in resting metabolic rate. Incorporating both aerobic exercise and strength training in weight-loss programs for older people will maximise benefits.
Increasing energy expenditure results in increased nutrient intakes. The nutrient intake of a group of previously sedentary older women on an exercise training program of 30 to 40 minutes' walking five days a week was compared with the intake of very fit older women to determine if increasing the activity of the sedentary group would enhance their nutrient intake. A 12-week walking program was found to provide insufficient stimulus to improve overall nutrient intake in the sedentary group. In comparison, the highly active women averaged more than 100 per cent of the recommended dietary allowance for energy, despite weighing on average 10 kilograms less than members of the sedentary group. The researchers concluded that for highly active women nutrient intake can be expected to increase when exercise increases to high levels.

**Bone mineralisation and exercise**

Skeletal fragility associated with osteopenia, muscle weakness related to sarcopenia, and declining balance are all risk factors for bone fracture resulting from falls. Increased weight-bearing activity can slow the rate of bone loss and decrease the incidence of falls. Thirty-nine post-menopausal women were randomly assigned to a strength-training group for two days a week for 12 months. There were significant increases in lumbar spine and femoral bone density for the strength-trained women, who also showed evidence of improved muscle mass, strength and balance, and increased overall physical activity. This suggests that strength training is just as efficient as aerobic exercise in maintaining bone density as well as providing other functional benefits.

In the 1995 National Health Survey the most common long-term condition reported by respondents aged over 65 years was arthritis: approximately half of these people reported suffering from arthritis for six months or more. Weight loss is the primary focus of nutritional care for an arthritic person who is overweight. This is especially important if the arthritis is in the spine or in weight-bearing joints because it reduces physical activity and makes it difficult to lose weight. Resistance exercise may be beneficial in improving strength and reducing the pain of arthritis.

**Body mass index and older people**

The relationship between weight and mortality is illustrated by a U-shaped or J-shaped curve, which shows that mortality risk is higher at the extremes of underweight and overweight. Research evidence indicates, however, that for people over 74 years a higher body weight may be associated with a lower risk of mortality from all causes, although this result may be confounded by the fact that in studies of this age group underweight subjects may already be suffering from a significant disease.
The NHMRC recommends use of the body mass index to assess body fatness. The following formula is used:

\[ \text{BMI} = \frac{\text{weight (kg)}}{\text{height (m)}^2} \]

In the older population height may decrease with age—as a result of changing spinal shape and intervertebral disc thickness—making it difficult to determine height and BMI.

The NHMRC’s reference ranges for BMI are underweight <20; acceptable weight \( \leq 20–25 \); overweight 25–\( \leq 30 \); and obese \( > 30 \). The World Health Organisation defines additional categories: obese class I, 30.0–34.9 kg/m\(^2\); obese class II, 35.0–39.9 kg/m\(^2\); and obese class III, \( \geq 40 \) kg/m\(^2\).

With increasing age these reference values become less distinct, as identified in a recent study in which the U-shaped mortality curve for weight flattened out with advancing age.28 As part of the Cancer Society’s Cancer Prevention Study I, 62 116 men and 262 019 women were assessed from 1960 to 1972. The study found that among men and women aged 30 to 74 years greater body weight increased the risk of death from any cause and of cardiovascular disease, although the relative risk associated with excess weight was higher among younger subjects (see Appendix G).28 The results of these studies suggest that an older person’s general health status is more important than a moderately elevated BMI. In one American study a BMI of 27–30 for men and 30–35 for women was found to be protective for all causes of mortality for people over 70 years of age.34 Wahlqvist suggests that a BMI range of 22–26 is acceptable for older Australians.

Despite the apparent statistical association between weight and health status, the causes of an elevated BMI must be taken into consideration when counselling an older person who is overweight. Current weight status is not reflective of a lifetime accumulation of body fat and the development of atherosclerosis.35 The monitoring of health improvements resulting from a physical fitness and weight reduction program is best achieved and managed by lowering blood pressure and normalising blood lipids rather than actual weight reduction.29

Overall, considering both morbidity and mortality, for the obese older person a reduction of the BMI to 30 or below provides the healthiest long-term option, but further research is needed to determine the optimum BMI range for Australians.

**Weight loss**

Older people can lose weight for no apparent reason, and the weight loss can be accompanied by a concurrent decline in biological, psychological and social function. This combination of problems is often called ‘failure to thrive’ or ‘the
dwindles’. Failure to thrive is usually a multi-factorial condition, often involving one or more of the following problems, known as ‘the 11 Ds of the dwindles’:

- diseases—medical illnesses such as chronic obstructive lung disease and heart failure
- dementia
- delirium
- drinking alcohol and other substance abuse
- dysphagia
- deafness, blindness and other sensory deficits
- depression
- desertion by family and friends—social isolation
- destitution—poverty
- despair—giving up
- drugs.

Drugs are an important factor in failure to thrive because they can have side-effects—such as nausea, vomiting, anorexia, catabolism, dry mouth, altered taste and hypermetabolism—that contribute to weight loss.

Any weight loss of more than 5 per cent of normal body weight needs to be investigated.

PRACTICAL ASPECTS OF THIS GUIDELINE

Exercise recommendations

In any age group, but particularly in the older population, the greatest public health benefit will result from an increase in physical activity on the part of people who are inactive or sedentary. The Physical Activity Guidelines for Australians recommend small increases in moderate-intensity activity as most beneficial and appropriate for older people; this should include some strength training and stretching to maintain muscle strength and joint integrity.

The following recommendations for exercise—at both an individual and a community level—are based on recommendations developed by the Noll Physiological Research Centre at Pennsylvania State University. They provide a basic framework for exercise programs for older people.
At the individual level: muscle-strengthening exercise

Candidates
Adults of all ages are eligible for involvement in a strength-training exercise program, but very elderly people and people with hypertension should have a medical examination before embarking on such a program.

Exercises
Strength training should focus mainly on the large muscle groups that are important for everyday activities; for example, muscles in the shoulders, arms, spine, hips and legs.

Training intensity and duration
High-intensity resistance training has been shown to have the most dramatic effect on improving muscle strength at all ages. It involves training at a level that will result in muscular fatigue after the weight has been lifted and lowered with the correct repetitive action. The weight of the load should increase as muscle strength builds.

Breathing technique
The proper breathing technique is to inhale before lifting the weight, exhale during the lift, and inhale as the weight is lowered to the starting position. People should not hold their breath when lifting. The proper breathing technique should be used even when exercising with light weights. Proper breathing means less cardiovascular stress, and heart rate and blood pressure should rise only slightly above normal resting values.

Equipment
Any weight or equipment that is sufficient to stress the muscles beyond what is usually lifted can be used. Simple weight-lifting devices such as Velcro-strapped wrist or ankle weights are ideal. It is possible to use heavy household objects, such as food cans of various sizes, but this is not recommended because of the potential risk of accident or injury.

At the individual level: physical activity and aerobic exercise

Initial health assessment
Anyone over the age of 50 who wants to begin a vigorous training program should have a stress test under a doctor’s supervision. If it is simply a matter of walking, however, a stress test is probably not necessary: instead, a questionnaire relating to
fitness level and medical history may be adequate to ascertain the level at which a person should start a physical activity program.

**Warm-up and cool-down**

The muscle stiffness associated with increasing age is a result of the reduced elasticity of connective tissue. If an older person warms up and stretches properly the exercise they do will be more effective and less likely to result in injury. A five-minute warm-up followed by stretching exercises is advised. The exercise session should be completed with a cool-down stretch when tendons and ligaments are much more elastic.

**Exercise intensity and duration**

As noted, the Physical Activity Guidelines for Australians recommend at least 30 minutes of accumulated exercise on most days. The recommendation for the intensity of activity is the level at which you ‘huff and puff’. Technically this would be 70–85 per cent of maximum heart rate, which is calculated as 220 minus your age.¹

**Environmental and policy approaches to exercise**

Exercise programs directed at particular population subgroups have had limited or inconsistent success. One reason for this may be lack of support from the broader environment within which such interventions take place. Environmental and policy interventions should complement interventions that focus on behaviour change among individuals and groups.²

The NHMRC’s *Acting on Australia’s Weight* outlines strategies for changing the macro-environment of food supply and for increasing opportunities for physical activity. It firmly acknowledges the influence of the environment in relation to exercise:

> Much of the physical activity in people’s daily lives is not as a result of planned exercise training programs or training for sporting events but is acquired in the course of occupation and leisure time. Experts in planning, designing and engineering the physical environment of towns, buildings, worksites, schools, shopping centres and parks and gardens will need to consider what they may have to offer in terms of opportunity and safety for members of the public to increase their levels of activity. (p. 23)

Strategies from that document must be applied to this guideline to ensure that older people—those living independently and the residents of aged care accommodation—also benefit from increased opportunities to exercise.
At the community level

Community-level programs can be designed specifically to meet the needs of older people. When establishing a community-based exercise program for older people the following recommendations might be useful.\textsuperscript{15}

- Work with local or State or Territory agencies. For example, local councils may have funds allocated to activities for senior citizens in their area.
- Use infrastructure that already exists. Councils on ageing may have a facility that is specifically designed for use by older people. Local hospitals may be aware of these outlets.
- Promote the social aspects of your exercise program, which may well appeal more to older people than the fitness benefits.
- More women than men will become involved, so develop strategies for encouraging men to participate.
- Plan for widely varying levels of physical fitness and functional capacity. Highly fit and very frail people might wish to join the same exercise program: it may be necessary to run two groups.
- Establish a medical advisory group of local doctors, who can refer patients to the group and conduct stress tests for potential participants.
- Try to incorporate some strength training in new programs.

RELATION TO OTHER GUIDELINES

\textit{Enjoy a wide variety of nutritious foods. Eat plenty of cereals, breads and pastas. Include foods high in calcium.} Exercise increases energy intake. The extra kilojoules can be consumed as a variety of nutritious foods—for example, vegetables and fruit, cereals, breads and pastas, and foods that are high in calcium. Consumption of these foods will increase the nutrient density of the diet.

\textit{Eat at least three meals every day.} Regular participation in an exercise program will increase appetite and promote regular consumption of meals.

\textit{Drink adequate amounts of water and/or other fluids.} It is important that all people who participate in regular physical activity maintain a balanced hydration status. Fluids should be consumed throughout physical activity, to prevent delayed dehydration.

CONCLUSION

If older people participate in aerobic exercise and strength training they will decrease their risk of diabetes, hypertension, heart disease, osteoporosis and colon cancer. Age-related loss of muscle mass is strongly associated with a decline in
functional independence in older people: it can be delayed by participation in a regular aerobic and strength-training program. Physical activity leads to increased energy intake and is an excellent way of increasing nutrient density in older people. Further, the generally improved physical and mental status resulting from regular physical activity will enhance older people’s quality of life, whether they are living independently or in aged care accommodation.

REFERENCES


3 EAT AT LEAST THREE MEALS EVERY DAY

by Ms Roslyn Giglia and Professor Colin Binns

Good nutrition and appropriate eating habits—which includes regular meal patterns—are important throughout life for the maintenance of health. They are essential if older people are to maintain their nutrient intake and the general quality of their diet. The decreased appetite and food intake and the declining physical activity that usually accompany the ageing process must be balanced against the need to preserve nutrient intake. This means nutrient density must increase to ensure recommended daily intakes are still met. Eating a minimum of three nutritious meals every day will help maintain older people’s nutritional status and ensure variety in their diet.

BACKGROUND

Advanced age, the use of multiple medications, the presence of acute or chronic disease, dietary restrictions, loss of appetite, lack of income, living and eating alone, an inability to shop or cook, limited ability to chew, and dysphagia—these are some of the many reasons for a decline in older people’s food intake.

The 1995 National Nutrition Survey found that a greater proportion of people over the age of 65 years who ate two to four meals a day were more likely to meet the recommended dietary intakes than those who ate less than two meals. As the number of meals increased so did the number of older people who were achieving their RDI. The results serve to highlight the importance of older Australians eating at least three meals a day to ensure adequate nutrient intake.

There has been no comprehensive research into which meals are most commonly skipped by older Australians, but an American study of 474 people aged 65 to 98 years examined food intakes and dietary patterns. Lunch and snacks were the meals most often skipped, and it was more common for males not to eat lunch and for females not to eat snacks. Breakfast and dinner were the meals most likely to be eaten.

SCIENTIFIC BASIS

The importance of breakfast

Breakfast appears to be an important meal for older people. Approximately 95 per cent of Australians over 65 years old eat breakfast five days or more a week; this is the highest proportion for any age group. Table 3.1 shows that for each nutrient analysed older Australians who eat breakfast have a higher daily intake of nutrients than ‘breakfast skippers’ and are more likely to exceed 70 per cent of the RDIs for
core food group cereal serves and fibre intake. Promoting breakfast in the dietary pattern of older people should improve overall daily dietary intake. People who eat breakfast consume more fibre, and the fortification of cereals with nutrients can improve the nutrient density of the diet (see Guideline 6).³

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Males Eaters</th>
<th>Males Skippers</th>
<th>Significance</th>
<th>Females Eaters</th>
<th>Females Skippers</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>4</td>
<td>23</td>
<td>n.s.</td>
<td>6</td>
<td>12</td>
<td>n.s.</td>
</tr>
<tr>
<td>Thiamin</td>
<td>5</td>
<td>28</td>
<td>a</td>
<td>4</td>
<td>21</td>
<td>b</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>9</td>
<td>40</td>
<td>a</td>
<td>8</td>
<td>24</td>
<td>a</td>
</tr>
<tr>
<td>Niacin</td>
<td>1</td>
<td>8</td>
<td>n.s.</td>
<td>1</td>
<td>3</td>
<td>n.s.</td>
</tr>
<tr>
<td>Folate</td>
<td>5</td>
<td>26</td>
<td>n.s.</td>
<td>14</td>
<td>49</td>
<td>c</td>
</tr>
<tr>
<td>Vitamin A</td>
<td>23</td>
<td>58</td>
<td>b</td>
<td>29</td>
<td>35</td>
<td>n.s.</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>8</td>
<td>15</td>
<td>n.s.</td>
<td>7</td>
<td>23</td>
<td>c</td>
</tr>
<tr>
<td>Calcium</td>
<td>26</td>
<td>64</td>
<td>b</td>
<td>57</td>
<td>65</td>
<td>n.s.</td>
</tr>
<tr>
<td>Iron</td>
<td>1</td>
<td>16</td>
<td>n.s.</td>
<td>2</td>
<td>16</td>
<td>a</td>
</tr>
<tr>
<td>Magnesium</td>
<td>15</td>
<td>58</td>
<td>c</td>
<td>17</td>
<td>44</td>
<td>b</td>
</tr>
<tr>
<td>Zinc</td>
<td>30</td>
<td>55</td>
<td>n.s.</td>
<td>52</td>
<td>67</td>
<td>c</td>
</tr>
</tbody>
</table>

n.s. Not significant.
a. p<0.05.
b. p<0.01.
c. p<0.001.

Note: In this instance ‘older Australians’ means males aged 65 and over and females aged 55 and over. Data were taken from the 1995 National Nutrition Survey.

The social context of eating

Eating is both a physiological activity and an enjoyable social experience, an important part of behaviour and culture. Much consideration has been given to the influence of social isolation and living alone on diet. Eating is not only necessary but also an inherently social activity and when undertaken alone it becomes more of an obligation than an opportunity for social interaction. The relationship between living alone and dietary quality in the older population is unclear. Varying results—some even arguing against the existence of such a relationship—have been reported.⁴

In a survey of the dietary adequacy of older people who were living independently it was found that respondents who were more socially active had increased nutrient intakes.⁵ In another, small study of people aged 50 to 94 years ‘to have company’ was reported to be the most important way of feeling healthy.⁶

Bereavement has also been shown to have adverse effects on eating behaviours and nutrient intakes.⁷ Fifty recently widowed males and females over 60 years were
matched to a ‘married’ control group. A greater negative response to selected questions on eating behaviour was obtained from the widowed group. Married subjects enjoyed mealtimes and reported good appetites more often than widowed subjects. A recurring response from the widowed group concerned feelings of loneliness at mealtimes since the death of their spouse; this group reported a decrease in the pleasure obtained from meals and saw eating as a daily chore to be endured. Considerable unintentional weight loss was reported and recorded by the widowed subjects.

The study also examined financial factors contributing to the purchase of adequate amounts of food. All participants had adequate finances to buy food and adequate facilities to prepare meals, suggesting that the social activity associated with eating is the primary determinant of changes in eating behaviour and nutrient intakes among widowed people. Similarly, the National Nutrition Survey found that less than 1.1 per cent of people aged 65 years or more reported having run out of food and having had no money to buy more in the preceding 12 months.1

A change in eating patterns and the number of meals consumed can also occur in the older population as a result of a change in work routine or health status. Older people living in rural Kentucky in the United States were most likely to have a cold meal in the evening, whereas previously they had always consumed a hot cooked meal. Respondents said that this was because their children were no longer eating at home and their appetite had decreased as a result of doing less physical work.8 Changes in digestion and diet as a consequence of chronic health conditions such as diabetes or heart disease are other reasons for altered eating patterns.9

**PRACTICAL ASPECTS OF THIS GUIDELINE**

It is not always practical for older Australians to prepare and cook three meals every day. In a nursing home or institutional setting people are employed specifically to do this task. Meal-assisted older people may not always be able to prepare and cook meals, and they should be encouraged to keep on hand pre-prepared foods that are nutritious, easy to store and easy to prepare. For example, having cereal, yoghurt or toast, or all three, for breakfast saves on preparation time and effort. Bread can be kept in the freezer and used when needed to make toast (or a sandwich at lunch or dinner).

When preparing the second non-delivered meal of the day (that is, lunch or dinner) a variety of pre-prepared foods can be used. The most simple of meals to prepare is a sandwich, and if it contains a main ingredient such as cheese, tuna or boiled egg, a quick high-protein meal can easily be prepared. Accompanying this meal with fruit (canned or fresh) and a glass of milk or some yoghurt will further increase the nutrient quality of the meal. Other preparation suggestions include cooking enough of a particular dish at one time to allow some to be frozen for a subsequent meal or two. Pre-prepared frozen meals that need only to be heated in a conventional oven or a microwave oven are also useful. In addition, most
supermarkets and butchers now sell cuts of meat that need no further preparation other than cooking; prepared salads and cut-up vegetables are also available and can be used as an accompaniment.

**RELATION TO OTHER GUIDELINES**

*Enjoy a wide variety of nutritious foods.* Eating at least three meals a day provides the opportunity to incorporate in the diet many different foods, including foods from other cultures.

*Eat plenty of vegetables (including legumes) and fruit.* Eating some type of fruit or vegetable, or both, at each mealtime and snack provides a nutritious, low-fat accompaniment to the meal.

*Eat plenty of cereals, breads and pastas.* Cereal-based foods can be the foundation of every meal: they are nutrient dense, low in fat, and relatively inexpensive.

*Drink adequate amounts of water and/or other fluids.* Mealtimes provide an excellent opportunity to drink water or other fluids.

*Include foods high in calcium.* Eating something that is rich in calcium at each meal will help older Australians meet the recommended dietary intake for this nutrient.

**CONCLUSION**

To ensure an adequate nutrient intake, older Australians—no matter what their living environment—need to eat at least three meals a day. Older people’s energy and nutrient intake is often already limited, and eating fewer than three meals a day has been shown to adversely affect their nutritional status. Encouraging them to eat breakfast, not to skip meals, and to eat in a social environment whenever possible will promote an increased food intake, leading to improved nutritional status. People living in aged care accommodation should be carefully assessed, to determine whether they are able to eat independently and what individual and environmental factors may act to reduce their food and nutrient intake. All practicable action should be taken to promote as much independence as possible when eating and to promote an adequate nutrient intake at all times.

**REFERENCES**


CARE FOR YOUR FOOD: PREPARE AND STORE IT CORRECTLY

by Ms Jennifer Leong and Professor Colin Binns

Australia has one of the world’s safest food supply systems, yet the reported incidence of foodborne illnesses in Australia has been increasing in recent years. It is estimated that 4.2 million cases of foodborne illness occur every year here.\(^1\) While foodborne illnesses can have devastating effects, they are highly preventable and their incidence can be minimised if food is carefully selected, transported, stored, prepared, cooked and served.

‘Food safety’ refers to the prevention of foodborne illnesses through the application of safe handling and processing procedures at all stages of preparation, from gathering the raw materials to final consumption.\(^2\) Food producers and consumers must take precautions against foodborne illnesses. Early diagnosis and appropriate treatment of foodborne illness are also essential. Infants, children, pregnant women, older people and immuno-compromised individuals are particularly vulnerable to foodborne illnesses.

BACKGROUND

While all population groups are susceptible to foodborne illnesses, older people are particularly vulnerable because of the physiological changes associated with ageing. Attention to food safety is therefore of great importance.\(^3,4\) The physiological changes associated with ageing are an important factor in food safety for older people.

The main causes of foodborne illness in Australia\(^1\) are:

- inadequate cooking;
- improper holding temperature;
- contaminated equipment;
- unsafe food source;
- poor personal hygiene.

The foods most likely to harbour micro-organisms that cause foodborne illnesses are under-cooked and raw foods (particularly meat, eggs and unwashed fruit and vegetables) and pre-cooked cooled foods.\(^5\) The risk of foodborne illness increases if these foods have been handled in an unhygienic way or poorly stored.
SCIENTIFIC BASIS

Food safety and older people
Age-related declines in physiological systems leave older people more susceptible to foodborne illnesses, often with serious consequences. Older people may become infected with foodborne pathogens at low doses that might not produce a reaction in healthier people. Among the main age-related conditions that can affect older people in relation to food safety are a decline in immune system function, altered gastrointestinal tract function, and decreased sensory function.

Immune system function
Ageing produces a progressive decline in immune system function. The body's ability to defend itself against specific invading agents such as foodborne microorganisms declines and as a result older people, especially those with compromised immune systems, are more susceptible to all types of infection and are likely to suffer more severe consequences. In the case of foodborne illnesses, these consequences range from mild dehydration to neuromuscular dysfunction or death; older people can also take longer than the general population to recover from such illnesses.

Gastrointestinal tract function
Gastrointestinal changes associated with ageing, nutritional deficiency or infection cause gastritis and a resultant decline in gastric secretion of hydrochloric acid. A decrease in stomach acidity increases the likelihood of infection if foodborne pathogens are ingested. A decrease in the motility of the digestive process may allow for the rapid growth of pathogens. Gastritis and gastric atrophy affect 50 per cent of the population aged more than 50 years. The incidence of gastritis and atrophy and consequent achlorhydia, increases with age. Improved management of Helicobacter pylori infection will decrease the prevalence of chronic gastritis in the long term. Malnutrition at all ages predisposes to gastrointestinal infection.

Decreased sensory function
The senses of sight, taste and smell are important in the enjoyment of eating. The inability of the ageing eye to focus clearly can mean that an older person fails to see signs of food spoilage when shopping or preparing meals. Taste and smell acuity also declines with age. Loss of taste is associated with the decrease in number of taste buds, which leads to reduced sensitivity to sweet, salty, bitter and sour tastes; this can lead to difficulty discriminating between sound and unsound foods. A decline in smell acuity can cause similar problems. Sensory changes can also be effected by medication, disease states, and poor nutritional status and oral hygiene. It should be noted, however, that only a minority of cases of food poisoning would originate from foods in which spoiling could be detected by appearance, taste or smell.
The prevalence of foodborne illnesses

Reported data on foodborne illnesses consistently underestimate the true incidence of these illnesses, and complete diagnostic testing is usually undertaken only in more severe cases or when there are extensive common-source outbreaks.\textsuperscript{11,12} Because of the apparently increasing incidence in Australia, and worldwide, foodborne diseases remain a significant public health problem.\textsuperscript{13} A number of factors are responsible for this apparently increasing incidence:\textsuperscript{1,14}

- the global economy—international trade in agricultural products and commodities is extensive and growing. It poses some risk of introducing new foodborne pathogens into countries or spreading pathogens across boundaries;\textsuperscript{14}
- changing eating patterns—foodborne hazards have emerged as a result of the considerable changes in eating patterns.\textsuperscript{1,13} Consumers are demanding healthier and minimally processed foods such as fresh fruits and vegetables, fresh-cut salads, and convenient, ready-to-eat and pre-prepared foods;
- demographic changes—as noted, foodborne illnesses pose the greatest risk for very young children, pregnant women, older people and people with weakened immune systems.\textsuperscript{1} People now live longer and as they age they become more susceptible to foodborne diseases;
- changes in food production—the potential hazards associated with advances in food production (for example, animal husbandry, extensive food distribution and increased scales of production) need to be identified and controlled if we are to minimise the risk of foodborne illness;
- better reporting and identification of pathogens\textsuperscript{1}—dramatic scientific and technological improvements in the detection of pathogens have contributed to the reporting of increasing numbers of cases of foodborne disease that may have previously gone unreported;
- increased awareness among consumers and health professionals;
- new pathogens—some pathogens (for example, \textit{Listeria}) have only recently been shown to be predominantly foodborne.\textsuperscript{15} Many pathogens are also becoming resistant to antimicrobial agents;
- new foods being eaten or foods being eaten in new ways—for example, raw bean sprouts;
- changing bacterial behaviour—for example, acid-resistant \textit{Salmonella}.

Foodborne illnesses cost Australia $2.6 billion each year.\textsuperscript{1} A reduction in the incidence of such illnesses would benefit the Australian community through lower health care costs, less absenteeism, improved business productivity, increased competitiveness in world markets, and a reduction in business failure and associated costs, including litigation.\textsuperscript{1} It is estimated that an average case of foodborne illness costs Australians $630; this is lower than the estimated cost of A$1679 in the United Kingdom and A$1531 in the United States.\textsuperscript{3}
In 1997 and 1998 the three most common notified foodborne diseases in Australia were infections with *Campylobacter*, *Salmonella* and hepatitis A\(^{12}\) (see also Table 4.1).

**Table 4.1 Notifications of foodborne illnesses received by Australian health authorities: selected pathogens, 1991 to 1998**

<table>
<thead>
<tr>
<th>Year</th>
<th>Campylobacter</th>
<th>Hepatitis A</th>
<th>Listeria</th>
<th>Salmonella</th>
<th>Yersinia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>8 672</td>
<td>2 195</td>
<td>44</td>
<td>5 440</td>
<td>515</td>
</tr>
<tr>
<td>1992</td>
<td>9 136</td>
<td>2 109</td>
<td>38</td>
<td>4 614</td>
<td>567</td>
</tr>
<tr>
<td>1993</td>
<td>8 111</td>
<td>2 006</td>
<td>53</td>
<td>4 731</td>
<td>459</td>
</tr>
<tr>
<td>1994</td>
<td>10 117</td>
<td>1 901</td>
<td>34</td>
<td>5 327</td>
<td>414</td>
</tr>
<tr>
<td>1995</td>
<td>10 933</td>
<td>1 600</td>
<td>58</td>
<td>5 895</td>
<td>306</td>
</tr>
<tr>
<td>1996</td>
<td>12 158</td>
<td>2 150</td>
<td>70</td>
<td>5 819</td>
<td>268</td>
</tr>
<tr>
<td>1997</td>
<td>11 848</td>
<td>3 076</td>
<td>71</td>
<td>7 004</td>
<td>245</td>
</tr>
<tr>
<td>1998</td>
<td>13 135</td>
<td>2 528</td>
<td>56</td>
<td>7 889</td>
<td>208</td>
</tr>
</tbody>
</table>

The Centers for Disease Control in the United States have targeted *Campylobacter*, *Escherichia coli*, *Salmonella*, *Shigella*, *Vibrio* and *Yersinia* because they are significant contributors to outbreaks of foodborne illnesses; they are easily transmitted and multiply rapidly in food.\(^{17}\) Table 4.2 shows the number of cases reported in 1997 for people aged 50 years and over.

**Table 4.2 Cases of foodborne illness reported for people aged 50 years and over, United States, 1997**

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>50–59 years</th>
<th>60+ years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of cases</td>
<td>% of cases</td>
<td>No. of cases</td>
</tr>
<tr>
<td>Campylobacter</td>
<td>373</td>
<td>9.4</td>
<td>432</td>
</tr>
<tr>
<td>E. coli</td>
<td>24</td>
<td>7.1</td>
<td>38</td>
</tr>
<tr>
<td>Listeria</td>
<td>8</td>
<td>10.5</td>
<td>42</td>
</tr>
<tr>
<td>Salmonella</td>
<td>134</td>
<td>6.1</td>
<td>228</td>
</tr>
<tr>
<td>Shigella</td>
<td>56</td>
<td>4.5</td>
<td>33</td>
</tr>
<tr>
<td>Vibrio</td>
<td>4</td>
<td>8.0</td>
<td>8</td>
</tr>
<tr>
<td>Yersinia</td>
<td>5</td>
<td>3.6</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>604</td>
<td>7.5</td>
<td>792</td>
</tr>
</tbody>
</table>
The most common reported cause of foodborne illness in the older population is Listeria, a bacterium found in many foods. Among the reasons for its widespread presence are its ability to grow at refrigerator temperatures and its resistance in the face of adverse conditions. Between 25 and 35 per cent of severe cases of Listeria infection can lead to death. Symptoms vary according to the susceptibility of the person affected and the strain of Listeria: some people experience flu-like symptoms; others develop meningitis and septicaemia. Listeria outbreaks have been linked to the consumption of a number of contaminated foods—milk, raw vegetables, coleslaw, soft cheeses, smoked seafood, pates and cold chicken, for example. Table H.1 lists other foodborne micro-organisms, their food sources, and the symptoms they produce.

In the United Kingdom food poisoning notifications increased by 500 per cent in the 15 years to 1998. Similar trends are evident in most developed countries.

**The causes of foodborne illnesses**

Foodborne illnesses can be caused by bacteria, viruses or toxins. Bacterial food poisoning is the most common foodborne illness in Australia. Foods should be stored below 5°C or above 60°C to minimise bacterial replication. The shorter the time foods—cooked or uncooked—spend in the temperature danger zone (5–60°C; see Figure 4.1), the lower the risk of food poisoning. The principal factors affecting bacterial growth are time, temperature, nutrients and water.

**Time**

The longer food is left in the temperature danger zone, the more quickly bacteria will multiply. Bacteria in the temperature danger zone can reach an infective dose for healthy adults in four to six hours.

**Temperature**

Cooking to high temperatures will destroy the vegetative cells of bacteria; cooling at low temperatures will slow bacterial growth. Some bacteria do, however, have heat-resistant spores and toxins that survive the cooking process—Bacillus cereus is an example.
Nutrients

Bacteria need adequate nutrients for replication. Among the most suitable media are high-protein, perishable foods such as dairy products, egg products, seafood, meat and poultry. The acidity or alkalinity of a food will affect bacterial growth: bacteria are least active in very acidic foods (those with a pH less than 4.5). Often foods are preserved using vinegar to reduce the bacterial growth, although moulds may still grow in these conditions.

Water

Bacterial growth is limited in the absence of moisture, so bacteria are less likely to survive in dried products such as breakfast cereals and powdered milk. Some bacteria, or some forms of bacteria, can, however, survive the dry conditions and when fluid is added to the food they will grow again.

Cross-contamination

Cross-contamination is an important pathway for food poisoning. The term is used to describe the inadvertent transmission of foodborne pathogens from one food product or utensil to another. Transmission can occur in several ways.

- During food preparation, utensils, other equipment and the preparation area can be contaminated with bacteria. All equipment must be carefully washed using detergent and hot water and preferably air-dried or dried with a clean tea towel after every use. Personal hygiene is also important.
- Storing perishable foods in the temperature danger zone will encourage bacterial growth. Store cold foods in the refrigerator (at less than 5°C) and hold hot foods at steaming hot (over 60°C) to minimise the risk of food poisoning.
Separate raw and cooked foods and store them separately in the refrigerator to avoid cross-contamination.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

**Optimising food safety**
To optimise food safety, care should be taken at all stages of the consumer’s ‘food chain’—purchasing, transport, storage, preparation, cooking, serving and cleaning.

**Purchasing**
Although the standard of foods in Australia is generally very high, it is important that buyers examine each package carefully, looking for defects in packaging, foreign objects, and signs of spoilage. Always check the use-by date, and be mindful of how the food is being stored and displayed. It is best to leave the buying of chilled and frozen foods to the end of the shopping trip, to prevent them from warming. Foods such as this can be put in a cooler with ice, and groceries can be put in the air-conditioned part of the car during warm weather.

**Storage**
The various food types need to be stored correctly to retain their nutrient value, freshness, aroma and texture and to keep them safe. Always read the label for storage conditions.

**Refrigeration**
Refrigeration retards the growth of bacteria and the rate of chemical change in food. The refrigerator temperature should be around 5°C or less.

Uncooked meats, poultry, offal and seafood need particular attention because they always carry large numbers of spoilage bacteria; food poisoning bacteria may also be present. These foods should be stored in the coldest part of the refrigerator, as close to 0°C as possible.

All cooked foods should be covered and stored on a shelf above uncooked foods. Leftovers and ready-to-eat meals should be used the next day or stored in the freezer. Raw meats should be wrapped or placed in a container and stored near the bottom of the refrigerator, to ensure that the juices do not drip onto other foods.

Table H.2 provides information about refrigeration conditions and the storage life of foods.
Frozen foods

Frozen foods should be put into the freezer as soon as possible after they have been bought. Thawing, or even a rise in temperature without completely defrosting, stimulates chemical and microbiological activity and may result in spoilage.\textsuperscript{3}

Freezing food almost completely stops microbial deterioration\textsuperscript{24,26}. The freezer temperature should be \(-18^\circ\text{C}\) or lower.\textsuperscript{24,26,27} Place only fresh or freshly cooked food in the freezer. Foods lose their flavour and quality if they are frozen for too long.\textsuperscript{24,26,27}

Dehydrated and dried foods

Dehydration inhibits the growth of micro-organisms by removing water but it does not make the food sterile\textsuperscript{24}: a high level of micro-organisms may remain, only to become active again when the food is rehydrated. Rehydrated foods should be treated as perishables and be stored in the refrigerator.\textsuperscript{24}

Dried food should be stored in a sealed container and in a cool, dry place, away from direct heat or sunlight. It should be regularly inspected for insect infestation.\textsuperscript{24} Opened packages can also be stored in the refrigerator to maintain quality for longer.

Canned food

Canned foods are sterilised during processing\textsuperscript{24} and should be stored in a cool place. Read labels carefully for storage instructions and take note of the use-by date.\textsuperscript{24} Once opened, canned foods should be stored in the refrigerator, preferably not in the can. Swollen or leaking cans indicate faulty processing and their contents should not be eaten. Throw out the contents of any can if there is an unusual odour.

Appendix H provides information about food storage.

Preparation

Wash hands with soap and water before beginning food preparation and after handling raw foods, touching animals or using the bathroom.\textsuperscript{28,29,30} Bacteria readily persist in kitchen towels, sponges and cloths\textsuperscript{28,30}: wash them often and replace sponges regularly. Benches, cutting boards and utensils should be cleaned with hot soapy water. Special care should be taken with cleaning after cutting up raw meat and before dicing vegetables. Marinate raw foods in the refrigerator.\textsuperscript{28} The marinade can be used during cooking but do not re-use it.

Chopping boards with a non-absorptive surface (for example, glass or plastic) are easier to clean than wooden chopping boards.\textsuperscript{28,30} Use a different chopping board and utensils when preparing foods to be eaten raw and those for cooking.
Never place cooked food on plates that have held raw meat, poultry or seafood. And never use the tea towel as a hand towel or for cleaning surfaces.

Never thaw foods on the counter. Thaw them in the refrigerator or under cold water in an airtight plastic wrapper or bag, changing the water every 30 minutes. Only thaw in the microwave if the foods are to be cooked immediately afterwards. Thawed foods should not be refrozen and the thawing fluids should not contaminate other foods, containers and serving utensils.

**Cooking**

Not all meat needs to be cooked thoroughly—steaks, whole fillet, chops and whole pieces of roast meat can be eaten rare. Rolled and/or stuffed meats and other pieces of meat, poultry, pork, sausages and mince should always be cooked to a centre temperature of at least 75°C. To check the temperature use a thermometer: the colour of the meat and the juices is not an accurate indicator of centre temperature.

Cooking alone does not guarantee safety because some bacterial spores can survive several hours of cooking. Foods such as stews should be cooled as quickly as possible to prevent spores from germinating and the bacteria from multiplying.

When using a microwave to cook, rotate and stir the food so that it cooks evenly. Cover it with a lid or plastic wrap so that the steam can aid thorough cooking. Food finishes cooking during standing time, so it is important to wait until the standing time has elapsed before checking that cooking is complete.

Never refrigerate partially cooked products and finish cooking them later. Meat, fish and poultry must be cooked thoroughly; they can then be refrigerated and reheated later.

When reheating food, cook it until it is ‘steaming hot’ throughout: this will destroy any bacteria that have grown on the food during refrigeration. Bring soups, sauces and gravies to a rolling boil. Do not reheat food more than once.

Place leftovers in the refrigerator to cool—for quick cooling, divide them into smaller portions and store them, covered, in shallow containers. Do not leave them to cool completely on the bench. They should be refrigerated within two hours of cooking and be used within three days.

**Serving**

Serving food safely is essential. Food poisoning can result if food is not handled and served safely as soon as possible after it is cooked. Hands should be washed with soap and water and the food should be served on clean plates. Never put cooked food on a plate that has held raw food. Keep cooked foods above 60°C: the time between cooking and eating is when a food is most vulnerable to recontamination or the growth of micro-organisms with heat-resistant spores.
Cleaning
Use hot, soapy water to wash all work surfaces, crockery, cutlery, cooking utensils and other equipment. Change tea towels regularly: they are likely to harbour food-poisoning pathogens.

RELATION TO OTHER GUIDELINES

Keep active to maintain muscle strength and a healthy body weight. Research has shown that immune cells are responsive to the effects of acute exercise, in terms of both number and function. Regular physical activity can be beneficial for older people’s immune system function and increase the body’s ability to defend itself against foodborne illnesses.34

Eat plenty of vegetables (including legumes) and fruits. This guideline closely relates to food hygiene and the purchase, transport, storage, preparation and cooking of vegetables and fruits. When these foods are stored correctly their nutritional quality and storage life are maximised. Buy fresh vegetables and fruits that are ‘firm’ and make sure canned and frozen varieties have complete packaging and are undamaged.

Eat plenty of cereals, breads and pastas. Eat a diet low in saturated fat. Include foods high in calcium. Correct storage will maximise the storage life and prevent spoilage of breads, cereals, pastas, fats (including cooking oils) and dairy products. It is important to make sure that packaging is whole and undamaged.

CONCLUSION

The education of all food handlers, health care providers and the general public is essential if we are to reduce the incidence of foodborne illness. Although most foodborne illnesses can be avoided by safe food-handling procedures, risk reduction is very important at every step of the way, from food purchase to meal serving.

REFERENCES


There is a growing awareness of the health benefits associated with the regular consumption of a diet rich in fruits and vegetables. The Australian Dietary Guidelines, and those of many other Western countries, encourage people to eat at least seven serves of fruit and vegetables each day. Although most of the emphasis is on the value of a diet rich in fruit and vegetables throughout life, substantial evidence points to a meaningful benefit to be gained even if such a diet is adopted later in life.

BACKGROUND

Epidemiological studies of populations around the world have consistently provided evidence that people who habitually consume diets high in fruits and vegetables (including legumes) have substantially lower risks of coronary heart disease, stroke, several major cancers, possibly hypertension, non–insulin dependent diabetes mellitus, and cataract and macular degeneration of the eye. Experimental studies with model systems have provided further evidence of the protective effect of fruits and vegetables against non-communicable degenerative diseases. They have also provided some clues about the actual substances in these foods that may afford this protection, as well as the mechanisms by which they may act. The term ‘phytochemicals’ has recently been added to the vocabulary of nutritionists; it refers to the many different substances that occur naturally in small amounts in plant foods, in addition to the well-established nutrients. These substances appear to contribute significantly to reducing the risk of non-infectious degenerative diseases.

Types of plant foods

Plant foods can be divided into four broad groups: vegetables, fruits, legumes and nuts.

Vegetables

The term ‘vegetable’ applies to all leafy green vegetables (for example, spinach, lettuce, silverbeet and bok choi), members of the crucifer family (for example, broccoli, cabbage and Brussels sprouts), all root and tuber vegetables (for example, carrots, yams and potatoes), edible plant stems (for example, celery and asparagus), gourd vegetables (for example, pumpkin and cucumber), allium vegetables (for example, onions, garlic and shallot), and sweet corn. Some vegetables are eaten raw; others are best cooked because this makes them more palatable and digestible.
Fruits

The term ‘fruit’ generally applies to the sweet, fleshy, edible portion of a plant that arises from the base of the flower and surrounds the seeds (examples are apples, oranges, plums and berries). Most fruit is eaten raw, although cooking and drying some fruits can offer a tasty alternative.

Legumes

The term ‘legume’ applies to all forms of edible beans and peas and preparations made from them—dried legumes, legume flour, bean curd, canned legumes, cooked legumes, and so on. Among the better known legumes are butter beans, haricot (navy) beans, red kidney beans, soybeans, mung beans, lentils, chick peas, snow peas and various other types of fresh green peas and beans. Legumes are usually cooked because this increases their nutritional value and improves their taste, but occasionally they are eaten raw (snow peas, for example). Strictly speaking, legumes are specialised forms of fruit: the pod surrounds the seeds and arises from the base of the flower, as is the case with fruit. But, because the main food material in legumes is the seeds—as opposed to the flesh surrounding the seeds—legumes are generally placed in a separate category.

Nuts

Like legumes, many nuts are actually fruits in which the seed forms the main edible component and the entire structure becomes dry on maturing. Most nuts provide a wide range of nutrients and are generally pleasant tasting, so they can usefully be included with fruits and vegetables in vegetarian-type and other dishes.

SCIENTIFIC BASIS

Coronary heart disease

A recent review of 28 studies relating fruit and vegetable consumption to the risk of coronary heart disease in humans found good evidence of a protective effect associated with higher intakes of plant foods. In 1993 the US Food and Drug Administration allowed a ‘health claim’ to the effect that diets low in saturated fat and cholesterol and rich in fruits, vegetables and grain products that contain fibre, particularly soluble fibre, may reduce the risk of coronary heart disease.

Recent experimental studies suggest that protection against heart disease probably arises in several ways, including through the presence of antioxidant phytochemicals (for example, bioflavonoids and carotenoids) and antioxidant vitamins (for example, vitamins C and E) at significant levels in fruits and vegetables, which may reduce the risk of cholesterol becoming oxidised in coronary blood vessels and deposited to form atheromatous plaques. Also important is the apparent capacity of vegetable protein to reduce blood cholesterol
levels in people habitually consuming an omnivorous diet. At present particular emphasis is being given to the importance of the vitamin folate in reducing blood levels of the compound homocysteine, which is an established risk factor for coronary heart disease. Of note is the fact that green leafy vegetables are an important source of dietary folate: studies suggest that many adults' folate intakes are well below the level needed to minimise the risk associated with raised homocysteine levels.

**Stroke**

An evaluation of 14 appropriate studies relating fruit and vegetable consumption to the risk of stroke found strong evidence of a protective effect associated with higher intakes of plant foods. The mechanism for this apparent protection is not clear, but it appears to apply to strokes of both haemorrhagic and ischaemic origin. Further, one large study, which extended over eight years, found that protection was associated with vegetable intake rather than fruit.

**Cancer**

Health authorities have estimated that at least 30 per cent of many major cancers have a strong dietary association, and this link may be far greater in some cases. Dietary factors underlying this association include substances that may hasten the development of cancer. Very importantly, some may reduce cancer risk. Dietary components in this latter group include fibre, fruits and vegetables. The association between a diet high in fruits and vegetables and reduced cancer risk is sufficiently well recognised that the US Food and Drug Administration has allowed a health claim to the effect that diets low in fat and rich in fruit and vegetables may reduce the risk of some cancers.

Not surprisingly, the protective effect of fruit and vegetables has been noted especially in relation to the oral cavity, larynx, oesophagus, stomach and large bowel, where local contact may be a factor; significant risk reduction has, however, also been observed in relation to cancers of the lung and possibly the breast, endometrium and pancreas. Many putative factors in fruit and vegetables have been proposed to account for this protective effect and many potential mechanisms have been suggested. At present particular attention is being given to the many novel phytochemicals found in plant foods (carotenoids, phytoestrogens, isoflavones, bioflavonoids, isothiocyanates, indole carbinols, and so on) and to several established vitamins and minerals (for example, vitamins C and E, folate, selenium and calcium). A number of possible mechanisms have been proposed: reduced formation of cancer-promoting substances in the gastrointestinal tract; antioxidant activity; the part played by phytochemicals and micronutrients in detoxification of carcinogenic substances; and functions relating to the containment and destruction of existing cancer cells through a variety of physiological processes and improved immunosurveillance.
Hypertension

Because plant foods contribute significantly to the intake of potassium and magnesium—both of which have been proposed to be associated with lower blood pressure—diets high in fruit and vegetables will increase the daily intake of both minerals and may help prevent or control hypertension. A recent US study found that lowered blood pressure in women was associated with higher intakes of fruits and vegetables, fibre and magnesium.

In the DASH (Dietary Approaches to Stop Hypertension) trial of 459 adults, the effects of dietary patterns on an individual’s blood pressure were investigated. Subjects were randomly assigned for eight weeks to a control diet, a diet rich in fruits and vegetables, or a combination diet rich in fruits, vegetables, and low-fat dairy products with reduced saturated and total fat. The study results showed that the combination diet or the fruit and vegetable diet reduced blood pressure more from the baseline than did the control diet.

Non–insulin dependent diabetes mellitus

At the population level, an association has been noted between increased consumption of plant foods and lower incidences of obesity (a risk factor for diabetes) and non–insulin dependent diabetes mellitus, although it is not yet clear whether this apparent protection by plant foods arises principally from a lower body weight. In the dietary control of the disease, vegetables in particular are likely to be of value because of their fibre and complex carbohydrate content and their possible hypoglycaemic activity.

Cataract and macular degeneration of the eye

Several studies have reported that the risk of developing cataract is significantly higher in people with low dietary intakes of fruit and vegetables and vitamins C, E and b-carotene. A similar increased risk was observed in people with low levels of vitamins C and E in their blood. Experimental studies with model systems lend further support to the notion that above-average intakes of antioxidant nutrients may delay the onset of senile cataract.

Age-related degeneration of the macula (the colour-sensitive yellow spot on the retina) is another serious cause of blindness in older people; it is not reversible. Findings from a number of studies suggest that people who smoke and have low levels of carotenoids and the antioxidant vitamins C and E in their blood are at increased risk of developing macular degeneration. Experimental studies suggest that two carotenoids in particular—lutein and zeaxanthin—are accumulated by the macula; one study that analysed the dietary intake of carotenoids found that the sum of the intake of lutein and zeaxanthin had the strongest protective effect against macular degeneration. These findings suggest that in many cases macular degeneration may be prevented by eliminating smoking and ensuring an adequate intake of fruit and vegetables.
PRACTICAL ASPECTS OF THIS GUIDELINE

Selection of fruit and vegetables

Because of the wide distribution of nutrients and phytochemicals in plants and the many different ways in which these substances may act to maintain health in humans, the best approach to obtaining optimal benefit from fruit and vegetables is to eat a variety of plant foods in an amount equivalent to about seven servings each day (two of fruit, five of vegetables), as recommended by the NHMRC. This recommendation is for all Australians, although for older Australians serving sizes may need to be reduced (for example, from half a cup to a quarter) if energy expenditure is lower. By reducing the serving size, but still eating the recommended seven servings a day, older Australians will be able to maintain a variety of fruits and vegetables in their diet.

To ensure an adequate intake of some of the less widely distributed dietary components, certain foods should be deliberately selected; for example, green leafy vegetables for folate and yellow and orange fruits and vegetables for carotenoids. Cruciferous vegetables provide dithiolthiones and isothiocyanates, which improve the body’s detoxification capacity; the allium family provides allyl sulfides, which also stimulate detoxification processes; fruit provides bioflavonoids, which appear to have many beneficial functions in the body, including acting as antioxidants; and citrus fruits and capsicum provide vitamin C.

Preparation of fruit and vegetables

Some nutrients and phytochemicals in plant food are damaged by cooking; others are not. In fact, in some cases the cooking process may increase the availability of a nutrient; for example, carotenoids are absorbed better from cooked tomatoes than raw ones. As a general rule, however, a good proportion of fruit and vegetables should be eaten raw as fruits and salads.

Overcooking vegetables causes loss of nutrients. Stir-frying is an effective way of cooking vegetables: it tends to minimise nutrient loss and provides a tasty product with good texture. Light microwaving and steaming are better than deep frying or prolonged boiling. When cooking vegetables it may be of value to use a small amount of poly- or mono-unsaturated oil: this will enhance absorption of the fat-soluble vitamins (for example, vitamins A and E) and other fat-soluble dietary components such as carotenoids.

Where required, frozen and canned varieties of fruit and vegetables are acceptable since good levels of nutrients are retained by both processes, especially freezing. But regular consumption of fresh fruit and vegetables is always necessary.

Presentation of fruit and vegetable dishes

The objective of the fruit and vegetable guideline is not to encourage people to eat only vegetarian meals; rather, it seeks to highlight the important health benefits to be derived from regular consumption of vegetarian dishes together with individual
fresh and cooked fruit and vegetables. Following are some useful suggestions for ensuring an adequate intake of fruit and vegetables:

- include an all-vegetable dish (vegetable curry or ratatouille, for example) in your menu or meal plan at least three times a week;
- accompany all meat and fish dishes with lightly cooked vegetables or a salad;
- make more use of fruit salad and baked fruit for desert;
- include fruit juice and fresh fruit at breakfast time, either as the fruit alone or on top of breakfast cereal or porridge; and
- explore a wider range of cuisines by including vegetable-based Asian and European dishes as part of your meals.

**RELATION TO OTHER GUIDELINES**

*Enjoy a wide variety of nutritious foods.* To obtain optimal health benefits, eat a wide variety of fruit and vegetables.

*Eat at least three meals every day.* Fruits and vegetables are well suited to contributing to tasty breakfasts, lunches and dinners.

*Care for your food: prepare and store it correctly.* Although fruit and vegetables are less likely than animal products to cause sickness if they are not stored carefully, their nutritional value, and their palatability, will decline if they are not stored properly.

*Eat plenty of cereals, breads and pastas.* Apart from providing a good source of energy, cereal-based foods contribute to the diet a number of protective factors that complement and extend many of the benefits derived from fruit and vegetables.

*Eat a diet low in saturated fat.* Fruit and vegetables are low in saturated fat.

*Choose foods low in salt and use salt sparingly.* Fruits and vegetables—fresh or canned—are good sources of potassium.

*Use added sugars in moderation.* The natural sweetness of many plant foods, especially fruit, reduces the need for added sugar.

**CONCLUSION**

Regular consumption of fruit and vegetables can reduce the risk of coronary heart disease, stroke, several types of cancer, and non–insulin dependent diabetes, all conditions common in the older population. There is increasing evidence that phytochemicals found in fruits and vegetables have a protective effect, which gives even greater cause for promoting fruit and vegetable consumption by older Australians.
REFERENCES


The Dietary Guidelines for Australians were published in 1992; the guideline relating to cereal foods reads, ‘Eat plenty of breads and cereals (preferably wholegrain), vegetables (including legumes) and fruits.’ In these Dietary Guidelines for Older Australians, the recommendation relating to vegetables (including legumes) and fruit has become a separate guideline, to give it greater prominence, and the wording of the guideline relating to cereal foods has been changed. The word ‘cereals’ is intended to mean cereal grains, cereal products and grain-based foods, and cereals are placed ahead of breads in order to highlight the lower salt content of cereals compared with most breads. Pastas are included separately to emphasise the value of these increasingly popular foods. The word ‘wholegrain’ has been removed because of potential problems stemming from the higher prevalence of poor dentition in older people.

The emphasis in this guideline is on cereals that are high in fibre and have a lower glycaemic index (see Appendix I). The words ‘eat plenty’ are used to encourage people to choose these foods liberally as the main basis of their daily diet.

BACKGROUND

In terms of quantity, cereals and the many foods made from them are the most important food group: they form the basis of people’s diets in most parts of the world. Whole cereal grains generally are excellent sources of carbohydrate and dietary fibre and are important protein sources too. Table 6.1 shows the protein content of selected cereals.

<table>
<thead>
<tr>
<th>Cereal</th>
<th>Protein content (g/100 g of cereal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat flour, white</td>
<td>10.8</td>
</tr>
<tr>
<td>Wheat flour, wholemeal</td>
<td>12.1</td>
</tr>
<tr>
<td>Rye flour</td>
<td>12.8</td>
</tr>
<tr>
<td>Barley</td>
<td>8.6</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>16.7</td>
</tr>
<tr>
<td>Oats</td>
<td>10.7</td>
</tr>
<tr>
<td>Brown rice</td>
<td>7.7</td>
</tr>
<tr>
<td>White rice</td>
<td>6.6</td>
</tr>
</tbody>
</table>
Cereals are all generally low in fat and contain no cholesterol. They are good sources of B-group vitamins and vitamin E and of many minerals, notably iron, zinc, magnesium and phosphorus. They are also relatively inexpensive: in 1993–94, purchases of cereal products accounted for only 7 per cent of household food expenditure. Eating enough cereal foods helps ensure an adequate nutritional intake. For these reasons all current dietary guides have cereal foods as the largest component of the recommended daily food intake.

Definitions

Cereal foods

‘Cereal foods’ refers to the whole class of foods, including cereal grains, breakfast cereals, bread, low-fat crackers, flours and other plain cereal items but excluding cereal-based products such as cakes, pastries and biscuits.

Cereals

‘Cereals’ refers to breakfast cereals (preferably those that are higher in dietary fibre and lower in added fat, sugar and salt), rice, oats, barley, other cereal grains (for example, amaranth, buckwheat, millet, quinoa, sorghum and triticale) and cereal products (for example, flour, polenta, semolina and burgul).

Breads

‘Breads’ refers to wholemeal, white, mixed-grain, rye and pita breads, rolls, bagels, crispbreads and low-fat crackers. Wholemeal and salt-reduced breads are preferred.

Pastas

‘Pastas’ refers to white and wholemeal pasta and plain noodles.

Wholegrain cereal foods

‘Wholegrain cereal foods’ refers to cereal foods that incorporate all the components of the natural grain, including the bran and germ. It includes wholemeal breads.

Australian consumption of cereal foods

Apparent consumption of cereal foods in Australia has remained relatively constant since the 1930s; in 1996–97 it was 148.1 kilograms per person. There have, however, been changes in the mix of products since the 1930s: consumption of rice and breakfast cereals has increased significantly and consumption of flour has fallen. Bread consumption has remained relatively stable.

The 1995 National Nutrition Survey found that 98.5 per cent of Australians aged more than 65 years had eaten cereal foods on the day of the survey, bread
(89.4 per cent) and breakfast cereals (76.3 per cent) being the most commonly consumed.

The mean daily intakes for people in this age group were 212 grams for men and 160 grams for women. Intakes were somewhat lower among people in rural and remote areas compared with people in metropolitan areas and significantly higher than average among people born in Southeast Asia (because of their much higher consumption of rice).

The Survey found that for adult Australians cereal foods are important sources—that is, they provide more than 20 per cent of the total daily intake—of energy, carbohydrate, dietary fibre, thiamin, iron and magnesium. Table 6.2 provides details.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>20.0</td>
<td>20.8</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>33.2</td>
<td>33.1</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>34.9</td>
<td>33.6</td>
</tr>
<tr>
<td>Thiamin</td>
<td>41.3</td>
<td>40.5</td>
</tr>
<tr>
<td>Iron</td>
<td>30.1</td>
<td>29.3</td>
</tr>
<tr>
<td>Magnesium</td>
<td>24.3</td>
<td>24.8</td>
</tr>
</tbody>
</table>

Note: Biscuits, cakes, and other cereal items are excluded.

Cereal foods also provide more than 10 per cent of the daily intakes of protein, polyunsaturated fat, riboflavin, niacin, folate, calcium, phosphorus and zinc.

One study of the cereal intake of various socio-economic groups in Australia found that cereal foods contribute more to nutrient intakes among upper occupational groups for both males and females. It also showed that cereals’ contribution to nutrient intake was greater in males over the age of 60 years when compared with other age groups.

Most older Australians seem to be satisfied with the amount of cereal foods they eat. In the 1995 National Nutrition Survey only 1 to 3 per cent of respondents aged more than 50 years reported they would like to change the amount they consumed; this compares with up to 20 per cent of this group reporting that they wanted to eat more fruit and vegetables. Despite this, the mean number of core food group serves of cereal these people eat is less than the recommended 5.1 serves for men over 65 years and 4.1 serves for women over 55 years. Only 12 per cent of people over 55 years met the recommended targets, compared with 25 per cent of people aged 25–44 years. This is also reflected in the smaller proportion of the older population who met the recommendation for dietary fibre (30 grams a day): only 15.3 per cent of people over 55 compared with 22.5 per cent of people aged 25–45 years.
SCIENTIFIC BASIS

Coronary heart disease

The published results of over 200 human trials have led to the general conclusion that food rich in soluble fibre can lower plasma cholesterol. Australia’s National Heart Foundation has noted, ‘the consumption of dietary fibre, especially cereal fibre, is associated with a lower risk of CHD.’  The principal mechanism is probably the action of viscous polysaccharides acting in the gastrointestinal tract to decrease reabsorption of biliary cholesterol or bile acids, but fibre may also cause altered serum concentrations of hormones or short-chain fatty acids that affect lipid metabolism. Although wheat fibre has been shown repeatedly not to have a direct cholesterol-lowering effect, meta-analyses of studies with two cereal foods—oats and psyllium—have shown that these foods are particularly effective in reducing serum cholesterol. In the case of barley and oats, in addition to the effect of the soluble fibre, another proposed mechanism is the influence of a-tocotrienols, which may reduce cholesterol synthesis by inhibiting the activity of hepatic HMG-CoA reductase; there is, however, conflicting evidence of this inhibitory effect. Among other suggested mechanisms for the protective effect of foods providing soluble fibre are lowered plasminogen activator inhibitor type 1, slower absorption of macronutrients, and the provision of nutrients such as vitamin E and folic acid.

A large prospective study of US male health professionals found dietary fibre intake was strongly associated with reduced rates of myocardial infarction and that cereal fibre was apparently more protective than fibre from fruits or vegetables. That study reported a 29 per cent reduction in coronary heart disease for every 10-gram increase in daily intake of cereal fibre. In older women there is also evidence from the Iowa Women’s Health Study of a clear inverse association between wholegrain intake and the risk of ischaemic heart disease.

Obesity

A high-carbohydrate diet is recommended for maintenance of body weight and prevention of obesity, and obesity is associated with low fibre intake. There are several reasons why foods such as high-fibre cereals can reduce food intake and help maintain weight: they take longer to eat; they decrease the energy density of a meal; and some fibres may slow gastric emptying and affect some gastrointestinal hormones that influence food intake.

For older people, individualisation of dietary intake is necessary. Some may be at risk of either undernutrition or obesity and, although a high-carbohydrate diet is generally recommended for prevention of weight gain and obesity, some may need diets higher in energy density (for example, with a higher fat intake) in order to prevent or treat malnutrition.
Diabetes

The prevalence of impaired glucose tolerance and of diabetes increases with age. Morbidity and mortality from atherosclerotic complications related to non-insulin dependent diabetes mellitus are highest in the older population. In one prospective study, NIDDM was a significant risk factor for new coronary events in older men and women both with and without prior coronary artery disease.\(^{25}\)

The FAO consultation on carbohydrate concluded that there is support for the suggestion that foods rich in slowly digested, or resistant, starch or high in soluble fibre might be protective against diabetes.\(^{24}\) Recent large prospective studies of men and women have found cereal fibre intake was inversely associated with risk of developing NIDDM and that the protective effect was even greater when combined with a low total glycaemic load.\(^{26,27}\)

For older people with established NIDDM, foods with a low glycaemic index are associated with overall improvement in glycaemic control.\(^{28}\)

Cancer

A number of major reviews of the relationship between cereal consumption and cancer prevention have been published. It is difficult to evaluate these studies because of the paucity of biological markers; the inadequacy of many methods of measuring food intake, which often do not take account of the degree of refinement of cereal foods; and the low level of intakes of cereal fibre in many of the epidemiological studies from the United States. There is, however, emerging agreement on the probable or possible protective role of cereals in relation to some important cancer types, among them colorectal, breast and stomach cancer.

Colorectal cancer

Prospective data from the large Health Professionals Follow-up Study suggest that dietary fibre intake is inversely associated with the risk of colorectal adenoma in men, the relative risk in the highest versus the lowest quintile being 0.36. All sources of dietary fibre were protective, but the effect was stronger for grain sources than for fruit or vegetables.\(^{29}\)

The World Cancer Research Fund and the American Institute for Cancer Research concluded that diets high in both starch and dietary fibre could possibly decrease the risk of colorectal cancer.\(^{30}\) There are two possible mechanisms. First, dietary fibre may decrease risk by binding bile acids and increasing stool bulk, thus diluting carcinogens. Second, bacterial fermentation of soluble fibre and resistant starch may be protective by increasing bulk, lowering pH (thereby reducing the conversion of primary to secondary bile acids), and producing short-chain fatty acids that may be directly anti-carcinogenic.\(^{31}\) It was concluded that cereals may well have a protective effect but that there was still insufficient evidence.\(^{30}\)
The protective action of fibre on the development of colon cancer has recently been disputed. Using the prospective cohort of 88,757 women aged 34 to 59 years from the Nurses Health Study initiated in 1976, 16 years (or 1,408,232 person-years) of follow-up were analysed for colorectal cancer. The hypothesis that dietary fibre intake can reduce the risk of colon cancer was inconclusive in this study as the range of median cereal fibre intakes in the participants was quite low (1.0 grams a day to only 4.8 grams a day in the highest quintile).

Two other reviews have reported more definite conclusions. A recent consensus statement from the European Cancer Prevention Organisation, based on a review of 58 epidemiological studies of diet and colon cancer, reported that a diet rich in high-fibre cereal is associated with a reduced risk of this cancer. This conclusion is supported by a meta-analysis of case-control studies of wholegrain intake and colorectal cancer, which also found a pooled odds ratio of 0.79 when high and low intakes of whole grains were compared.

In prevention trials, supplements of wheat bran have produced a reduction in the incidence of rectal polyps in predisposed individuals and, when combined with a low-fat diet, reduced the incidence of large, but not all, adenomas in an Australian multi-centre trial. Reviews of strategies for the prevention of gastrointestinal cancers generally support a recommendation of up to 30 grams of fibre daily, preferably insoluble fibre. High-fibre cereal foods play a vital role in meeting this target in the Australian diet. It appears that resistant starch may also favourably affect some of the faecal markers of colon cancer risk, in a way similar to dietary fibre. Cereal foods are estimated to provide 42 per cent of the resistant starch in the Australian diet.

Breast cancer

Fibre may reduce the intestinal reabsorption of oestrogen that is excreted via the biliary system, and bioactive food components such as lignans may have protective effects through their action as weak phytoestrogens. One Australian case-control study found an inverse association between dietary fibre and risk of breast cancer. The World Cancer Research Fund and the American Institute for Cancer Research concluded that dietary fibre possibly decreases the risk of breast cancer; the European Cancer Prevention Organisation consensus meeting agreed that there is evidence to suggest that cereal fibre provides protection against breast cancer.

Stomach cancer

In relation to stomach cancer, the World Cancer Research Fund and the American Institute for Cancer Research report concluded from the evidence of six case-control studies that there was a possible protective association for consumption of wholegrain cereals and cereal products but that the evidence for cereals as a whole was inconsistent and inconclusive.
Constipation and diverticular disease

Constipation and diverticular disease are common problems in older people. Many factors contribute to the development of constipation in this age group, among them the effects of medication; a reduction in physical activity, which depresses the muscular stimulus in normal bowel activity; and a decline in intestinal motility. These problems are likely to be greater for residents of aged care accommodation than for older people who are living independently.

There is a strong correlation between dietary fibre intake and mean daily stool weight, and cereal fibre has been found to improve bowel function by increasing faecal bulk and reducing transit time, resulting in softer, larger stools and more frequent bowel action. Diets rich in insoluble fibre, such as that present in wholegrain cereals and breads, are associated with a low prevalence of constipation and diverticular disease. In the United States a prospective study of 43,881 male health professionals found evidence that a diet high in fibre, particularly the cellulose component of insoluble fibre, was significantly associated with decreased risk of diverticular disease.

Awareness of the need to increase fibre intakes is high among older people and is reflected in the widespread use of unprocessed bran supplements. In a 1980s study of a group of randomly selected older Australians, nearly one-quarter were using unprocessed bran, usually on a daily basis. Older Australians are also much greater users of bran-based breakfast cereals than younger people. There have been a number of successful nursing home trials aimed at alleviating constipation and reducing laxative use by introducing a higher fibre diet incorporating more bran-based foods.

Hypertension

Hypertension remains an important risk factor for cardiovascular morbidity and mortality at least up to 80 years, and a reduction in sodium intake is one of the primary preventive measures. Cereals in their natural state are very low in salt and have a favourable potassium:sodium ratio, but processed cereal foods, especially bread, are significant sources of salt in the Australian diet. The Victorian Nutrition Survey found that processed cereal products gave men 28 per cent of their daily sodium intake and women 26 per cent—more than twice as much as any other food group. Both dietary fibre and magnesium may be protective against hypertension in older adults, and cereal foods are important sources of both these nutrients.

Immune function

Recent research suggests that vitamin E and zinc may help prevent the age-related decline in immune system function or enhance immune function in older adults. A diet rich in wholegrain cereal foods will help to allow a useful intake of these two nutrients.
International recommendations

The American Dietetic Association

The American Dietetic Association’s position paper on the health implications of dietary fibre notes that one to two servings daily of higher fibre foods (for example, legumes, whole grains and cereal brans) or concentrated fibre sources may be necessary to achieve adequate intakes in people whose energy needs are low relative to their body mass. This includes older people, hospitalised or ill patients, and people in long-term care facilities.\(^5\)

The Food and Agricultural Organisation and the World Health Organisation

*Carbohydrates in Human Nutrition* is the recently published report of an expert consultation held in Rome in 1997.\(^2\) Two of the recommendations were as follows.

- In an optimum diet at least 55 per cent of total energy should come from carbohydrate obtained from a variety of food sources.
- The bulk of carbohydrate-containing foods consumed should be those rich in non-starch polysaccharides and with a low glycaemic index.

The US Department of Agriculture

In the 1995 revision of the *Dietary Guidelines for Americans* the third guideline is ‘Choose a diet with plenty of grain products, vegetables and fruits.’ Compared with the 1990 version, this guideline was reworded to put grain products first in the list; the accompanying text emphasises grain products’ contribution to total nutrient intake, not just as sources of starch and fibre.

PRACTICAL ASPECTS OF THIS GUIDELINE

Glycaemic index

The glycaemic index of a food is a physiologically based classification of carbohydrate-containing foods according to their potential to raise blood glucose. It is defined as the incremental area under the blood-glucose response curve of a portion of a test food containing 50 grams of available carbohydrate, expressed as a percentage of the response to the same amount of carbohydrate from a standard food (usually glucose or white bread) taken by the same subject (see Appendix I). The FAO–WHO consultation on carbohydrates recommended that ‘the glycaemic index of foods be used in conjunction with information about food composition to guide food choices’.\(^2\) Over 600 foods have been tested around the world to date and the results tabulated.\(^5\) On a scale of 0 to 100 (where 50 grams of glucose has a GI value of 100), foods are classified as high if they have a value greater than 70

* These recommendations are for all adults.
and low if they have a value below 55. Low-GI foods are digested and absorbed more slowly than foods with a high GI (see Appendix I).

Various factors can affect the GI value of a food, among them the particle size of milled grains, the ratio of amylose to amylopectin, the degree of starch gelatinisation, and the presence of other food components such as viscous soluble fibres, fat, protein and organic acids. It is thus difficult to predict GI from a knowledge of the chemical composition of a food, although there is a reasonably good correlation with in-vitro digestion. Many processed starchy cereal foods—such as most breads, rices and breakfast cereals—tend to have high GI values. Pasta, grainy breads and some breakfast cereals have low GI values (see Appendix I).

For a number of reasons it seems prudent to recommend lower GI food choices for older people. First, there is emerging evidence of the possibly protective effect of lower GI diets for both diabetes and heart disease. Second, slower digestion of carbohydrate is associated with higher satiety, so low-GI diets may help with weight control. This does not mean that high-GI grain foods need to be avoided altogether: the glycaemic load of a diet can be balanced by combining high- and low-GI carbohydrate sources in the same meal. Exchanging half the carbohydrate from high to low GI will lower the GI of the overall diet by about 15 units, sufficient to bring about clinical improvements in glucose metabolism. A reasonable target is to include one low-GI food in each meal.

**Mineral bioavailability**

High intakes of dietary fibre and phytate could potentially have adverse effects on the bioavailability of zinc, calcium and iron, and older people, whose mineral intake (especially of calcium and zinc) may already be marginal, may be at greatest risk. It has, however, been concluded that there is no convincing evidence of adverse effects on mineral bioavailability in humans when fibre is consumed in even quite large amounts—up to 50 grams of total fibre a day.

**Sodium intake**

Bread is the most commonly consumed cereal food in Australia; it has a typical sodium content of around 450 milligrams per 100 grams. The average daily consumption of regular and fancy breads by people over 65 years reported in the 1995 National Nutrition Survey was 90.9 grams, which would contribute 409 milligrams of sodium—around 18 per cent of the recommended maximum sodium intake. High consumption of cereal foods with high salt levels could make it more difficult for people to meet the target for sodium intake, but this is not a reason to recommend against a general increase in the consumption of cereals. People seeking to increase their cereal food intake should prefer those cereal foods that are lower in salt—such as rice and pasta and lower salt varieties of breakfast cereals and breads.
**Nutrient density**
Several studies of the diets of older Australians have shown that a significant proportion have diets that are deficient in one or more nutrients.63,64,65 People who live in nursing homes may be at special risk: low levels of nutrients such as folate and vitamins B_6_ and C are prevalent in this group.66 In the United Kingdom, a high proportion of people over 65 years who were living independently have been found to have sub-optimal riboflavin and B_6_ status, despite apparently adequate dietary intakes.67 For older people the nutrient density of the diet is a particular consideration.

Two of the main cereal foods—breakfast cereals and breads—are often fortified with vitamins and minerals that may be marginal in the diets of older people. For example, data from the 1995 National Nutrition Survey show that, among women over the age of 55, those who regularly include breakfast cereal in their diet are much more likely to meet the recommended dietary intake for iron, calcium, magnesium, folate, riboflavin and thiamin.45 Bread is also fortified with thiamin. Breakfast cereals and breads are relatively inexpensive, require no special storage, and are easy to prepare, so they are ideal nutrient-dense foods to form the basis of simple meals for people with limited cooking skills or kitchen facilities or mobility.

**Dentition**
Poor natural dentition and dentures are known to cause inferior chewing efficiency and nutritional status can thus be affected.68 Some older people complain of discomfort when eating cereal foods with distinct whole grains that cause problems with teeth or dentures. Although there is emerging evidence of the health benefits of intact-grain cereals, the most important thing is to ensure an adequate overall carbohydrate and fibre intake. It is preferable to include wholegrain breads and cereals in the diet if these are tolerated, but finer textured wholemeal and fibre-enhanced products are good alternatives.

**Constipation and bran supplementation**
In vulnerable groups such as older people the potential benefits of bran supplementation may be outweighed by adverse effects on mineral absorption. In healthy older volunteers calcium absorption decreased by an average of 50 per cent when two level tablespoons of wheat bran were taken three times daily.69 It is important that messages about the need for dietary fibre are not misconstrued as simply proposing dietary supplementation with unprocessed bran: increasing the amount of cereal fibre through the use of bran-based breakfast cereals and wholemeal breads, along with regular exercise and consumption of plenty of fluids, will probably be an effective and safer strategy for most older people.
RELATION TO OTHER GUIDELINES

Enjoy a wide variety of nutritious foods. Different cereals provide varying amounts and types of dietary fibre as well as different levels of potentially active phytochemicals such as flavonoids, lignans and nutritive antioxidants.\(^7\) The levels of some nutrients, such as selenium, in cereals vary considerably according to the growing region. It is important to eat a wide variety of cereal foods to maximise their nutritional benefits.

Eat a diet low in saturated fat. Cereals are naturally very low in saturated fat, so increased cereal consumption assists with this guideline. Care needs to be taken, however, with many other cereal-based foods such as biscuits, cakes and pastries: they can have high levels of added saturated fat.

Drink adequate amounts of water and/or other fluids. If cereal fibre intake is substantially increased it is important to balance this with adequate fluid intake, to prevent constipation.

Choose foods low in salt and use salt sparingly. Standard commercial breads and some breakfast cereals are major sources of salt in the diet. To cut down on salt intake, choose lower salt cereal products and unprocessed whole grains.

CONCLUSION

Inclusion in the diet of adequate amounts of cereal foods is very important for older Australians. Cereals are a most important source of macro- and micro-nutrients. It is recommended that the emphasis in interpreting this guideline be on high-fibre cereal choices that have a lower glycaemic index. The words ‘eat plenty’ are used to encourage people to choose these foods liberally as the basis of their daily diet.

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The Dietary Guidelines for Australians\(^1\) recommended for the population in general—focusing on younger adults—a diet low in fat. Among the reasons for this were the prevention of cardiovascular disease and obesity and the epidemiological association of fat with cancers of the breast and large intestine. In 1999 the opinion that fat consumption relates directly to obesity is no longer unanimous\(^2\); the prevalence of obesity in industrial countries has been increasing while total fat intakes have been decreasing.\(^2,3\)

**BACKGROUND**

Current opinion suggests that low-fat diets may not provide the level of health benefits previously thought for the population in general. Further, it is evident that low-fat diets do not provide health benefits at the two ends of life. The NHMRC’s Dietary Guidelines for Children and Adolescents\(^4\) advise that ‘low-fat diets are not suitable for young children’ because of the requirement for lipids during growth. Similarly, low-fat diets are not suitable for convalescent older people and frail very old people because of the possible adverse effects of energy restriction.

Anthropometric data from the 1995 National Nutrition Survey\(^5\) show that in men mean body mass index declined after about 60 years—see Table 7.1. Men’s waist-to-hip ratio leveled off at 60 years and declined after 75 years. In women mean body mass index declined more steeply, from 28.1 at 55–59 years to 22.8 at 80+ years. Increasing overweight is thus not the public health problem in Australians over 65 years that it is for Australians in their 20s, 30s, 40s and 50s.

| Table 7.1 Body mass index of older Australians: National Nutrition Survey |
|-----------------------------|-----------------------------|-----------------------------|
| Age group                  | Males (percentile)          | Females (percentile)        |
|                            | 5<sup>th</sup> | Median | 95<sup>th</sup> | 5<sup>th</sup> | Median | 96<sup>th</sup> |
| 50–54                       | 22.2  | 27.6  | 34.3  | 20.9  | 26.4  | 36.6  |
| 55–59                       | 21.6  | 26.9  | 34.3  | 20.4  | 27.1  | 38.9  |
| 60–64                       | 21.4  | 27.4  | 36    | 20.3  | 26.6  | 35.8  |
| 65–69                       | 20.7  | 26.9  | 34.6  | 21.5  | 26.6  | 36.7  |
| 70–74                       | 20.8  | 27.1  | 34.2  | 20.1  | 25.7  | 36.2  |
| 75–79                       | a     | 26.7  | 32.9  | a     | 25.2  | 34.4  |
| 80+                         | a     | 25.3  | 31.7  | a     | a     | 28.4  |

a. Insufficient data.
The 24-hour food intake data from the 1995 National Nutrition Survey show that the (unweighted) mean percentage of energy from fat was 32.9 from 25 to 64 years and 32.4 from 65 years for men and 33.35 at 25 to 64 years and 33.05 at 65 years and over for women. There is thus no indication that as energy expenditure and energy intake decline with age there is a relative increase in fat consumption. The Survey’s subjects were people living in their homes: older people living in institutions such as hostels, nursing homes and hospitals were not included.

The NHMRC’s 1992 report on the role of polyunsaturated fats in the Australian diet recommended that Australians reduce their total fat intake from an estimated 37 per cent of energy in the 1980s to 30 per cent. This was, of course, advice for the majority of the population; that is, mostly for younger adults. For saturated fat the recommendation was that intakes should be reduced from an average of 15 per cent of energy in the 1980s to 10 per cent.

In the 1995 National Nutrition Survey the proportion of energy derived from saturated fat averaged 14.2 per cent for both sexes from the age of 25 years on. There were slightly higher values for females and slightly lower values for men aged 60 to 70 years. Saturated fats made up 42–44 per cent of total fatty acids. The reduction in energy from total fat, from 37 per cent in the 1980s to 33 per cent in 1995, was 11 per cent, while the reduction in energy from saturated fat, from 15 per cent in the 1980s to 14.2 per cent in 1995, was only 5 per cent.

It thus appears that Australian adults have achieved a greater reduction in energy from total fat than from saturated fat. To meet the NHMRC’s 1992 recommendations, more effort will need to be devoted to reducing saturated fat than total fat. Forty-three per cent of total fat is saturated, so any effective reduction in saturated fat would carry with it a reduction in total fat, unless the reduction is done on a selective basis.

**SCIENTIFIC BASIS**

**Dietary fat and coronary heart disease**

Of the risk factors that can be influenced by diet, plasma LDL cholesterol, which is reflected in plasma total concentration, remains the best established. It has been found to be a significant risk factor in at least 50 prospective studies involving more than 600,000 subjects in 18 countries. The importance of plasma cholesterol has been confirmed by trials with ‘statin’ drugs, which are showing a reduction in coronary events (with reduced all-causes mortality) even among people starting with average US plasma cholesterol levels. Saturated fatty acid intake is the strongest dietary determinant of plasma LDL-cholesterol concentration.

The reduced saturated fat diets used to help prevent coronary heart disease have nearly always contained increased unsaturated fatty acids. Omega-6 polyunsaturated fatty acids lower plasma LDL cholesterol and reduce the risk of dangerous cardiac arrhythmias. A meta-analysis of nine intervention trials with
increased omega-6 polyunsaturated fatty acids and decreased saturated fats showed a 19 per cent reduction in coronary events. Most prospective studies have not assessed dietary fat type at the start but, in the 11 studies that have, omega-6 polyunsaturated fat intake has most often emerged as a significant protective factor.

Omega-3 polyunsaturated fatty acids in oily fish (chiefly eicosapentaenoic acid, 20:5) reduce both the tendency to thrombosis and the incidence of cardiac arrhythmias. Alpha linolenic acid (18:3, omega-3), which is present in a few vegetable oils, may produce some of these effects but until recently the best source of ‘omega-3 benefit’ has been fatty fish. The best source of vegetable oil omega-3 polyunsaturated fatty acids is flaxseed oil, which contains 50–60 per cent; canola oil contains 10 per cent. Regular fish consumption has been found to be protective against coronary heart disease in most, but not all, prospective studies that examined this relationship.

The unsaturated oils and foods containing them—nuts and seeds—are the principal sources of vitamin E in the diet. Olive oil also contains polyphenols, which are potential antioxidants.

These beneficial effects of most plant oils and of fish oils provide the reason for not making blanket recommendations for low-fat diets for older Australians. Shrapnel points out that, in response to the general low-fat guideline, Australians have been reducing their consumption of polyunsaturated fatty acids proportionately more than their consumption of saturated fatty acids. Three leading researchers in lipid nutrition—Katan, Grundy and Willett—now argue that instead of low-fat diets we should replace the majority of saturated and trans fats in our diets with oils high in unsaturated fatty acids. In the nurses cohort study, while total fat intake was not a significant risk factor, saturated fat and trans unsaturated fat both significantly increased risk of coronary heart disease; polyunsaturated fat (that is, omega-6, linoleic acid) was strongly protective.

The question is, do these contemporary views about dietary fats apply to older people? In Australia older people have younger lifestyles and longer life expectancies than they used to. Anyone refusing to give a sprightly 66-year-old dietary advice to prevent cardiovascular disease could be accused of age discrimination.

Further, although the increased relative risk of raised plasma cholesterol for coronary heart disease tends to be smaller in older people than in younger adults, it is still significant in the 65–75 year age group. Since the absolute risk of coronary disease is greater at this age, even a small change in risk can influence a large number of events.

The health benefit of cholesterol lowering has now been clearly demonstrated with the ‘statin’ drugs in people over 65 years. In the CARE trial ‘the effect of Pravastatin on the rate of major coronary events was not substantially altered by the patients’ age at base line’ (60–75 or 24–59 years). In approved product information, ‘the efficacy of Simavastatin for patients over the age of 65 years, as
assessed by reduction in total and LDL cholesterol levels, was similar to that seen in the population as a whole'. There was no apparent increase in the frequency of adverse findings in older age groups.

The ‘statin’ trials have also raised again the real possibility that cholesterol lowering reduces the risk of stroke7, which is another major cardiovascular cause of morbidity and mortality in older people. In at least one dietary trial, in US veterans, a diet high in polyunsaturated fat reduced the incidence of stroke by 45 per cent. Half the 846 participants were aged more than 65 years (and a few were over 85) when they started this seven-year trial.20

There is no indication that the effect on plasma total and LDL cholesterol of a diet low in saturated fats and with increased polyunsaturated fat differs between people over or under 65 years of age. In the Los Angeles Veterans Administration trial19 there is no mention that the many subjects over 65 years failed to show a reduction in plasma cholesterol. Twenty-three of the subjects in an Oslo secondary prevention trial were over 65 years at the start; their serum cholesterol did not appear to differ from those of the younger subjects—that is, they fell and remained down for five years of follow-up.21 Lichenstein et al. report plasma cholesterol reductions on corn oil or canola in subjects with ‘advanced’ ages up to 78 years.22

**Dietary fat and cancer**

Large cohort studies published since 1991 have failed to confirm earlier case–control study reports of a modest association of fat intake with risk of breast cancer.23 Further, the association between total fat intake and colorectal cancer is now emerging as weaker than it appeared when fewer epidemiological studies had been completed.24 In the United Kingdom the 1998 review of the nutritional aspects of the development of cancer23 concluded, ‘There is weakly consistent evidence that higher total fat intakes are associated with higher risk of colorectal cancer.’ Although the majority of studies are in the direction of higher risks with higher fat consumption, in most the relative risks are close to one and do not reach statistical significance, and in no case is the relative risk greater than 2.00.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

A small change in dietary intake of saturated fat can have a significant influence on the risk of related diseases in older Australians. To decrease total saturated fat in the diet, older people can avoid fatty (marbled) meat, take the visible fat off meat, use reduced-fat milks (2 per cent fat), and drink calcium-fortified soymilks. Of processed foods that contain predominantly saturated fat, cheese (in moderation) is better than cakes or biscuits because it is rich in protein and calcium and can be used to make tasty meals.

A little polyunsaturated oil (such as sunflower oil) or mono-unsaturated oil (such as olive or canola oil) is best for frying foods. Using polyunsaturated or mono-unsaturated margarine instead of butter as a spread will also help increase older Australians’ intake of unsaturated fatty acids.
Regularly eating oily fish—tuna, sardines, salmon, herring and mackerel are examples—will promote an increased intake of omega-3 polyunsaturated fatty acids. Eggs are nutritious: one egg makes a useful light meal, and there seems to be no good reason why older people should not eat an egg most days. For people with high blood cholesterol levels, however, egg consumption should be limited to no more than two a week. Most nuts are rich in unsaturated fats, and frequent consumption of nuts appears to offer protection against coronary heart disease.

**RELATION TO OTHER GUIDELINES**

*Enjoy a wide variety of nutritious foods.* Limiting total fat and increasing the proportion of unsaturated fats in the diet will help to prevent coronary artery disease. Eating a variety of foods that are rich in unsaturated fatty acids offers a greater range of beneficial fats: such foods should be consumed regularly as part of a healthy, balanced diet.

*Eat at least three meals every day.* Including a small amount of unsaturated fat at each meal will help increase the unsaturated fatty acid profile of the diet and provide a good source of energy.

*Eat plenty of vegetables (including legumes) and fruit.* Fruits and vegetables are low in saturated fat and the small amount of fat found in some vegetables is relatively high in polyunsaturated or mono-unsaturated fatty acids.

*Eat plenty of cereals, breads and pastas.* Cereals, breads and pastas are low in saturated fat and are an excellent accompaniment to small amounts of unsaturated fatty acids.

*Include foods high in calcium.* Dairy foods that are high in calcium are often also high in saturated fat. It is best to choose reduced-fat forms of these products.

**CONCLUSION**

Reducing the amount of saturated fat in the diet and regularly consuming small amounts of mono- and poly-unsaturated fats can decrease the risk of coronary heart disease and protect against its development. Older Australians should be encouraged to incorporate these changes in their diet: the benefits can continue to be gained well into later life.

**REFERENCES**


Fluids are essential to life and so form a vital part of the diets of people in all age groups. Older people can, however, be at greater risk of water imbalance or dehydration when compared with younger people because of inadequate fluid intake or increased fluid loss, or both. Water homeostasis becomes increasingly precarious for older people.

**BACKGROUND**

Decreased fluid consumption and age-related loss of body water pose a threat to some older people, particularly those who are frail or have a chronic illness. Ageing produces a decrease in thirst sensation; dehydration may go undetected and lead to electrolyte imbalance and confusion. Hypodypsia can also occur as a result of changes in renal function, mental dysfunction or use of diuretics.

The prevalence of dehydration in older Australians is not known, but dehydration is the most common fluid and electrolyte disturbance in older people in the United States.

**Water requirements**

It is assumed that the daily requirement for water remains the same throughout adult life, at 30 millilitres per kilogram, or 0.25 millilitres per kilojoule. This amount will provide adequate dilution for the excretion of solutes through the kidney. Energy requirements reduce with ageing, because of decreased lean body mass, so the average older person of healthy weight (55 to 75 kilograms) needs between 1650 and 2500 millilitres of fluid a day. Solid foods and some metabolic water provide a significant proportion of this fluid, but the remainder needs to come from drinks of water and other fluids. Even very underweight older people need a minimum of about 1500 millilitres of fluid a day.

**Older Australians' fluid intakes**

Not enough is known about older Australians' fluid intakes. Studies of dietary intake rarely analyse water intakes, mainly because of the difficulty of obtaining accurate intake records. Anecdotally, it is often said that older people do not drink enough, and it certainly seems that fluid intakes may be minimal for frail older people and residents of aged care facilities.

In a study of people aged over 70 years and living in Adelaide 10.1 per cent of participants stated they did not drink six to eight cups of fluid daily; the proportion of such people increased with age.
The 1995 National Nutrition Survey estimated fluid intakes from various sources. According to the survey data, men aged 65 years and over consumed 1644 grams of fluids and women aged 65 years and over consumed 1714 grams. Women appear to drink more water and mineral waters than men; the differences for other fluids such as tea, coffee, fruit juices and soft drinks are insignificant. Actual water intakes may, of course, be much higher than this: other fluids, alcoholic beverages, and foods with high water content such as soup, milk, jelly and ice cream also need to be taken into account.

There is insufficient evidence to state that the average older Australian drinks insufficient fluid, but a significant proportion of the older population—possibly as high as 10 per cent of those living independently—may be at risk of insufficient water intake.

**SCIENTIFIC BASIS**

**Body water**

The changes in body composition that occur with normal ageing lead to a decline in body water. This is consistent with a decrease in lean body mass and an increase in body fat and reflects a decline in intracellular rather than extracellular water.

Mature adults are about 70 per cent water. In older adults water content falls to 60 per cent and in later years may fall below this. Older people thus have a smaller reserve of water owing to this lower body content. There is also reduced volume for distribution of water-soluble substances such as alcohol.

**Thirst and regulation of fluid intake**

The ageing process appears to produce a reduction in thirst in response to water deprivation. Older subjects report less thirst and drink less following a period of restriction than do younger subjects. A group of healthy older men (aged 67 to 75 years) and younger men (aged 20 to 31 years) were deprived of all fluids for 24 hours and then allowed free access to water for 60 minutes. In spite of a higher serum osmolality in the older subjects following dehydration, these subjects were less thirsty and drank only half as much water during the rehydration period.

This means that the sensation of thirst cannot be relied on to prevent dehydration. Many older people are not aware of this and may not take the necessary precautions, even when they live in hot climates, which are common in Australia.

**Renal function and water balance**

Normal ageing is accompanied by a number of changes in renal anatomy and function, as follows:

- renal changes;
– decreased kidney mass
– decline in renal blood flow
– decline in glomerular filtration rate
– impaired distal renal tubular diluting capacity
– impaired renal concentrating capacity
– impaired sodium conservation
– impaired renal response to vasopressin

• hormonal changes;
  – vasopressin—normal or increased basal secretion, increased response to osmotic stimulation, and decreased nocturnal secretion
  – atrial natriuretic hormone—increased basal secretion, increased response to stimulation, decreased plasma renin activity, and decreased aldosterone production

• fluid intake changes.
  – decreased thirst perception.

Glomerular filtration begins to decline at a rate of about 0.8 mL per minute per 1.73m² after about age 40. There is, however, considerable variability in this alteration within the older population. The changes in thirst response and renal function in ageing appear to be physiological rather than the result of acute or chronic disease. As the incidence of illness increases with ageing, and with it the rate of medication use, other factors may also add to deteriorating water homeostasis. Among the more common problems are cognitive changes and dementia, dysphagia, limited mobility and dexterity, and the use and misuse of diuretics and laxatives. Some of these problems limit an older person's ability to maintain an adequate water intake; others increase water output.

**Environmental factors**

The ability to acclimatise to moderate heat stress does not deteriorate dramatically with age. The lower body water of an older person does, however, mean there is less water available to act as a thermal buffer and ‘heat sink’ against hyperthermia and hypothermia. Unfit, overweight older people may be especially at risk, particularly if they are subjected to strenuous exercise.

During summer, when heat stress may be high, water depletion can lead to heat exhaustion, loss of consciousness and heat stroke.

**Dehydration**

It is to be expected that dehydration in older people would be most common in summer, but other conditions are also known to increase the risk in this age group: the presence of a febrile illness, diarrhoea, vomiting, and ketoacidosis associated
with diabetes are examples. A loss of more than 10 per cent of body weight can be life threatening. Because body water is the diluent for water-soluble medications, these drugs will be distributed in a smaller body space in a dehydrated person, resulting in overmedication and possible toxicity. Older people are also more prone to excessive or inappropriate diuretic therapy and need careful monitoring when undergoing such therapy.

Dehydration, particularly in the early stages, is not always easily recognised in an older person. It can cause syncope, tachycardia and orthostatic hypotension, as well as constipation, lethargy, dizziness, altered cognition and confusion, which may be attributed to other causes.

**Bladder cancer**

Results from the prospective Health Professionals Follow-up Study of men aged 45 to 75 years showed that total daily fluid intake was inversely associated with the risk of bladder cancer. The study showed that consumption of water contributed to the lowest risk of bladder cancer when compared with other fluids.

**Access to water and other fluids**

Forty-eight per cent of people aged more than 65 years have some form of handicap—for 17 per cent the handicap is profound or severe—that is, likely to affect their mobility, self care, and/or communication. Any of these handicaps can limit these people’s ability to maintain a varied and adequate fluid intake.

An older person with limited mobility may have difficulty shopping, or even moving around their house to obtain fluids. If dexterity is a problem, turning taps or opening bottles can be difficult without special aids.

Cognitive difficulties may result in limited access to fluids because of difficulty in planning how to maintain supplies, making tea or coffee, or preparing other drinks. A person with dementia may no longer be able to safely operate household equipment such as kettles or may not remember to drink without being prompted.

Communication problems can also affect a person’s ability to obtain sufficient fluids by making it difficult to shop, or even ask for help. In extreme circumstances older handicapped people may be totally dependent on their carers, whether at home or in residential care, to anticipate their fluid requirements.

**Renal calculi**

Kidney stone prevalence is higher among people with low urinary volume. Decreased fluid intake leads to low urine volume and increased concentrations of all stone-forming salts. Studies have shown high fluid intakes can inhibit the recurrence of renal calculi (kidney stones). A sufficiently high intake of water and other fluids such as coffee, tea, beer and wine has a preventive effect for kidney stones and their recurrence. A high water intake is an effective and economical way of preventing kidney stones.
prospective cohort study of women aged 40 to 65 years, also found that an increase in total fluid intake reduces the risk of stones. The reduction in risk of stone formation varied according to the choice of fluids (see Table 8.1) as well as the amount of fluid consumed.

Table 8.1   Reduction in risk of kidney stone formation

<table>
<thead>
<tr>
<th>Fluid</th>
<th>Nurses Health Study</th>
<th>Health Professionals Follow-up Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Decaffeinated coffee</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Tea</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td>Wine</td>
<td>59</td>
<td>39</td>
</tr>
</tbody>
</table>

Note: Proportions are for each 240-millilitre serving.

Limiting fluids

Some older people will voluntarily limit their fluid intake: they may not have more than four or five cups of fluid a day or they may never drink after, say, 3 p.m. The most common reported reason for this behaviour is the desire to reduce the risk or occurrence of incontinence, particularly at night. In addition, some older people go to bed very early and if they have limited mobility they may fear falling, particularly if they need to get up at night; they may go for 12 or more hours without fluids, so that they do not have to leave their beds until the morning.

Unfortunately, strategies such as these not only increase a person’s vulnerability to dehydration but are also unlikely to have the desired effect. Production of more concentrated urine irritates the bladder and encourages more frequent urination. Limiting fluids can also lead to constipation, and this in turn is likely to increase urinary incontinence.

It has been proposed that nocturnal dehydration is more common among older people because of this common limiting of fluid intake.

PRACTICAL ASPECTS OF THIS GUIDELINE

What to drink?

Water is an ideal drink for older people, just as it is for younger people. There are, however, good reasons for suggesting that a variety of fluids be used in order to provide other nutritional benefits as well as adequate fluids. The ‘fluid pyramid’ in Appendix J shows how approximately 2 litres of fluid can be consumed through a variety of sources.
Caffeine acts as a mild diuretic and this fact is sometimes used to discourage older people from drinking caffeine-containing fluids such as coffee, tea and colas. There is no objective evidence that enables the calculation of available water from these beverages. The decision to avoid or reduce caffeine may need to be made on other grounds, such as an irritating effect on the bladder, which may exacerbate incontinence. Alternatively, decaffeinated coffee can be chosen. Some fluids, particularly tea, contain other nutrients such as antioxidants and so may have an important role in the health of older people.

Green tea has been generating particular interest in cancer research because it contains polyphenols, which are anti-oxidants that act as chemopreventive agents. Green tea is primarily consumed in Asian countries, and the low lung cancer rate in Japan, despite high smoking rates, has been attributed to green tea consumption. Many of the studies have found conflicting evidence in relation to the chemopreventive benefit of green tea on specific cancer sites. It has been speculated that the effect of green tea consumption may depend on the causative factors of the specific cancer.

Alcohol consumption can also increase the rate of fluid loss, but there are other more important reasons for older people to limit their alcohol intake—medication use and the risk of serious consequences from falls are examples.

Milk, or an alternative containing similar amounts of calcium, needs to be included in older people’s fluid intake if they are to have adequate calcium intakes. Most people would probably not be able to achieve the recommended dietary intake for calcium without some liquid dairy products.

Fruit and vegetable juices can be a useful source of ascorbic acid, potassium and folate for older people who limit their consumption of fresh fruit and vegetables because of dental problems. Fruit juices are an important component of delivered meals for this reason. There is, however, probably no reason for the obligatory intake of fruit juices if fresh fruit and vegetables are eaten.

Fluids with higher energy density, such as those containing large amounts of sugar, and higher fat liquid dairy products should probably be limited by people who, because of age and limited activity need to reduce their energy intake. Alternatively, the use of low-joule soft drinks or the addition of a small amount of cordial to water to improve palatability can promote fluid intake without contributing unwanted kilojoules.

In terms of practical dietary advice, older people should be encouraged to include a variety of fluids in their daily intakes. It is estimated that six household cups or glasses (at least 150 millilitres each), in combination with an adequate intake of food, will provide more than 2 litres of water daily. Under normal circumstances in temperate climates this would be sufficient.
RELATION TO OTHER GUIDELINES

*Keep active to maintain muscle strength and a healthy body weight.* Active older Australians need to ensure adequate fluid intake during periods of exercise, to prevent dehydration.

*Eat plenty of cereals, breads and pastas.* Fluids are important in preventing constipation, particularly if wholemeal or wholegrain cereal foods are consumed in large amounts.

CONCLUSION

Older Australians are vulnerable to the effects of inadequate fluid intake, leading to increased morbidity, and even mortality, in this age group. They should be encouraged to drink an adequate amount of a variety of fluids, including water. Although healthy older Australians living independently appear to drink sufficient fluid their risk of inadequate hydration increases with medication use, chronic illness and frailty. Older people who are dependent on others for the supply and preparation of fluids are particularly at risk and need extra monitoring to ensure that their fluid intake is adequate.

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Dietary Guidelines for Older Australians


IF YOU DRINK ALCOHOL, LIMIT YOUR INTAKE

by Professor AS Truswell

Alcohol provides about 5 per cent of the energy intake of Australian adults and 4.8 per cent of the energy intake of Australians over the age of 65 years. For many people, an alcoholic drink is a regular and enjoyable part of major meals. On this basis advice on alcohol is included in the general Dietary Guidelines for Australians.¹

BACKGROUND

Consumption of alcoholic beverages (and of grams of alcohol per day) declines with age. This is evident in data from the 1995 National Nutrition Survey (see Table 9.1).² The average intake of alcoholic beverages, the average intake of alcohol (in the Survey’s 24 hours) and the proportion of people who had an alcoholic drink on the day of the Survey were all lower for people aged over 65 years. The standard deviations are large (proportionately larger in women) and the coefficient of variation increases in older age groups.

Table 9.1 Alcohol consumption: males and females aged 25 years and over, 1995

<table>
<thead>
<tr>
<th>Age</th>
<th>Males</th>
<th></th>
<th></th>
<th></th>
<th>Females</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>75%ile</td>
<td>95%ile</td>
<td>Mean</td>
<td>Median</td>
<td>75%ile</td>
<td>95%ile</td>
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<td>97</td>
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<td>0</td>
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<td>30–34</td>
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<td>0</td>
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<td>99</td>
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<td>18</td>
<td>0</td>
<td>19</td>
<td>99</td>
<td>9</td>
<td>0</td>
<td>8</td>
<td>48</td>
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<td>40–44</td>
<td>21</td>
<td>0</td>
<td>22</td>
<td>121</td>
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<td>45–49</td>
<td>19</td>
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<td>50–54</td>
<td>20</td>
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<td>8</td>
<td>0</td>
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<td>21</td>
<td>6</td>
<td>35</td>
<td>83</td>
<td>6</td>
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<td>0</td>
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<td>60–64</td>
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<td>90</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>31</td>
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<tr>
<td>65–69</td>
<td>18</td>
<td>3</td>
<td>27</td>
<td>77</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>34</td>
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<td>70–74</td>
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<td>0</td>
<td>19</td>
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<td>0</td>
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<td>27</td>
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<tr>
<td>75–79</td>
<td>14</td>
<td>0</td>
<td>17</td>
<td>67</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>27</td>
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<tr>
<td>80+</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>50</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>18</td>
</tr>
</tbody>
</table>
DIETARY GUIDELINES FOR OLDER AUSTRALIANS

On the survey day 44 per cent of men and 21 per cent of women aged 65 years and over consumed alcoholic beverages. For all ages the respective proportions were 42 per cent and 24 per cent.

The 24-hour recall used for the National Nutrition Survey does not record the pattern or the total weekly alcohol intake. A sizeable proportion of people drink little on the average day but drink a large amount periodically (‘binge’ drinking). It is also to be expected that the Survey did not include in its sample the full proportion of the population who were socially disorganised (for example, homeless men) or living in aged care accommodation as a result of alcohol abuse.

Medical and social complications differ according to people’s pattern of drinking; there are five broad drinking patterns:
- the inexperienced drinker who misjudges the dose and has an accident—common in adolescents but rare in older people;
- the person who doesn’t drink during the week but may drink to excess and get drunk on a weekend evening or at a party;
- the person who enjoys a controlled drink or two most days with dinner;
- the person who has too many drinks each day but more or less maintains a normal (but probably increasingly inefficient) lifestyle;
- the person who engages in weeks of heavy drinking.

SCIENTIFIC BASIS

Alcoholic beverages are the most highly prized element of the total diet—no other dietary component commands the price of a bottle of Grange Hermitage—but at the same time they are obviously dangerous if consumed beyond a relatively small dose. Ethyl alcohol is a nutrient, with a caloric (kilojoule) value, but it is also a drug affecting the brain and, above the socially beneficial dose, a toxin affecting most tissues of the body. Following are some of the medical complications of excess alcohol consumption:
- acute intoxication, which can cause coma or death;
- motor vehicle and many other types of accidents;
- injuries of all sorts, including head injury;
- violence, domestic violence and homicide;
- depression, which can lead to suicide;
- dependence and addiction;
- hangover and dehydration;
- withdrawal symptoms such as delirium tremens, hallucinations and anxiety;
- gastritis and gastric ulcers;
- acute and chronic pancreatitis;
- fatty liver, alcoholic hepatitis and cirrhosis;
- hypertension, which can cause cerebral haemorrhage;
- cardiomyopathy;
- aspiration pneumonia;
- cancer of the pharynx, oesophagus, rectum, liver and female breast;
- convulsions;
- peripheral neuropathy;
- hypoglycaemia;
- lactic acidosis;
- hyperuricaemia, causing gout;
- hypertriglyceridaemia;
- hypercortisonism;
- sexual dysfunction;
- acetaldehyde reaction;
- Wernicke's encephalopathy, leading to Korsakoff's psychosis;
- alcohol-related brain degeneration;
- folate deficiency;
- vitamin A depletion;
- pellagra;
- undesirable effects of interactions with drugs.

Alcohol is responsible for one in every 20 deaths in the United States and one in every 34 in Australia. This is across all ages but, with the exception of deaths resulting from violence and accidents, older people are more susceptible to the toxic effects of alcohol.

With ageing, the body, especially the lean body mass, becomes smaller, so the volume in which absorbed alcohol is distributed is smaller and the extracellular fluid concentration achieved for each standard drink is higher. Gastric first-pass alcohol metabolism declines with age and the liver, where 80 per cent of alcohol is catabolised, shrinks from about 25 grams per kilogram of body weight to about 20 grams. This means that an older person will become more intoxicated after, say, three standard drinks than a younger person. The safe dose for an older woman is even smaller than that for an older man.

To reduce the risk of all the medical complications just listed, older people must be careful not to drink too much alcohol. But there are two other reasons why alcohol is more dangerous in older people.

One is falls. Older people have less muscle strength to help them avoid falling if they trip. They are more likely to trip because their eyesight and balance may be impaired. And, if they do fall, osteoporotic bones are more likely to fracture. Fractured neck of the femur in old people is a very serious illness with a high death rate.
The other important reason older people should take great care with alcohol is that induction of liver microsomes, mostly CYT 2E1, interferes with metabolism of a number of commonly prescribed powerful drugs—and of course the likelihood of taking multiple medicinal drugs increases steadily with age. Table 9.2 shows some of the important drug–alcohol interactions.

To quote Alex Comfort, who wrote so sympathetically about being old:

_Alcohol can get to be a major problem in old age for people who had no problems with it earlier. This is partly because tolerance for alcohol decreases, and partly because society may make age so stressful that people drink to escape it. Alcohol causes confusion and affects memory. The older you are the more you need your head straight. Alcohol can also be fatally incompatible with many medications. You already run the risk of overmedication as you age._ (p. 36)

### Table 9.2 Some important drug–alcohol interactions

<table>
<thead>
<tr>
<th>Drug type</th>
<th>Interaction with alcohol</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitors</td>
<td>Enhanced hypotensive effect</td>
</tr>
<tr>
<td>Analgesics</td>
<td>Sedative and hypotensive effects of opioids enhanced</td>
</tr>
<tr>
<td>Antibacterials</td>
<td>Disulfiram-like reaction with metronidazole, etc</td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>Warfarin-enhanced anticoagulant effect</td>
</tr>
<tr>
<td>Antidepressants</td>
<td>Sedative effect of tricyclics enhanced</td>
</tr>
<tr>
<td>Antidiabetics</td>
<td>Flushing with chlorpropamide, hypoglycaemia</td>
</tr>
<tr>
<td></td>
<td>Increased risk of lactic acidosis with metformin</td>
</tr>
<tr>
<td>Antihistamines</td>
<td>Enhanced sedative effect</td>
</tr>
<tr>
<td>Antihypertensives</td>
<td>Enhanced hypotensive effect</td>
</tr>
<tr>
<td></td>
<td>Sedative effect of indoramin enhanced</td>
</tr>
<tr>
<td>Antipsychotics</td>
<td>Enhanced sedative effect</td>
</tr>
<tr>
<td>Barbiturates</td>
<td>Enhanced sedative effect</td>
</tr>
<tr>
<td>Beta-blockers</td>
<td>Enhanced hypotensive effect</td>
</tr>
<tr>
<td>Cytotoxics</td>
<td>Disulfiram reaction with procarbazine</td>
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<tr>
<td>Dopaminergics</td>
<td>Reduced tolerance to bromocryptine</td>
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<tr>
<td>Nabilone</td>
<td>Enhanced sedative effect</td>
</tr>
<tr>
<td>Nitrates</td>
<td>Enhanced hypotensive effect</td>
</tr>
</tbody>
</table>

### The ‘J-curve’

Results from the 1995 National Nutrition Survey showed that men over 65 years drank on average about 1.5 alcoholic drinks on the day of the Survey and women averaged less than one such drink. From prospective studies completed during the 1980s and 1990s it has emerged that people who average one or two alcoholic drinks a day have better life expectancy than teetotallers. This result has been found in at least 20 large prospective cohort studies in at least nine countries.
one of them Australia. The reason mainly concerns a protective effect alcohol has against coronary heart disease. Among the mechanisms for this protective effect are increased HDL-cholesterol concentration, reduced aggregation of platelets, increased insulin sensitivity, and possibly the antioxidant effect of polyphenols in red wine.

Alcohol in moderation offers a health benefit. One or two drinks—but no more than this—on most days will confer better health than complete abstinence. Among older people, and in communities with a high incidence of coronary heart disease, the health benefit of drinking alcohol just outweighs the negative effects from all medical complications. From an examination of New Zealand health statistics, Scragg estimated that alcohol caused 20 per cent of all deaths among 15–34 year olds, prevented 0.5 per cent of all deaths among 35–64 year olds and prevented 3.4 per cent of all deaths among people aged 65 years and older. On the basis of British data, Doll concluded that for middle-aged and older men in Britain the beneficial effects on total mortality outweigh the harmful effects of up to four units of alcohol a day or in women up to somewhat less.

In younger adults the main health message about alcohol is to avoid excess: moderate drinking will do no harm. Among older people, for whom coronary disease is a common cause of death, moderate drinking is better than harmless, although it should be remembered that as people age the safe dose of alcohol diminishes. It is probably more beneficial to have one or two drinks most days with meals than to drink the same weekly quantity on only one or two days of the week. This is not to suggest, however, that current non-drinkers should start drinking alcohol.

The international epidemiological findings are supported by experience with older Australians in Dubbo, New South Wales, where 1236 men and 1569 women aged more than 60 years were followed for six-and-a-half years. Mortality was lower in men and women taking up to 28 drinks a week than in abstainers. Those taking any alcohol had fewer deaths from cardiovascular disease but more from cancers. The most popular drink was beer, especially in men.

Alcoholic beverages provide largely ‘empty calories’. As well as alcohol, they contain a little sugar and about 2 mmol of potassium per 100 grams. But concern about overweight is not a sufficient reason for older people to miss out on one or two drinks a day if they enjoy them. There is good metabolic ward evidence that the energy provided by alcohol is less than the 30 kJ per gram (7 kcal per gram) of energy it yields in the bomb calorimeter, and in some experiments people have lost weight when alcohol was isocalorically exchanged for carbohydrate.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

A little alcohol with meals may be useful for older people by stimulating appetite. In a special analysis of the 1994–95 British National Diet and Nutrition Survey, intermediate alcohol consumption (0.1 to 14 units per week) in 1200 adults aged
over 65 years was associated with higher intakes of vitamins C and E, thiamin, iron, calcium, carbohydrate, dietary fibre (non-starch polysaccharide) and energy from food than either abstinence or consuming over 28 units of alcohol a week. Intermediate alcohol consumption was also associated with higher blood concentrations of vitamin C and carotenoids.

Alcoholic beverages of particular types are part of the food habits of different cultures in Australia; for example, many Anglo-Celtic Australians enjoy a cold beer with their main meal, whereas people of Mediterranean background regard wine as part of a proper meal. Alcohol in moderation is one of life’s pleasures, and it can enhance a fairly ordinary meal. There is no reason why older people living in aged care accommodation should not have an alcoholic drink with their main meal—indeed, the evidence suggests that if this is what they would like it should improve their health.

**RELATION TO OTHER GUIDELINES**

*Enjoy a wide variety of nutritious foods.* As part of a balanced diet, alcohol offers health and social benefits for older Australians.

*Eat at least three meals every day.* Drinking alcohol with the main meal of the day—without exceeding the recommendation of one to two drinks—is safe for older Australians and can be beneficial. Alcohol in moderation is one of life’s pleasures; drinking a glass or two of water at the same meal will help to prevent dehydration.

*Drink adequate amounts of water and/or other fluids.* Water is the drink of choice for all older people. If they are drinking alcohol they should drink other fluids at the same time, to help prevent dehydration.

**CONCLUSION**

One to two glasses of alcohol with a meal can provide health and social benefits for older Australians. Research shows that a small amount of alcohol taken regularly is protective against coronary heart disease. Alcohol can also help stimulate appetite and create a pleasant environment that is conducive to eating.

**REFERENCES**


Salt, a chemical compound of sodium and chloride, is found naturally in many foods and is also added as salt or other sodium compounds. The health effects of dietary salt have long been debated and subject to much investigation. The relationship between salt intake and hypertension is now well recognised, and many Australians choose to limit their salt intake in an effort to reduce the harmful effects of a diet high in salt.

BACKGROUND

The first edition of the Dietary Guidelines for Australians contained a guideline saying, ‘Use less salt’.

But few people realise that 75 per cent of the salt they eat is in processed foods that may not always seem salty, so the second edition adopted a guideline saying, ‘Choose low-salt foods and use salt sparingly’.

This guideline is needed because the recommended dietary intake for sodium is 40–100 mmol per day. For the 80 per cent of Australians who exceed this intake compliance with the RDI would be useful in preventing and treating over a dozen health problems. The most important of these is hypertension, and the RDI was adopted mainly to limit the increase in blood pressure that occurs with increasing age: nearly all Australians have experienced at least some increase before their seventieth birthday, and by that age about half the population requires treatment for hypertension. The evidence that limiting sodium consumption to the RDI would have a preventive effect has further strengthened since the last revision of the Dietary Guidelines for Australians.

Among patients with established hypertension, the elderly are usually more responsive to a lower salt intake, often being able to control the condition without drugs or with lower doses. Of all dietary improvements, keeping within the RDI for sodium has the most immediate effect on reducing the problem of polypharmacy in the elderly. Among other health benefits of adopting the RDI for sodium include its effect on calcium excretion and osteoporosis at a time of impaired calcium absorption.

SCIENTIFIC BASIS

Sodium and health

Sodium causes fluid retention by expanding extracellular fluid volume. It increases calcium excretion and raises blood pressure. Salt in preservative concentration is associated with chronic gastritis and cancer of the oesophagus and
stomach. Its role as a co-carcinogen in stomach cancer has been confirmed experimentally. Salt also causes enlargement of the heart, independently of its effect on blood pressure. In addition, it is associated with the prevalence and severity of asthma and with arterial rigidity, independently of blood pressure and atheroma. Most people with kidney disease are advised to limit their salt intake on the basis of experimental evidence that salt damages small arteries in the kidney and raises intraglomerular pressure.

Fluid retention occurs at intakes within the RDI and probably throughout the range. Despite normal kidney function, the effect of excess salt at every meal is to keep extracellular fluid permanently expanded by about 10 per cent, or by 1.5 litres for a body weight of 70 kilograms, exacerbating oedematous states such as idiopathic oedema, premenstrual syndrome, travel oedema, carpal tunnel syndrome and Meniere’s syndrome.

Urinary calcium loss always accompanies excretion of excess sodium—in both animals and humans—and osteoporosis and kidney stones are attributed partly to the salt in the Western diet. Urinary calcium loss increases across the usual range of sodium excretion in the Australian population. It can be reduced by thiazide diuretics, but a lower salt intake is obviously preferable to mass medication. Reducing sodium intake to the RDI level may be especially valuable in terms of calcium nutrition since advancing age impairs calcium absorption.

**Sodium and hypertension**

Hypertension secondary to identifiable causes may be ‘curable’, but treatment of secondary hypertension will not prevent a subsequent rise in blood pressure with age. This rise may reach hypertensive levels, although there is now international consensus that essential, or hereditary, hypertension is preventable.

Some degree of genetic predisposition to hypertension is almost universal: over 90 per cent of Australians experience some increase in blood pressure by the age of 65–69 years. Prevention depends on control—in the whole population—of known environmental factors, especially excess body weight, lack of physical exercise, excess alcohol intake, excess sodium intake, inadequate potassium intake, and psychological factors.

**The relative importance of salt**

Important evidence of salt’s relative importance was provided by the Intersalt study, an epidemiological survey of sodium and potassium excretion, body weight, reported alcohol consumption and blood pressure in 10 079 people from 52 centres in 32 countries, with careful population sampling, standardisation of clinical and laboratory procedures, and detailed analysis of several confounding factors.

Three ‘salt-free’ centres had median sodium excretion rates below the RDI and little if any increase in blood pressure with increasing age. Two others had rates within the RDI, but with relative potassium deficiency and high sodium-potassium...
ratios. The remaining 47 centres exceeded the RDI for sodium but the association with blood pressure seemed stronger for obesity and alcohol. A single 24-hour urine collection is, however, a poor index of habitual sodium intake in industrial societies, and correcting for regression dilution bias from this source shows a stronger association than first reported, especially in the slope of the increase in blood pressure with increasing age. People who leave ‘salt-free’ societies often develop hypertension, revealing the same genetic predisposition that we have. They have more salt but may also gain weight, take less exercise, drink alcohol, eat less fruit and vegetables (less potassium), and possibly find acculturation stressful. The relative importance of salt can be tested only by giving such people salt with no other change of diet or lifestyle. This was done in Papua New Guinea: salt did in fact induce a significant rise in blood pressure in 10 days. Blood pressure was not measured under ‘blind’ conditions, but zoo chimpanzees become hypertensive on biscuits with a sodium content of 240 milligrams per 100 grams—less than that of bread and many breakfast cereals—and the causal role of salt alone (in ‘normal’ amounts) was conclusively demonstrated.

**Interaction with potassium**

Evolution adapted us to a low-sodium and high-potassium diet (Na:K ratio <1.0), and an inverted dietary Na:K ratio from excess sodium is phylogenetically recent. Adoption of the RDI for potassium (50–140 mmol a day) tends to correct this because it exceeds the range for sodium (40–100 mmol a day).

Potassium is the predominant intracellular cation in unsalted foods of both animal and vegetable origin, including in the diets of terrestrial mammals, the breast-fed infants of all human societies, and adults in today’s normotensive ‘salt-free’ societies. Apart from a few seafoods, which may be contaminated with seawater, the only permanent exceptions in the Australian food tables are mammalian kidneys (from intracellular sodium in the tubules) and hen eggs, which have no cellular structure. An occasional artefact of cultivation gives silverbeet and beetroot a sodium:potassium ratio of >1.0 because salt tolerance makes these foods commercially viable where soil or irrigation water is too salty to grow anything else.

Extra potassium can reduce blood pressure at high salt intakes but it has no effect on blood pressure in subjects who follow the RDI for sodium. Potassium supplements will not prevent salt-induced hypertension in rats. In any case, world supplies of potassium would not balance current sodium consumption.

Food processing inverts the natural sodium:potassium ratio of the raw material by removing potassium and adding sodium. Potassium losses of over 50 per cent make white flour and white rice unsuitable even for famine relief. The food preparation methods of some caterers and home cooks also lead to potassium waste.
DIETARY GUIDELINES FOR OLDER AUSTRALIANS

The ideal sodium:potassium ratio is speculative, there being no proof of a safe boundary at Na:K ratio 1.0. Hypertension in zoo chimpanzees was attributed to a cereal biscuit supplied in several formulations with Na:K ratios varying between 0.42 and 0.59, and the range that induced hypertension in a controlled trial was 1.17 to 2.25. Breast milk has an Na:K ratio of 0.46, and the mean adult Na:K ratios (±SD) of the three ‘salt-free’ societies in Intersalt ranged from 0.01 (±0.04) to 0.62 (±0.57). Even these ratios show a gradient parallel with the mean blood pressure. The safest ratio may be 0.5 or less, but the current recommendation that the ratio not exceed 1.0 should also apply to older people. It is certainly feasible: it was (unwittingly) observed by 5 per cent of men and 19 per cent of women in a Hobart survey of 194 people.

Other questions in the hypertension debate

Among other questions in the continuing hypertension debate are sodium sensitivity, reversal of hypertension or ‘normotension’ (age-related blood pressure increase of lesser degree), and safety.

Sodium sensitivity

Theoretically, only ‘sodium-sensitive’ people need to avoid salt, but no short-term test to predict the final outcome of exceeding the RDI can be considered reliable until it has been validated by a lifetime of prospective surveillance. Meanwhile, we know that sensitivity increases with age, and the Intersalt data show an association between sodium and blood pressure in normotensives (n=8344) similar to that for the whole cohort (n=10 079), suggesting that measurable sensitivity is widespread and not restricted to hypertensives.

Reversal of hypertension

In responsive patients a very low salt intake can cause substantial reversal. It is the only non-drug measure known to reverse malignant hypertension. At the typical salt intake of the industrial societies a drop to the RDI will often lead to partial reversal of mild hypertension. Law et al. found that the fall in mean blood pressure was less than predicted in 45 trials lasting four weeks or less, but as high as predicted in 33 trials lasting five weeks or more. The effect increases with age and with initial blood pressure, but is usually disappointing in two weeks or less. In older persons a drop to the RDI from a more typical intake can match the effect of prescribing a thiazide diuretic. It enables hypertension to be managed without diuretics, which are prescribed for over 50 per cent of the institutionalised elderly in some studies. With the exception of calcium channel blockers, it also potentiates other antihypertensive agents, especially ACE inhibitors and angiotensin antagonists.
Various large community trials have recently found hypertension difficult to reverse by so-called low-sodium diets, but they were not testing the RDI for sodium (they failed to reach it).\textsuperscript{53,54}

\textbf{Safety}

Among the safety-related concerns are ‘paradoxical hypertension’, heart attacks, longevity, nutritional adequacy, and miscellaneous ‘side-effects’.

- Groups that reduce their salt intake experience a redistribution of blood pressure upwards as well as downwards.\textsuperscript{55,56} This ‘paradoxical hypertension’ is attributed to the random variation expected among non-responders. When salt feeding is discontinued in rats with salt-induced hypertension about 40 per cent are non-responders and they display the same random variation of blood pressure.\textsuperscript{57} There is no published evidence of a persistent and progressive increase in human blood pressure resulting from avoiding salt.\textsuperscript{58}

- A claim that men treated with antihypertensive medication seemed to have more heart attacks at lower salt intakes had the peculiar flaw that there were no measurements of, or even questions about, the men’s usual sodium intake.\textsuperscript{59} Theoretically, a rise of plasma renin activity (PRA) at lower salt intakes might increase the risk of heart attacks\textsuperscript{60}, but even the ‘salt-free’ societies with extremely high PRA levels offer no published support for this thesis.

- A paradoxical claim of greater longevity at higher salt intakes disappeared after adjustment for energy intake, which was necessary since subjects with higher salt intakes consumed more kilojoules.\textsuperscript{61}

- An assertion that low-salt diets may be nutritionally inadequate is often quoted\textsuperscript{62}, but was published without supporting evidence.\textsuperscript{58} One trial reported a 15 per cent reduction in calcium intake\textsuperscript{63} but energy intake was also reduced (not a necessary feature of sodium reduction) and, in any case, low-salt diets conserve calcium.\textsuperscript{28}

- The so-called low-sodium group in the Trials of Antihypertensive Intervention and Management (TAIM) study reported adverse effects even at an intake above the RDI\textsuperscript{53}, but miscellaneous ‘side-effects’ are expected in groups that take placebo tablets (as this group did) and there was no evidence incriminating the diet.

\textbf{Sodium in the Australian diet}

Two small Australian surveys based on systematic samples from the Commonwealth electoral roll have produced similar findings.\textsuperscript{6,64} The larger and more recent survey found that men (n=87) had a mean urinary sodium excretion rate (±SD) of 170 (±52) mmol a day and women (n=107) had a rate of 118 (±42) mmol a day.\textsuperscript{6} The range for men was 39–337 mmol a day and for women 26–241 mmol a day. In a Sydney survey of adults mostly from a university community, the figures were very similar, except for subjects with an Asian diet, where the men (n=29) averaged 195 mmol a day of urinary sodium and the women (n=21) averaged 140 mmol a day.\textsuperscript{65}
The results from ordinary Australian diets are remarkably close to those of respondents selected from the UK electoral roll a decade earlier, where the urinary sodium excretion rate for men (n=681) was 171 mmol a day and for women (n=712) 132 mmol a day, with a range for men of 20–498 mmol a day and for women 21–354 mmol a day. Population surveys show that women excrete about 20–25 per cent less sodium than men, but the gender difference was non-significant after adjusting for creatinine excretion in the 1995 Hobart data, suggesting that it reflects only the lower food intake of women. A lower RDI of perhaps 30–80 mmol a day may be more appropriate for women, and downward adjustment for older people of both sexes could be proposed on the same grounds.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

**Achieving a reduction in sodium intake**

It may be difficult to avoid salt in the United States, but about 20 per cent of the general population in Australia and the United Kingdom—without dietary instruction—produce at least one 24-hour urine collection that meets the RDI for sodium. Although single urine results are a poor index of habitual consumption and some low values may be due to under-collection, the UK sodium excretion rates were nevertheless reliable enough to show the expected association with blood pressure throughout the range from 70 to 400 mmol a day. This is strong evidence that a reduction in sodium intake is already being achieved by a substantial minority of Western populations, despite the many social and practical obstacles.

Every food group can be enjoyed with less salt. Vegetables are delicious raw in salads and can be served with a variety of low-salt dressings. Herbs and spices can be used as salt alternatives for flavour during cooking. Cooking to conserve potassium also conserves flavour. Suitable methods are steaming, microwaving, stir-frying, grilling, baking or roasting (but not boiling). Fruits are especially palatable alone, and they improve salads and savoury dishes without salt being added. Even some conventional cookbooks contain recipes for salt-free chutneys, sauces and pickles.

Unprocessed cereals contain even less sodium than breast milk (<14 milligrams per 100 grams), but some processed cereals are salty enough to give men 28 per cent of their total daily sodium intake and women 26 per cent—more than twice as much as from any other single food group. Yet muesli and many other low-salt breakfast cereals, including porridge, are highly palatable when served with stewed fruit.

Bread has a relatively high salt content but salt-free bread is on sale in all Australian capital cities and the palate usually adapts to it as readily as it does to tea without sugar, especially when the recipe includes wholemeal or rye flour and whole grains. Potassium chloride is a satisfactory substitute for salt in bread.
Every kind of meat, poultry and fish is a low-salt food when fresh, although some
seafoods such as oysters may have a high sodium content as a result of
contamination with seawater. A fruit cheese with a reduced fat content and a
sodium content of 35 milligrams per 100 grams won a silver medal at the 1997
Royal Melbourne Dairy Show.

It is a common misconception that food with less salt will be less appetising,
although two ranges of salt preference are recognised—high (usual) and low. People who adopt the RDI enjoy their food if it is properly prepared and find the
salt content of olives, anchovies and pizzas intolerable, even when they liked them
previously. Furthermore, one study of salt preference in chicken broth found it
was the elderly who preferred less salt.

It is difficult to ‘choose low-salt foods’ in shops: the labels are not easy
to interpret. Such foods are defined in the Food Standards Code and Codex
Alimentarius (sodium up to 120 milligrams per 100 grams) and professionals
can identify them from the nutrition information panel. But consumers need
something less technical and in larger print, such as a simple grid showing
whether a food is low, moderate, high or very high in each nutrient covered by
the Dietary Guidelines (total fat, saturated fat, sugar and salt).

**Current international consensus**

Australia was the first country to adopt a recommended dietary intake for sodium
of 40–100 mmol a day. Many other countries have since followed suit with a
recommended upper limit of 100 mmol a day. One US recommendation describes
100 mmol as more feasible but suggests that 75 mmol would ultimately be better. Singapore has adopted 75 mmol.

Some recent studies challenging the international consensus have been funded by
the salt industry and certain sections of the food industry. This highly effective
strategy ensures that paradoxical conclusions reaching the medical journals
(despite obvious flaws) can expect wide, even sensational, coverage in other
media while persistently side-stepping the main issue—that the international
consensus for universal dietary salt reduction is based on the evidence for primary
prevention of hypertension, which remains extensive and compelling.

Among the many benefits of dietary salt reduction that older people can expect are
partial reversal of established hypertension, reducing or replacing diuretics, and
potentiating many other drugs, permitting lower dosage. With two ACE inhibitors
in the top 10 drugs ranked by cost to government, a dietary improvement to
enhance the drugs’ effect and reduce their dosage rate has economic as well as
health implications. Reducing sodium intake levels to within the RDI range for the
first time in old age is feasible, although it needs to be done gradually, so that the
taste buds can adapt.

The Australian food industry has shown commendable leadership in developing
and marketing low-salt foods that comply with the salt guideline and the Food
Standards Code, but the opportunity to do more remains: older people especially
need education at the point of sale.
DIETARY GUIDELINES FOR OLDER AUSTRALIANS

RELATION TO THE OTHER GUIDELINES

Enjoy a wide variety of nutritious foods. Incorporating in the diet many different foods from all the food groups will minimise the number of high-salt foods consumed.

Keep active to maintain muscle strength and a healthy body weight. In addition to reducing sodium in the diet, regular exercise and maintaining a suitable body weight will help to promote a healthy blood pressure level.

Eat at least three meals every day. Limit salt during the preparation and consumption of meals.

Eat plenty of vegetables (including legumes) and fruit. Fruit and vegetables (fresh and frozen) are naturally low in salt.

Eat plenty of cereals, breads and pastas. Choose low-salt varieties of cereals and avoid high-salt accompaniments.

If you drink alcohol, limit your intake. Alcohol can produce an elevation in blood pressure, so its intake should be moderated. Salty foods, which are often served and eaten in conjunction with alcoholic beverages, should also be kept to a minimum.

Include foods high in calcium. With the exception of cheese, most foods that are high in calcium contain only minimal amounts of salt.

CONCLUSION

Among the numerous adverse effects of a high sodium intake are hypertension, fluid retention and calcium loss at all ages. For older Australians the recommended dietary intake for sodium of 40–100 mmol a day is not only feasible but also beneficial, in both preventing and treating these problems. Simple dietary interventions will reduce the dependence on blood pressure medication and promote a wider intake of nutritious foods since it is highly processed foods that generally contain the highest levels of salt.

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37 Addison WLT. The use of sodium chloride, potassium chloride, sodium bromide and potassium bromide in cases of arterial hypertension which are amenable to potassium chloride. Can Med Assoc J 1928;18:281–5.


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Calcium is required for the normal development and maintenance of the skeleton. It is stored in the teeth and bones, where it provides structure and strength. It is also vital for a number of enzyme reactions. The richest sources of calcium in the Australian diet are dairy products: few other foods provide such a readily absorbable and convenient source of this nutrient.

**BACKGROUND**

Calcium has a number of metabolic roles, but the rationale for a dietary guideline on this nutrient is largely based on our understanding of calcium's role in the development and progression of osteoporosis.

Almost all of the body’s calcium reserve is stored in the skeleton and is indirectly affected by the dietary calcium intake and the amount of calcium lost from the body, either in urine or as calcium not absorbed from the intestine. The calcium reserve acts as a reservoir in the homeostatic mechanisms used to maintain calcium levels in the blood. These serum levels are tightly controlled by the calcium regulatory hormones, parathyroid hormone and vitamin D. A fall in serum calcium levels results in an increase in parathyroid hormone, which in turn increases serum calcium from bone resorption.

Even though a low calcium intake will affect the size of the skeletal reserve of calcium, bone mass is also affected by other non-nutritional factors such as genetics, hormonal status and exercise. A low dietary intake of calcium will not necessarily result in a low bone mass, but it will increase the risk of this occurring, especially if the low intake is maintained long term.

**Definition of osteoporosis**

Osteoporosis is a condition of low bone mass. It can lead to greater bone fragility and increased risk of fractures. Most fractures in older people are related to osteoporosis; in young adults trauma is the primary cause of fractures.

Clinically, osteoporosis is measured in terms of bone mineral density that is below the age-adjusted reference range. Individuals are considered osteoporotic if their bone mineral density is 2.5 SD or more below the young adult mean. This definition identifies about 30 per cent of all post-menopausal women as having osteoporosis and, of these, more than 50 per cent will have suffered a previous fracture.

In light of Australia's ageing population, it is estimated that hospital admissions for osteoporotic fractures will increase by 84 per cent by 2011.
Osteoporosis Epidemiology Study found that after the age of 60 years approximately 60 per cent of women and 30 per cent of men suffer from osteoporotic fractures. The resulting costs for rehabilitation and outpatient treatment were estimated in 1992 to be $779 million. The most common fracture sites related to osteoporosis are the hip, vertebrae and wrist, but hip fractures have the greatest overall public health impact. Considerable morbidity and mortality are associated with hip fractures and they lead to a substantial decline in physical function.

**SCIENTIFIC BASIS**

**Calcium's role in preventing osteoporotic fractures among older people**

Low bone density is associated with an increased risk of fracture; the lower the bone density the greater the risk. Peak bone mass achieved in early adulthood, genetics, hormonal status, exercise, and the subsequent rate of bone loss determine bone density in older people.

There is evidence that a high calcium intake will slow the rate of bone loss in older people and may reduce the risk of fracture. Only a limited number of randomised controlled trials of calcium supplementation have used fracture end-points. These studies did, however, consistently show a reduction in risk of 26 to 70 per cent.

The largest of these studies was conducted on 3270 French nursing home residents over 18 months. Subjects in the intervention group were supplemented with both calcium and vitamin D, which makes interpretation of the effects difficult. There was, however, a 27 per cent reduction in hip fractures in this group and a 26 per cent reduction in risk of nonvertebral fractures.

Reid et al. found a 70 per cent reduction in fractures among women with calcium supplementation. Chevally et al. found a 31 per cent reduction in vertebral fractures with calcium supplementation.

In a four-year study of women over the age of 60 who previously had a dietary calcium intake of less than 1000 milligrams a day, supplementation with 1200 milligrams of calcium prevented forearm bone loss. Of the women who had vertebral fractures at the start of the study, there was a 59 per cent reduction in the fracture rate.

**Calcium's role in preventing bone loss in older people**

A number of randomised trials have shown that calcium supplements are effective in slowing bone loss in older women. Nordin summarised the results of 20 prospective trials of calcium on bone density: the average rate of change in bone density was −1 per cent a year in subjects not on calcium supplements,
compared with no loss in the calcium-supplemented subjects.\textsuperscript{15} In a two-year study by Reid \textit{et al.}, a 1-gram calcium supplement reduced total body bone loss by 43 per cent in the supplemented group compared with the placebo group.\textsuperscript{16}

The two-year trial by Prince \textit{et al.} in Australia randomised subjects to one of four treatment groups: placebo, milk powder containing 1 gram of calcium, a daily tablet containing 1 gram of calcium, and a daily tablet containing 1 gram of calcium in addition to exercise.\textsuperscript{15} Calcium was found to be effective in slowing the rate of bone loss from the intertrochantic and trochanthic hip sites. This study demonstrated the equal effectiveness of calcium taken either as a tablet or in milk powder. The extra phosphorus or protein content of milk powder did not have any deleterious effects on the skeleton, as had previously been suggested.\textsuperscript{17,18}

One study, conducted over three years, compared women on high (over 2 grams a day) and low (800 milligrams a day) calcium intakes. Bone resorption and serum parathyroid hormone levels were found to be higher in the low–calcium intake group\textsuperscript{19}; the high–calcium intake group had values for serum parathyroid hormone and bone resorption that were similar to those of a group of young women. The data suggest that, if older women do not meet their calcium requirements to account for age-related urinary losses, secondary hyperparathyroidism and increased bone resorption can occur.

A controlled trial in older post-menopausal women\textsuperscript{14} compared the effects of two calcium sources—calcium carbonate and calcium citrate malate. Significant improvement in the rate of bone loss occurred when the calcium intake was increased to 800 milligrams a day. Calcium citrate malate was found to be more effective than calcium carbonate in preventing bone loss in the spine at this dose. Both calcium carbonate and calcium citrate malate prevented bone loss from the femoral neck and radius.

In a study of 295 women aged between 45 and 55 years, Elders \textit{et al.} compared three groups—1 gram of calcium a day, 2 grams of calcium a day, and a placebo—over two years.\textsuperscript{15} The daily supplement of either 1 gram or 2 grams reduced lumbar spine loss in the first year only.

Men do not have the rapid bone loss associated with menopause but the age-related pattern is similar to that observed in women. There have been fewer studies conducted in men. Orwoll \textit{et al.} found that for men with an already high calcium intake supplementation with 1 gram of calcium and vitamin D failed to stop loss of bone from the spine or radius.\textsuperscript{20}

**Defining calcium requirements for older people**

As noted, calcium is required for the normal development and maintenance of the skeleton and teeth. Since the skeleton is mostly calcium, requirements are largely determined by skeletal needs, which increase during periods of rapid growth (such as childhood and adolescence), during pregnancy and lactation, and in later life.
Calcium balance is determined by the balance between the dietary intake of calcium, the amount of calcium absorbed from the intestine, and the amount excreted in urine. Urinary losses of calcium may explain as much as 50 per cent of the variation between individuals.1 A negative calcium balance can result from an inadequate dietary intake or increased urinary losses, or both. Plasma calcium levels are tightly regulated by hormonal control, and when negative balance occurs demineralisation from the skeleton will follow.

For calcium balance to occur, the amount of calcium absorbed from the intestine must match the losses from urine, faeces or skin. The dietary calcium requirement is based on the amount of dietary calcium that will maintain calcium balance and optimise bone accretion rates.

Balance studies suggest that there may be a threshold effect for calcium intake. This means that calcium retention will increase up to a threshold, beyond which further calcium does not result in increased calcium retention. Calcium absorption from the small intestine occurs by active absorption at low levels but by passive absorption at higher levels. The unabsorbed calcium will be excreted in the faeces. Calcium requirements are determined from balance studies by the intake at which calcium intake and losses are equal. This is not the same as the recommended dietary intake, which is set to meet the calcium requirements of 95 per cent of the population.21

The NHMRC’s recommended intake of dietary calcium increases from 800 milligrams a day in pre-menopausal women to 1000 milligrams a day in post-menopausal women.21 This is to account for the accelerated loss of calcium from the skeleton after menopause. It appears that most of this loss is the result of urinary losses rather than changes in absorption. There is, however, a decline in intestinal calcium absorption with ageing.22,23 This may be related to a decline in the active form of vitamin D—1,25-dihydroxyvitamin D—which regulates intestinal calcium absorption. Recent data suggest that older people may have an intestinal resistance to 1,25-dihydroxyvitamin D.24 For older men the Australian RDI for calcium is 800 milligrams a day, the same as that for young men. There is some evidence, however, that this may not be sufficient since it does not take into account the age-related changes in calcium and vitamin D metabolism. The National Institute of Health consensus data set the recommended level at 1500 milligrams a day for both older men and older women.25

The increase in bone turnover that occurs after menopause results in a compensatory increase in urinary calcium excretion26,27 and a decrease in intestinal calcium absorption.26,28 By this mechanism serum calcium levels are maintained. Calcium absorption either decreases or does not change after menopause, which means that the obligatory loss of calcium must be compensated for by increasing the dietary intake of calcium. The extra amount required is equivalent to 200 milligrams a day.
The optimum calcium intake for older people

Older people require adequate calcium to minimise bone loss. The 1995 National Nutrition Survey found that the average daily intake of calcium among people aged 65 years and over was 796 milligrams for men and 685 milligrams for women. This is consistent with other studies conducted in Australia and North America, which have found calcium intakes below the RDI. Data from studies of institutionalised older people have also shown low intakes of calcium in Australia.

Dairy foods provide the main source of calcium in the Australian diet. In the National Nutrition Survey milk contributed to 52 per cent of the total calcium intake in men and 53 per cent in women. Yoghurt accounted for approximately one-third of the daily calcium intake in both men and women.

The preferred source is calcium-rich foods, especially dairy products, which provide the most readily absorbed source of calcium. Calcium supplements can be used for individuals who cannot meet their calcium requirements from food sources alone. Alternatively, consuming non–dairy food sources of calcium, such as calcium-enriched soymilk, and eating fish with bones (for examples, sardines) can contribute to the daily calcium intake.

The National Nutrition Survey included information on the intake of people who were taking calcium supplements on the day of their interview. Supplement use was much greater among women—9.8 per cent of women aged 45–64 years and 10.9 per cent aged 65 and over were taking a calcium supplement; for men, only 1.6 per cent aged 45–64 years and 2.4 per cent aged 65 and over were taking a calcium supplement. This is probably a reflection of women's awareness of calcium's role in osteoporosis prevention.

Vitamin D's role in preventing bone loss in older people

Vitamin D status—as measured by plasma 25-hydroxyvitamin D levels—declines with ageing. This can be a consequence of inadequate dietary intake, less efficient intestinal absorption, less efficient skin synthesis of vitamin D, or inadequate exposure to ultraviolet light. The main food sources of vitamin D are margarines fortified with vitamin D, fatty fish and eggs.

As noted, the active form of vitamin D—1,25-dihydroxyvitamin D—stimulates calcium absorption and is therefore essential for maintaining the skeleton. Severe vitamin D deficiency can result in osteomalacia, or disproportionate loss of calcium phosphate from the bones, and increased fracture risk.

The vitamin D status of residents of aged care accommodation can become compromised mainly because of lack of exposure to sunlight, but it may also be in part a consequence of the altered metabolism of vitamin D that occurs with ageing. Studies of nursing home patients have shown their vitamin D status is often marginal. One study of 290 hospitalised patients in Boston found a 43 per cent rate of vitamin D deficiency. Inadequate vitamin D intake, winter season and
housebound status were independent predictors of low vitamin D levels. Vitamin D supplementation of housebound older people and others not exposed to sunlight was first recommended by the NHMRC’s Nutrition and Public Health Committees in 1989.\textsuperscript{34} There is still not an RDI for vitamin D in Australia.

Community prevalence studies of vitamin D status in Australia are limited. A Tasmanian study of 109 community-dwelling subjects admitted to a short-stay geriatric ward and 52 non-hospitalised community-dwelling subjects did, however, find the prevalence of hypovitaminosis D to be common. In the hospitalised group (which had a mean age of 79 years) 67 per cent had a 25-hydroxyvitamin D level below the biochemical reference range (28–165 nmol per litre) and 15 per cent had very low levels—below 15 nmol per litre. Older subjects from both groups were more likely to be deficient in 25-hydroxyvitamin D, to score less well on functional activity indices, and to have less habitual sun exposure.\textsuperscript{35}

A Western Australian study investigated the frequency of vitamin D deficiency and secondary hyperparathyroidism in hip fracture patients living in the community. Of the 283 patients with hip fracture admitted into the study, 31.7 per cent had vitamin D deficiency and 17.7 per cent had hyperparathyroidism. The patients’ vitamin D deficiency was related to physical disability, reduced activity, and reduced exposure to sunlight. The findings of this study are important because ambient daily sunlight levels in Perth are considered optimal for preventing vitamin D deficiency. But, despite these optimal climatic conditions, the older people were not free of the risk of vitamin D deficiency.\textsuperscript{36}

The results of both these Australian studies emphasise that vitamin D deficiency is a common problem in frail, housebound, community-dwelling older Australians and is related to increasing age, poor physical function and activity, and low levels of exposure to sunlight.

Vitamin D supplementation appears to be effective in preventing fractures only in people who have marginal vitamin D serum levels. A prospective double-blind trial of vitamin D supplementation in 2578 independently living older people in Amsterdam failed to show a decrease in fracture incidence over three-and-a-half years.\textsuperscript{37} In their study of 3270 institutionalised women in France, Chapuy \textit{et al}. found that the risk of hip fracture for subjects supplemented with vitamin D and calcium for three years was 30 per cent lower than for the placebo group.\textsuperscript{8} The difference between this study and the Amsterdam study is most probably attributable to lower in intakes of calcium, lower vitamin D status, and less exposure to sunlight in the institutionalised subjects.

In yet another study, of 389 community-dwelling older men and women supplemented for three years with calcium and vitamin D, the rate of bone loss was reduced at the femoral neck, in the spine and in the total body.\textsuperscript{38} Although the sample size was small, there was also a supplementation-associated reduction in the incidence of non-vertebral fractures.
Supplementation of vitamin D intake may be necessary to improve calcium balance and reduce fracture risk in people whose vitamin D status may be marginal. Excessive doses of vitamin D can lead to hypercalciuria and hypercalcaemia, so supplementation should be carefully monitored. People living in aged care accommodation and people who are housebound are at much greater risk of vitamin D deficiency.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

Calcium is fundamental to the maintenance of adequate bone mineralisation and for this reason regular consumption of calcium-rich foods is extremely important for older Australians. Dairy foods offer the most concentrated dietary source of calcium and should be included in the diet daily. They are convenient to use and require little or no preparation.

Although rich in calcium, dairy foods are also high in saturated fat, so it is recommended that reduced-fat dairy foods be chosen. A variety of calcium-enriched milks that are also low in fat are readily available.

**RELATIONSHIP TO OTHER GUIDELINES**

*Choose foods low in salt and use salt sparingly.* There is evidence that high intakes of sodium chloride increase urinary calcium loss. Conservation of calcium is thus an additional reason for following the salt guideline. This is more important for older people, whose ability to absorb dietary calcium may be impaired.

Adding 100 mmol of sodium (2.3 grams) to the daily diet will result in a daily calcium loss of 1 mmol (40 milligrams). Nordin has calculated that, taking into account the absorption of calcium, an additional 500 milligrams of calcium would be required to meet the calcium requirement. 15

Because there is no known way of accurately measuring dietary intake of sodium, urinary excretion of sodium is used to estimate dietary intake. In a two-year longitudinal study of 124 post-menopausal women, Devine *et al.* examined the influence of urinary sodium excretion and dietary calcium intake on bone density. 39 Sodium excretion was negatively correlated with changes in bone density at the intertrochanter hip site. The data suggested that the higher the sodium intake the greater the bone loss. The authors proposed that reductions in bone loss might be achieved if individuals were to increase their intake of calcium and reduce their salt intake. Of course, reducing high intakes of salt would be preferred because calcium absorption may be impaired with advancing age and a lower salt intake offers many other benefits. 40
CONCLUSION

The health costs associated with hospital admissions for osteoporotic fractures are high in Australia. An adequate calcium intake can help delay bone loss and the onset of osteoporosis and so reduce the number of related fractures in older people. Dairy products are the most reliable source of calcium; they are readily available and convenient to use. If foods that are high in calcium are part of an older person's daily diet the physiological and social costs associated with a low-calcium diet will be reduced.

REFERENCES


12 USE ADDED SUGARS IN MODERATION

by Professor Colin Binns and Ms Roslyn Giglia

Much of the sugar consumed in the Australian diet is naturally occurring, in foods such as fruit and milk. Sugars, particularly sucrose, are also added to food products during processing, to increase their palatability and acceptability and sometimes to add bulk. Diets high in added sugar are associated with dental caries and the presence of significant amounts of sugar dilutes the nutrient density of the diet. For older people, however, inclusion of a moderate amount of added sugar as flavour enhancers can increase variety and palatability without compromising the nutrient intake. Sugars are also a readily absorbed source of energy.

BACKGROUND

The wording of this guideline differs from that of the sugar guideline for younger Australian adults—which says, ‘Eat only a moderate amount of sugars and foods containing added sugars’—because it takes into consideration the importance of increasing dietary variety for older people by including nutritious foods sweetened with added sugars. Compared with the sugar guidelines for younger adults, it has also been accorded lower priority.

The results of the 1995 National Nutrition Survey show a trend of decreasing percentage energy from total sugar intake from ages 2–3 years to 45–64 years, followed by a slight increase in intake in the 65 years and over age group (see Table 12.1).2 Reducing the amount of added sugar in the diet of older Australians could allow for increased consumption of foods that have greater nutrient density.

Table 12.1 Carbohydrate: mean contribution to energy intake, 1995

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>2–3</th>
<th>4–7</th>
<th>8–11</th>
<th>12–15</th>
<th>16–18</th>
<th>19–24</th>
<th>25–44</th>
<th>45–64</th>
<th>65+</th>
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<tr>
<td>Carbohydrate</td>
<td>52.1</td>
<td>52.7</td>
<td>50.9</td>
<td>52.1</td>
<td>49.6</td>
<td>46.9</td>
<td>45.0</td>
<td>44.1</td>
<td>45.8</td>
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<tr>
<td>Total sugar</td>
<td>30.3</td>
<td>27.3</td>
<td>25.1</td>
<td>24.7</td>
<td>24.5</td>
<td>21.5</td>
<td>19.1</td>
<td>18.4</td>
<td>20.6</td>
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<tr>
<td>Total starch</td>
<td>21.8</td>
<td>25.4</td>
<td>27.0</td>
<td>26.2</td>
<td>25.2</td>
<td>25.5</td>
<td>25.9</td>
<td>25.7</td>
<td>25.2</td>
</tr>
</tbody>
</table>

1 USE ADDED SUGARS IN MODERATION
Definition

Sugars are carbohydrates consisting of one or more saccharide units. Sucrose—cane sugar—has the lion’s share of the sweetener market in Australia; it is a disaccharide made up of fructose and glucose monosaccharides. The terms ‘refined sugars’ and ‘added sugars’ are sometimes used to denote sucrose and glucose used in the food industry and at home. Physiologically, there is no difference between sugars that occur naturally in food and the refined sugars that are added to the diet. Among foods rich in added sugars are confectionery, cakes, pastries, biscuits, fruit drinks, cordials and carbonated soft drinks. Foods with a high added sugar content often have low nutrient content but are energy dense.

Function of carbohydrates in the body

Carbohydrates provide the largest source of energy in the diets of most people—on average, 45 per cent of the energy in the Australian diet. Dietary carbohydrates are usually associated in foods with important micronutrients and phytochemicals. Diets high in carbohydrate are not associated with the development of obesity: people whose diets are high in carbohydrates usually have a lower prevalence of obesity, heart disease, non-insulin dependent diabetes mellitus, and some forms of cancer.

Among carbohydrates’ physiological functions are the following:

• provision of energy;
• effects on satiety and gastric emptying;
• effects on blood glucose and insulin metabolism;
• protein glycosylation;
• bile acid dehydroxylation;
• fermentation—production of hydrogen and methane;
• production of short-chain fatty acids;
• control of colonic epithelial cell function;
• bowel habit, laxation and motor activity;
• effects on large bowel microflora.

Patterns of carbohydrate consumption

In a study of 2195 Adelaide residents aged 65 years and over the intake of refined carbohydrates was found to be excessive and that of complex carbohydrates and dietary fibre inadequate. Table 12.2 shows the results. Table 12.3 shows the results from the 1995 National Nutrition Survey.
Table 12.2 Daily carbohydrate intakes for men and women, 1989

<table>
<thead>
<tr>
<th></th>
<th>Men, by age group (years)</th>
<th>Women, by age group (years)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>65–69 (n=346)</td>
<td>70–74 (n=293)</td>
</tr>
<tr>
<td></td>
<td>75+ (n=262)</td>
<td>65–69 (n=375)</td>
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<tr>
<td></td>
<td></td>
<td>70–74 (n=347)</td>
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<tr>
<td></td>
<td></td>
<td>75+ (n=350)</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>221±70</td>
<td>222±76</td>
</tr>
<tr>
<td>Complex carb. (g)</td>
<td>100±30</td>
<td>101±33</td>
</tr>
<tr>
<td>Simple carb. (g)</td>
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<td>120±56</td>
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<tr>
<td>% energy as</td>
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<tr>
<td>Total carbohydrate</td>
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<tr>
<td>Complex carb.</td>
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<td>Sugars*</td>
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<tr>
<td>Carbohydrate (g)</td>
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<td>237±76</td>
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<tr>
<td>Complex carb. (g)</td>
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<td>107±34</td>
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<tr>
<td>Simple carb. (g)</td>
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<td>130±54</td>
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<tr>
<td>% energy as</td>
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<tr>
<td>Total carbohydrate</td>
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<td>44.3</td>
</tr>
<tr>
<td>Complex carb.</td>
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<td>20.2</td>
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<td>Sugars*</td>
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<td>24.0</td>
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<td>Carbohydrate (g)</td>
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<tr>
<td>Complex carb. (g)</td>
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<td>Simple carb. (g)</td>
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<tr>
<td>% energy as</td>
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<tr>
<td>Total carbohydrate</td>
<td>45.1</td>
<td>45.1</td>
</tr>
<tr>
<td>Complex carb.</td>
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<td>20.2</td>
</tr>
<tr>
<td>Sugars*</td>
<td>24.6</td>
<td>24.6</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>206±67</td>
<td>206±67</td>
</tr>
<tr>
<td>Complex carb. (g)</td>
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<td>88±29</td>
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<tr>
<td>Simple carb. (g)</td>
<td>117±49</td>
<td>117±49</td>
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<tr>
<td>% energy as</td>
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<tr>
<td>Total carbohydrate</td>
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<td>44.9</td>
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<tr>
<td>Complex carb.</td>
<td>19.4</td>
<td>19.4</td>
</tr>
<tr>
<td>Sugars*</td>
<td>25.3</td>
<td>25.3</td>
</tr>
</tbody>
</table>

a. Includes all sugars occurring naturally and those added during processing.

Table 12.3 Daily carbohydrate intakes for men and women, 1995

<table>
<thead>
<tr>
<th></th>
<th>Men, by age group (years)</th>
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<td>80+ (n=350)</td>
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<tr>
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<tr>
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<td>44.4</td>
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<tr>
<td>Sugars*</td>
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<td>19.9</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
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<td>46</td>
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<tr>
<td>Complex carb. (g)</td>
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</tr>
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<td>46.8</td>
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<tr>
<td>Sugars*</td>
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a. Includes all sugars occurring naturally and those added during processing.

The results of the 1995 National Nutrition Survey show that there has been little change in total carbohydrate and sugar intakes since Horwath’s 1989 study.

Baghurst et al. summarised data from three Australian surveys conducted in the early 1980s that specifically examined intakes of refined sugars. Among survey respondents aged more than 60 years, refined sugars provided approximately 12 per cent of energy for men and 11 per cent for women. Total intakes of sugar were about 22 per cent of energy for both men and women in that age group, which is similar to the results from the National Nutrition Survey. The main contributor to the total intake of sugars was fruit and fruit juices. Jams, fruit pies and custards contributed more to the sugar intake of older age groups than they did for younger age groups.

Results from the 1985 and 1990 Victorian Nutrition Surveys showed that more people aged over 60 years had a higher intake of total carbohydrate than was the case for other age groups. The average amount of refined sugar consumed and the percentage of total energy obtained from it increased for all age groups in the 1990 survey, although this was still within 12 per cent of energy from refined sugars.
The increase in actual intake of refined sugar was less noticeable with age; there was very little increase in intake in the group aged 60 and over. Between the 1988 and 1993 Australian Food and Nutrition Surveys the intake of refined sugars decreased slightly for all age groups.

The intake of refined sugars is given as 11.1 kilograms per person per year in *Apparent Consumption of Foodstuffs 1997*. Total consumption is 117 grams a day, or about 15 per cent of total energy. The apparent consumption data do not represent actual consumption by individuals or population groups—some sugar is wasted, some is used for brewing, and so on—but they do give an indication of the trends in consumption. Baghurst *et al.* discuss the differences between apparent consumption of sugar and actual dietary consumption.

Between 1995–96 and 1996–97 there was an 11.7 per cent increase in the consumption of refined sugars, although the amount of sugar consumed in manufactured foods actually fell by 1.8 per cent, from 32.3 kilograms to 31.7 kilograms, during the period. In the 1930s 60 per cent of sugar used in Australia was in the form of added sugar.

**Sugar intake in relation to the total diet**

Studies of the effect of a low-fat diet on refined sugar intake consistently show an inverse relationship. One study, of 3290 people living in Victoria and South Australia, found that respondents who had the lowest relative intake of fats had high intakes of simple sugars, both natural and refined. Unfortunately, the data from this study were not grouped by age; another study, however, specifically investigated the effect of sugar intake on nutrient dilution in older South Africans.

A high intake of added sugars eaten at the expense of foods that are richer in micronutrients may increase the risk of nutrient deficiencies in older people. Two hundred non-institutionalised South Africans aged between 65 and 92 years and living in an area of low socio-economic status were administered a pre-tested food frequency questionnaire. As sugar intake increased there was a significant decrease in the proportion of energy derived from fat. Body mass index also tended to decrease as sugar intake rose, although this was not significant. A negative aspect of the increasing sugar intake was evidence of nutrient dilution: with the exception of folate and vitamin B₁₂, more than one-fifth of the subjects failed to consume 67 per cent of the recommended daily allowance for several vitamins and minerals. This sub-optimal nutrient intake can be explained by the intake of cakes, puddings, tarts, meat pies, snacks, soups, sauces and cool drinks contributing to overall energy intake.

The association between high refined sugar intake and low micronutrient intake was investigated by re-examining data from three large-scale Australian population surveys of dietary intake. The results of this review were inconsistent and failed to indicate a relationship between refined sugar consumption and micronutrient intake.

Summerbell *et al.* found that 17.5 per cent of older people’s daily energy intake was in the form of snacks and that the proportion of energy derived from total
sugars in snacks was greater than that in meals. Most often this sugar was provided by plain biscuits, milk and sugar added to cups of tea and coffee. It is important that snack foods that are high in added sugars are kept to a minimum in the diet of older people since foods that are high in refined sugars (such as soft drinks and confectionery) are energy dense but do not provide vital nutrients. Foods such as cakes, biscuits and sweets are high in both sugar and fat and are also energy dense: they provide few nutrients and are often eaten instead of more nutritious, necessary foods.

**SCIENTIFIC BASIS**

Epidemiological and clinical studies help to give us an understanding of the role of carbohydrates in the aetiology of disease. Few of these studies suggest a direct causal link between carbohydrate consumption and disease, and often disease processes have become established before people might be considered ‘older’.

**Obesity**

The 1995 National Nutrition Survey showed that, although obesity is an increasing problem for all age groups in Australia, the proportion of obese people appears to decrease after the age of 60 years. Fat is stored more efficiently than excess carbohydrate and the consumption of carbohydrates is unlikely to result in obesity in the long term. It is, however, important to stress that excess energy in any form will promote the accumulation of excess body fat and that high-carbohydrate diets should be promoted in older people only in accordance with their energy needs.

**Non–insulin dependent diabetes mellitus**

The rapid cultural change experienced by many populations previously consuming a traditional diet and the high incidence of centrally distributed abdominal obesity have been concurrent with high rates of non–insulin dependent diabetes mellitus in these populations. Some populations appear to have a stronger predisposition to the development of NIDDM than others, suggesting the involvement of genetic factors. Family history, diet, and lifestyle conditions that lead to obesity will influence the risk of developing NIDDM.

The development of NIDDM is not related to the ingestion of sugar or other carbohydrates: it is predominantly influenced by genetics, body weight and lifestyle factors.

**Cardiovascular disease**

Body mass index, abdominal obesity and genetic and lifestyle factors appear to be primary in the aetiology of coronary heart disease. There is some evidence that antioxidants offer protection against the development of heart disease: fruits and vegetables are rich in antioxidants and increasing the amount of these foods in the
diets can assist in the reduction of saturated fat, which will provide further
protection against heart disease.

There is no evidence of a causal role for sugar in the development of
cardiovascular disease. Ensuring that the diet contains adequate amounts of fruit,
vegetables and carbohydrate-rich foods—at the expense of fat—and maintaining a
healthy body weight are the basis of dietary advice aimed at reducing the risk of
coronary heart disease.\(^3\)

**Cancer**

Although it is widely recognised that diet influences the development of cancer, a
role for sugar has not been identified. Fruit, vegetables and cereal foods are
considered to be protective against cancer.

**Gastrointestinal diseases other than cancer**

Consumption of non-starch polysaccharides and resistant starch contributes to
stool weight: increasing the intake of these foods can effectively prevent
constipation, haemorrhoids and anal fissures.\(^3\)

**Dental caries**

Dental caries can cause loss of teeth and pain that may reduce dietary intake and
compromise nutritional status. The widespread belief that dental caries is not a
problem among older people because they no longer have teeth is unfounded: in
the United States the prevalence of root caries in older people is actually much
higher than in younger adults. Frequent intake of refined sugar has been strongly
linked to the development of caries in older people.\(^14\) Other factors such as type of
food, frequency of consumption, level of oral hygiene, the availability of fluoride,
salivary function and genetic factors have also been implicated.\(^3\)

The relationship between diet and dental caries is difficult to investigate because
of the high inter- and intra-individual variations in food intake, the extent of
fluoridation of the water supply, and the high amount of hidden sugars (refined
sugars incorporated in foods) in the diet. In addition, the extent of retention of
sugary foods in the mouth and the number of eating occasions are difficult to
describe and quantify.

Papas *et al.* used three-day food diaries to investigate the relationship between
root caries and diet in subjects aged over 65 years.\(^19\) Subjects in the highest quartile
for sugar consumption had significantly more caries than did those in the lowest
quartile, and subjects in the highest quartile of caries had significantly higher
intakes of sugars and sticky sugars than did those in the lowest quartile.
Interestingly, those in the highest quartile consumed approximately twice the
amount of liquid sugar (mainly as sugar added to coffee or tea) and sticky sugars
and 25 per cent more solid sugars such as cakes and cookies. Subjects who did not
develop root caries are twice as much cheese as those in the highest quartile for
caries.\(^15\)
This study demonstrated that both the amount and frequency of sugar consumption are important factors in the development of root and coronal caries in old age. The amount and frequency of sugar consumption are paramount in caries development: they should be limited, and the importance of oral hygiene should be stressed in an effort to decrease the incidence of caries in the older population.

Fresh fruits and vegetables contain sugars and may therefore be considered cariogenic. The sugar contained in the cellular structure of foods (intrinsic sugar) has, however, been found to have little cariogenic potential; it is foods high in extrinsic sugars that are most damaging to the teeth.\textsuperscript{16}

**Oral health**

In the 1988 UK dental survey, 67 per cent of the population aged 65 years or more was found to have no natural teeth.\textsuperscript{16} This figure is expected to decrease to 18 per cent by 2038, which will have a significant impact on the oral health care needs of this age group. Food intake is affected by masticatory function, which is in part dependent on the number of teeth a person has. Inefficient chewing will affect food intake, reflected in variations in consumption of intrinsic and milk sugars and non-starch polysaccharides between dentate and edentate subjects. A greater number of teeth has been associated with higher consumption of intrinsic and milk sugars and non-starch polysaccharides.\textsuperscript{16}

Ageing leads to changes in the submucosa, which result in an increased prevalence of exposure of the roots of the teeth to the oral environment. The surface of the exposed tooth is then susceptible to decay. Many factors contribute to this condition; one is the frequency of ingestion of sugars. Another change associated with ageing is a lowered secretion of saliva (xerostomia). This condition can be induced or exacerbated by many drugs prescribed for older people. The sensation of a ‘dry mouth’ is often counteracted by the use of strong gustatory stimuli, such as peppermint- or menthol-flavoured sweets, to stimulate saliva flow. Confectionery such as this can have a high sugar content, and its frequent use can result in rapid decay on exposed surfaces.\textsuperscript{16}

**Summary**

With the exception of dental caries, the evidence for sugar’s role in disease aetiology is very tenuous. Total sugars provide around 20 per cent of energy in the Australian diet\textsuperscript{2} and about 50 per cent of this is in the form of refined sugars. There are no recent data on the amount of refined sugar in the diet of older Australians. Three particular questions need to be answered.

- Does consuming about 11 per cent of energy as refined sugars dilute nutrient intake significantly?
- What would be the effect of removing sugar from the diet?
- Does the use of sugar as a sweetener or to add flavour actually increase food consumption and increase overall nutrient consumption?
For older Australians, an average consumption of approximately 15–20 per cent of energy as sugars is compatible with a healthy diet. Consumption of greater amounts than this would lead to a decrease in nutrient density. Hence this guideline: ‘Use added sugars in moderation.’

**PRACTICAL ASPECTS OF THIS GUIDELINE**

Adding a small amount of refined sugar can increase the palatability of some highly nutritious foods and increase the overall nutrient intake. For example, a small amount of sugar or honey added to porridge and spreading jam on bread or toast can greatly improve the taste and acceptability of the high-carbohydrate, nutrient-dense foods. On the other hand, stewed fruit added to porridge would offer equal palatability, with less sugar.

**RELATION TO OTHER GUIDELINES**

*Enjoy a wide variety of nutritious foods.* It is important that a wide variety of foods are included in the diet and that the consumption of foods high in added sugars is kept to moderate levels.

*Eat plenty of vegetables (including legumes) and fruit.* Adding a small amount of sugar to stewed fruits and some cooked vegetables can greatly increase their palatability.

*Eat plenty of cereals, breads and pastas.* Cereals, breads and pastas are an excellent source of energy and nutrients. Adding small amounts of sugar to cereals and breads can greatly increase their palatability.

*Drink adequate amounts of water and/or other fluids.* Adding sugar to hot beverages is a common practice; it should be regulated if a sizeable number of drinks are consumed each day. Artificial sweeteners can be useful in providing the sweetened flavour but reducing the amount of added sugar consumed.

**CONCLUSION**

The inclusion of added sugar in the diet of older Australians should be moderate, to ensure that valuable nutrients are not diluted by foods high in added sugar and limited in nutrient density. On the other hand, adding small amounts of sugar to foods that are energy and nutrient dense—for example, porridge with suitably sweetened stewed fruit or toast and jam—can increase the palatability of these foods and promote their intake.
REFERENCES


BACKGROUND

The National Health and Medical Research Council has prepared dietary guidelines for adults and for children and adolescents. It was decided that specific guidelines were required for Australians entering the latter stages of life.

A Working Party chaired by Professor Colin Binns prepared the *Dietary Guidelines for Older Australians* on behalf of the NHMRC. The guidelines were developed in accordance with NHMRC procedures for developing guidelines and in keeping with the following terms of reference established by the NHMRC:

- to develop dietary guidelines for older Australians, with particular reference to how the *Dietary Guidelines for Australians* apply to older people;
- to prepare comprehensive scientific background papers explaining the rationale for each guideline; and
- to undertake widespread consultation during the development of the guidelines.

In developing these guidelines, the Working Party was mindful of the changes in nutritional needs that occur with ageing. The guidelines apply to healthy Australians who are over 65 years old and able to live independently.

The guidelines are to be used collectively. The first four are ‘umbrella’ guidelines, dealing with general aspects of nutrition and lifestyle. The remainder deal with specific foods and nutrients and are ranked in approximate order of importance.

MEMBERS OF THE WORKING PARTY

Professor Colin Binns was contracted by NHMRC to develop the *Dietary Guidelines for Older Australians*.

Membership of the Working Party was as follows:

- **Prof. Colin Binns** (Chair)  
  Head, School of Public Health, Curtin University of Technology
- **Ms Jenny Bacon**  
  Dietitian, Bendigo Health Service
- **Ms Beryl Dawson**  
  Dietitian; Chairperson, Gerontology Special Interest Group, Dietitians Association of Australia
- **Dr Ivor Dreosti**  
  Chief Research Scientist, CSIRO Health Sciences & Nutrition
The Working Party acknowledges the contribution of the following people to the development of the 'Dietary Guidelines of Older Australians':

Dr Trevor Beard, from the Menzies Centre in Hobart, provided the information supporting the salt guideline.

Dr Janette Brand-Miller, from the University of Sydney, provided a background paper on the glycaemic index.

Dr Antigone Kouris-Blazos, from Monash University, provided information on food-based dietary guidelines.

Ms Leanne Lester helped with statistical analysis of the results of the 1995 National Nutrition Survey.

Ms Karina Desarmia, Project Manager, Health Advisory Unit, Office of NHMRC, provided secretariat support and coordination of the project.

THE CONSULTATION PROCESS

The guideline-development process involved extensive consultations with the Australian community and with experts working in the fields of nutrition and gerontology.

The first round of consultations took place from September to November 1998 and involved the following:

- a call for submissions, publicised in the Government Gazette and The Australian newspaper;
- the sending of 836 questionnaires about the proposed content of the guidelines to stakeholders—162 were returned and analysed;
- establishment of an interactive website containing the questionnaire and an invitation to make submissions;
• several meetings with stakeholders;
• a two-day meeting of the Working Party to incorporate the outcomes of the consultation process in a draft document.

Over 180 responses were received as a result of this consultation process.

A draft of the *Dietary Guidelines for Older Australians* was released for a second round of public consultations on 26 May 1999. The closing date for submissions was 2 July 1999. This consultation process involved the following:
• placement of advertisements in the *Government Gazette*, *The Australian* newspaper, the General Practice Divisions newsletter, the Royal Australian College of General Practitioners *Friday Fax* newsletter, and various stakeholder newsletters and bulletins;
• distribution of 430 draft documents to stakeholders;
• placement of the draft guidelines on the NHMRC website, linked to Curtin University’s website—statistics showed 377 site visits and 344 copies of the draft downloaded.

Forty-seven submissions were received in response to this round of consultations. The Working Party met in July to consider the comments and revise the draft.

An Expert Review Panel was established to consider the revised draft and to deliberate on responses to the submissions. Professor Binns attended the Panel’s meeting to observe the deliberations and incorporate the consequent changes in the document. Membership of the Expert Review Panel was as follows:

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<thead>
<tr>
<th>Name</th>
<th>Organisation</th>
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<tr>
<td>Ms Jaquie Krassie</td>
<td>Faculty of Medicine &amp; Health Science, Nutrition and Dietetics, University of Newcastle</td>
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<tr>
<td>Associate Professor Frank Fisher</td>
<td>Consumers Health Forum</td>
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<tr>
<td>Ms Louise Bartlett</td>
<td>Dietitians Association of Australia</td>
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<tr>
<td>Dr David Weller</td>
<td>Department of Evidence-based Care and General Practice, Flinders University</td>
</tr>
<tr>
<td>Ms Alison Stewart</td>
<td>Australian Association of Gerontology</td>
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<tr>
<td>Ms Betty Johnson</td>
<td>National Health and Medical Research Council</td>
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Professor Tony Worsley, from the Department of Public Health at the University of Adelaide, independently reviewed the final draft of the guidelines, assessing it against the NHMRC criteria for guideline development.
APPENDIX B  THE NUMBER OF DEATHS AND HOSPITAL ADMISSIONS RESULTING FROM DIET-RELATED CAUSES INCREASES WITH AGE

Figure B.1  Diet-related deaths in Australia, 1992 to 1995: proportion of all deaths, by age

APPENDIX C MEAL-ASSISTED OLDER AUSTRALIANS AND RESIDENTS OF AGED CARE ACCOMMODATION

BACKGROUND

A small proportion (about 7 per cent) of older Australians live in aged care accommodation. A larger proportion receive assistance with meals in their homes or in community centres. The 1996 Health Status Survey of 1000 Melbourne residents aged 65 years and over found that 26 per cent received home-delivered meals.\(^1\) A large number of older Australians also receive assistance through informal arrangements with family and friends.

This appendix provides additional discussion of the *Dietary Guidelines for Older Australians* as they apply to people who need assistance with meals and people who live in aged care accommodation. The recommendations here should not be followed in isolation from the main guidelines: they should always be read in conjunction with the corresponding chapters of this document.

SCIENTIFIC BASIS

Older people who are residents of aged care accommodation differ from older people who live independently in the community in a number of ways. They obviously are more likely to suffer from chronic illness, have lower energy expenditure and be less exposed to sunlight, and they may rely on their carers for food choices and help with eating. In these situations the NHMRC recommends that supplements of vitamin D be given. Depending on the energy expenditure and the nutrient density of the meals these people receive, additional nutritional supplements of micronutrients may also be necessary. Each individual’s situation must be assessed because low-fat, low-salt, and/or low-sugar diets may not be suitable for these people. Health professionals should use these guidelines in conjunction with the standards for nutritional care outlined by each organisation providing aged care accommodation. Wherever possible, a dietitian should be involved in planning and evaluating menus.
ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

Meal-assisted older Australians

For the reasons advanced in Chapter 1 it is important that older people eat a variety of foods each day. Older people living independently but receiving meal assistance are often able to choose other meals from a variety of sources, in addition to the meal received from meals-on-wheels or similar agencies. They should be informed about the benefits of a wide variety of foods and introduced to new products they may not be familiar with or foods from other cultures.

The ‘tea and toast’ scenario is a myth about older people living alone that appears to apply only during periods of illness or extreme tiredness. At these times older people do not often feel like eating a full meal and should be encouraged to eat ‘mini meals’ and quality snacks that are high in protein and nutrient dense. The following are examples:

- boiled or poached eggs with toast;
- canned fruit and icecream;
- cheese on toast;
- yoghurt and fruit;
- baked beans on toast;
- sardines on toast;
- peanut butter sandwich;
- canned ricecream with fruit;
- savoury mince on toast.

It is important that the normal meal pattern is resumed as soon as a person feels well again. Loss of appetite for more than a few days can result in a considerable decrease in nutrient intake and should be investigated. Weight loss of more than 5 per cent of original body weight should be investigated as soon as possible.2

Organisations responsible for providing meals for people living independently at home or in aged care accommodation should ensure that the meals are varied, so that meal recipients do not become bored with the food. Older people from non–English speaking backgrounds warrant particular attention: their dietary preferences may differ from those of older Australians from an English-speaking background. By the year 2001 people from non–English speaking backgrounds will make up almost a quarter of the population of older people in Australia.3 The cuisines of different cultures should be catered for, particularly if a large number of people with an ethnic background are receiving the meal service. These people should be given access to their traditional cuisine through private and community meal providers.

The importance of the food’s presentation should not be underestimated: aesthetic appeal should be a consideration for everyone and particularly for people receiving texture-modified (pureed) meals. Palatability of meals for nursing home
residents and older people living at home should also be considered, so that the most acceptable and cost-effective method of preparation is used. Where possible, freshness should be maintained: this makes food more palatable.

Older people receiving meals on wheels or a home-delivered meal from some other agency should be advised not to save part of the meal for later in the day or for the following day. Meals from these agencies most often consist of a soup, a main course, a slice of bread and a dessert. Often people keep the bread and soup for their evening meal, eating only the main meal and dessert for lunch. This reduces their daily food intake and can compromise their nutrient intake in the long term. If older people are found to be doing this regularly the reason should be investigated and their daily diet should be assessed to determine if it is adequate.

Poverty is often cited as a risk factor for undernutrition in the older population. One study of older Australians found a positive relationship between socio-economic status and favourable dietary habits. A poorer nutrient intake was observed among older adults whose only source of income was a government pension. In spite of this, the 1995 National Nutrition Survey asked respondents if they had run out of food in the preceding 12 months and fewer than 2 per cent of respondents aged 65 or more said they had.

Nutrition education campaigns directed at the older population can help reduce the impact of socio-economic status on nutrient supply among older people, many of whom have a decreasing available income. ‘Food Cent$’ is a program that has been successfully operating in Western Australia since 1992 and throughout various parts of Australia: it would be a good vehicle for educating older Australians about healthy eating on a limited income. The program is based on the Food Cent$ model of proportional spending while ensuring that individual daily nutrient requirements are met. In addition, programs that incorporate ‘cooking for one’ education sessions would be very useful for people living alone: their solitude often discourages them from cooking meals.

Residents of aged care accommodation

The ability of older people living in nursing homes to eat a meal must be assessed, to determine how long it takes them to eat the meal and if they need assistance with feeding. In all circumstances residents must have adequate time to enjoy their meal, whether they are feeding themselves or being helped. People living in nursing homes should be encouraged to be as independent as possible at mealtimes. Often this is one of the few opportunities they have to take control of the activities of daily living.

Maintaining an adequate nutrient intake—particularly protein intake—is important in this group. Older people in residential care are often immobile and at risk of pressure sores, which can cause severe wounds: an adequate intake of protein is necessary to promote wound healing.
It is common for people living in aged care accommodation and older people living independently at home to receive gifts of sweets and other ‘indulgence’ foods. If these foods are not compromising the person’s nutrient intake there is no reason why they should rigorously restrict their consumption of them.

The *Australian Guide to Healthy Eating* is a national nutrition education tool useful for all age groups and promotes the consumption of a wide variety of foods from within the five core food groups (see Appendix K). The guide outlines how different foods from the same food group contain varying amounts of similar nutrients and how choosing a variety of foods from within one group and across all five groups will ensure an adequate nutrient intake. The guide gives useful examples of how to increase food variety by recommending different foods in place of ones more regularly consumed. It can be used for planning menus in residential care settings and for planning home-delivered meals, although it is recommended that a dietitian be involved in the planning process.

2 **KEEP ACTIVE TO MAINTAIN MUSCLE STRENGTH AND A HEALTHY BODY WEIGHT**

**Meal-assisted older Australians**

It is more likely that meal-assisted older people who are living at home will be involved in regular physical activity, since they usually have more opportunities to exercise than do residents of aged care accommodation. The most common types of exercise are walking, gardening and other similar low-intensity aerobic activity. Exercise of any description needs to be encouraged if older people are to obtain the benefits of exercise described in Chapter 2. Nevertheless, more health campaigns and exercise programs promoting the benefits of strength training for meal-assisted older people (and older people who are living completely independently) need to be developed.

Encouraging older people to incorporate strength training in their daily routine will promote continued physical and mental functioning and prolong their independence. There are various options for disseminating information about the benefits of strength training in the older population and encouraging more people to become involved in this type of exercise:

- a national campaign to promote the concept of strength training for older people;
- education of doctors, physiotherapists and other health professionals;
- information about guidelines for strength training in media that are popular with older people—for example, current affairs programs, magazines and newspapers.
Residents of aged care accommodation

Residents of aged care accommodation vary considerably in their level of independence, from mobile and alert to very immobile and frail. Despite this variability in functioning status, all physically and mentally able nursing home residents should be encouraged to engage in some degree of strength-training exercise. Some type of exercise is already encouraged as part of nursing home residents’ daily routine, and strength training could easily be incorporated in existing exercise programs.

Furthermore, the continuation of exercise throughout a person’s later years will help with the maintenance of a healthy body weight. Minimising the accumulation of body fat is an important consideration in relation to being able to move around independently or when being lifted in a nursing home.

EAT AT LEAST THREE MEALS EVERY DAY

Meal-assisted older Australians

Because they are not governed by the regular mealtimes of a nursing home, older people living at home and receiving meal assistance are more likely to skip meals if they are not hungry. It is important that they be encouraged to continue with regular meal patterns. If they are experiencing a temporary reduction in appetite they should be encouraged to have high-protein, high-energy mini meals until their appetite returns. If they continue to experience a reduced appetite they should see their doctor before they start losing weight.

Older people receiving home-delivered meals should not rely on these meals to provide all the food for their day, nor should they save parts of the meal (soup and dessert, for example) for later. It should be emphasised that the home-delivered meal is but one meal, the main meal for the day. Older people receiving home-delivered meals should be assessed to determine whether they are capable of making the other, less labour intensive, meals and snacks for the day (for example, morning tea and lunch).

People receiving home-delivered meals for a long period may become despondent at regularly eating alone, although for many the contact with the delivery person remains important. Eating should be a social activity as often as possible. Incorporating meal programs in senior citizen venues' activities increases social interaction and the provision of a nutritious meal. Alternatively, encouraging older people to eat meals or between-meal snacks with friends or neighbours will increase their social interaction.
Residents of aged care accommodation

Residents of aged care accommodation receive meals in compliance with the *Aged Care Act 1997* and standards specific to each facility. Most commonly, a minimum of three meals a day is provided. There is, however, no guarantee that residents will eat the entire meal and so meet their nutrient requirements. In any nursing home it is recommended that expert dietary advice be sought when necessary. Having the menu checked regularly by a dietitian to ensure that it complies with the recommended dietary intakes will help promote positive nutritional status in residents.

Many nursing home residents are unable to feed themselves and rely on staff to feed them. Sufficient staff and time need to be allocated to do this. To encourage the consumption of extra nutrients to offset a low nutrient intake, nutritious snacks between meals and nutritious fluids should be offered every day. The following are examples:

- fruit bread spread with margarine or peanut butter;
- toasted English muffin halves with spread;
- cheese and toast triangles;
- milk with Milo;
- fruit smoothie;
- flavoured milkshake;
- bean soup and bread;
- fruit with custard;
- pita bread with homous;
- porridge.

Meals in nursing homes are often served at times that suit staffing requirements rather than patients’ appetites. Serving the evening meal at 5 p.m. may promote ‘night starvation’, whereby residents go to bed hungry or wake up hungry during the night. This hunger needs to be prevented or used as an opportunity to provide valuable nutrients. Serving a light supper or nourishing drink before bedtime will help prevent night starvation and increase nutrient intake.

If a resident’s eating pattern changes so that there is a reduction in their nutrient intake, nursing home staff should try to determine the cause. Medications, snacking on food brought in by family members and poor food quality may all be factors. Repeatedly refusing to eat a meal on a regular basis can result in weight loss and nutrient deficiencies, so it is important that meals and mealtimes be conducive to eating.

Providing a pleasant eating environment for people in a nursing home is an important aspect of nutrient intake. Environments that are unpleasant, noisy or stressful can quickly deter people from eating. The atmosphere and environment of the nursing home dining room need careful consideration and planning to promote healthy appetites in all residents. Partitioned meal areas or differing mealtimes for
residents with differing eating capabilities can promote positive eating practices and a pleasant atmosphere for all.\textsuperscript{11}

Nutrition screening tools can be useful for identifying people at risk of undernutrition. Appendix J presents two examples of nutrition screening tools: the Australian Nutrition Screening Initiative (ANSI) checklist\textsuperscript{12} and the Victorian Home and Community Care Program’s nutritional risk screening and monitoring checklist.\textsuperscript{13}

The ANSI checklist was developed by a committee made up of representatives of the Royal Australian College of General Practitioners, the Council on Ageing, the Dietitians Association of Australia, the Pharmaceutical Society and the Pharmacy Guild of Australia. The checklist can alert people working with the older population to whether a person either at home or in a care facility is at risk of malnutrition. It is not designed as a diagnostic tool; rather, it offers a screening method for predicting which older people are at risk of becoming undernourished. It can also be used to raise awareness of nutrition-related problems in the older population.\textsuperscript{12}

Similarly, the Victorian Home and Community Care Program’s nutritional risk screening and monitoring checklist can be used to identify and plan assistance for home-based adults who are nutritionally at risk.\textsuperscript{13} Both checklists look at simple nutritional risk ‘triggers’, such as the number of meals being eaten each day, weight loss, ability to self feed, and nutritional variety in the diet.

4 CARE FOR YOUR FOOD: PREPARE AND STORE IT CORRECTLY

Meal-assisted older Australians

Meal-assisted older Australians should follow the recommendations for food safety outlined in Chapter 4.

Meal preparers

ANZFA (the Australia New Zealand Food Authority) is drafting National Uniform Food Safety Standards\textsuperscript{14} with a view to reducing the incidence of foodborne illnesses in Australia. Organisations that prepare food for meal-assisted older Australians and people living in aged care accommodation will be required to adopt the new Standards, which will be released in 2000 and will be incorporated in the National Food Standards Code. The Food Safety Standards describe general requirements and practices in relation to food handling, cleaning, sanitising and personal hygiene to ensure food safety. Each organisation will be required to develop a food safety plan, which will be used to direct and monitor food safety practices.

A Hazard Analysis and Critical Control Point system (HACCP)\textsuperscript{15} approach will be used to develop the food safety plan. HACCP focuses on identifying, controlling and preventing hazards from contaminated food and has been used extensively in
the food industry to identify and reduce contaminants and determine whether control systems are working as intended to minimise or eliminate hazards. This is an efficient system that places responsibility for ensuring food safety on the food manufacturer and distributor.

The HACCP approach involves seven steps:\(^{15}\)

1. identification of hazards and assessment of their severity and risk;
2. determination of critical control points required to control identified hazards;
3. specification of critical limits that determine whether an operation is under control at a particular control point;
4. establishment of monitoring systems for critical limits;
5. initiation of corrective action if critical limits are not met;
6. verification that the system is operating according to specifications;
7. maintenance of records as a history of each HACCP system.

<table>
<thead>
<tr>
<th>Step</th>
<th>Factors to consider</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food service process</td>
<td>What is the food service process step?</td>
</tr>
<tr>
<td>Hazards</td>
<td>Is there a hazard at this food process step from</td>
</tr>
<tr>
<td></td>
<td>• food poisoning organisms?</td>
</tr>
<tr>
<td></td>
<td>• physical matter?</td>
</tr>
<tr>
<td></td>
<td>• chemicals?</td>
</tr>
<tr>
<td>Preventive measures</td>
<td>What are the controls that will prevent, reduce or eliminate the hazard from occurring?</td>
</tr>
<tr>
<td>Control limits</td>
<td>What are the control limits?</td>
</tr>
<tr>
<td>Monitoring procedures</td>
<td>How do you supervise these actions and monitor the controls?</td>
</tr>
<tr>
<td>Corrective action</td>
<td>What action would you take if the control actions for the hazard failed?</td>
</tr>
<tr>
<td>Records</td>
<td>What records do you keep to show that you always take these control actions? What records do you need to show you are monitoring your food service process?</td>
</tr>
</tbody>
</table>

The increasing number of new foodborne pathogens has contributed to the increased need for the HACCP approach to food safety.

In developing a food safety plan, each operation should refer to documents such as Western Australia’s *Code of Practice for Meals on Wheels Catering System*\(^ {17}\) to establish what steps it should take. The food safety plan should concentrate on personal hygiene; food purchasing, storage and cooking; holding conditions; thawing; reheating; and delivery.
Residents of aged care accommodation

Food handlers must take particular care when preparing meals for older Australians in residential care. These people often have chronic illnesses and thus compromised immune systems, which makes them more susceptible to foodborne illnesses. Food preparers will also have to adopt the new National Uniform Food Safety Standards when developing their food safety plan.

5 EAT PLENTY OF VEGETABLES (INCLUDING LEGUMES) AND FRUIT

Meal-assisted older Australians

Older Australians who receive assistance with meals tend to be living a largely independent lifestyle but having some difficulty obtaining or preparing sufficient food to meet their daily requirements. As a consequence, they probably receive one prepared meal a day from a commercial or welfare source.

In relation to the provided meal, attention should focus on two particular things. First, if the meal is pre-cooked it should be eaten soon after delivery and not kept warm for extended periods: this reduces the nutritional value of the vegetables as well as making them less palatable. Second, if the meal needs to be cooked, vegetables should be lightly cooked, as discussed in Chapter 5, and eaten shortly afterwards.

In relation to the two other meals—the non-delivered ones—attention should be paid to ensuring that fruit and vegetable groups not supplied in the delivered meal are, as far as possible, eaten. It is also important not to overcook fruit and vegetables.

Fruit and vegetables should be stored whole in the refrigerator, not cut up into pieces. This will extend their shelf life, which is important in the case of older people, for whom shopping may be difficult and done only once a week or less. Experimenting with simple recipes involving new vegetables and new flavours should be encouraged, as should consumption of vegetable-based dishes from other cuisines.

Two additional considerations are worth bearing in mind.

- A large European Union survey of consumer attitudes to food, nutrition and health—involving 15 member states and 14 331 subjects—found that respondents who mentioned the family as a central influence on food choice were more likely to regard eating more fruit and vegetables as part of a healthy diet. Considering that meal-assisted older people often live alone, there is an obvious need for a concerted effort to bring dietary guidelines to their attention.

- A survey recently conducted in Brisbane revealed that consumers who regularly ate food prepared by the food service industry ate significantly less fruit, vegetables and dairy products. This highlights the need to encourage the food service industry to change the mix of foods it supplies.
Residents of aged care accommodation

Providing fruit and vegetables in different forms—canned, raw, stewed, roasted, steamed, and so on—to nursing home residents can help promote their consumption of fruit and vegetables.

Providing sufficient time to eat, and possibly increasing the number of meals eaten each day, presents an opportunity to provide fruit and vegetable snacks since these foods generally look appetising, are tasty, and have a texture that makes them chewable for most older people.

6 EAT PLENTY OF CEREALS, BREADS AND PASTAS

Prefer high-fibre foods and those with a lower glycaemic index.

Meal-assisted older Australians

Being free to choose much of their own food, meal-assisted older people have the opportunity to choose a wide variety of cereals, breads and pastas. Incorporating cereal-based foods in the diet helps to promote the intake of low-fat and nutrient-dense foods. Older Australians commonly choose bread as their staple cereal: this practice should not be discouraged; rather, consumption of cereals that are high in fibre and of different varieties of cereals should be encouraged.

Breads and cereals are often fortified with vitamins and minerals. They are easily prepared, readily stored, and make excellent snacks. Older Australians with diabetes should be educated about the glycaemic index (see Appendix H), so that they can make better informed dietary choices.

Residents of aged care accommodation

Residents of aged care accommodation should regularly be offered a wide choice of breakfast cereals, including at least one bran-based cereal and one with a low glycaemic index. Providing a variety of cereals—which are fortified and can be stored for a considerable length of time without spoilage—will promote dietary variety and nutrient density.

It is a good idea to have bread readily available at every mealtime. The inclusion of fibre-enriched white and wholemeal breads will provide variety and increase the fibre content of the diet. Offering a cereal food—such as rice, noodles, pasta or couscous—as a starchy alternative in at least one main meal a day will promote added variety.

Nursing homes can readily incorporate different cereals in their menus by using cereals—such as barley and rice—to thicken soups and casseroles. A mixture of wholemeal and white flour can be used in the preparation of pastries and cakes, and low-fat cracker biscuits or crispbreads can be offered as alternatives to sweet biscuits and cakes at morning and afternoon tea.
If constipation is a problem among residents, additional cereal brans can be incorporated in breakfast porridge and some baked foods, such as muffins and crumble-topped desserts.

7 EAT A DIET LOW IN SATURATED FAT

Meal-assisted older Australians

Incorporation of added fats can increase the palatability of many foods. Information about the types and amounts of fats that are beneficial for the prevention of coronary heart disease would be useful for older people, particularly if it were readily available at the point of purchase. Where appropriate, home-delivery agencies should incorporate a minimum of saturated fat in their menus and use poly- and mono-unsaturated fats as a substitute.

Residents of aged care accommodation

With frail aged people, carers’ concern is for the person’s weight and strength. The main dietary principle here is to give a frail aged person frequent meals of foods they enjoy and can eat. Low-fat diets are obviously inappropriate: in this instance the type of fat is a lower priority than sufficient energy intake. In very old people plasma cholesterol correlates positively with general health; low cholesterol indicates an increased risk of mortality.²⁰

8 DRINK ADEQUATE AMOUNTS OF WATER AND/OR OTHER FLUIDS

Meal-assisted older Australians

Several measures for preventing and treating dehydration appear to be helpful for older people.²¹ Meal-assisted older people, particularly those who live alone in their own home, may be the population group at greatest risk of inadequate fluid intake. In Australia 17.6 per cent of people aged over 65 years and 45 per cent of people aged 80 or more receive meal assistance.²²

Twenty-five per cent of clients of home-based services and aged over 65 years need help with eating. It can be expected that this group will also need daily help to consume sufficient fluid.²²

It is important to provide to older people and their carers information about adequate fluid intakes. Among older people most at risk are those on medication or who have a chronic illness. Bed- or chair-bound people living at home, and their carers, need specific education about fluid requirements. This is particularly important for people who live in hot climates and have no air-conditioning.

Training for people who provide services for frail elderly people who live at home should include the provision of information about practical interventions to ensure
an adequate fluid intake in this group. Health promotion activities for older people and their carers should also include the provision of information about maintaining an adequate fluid intake.

Residents of aged care accommodation
Adequate hydration and nutrition for residents of aged care accommodation are required by the Quality of Care Principles 1997, which come within the *Aged Care Act 1997* and are detailed in *Standards and Guidelines for Residential Aged Care Services*. These standards and guidelines, do not, however, provide information on how adequate hydration should be measured or achieved.

Many residents of aged care accommodation are totally dependent on staff for access to food and fluids: 89.5 per cent of people in residential care in Australia—or 69,816 people—need such assistance. For these people, ready availability of a variety of fluids, with assistance provided where needed, is essential. Menu planning should take this into account, as should determination of staffing levels and selection of food service systems.

9 IF YOU DRINK ALCOHOL, LIMIT YOUR INTAKE

Meal-assisted older Australians
Meal-assisted older Australians are free to choose alcohol as a beverage. They should be educated about safe levels of drinking alcohol and should not be discouraged from consuming alcohol, in moderation, as a regular part of their diet. A drink to be enjoyed in limited amounts, alcohol does not contribute to the total daily fluid intake.

Residents of aged care accommodation
Alcohol can help promote a sociable mealtime atmosphere in nursing homes. Allowing residents to drink a small amount of alcohol at mealtimes can help stimulate their appetite and create a more convivial atmosphere.

10 CHOOSE FOODS LOW IN SALT AND USE SALT SPARINGLY

Meal-assisted older Australians
Older Australians who are living independently at home should try to limit their salt consumption by choosing reduced-salt varieties of foods and snacks where possible. People involved in preparing meals for older Australians who are living independently should develop a reduced-salt menu for all meal recipients. If meal-assisted people and their carers are educated about low-salt products they will find it easier to choose these products when shopping or dining out.
Residents of aged care accommodation

The meals served to residents of aged care accommodation should generally have lowered salt content. Maintaining an adequate food intake is most important for these people, but sudden changes to life-long eating habits are not advisable for the very old.

11 INCLUDE FOODS HIGH IN CALCIUM

Meal-assisted older Australians

Older people who are involved in preparing their own meals should be encouraged to use calcium-enriched, reduced-fat dairy products. If regular shopping is a problem, ‘long-life’ (UHT) milk and other calcium sources will ensure that sufficient calcium is obtained. If for some reason dairy products are avoided, older people should be educated about alternative high-calcium food sources, such as calcium-enriched soymilk and fish with edible bones such as canned tuna or salmon. Providing all meal-assisted older Australians with information about their calcium requirements and how these can be met is an important part of public health initiatives directed at the older population.

Menus for meal-assisted older people should be designed to meet calcium requirements. Calcium-rich foods, such as milk products, should be offered in a suitable form. A dietitian can provide expert advice on how to meet calcium requirements.

Vitamin D supplementation may be necessary to improve older people’s calcium balance and reduce their fracture risk. The vitamin D status of people who are confined indoors and not exposed to sunlight regularly should be assessed to determine if supplementation is necessary.

Residents of aged care accommodation

The daily menus for residents of aged care accommodation should contain enough calcium to meet their daily requirements—the suggestions applying to meal-assisted older Australians apply here too. Residents’ calcium intake can be further increased if calcium-rich snacks and drinks are offered between meals.

Lack of exposure to sunlight and changes in vitamin D metabolism associated with ageing may cause a decline in vitamin D status for residents of aged care accommodation. Ensuring adequate exposure to sunlight or providing vitamin D supplements may be necessary to improve calcium balance and reduce fracture risk in people whose vitamin D status may be marginal.
12 USE ADDED SUGARS IN MODERATION

Meal-assisted older Australians

Nutrient density needs to be taken into consideration when choosing and preparing food for meal-assisted older Australians. Dependence on pre-prepared foods can often result in the consumption of foods that are high in added sugars and have little nutrient value. Meal-assisted older Australians should be encouraged not to eat meals and snacks that are high in added sugars too often but instead to use fresh produce that is available as the basis for most meals. Menu preparers should assess the sources of added sugar in their clients’ menus to determine whether more nutritious food alternatives, such as fresh fruit, might be included.

Residents of aged care accommodation

When people are planning menus for residents of aged care accommodation the contribution of energy from added sugar needs to be taken into account and a dependence on low-joule foods avoided. A nutrient-dense menu with a minimum of added-sugar products to add variety and palatability is recommended. Residents should be encouraged not to ‘over-snack’ on gifts or purchases of sweets, confectionery and cakes. Such products are high in added sugars and over-indulgence could result in regular meals being skipped.

REFERENCES


17 Health Department of Western Australia (Environmental Health Branch). *Code of practice for meals on wheels catering system*. Perth: Health Department of Western Australia.


If cuisines and foods from other countries are incorporated in the diet the result will be greater food variety and possibly a healthier diet, which may offer protection against chronic diseases.

Assessing food variety is a quick, efficient and relatively effective way to determine the nutritional adequacy of a diet. Savige et al. describe it as a quick, effective method to calculate food variety. Clients use it to help them remember and record all the different foods they consumed in the past week and then total the score. This food variety score is then related to a dietary adequacy score, as shown in Table D.1. Additional factors such as meal patterns and appetite should be used in conjunction with the food variety checklist to further assess nutritional adequacy.

**APPENDIX D MEASURING FOOD VARIETY IN THE DIET**

The food variety checklist (1)

**Grains and cereals**
- Wheat—including ready-to-eat cereals such as Weet-Bix and Bran Flakes, and wholemeal or white bread
- Rye—including ready-to-eat products
- Barley—including ready-to-eat products
- Oats—including ready-to-eat products
- Rice—including ready-to-eat products
- All other grains and cereals—for example, buckwheat, millet, quinoa, sago, semolina, tapioca, triticale

**Fruit**
- Stone fruit—for example, apricots, avocado, cherries, nectarines, olives, peaches, plums, prunes
- Citrus—orange, lemon, grapefruit
- Apples
- Bananas
- Berries—for example, raspberries, strawberries
- Grapes—including raisins, sultanas
- Melons—for example, honeydew, rock melon, watermelon
- Pears, nashi
Tropical fruit—for example, guava, jackfruit, lychees, mango, papaya, pineapple, star fruit
Dates, kiwi fruit, passionfruit

Vegetables
- Root—for example, carrots, sweet potatoes, potatoes, bamboo shoots, beetroot, ginger, parsnip, radish, water chestnut
- Leafy greens—for example, spinach, cabbage, Brussels sprouts, silverbeet
- Marrow-like vegetables—for example, cucumber, eggplant, marrow, pumpkin, squash, swede, turnip, zucchini
- Flowers—for example, broccoli, cauliflower, endive, chicory, lettuce
- Stalks—for example, celery
- Onion—for example, spring onion, garlic, leek
- Peppers—for example, capsicum
- Tomatoes, okra

Legumes/pulses
- Beans—for example, green beans, snow peas, snap beans, dried peas
- Adzuki, baked beans, haricot, black beans, black-eye beans, borlotti beans, cannellini beans, chickpeas, kidney beans, lentils, lima beans, lupins, mung beans (sprouts), pinto beans, soya beans (sprouts), soya-milk bean curd

Nuts and seeds
- Almonds, brazil nuts, cashews, chestnuts, coconut, hazelnuts, peanuts, peanut butter, pecan nut, pine nuts, pistachios, pumpkin seed, sesame seed, tahini, homous, sunflower seed, walnut

Meats
- Pork—including ham and bacon
- Beef, lamb, veal
- Poultry—for example, chicken, turkey, duck
- Game—for example, quail, wild duck, pigeon, kangaroo, rabbit
- Liver, brain, other organ meats

Seafood
- Shellfish and molluscs—for example, mussels, squid, oysters, scallops
- Crustaceans—for example, prawns, lobster, crab, shrimps
- Fatty fish—for example, anchovies, tuna, salmon, sardines, herring, mackerel, kipper, pilchards
- Other saltwater fish
Freshwater fish
Roe (caviar)

**Dairy**
Milk, yoghurt (without live culture), icecream, cheese
Yoghurt with live culture—for example, acidophilus, bifidobacteria

**Eggs**
All varieties

**Fats and oils**
Oils
Hard and soft spreads

**Fermented foods**
Miso, tempeh, soya sauce
Sauerkraut
Other

**Beverages**
Non-alcoholic (tea, coffee, cocoa)
Alcoholic

**Herbs and spices**
Use regularly

**Yeast**
Vegemite, Marmite, brewer’s yeast

**Fungi**
All varieties

**Sugar and confectionery**
All varieties—including soft drinks

**Water**
Including mineral water
DIETARY ADEQUACY

The concept of dietary adequacy embraces essential nutrient adequacy but also takes into account other food components and food properties. From the point of view of health risk and health outcomes, consumption of about 60 per cent of available variety is very good and about 40 per cent is fair.

<table>
<thead>
<tr>
<th>Total food variety score</th>
<th>Dietary adequacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;30 per week</td>
<td>Very good</td>
</tr>
<tr>
<td>25–29 per week</td>
<td>Good</td>
</tr>
<tr>
<td>20–24 per week</td>
<td>Fair</td>
</tr>
<tr>
<td>&lt;20 per week</td>
<td>Poor</td>
</tr>
<tr>
<td>&lt;10 per week</td>
<td>Very poor</td>
</tr>
</tbody>
</table>

REFERENCE

APPENDIX E  RISK FACTORS FOR UNDERNUTRITION

### APPENDIX F  DRUG–NUTRIENT INTERACTIONS

<table>
<thead>
<tr>
<th>Drug</th>
<th>Effect</th>
<th>Nutrients affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antipsychotic/psychoactive</td>
<td>Lack of interest in food, sedation</td>
<td>Protein-calorie intake reduced</td>
</tr>
<tr>
<td>Diuretic</td>
<td>Alterations in renal tubular function</td>
<td>Loss of sodium, potassium, zinc, magnesium</td>
</tr>
<tr>
<td>Cardiac glycosides</td>
<td>Anorexia, nausea, vomiting, lack of interest in food</td>
<td>Protein-calorie intake reduced</td>
</tr>
<tr>
<td>Phenytoin phenobarbitone</td>
<td>Induction of liver enzymes</td>
<td>Altered vitamin D metabolism</td>
</tr>
<tr>
<td>Salicylate</td>
<td>Gastrointestinal blood loss</td>
<td>Iron deficiency</td>
</tr>
<tr>
<td>Corticosteroid</td>
<td>Inhibition of calcium absorption, alteration of glucose metabolism, electrolyte imbalance</td>
<td>Calcium imbalance (osteoporosis), hyperglycaemia, sodium retention, potassium deficiency</td>
</tr>
<tr>
<td>Mineral oil laxative</td>
<td>Inhibition of fat-soluble vitamin absorption</td>
<td>Vitamin A, D, E, and K malabsorption</td>
</tr>
</tbody>
</table>

APPENDIX G  RELATIONSHIP BETWEEN BODY MASS INDEX AND MORTALITY AND MORBIDITY

Figure G.1  Relative risk of death from any cause among healthy white men and women who had never smoked, by age group and body mass index
Figure G.2  Relative risk of death from cardiovascular disease among healthy white men and women who had never smoked, by age group and body mass index

## APPENDIX H  FOOD SAFETY AND HYGIENE

### Table H.1  Foodborne micro-organisms, their food sources and symptoms: a summary

<table>
<thead>
<tr>
<th>Food poisoning</th>
<th>Food source</th>
<th>Onset period</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salmonella</td>
<td>Raw meat, milk, egg, poultry</td>
<td>6–72 hours</td>
<td>Fever, diarrhoea, abdominal pain, vomiting</td>
</tr>
<tr>
<td>Staphylococcus aureus</td>
<td>Raw milk—main human contamination from poor personal hygiene</td>
<td>1–6 hours</td>
<td>Vomiting, hypotension, diarrhoea, abdominal pain</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>Raw meat and meat stored inappropriately</td>
<td>8–22 hours</td>
<td>Diarrhoea, abdominal pain</td>
</tr>
<tr>
<td>Virbio parahaemolyticus</td>
<td>Seafood</td>
<td>2–48 hours</td>
<td>Profuse diarrhoea, vomiting, abdominal pain</td>
</tr>
<tr>
<td>Bacillus cereus</td>
<td>Cereals</td>
<td>1–5 hours</td>
<td>Vomiting, nausea, diarrhoea</td>
</tr>
<tr>
<td></td>
<td>– vomiting type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– diarrhoea type</td>
<td>8–16 hours</td>
<td>Abdominal pain, diarrhoea, nausea</td>
</tr>
<tr>
<td>Escherichia coli</td>
<td>Raw meat</td>
<td>5–48 hours</td>
<td>Abdominal pain, diarrhoea, vomiting, fever, nausea, chills, headache, muscular pain</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>Egg and vegetables</td>
<td>24–72 hours</td>
<td>Abdominal pain, diarrhoea (with blood and mucus), fever</td>
</tr>
<tr>
<td>Yersinia enterocolyti</td>
<td>Raw milk, seafood, meat and pate</td>
<td>24–36 hours</td>
<td>Fever, appendicitis-type pain, dysentery</td>
</tr>
<tr>
<td>Listeria monocytogenes</td>
<td>Raw meat, seafood, milk, soft cheeses, coleslaw, chicken</td>
<td>1–21 days</td>
<td>Flu-like symptoms (including fever), nausea, vomiting, headache. Causes miscarriages and still births and meningitis</td>
</tr>
<tr>
<td>Clostridium botulinum</td>
<td>Seafood, meat and vegetables</td>
<td>12–36 hours</td>
<td>Fatigue, headache, dizziness, visual disturbances, inability to swallow, paralysis</td>
</tr>
<tr>
<td>Viral gastroenteritis</td>
<td>Seafood</td>
<td>24–48 hours</td>
<td>Nausea, fever, diarrhoea, vomiting</td>
</tr>
<tr>
<td>Ciguatera</td>
<td>Fish</td>
<td>1–36 hours</td>
<td>Nausea, vomiting, diarrhoea, abdominal pain followed by numbness and tingling of the extremities and high temperature</td>
</tr>
</tbody>
</table>
Table H.2  Refrigeration conditions for some foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Storage temperature (°C)</th>
<th>Storage life at home</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seafood</td>
<td>0–3</td>
<td>3 days</td>
</tr>
<tr>
<td>Meat</td>
<td>0–3</td>
<td>3–5 days</td>
</tr>
<tr>
<td>Minced meat and offal</td>
<td>0–3</td>
<td>2–3 days</td>
</tr>
<tr>
<td>Cured meat</td>
<td>0–3</td>
<td>2–3 weeks</td>
</tr>
<tr>
<td>Poultry</td>
<td>0–3</td>
<td>3 days</td>
</tr>
<tr>
<td>Fruit juices</td>
<td>0–7</td>
<td>7–14 days</td>
</tr>
<tr>
<td>Milk</td>
<td>1–7</td>
<td>5–7 days</td>
</tr>
<tr>
<td>Cream</td>
<td>1–7</td>
<td>5 days</td>
</tr>
<tr>
<td>Cheese</td>
<td>0–7</td>
<td>Variable (1–3 months)</td>
</tr>
<tr>
<td>Butter</td>
<td>0–7</td>
<td>8 weeks</td>
</tr>
<tr>
<td>Oil and fat</td>
<td>2–7</td>
<td>Variable (6 months)</td>
</tr>
<tr>
<td>Margarine</td>
<td>2–7</td>
<td>Variable (6 months)</td>
</tr>
</tbody>
</table>

STORING FRUITS AND VEGETABLES

The quality and shelf life of fruits and vegetables depend largely on the way they are handled, transported and stored. Each type of fruit and vegetable will have its own optimal storage condition. A general guide is to keep them refrigerated.

Table H.3  Storage conditions for selected fruits

<table>
<thead>
<tr>
<th>Food</th>
<th>Storage conditions</th>
<th>Storage in refrigerator</th>
<th>Storage at room temperature</th>
<th>Storage in freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td>Unripe or hard apples are best stored at cool room temperature until ready to eat.</td>
<td>1 month</td>
<td>At cool room temperature until ready to eat</td>
<td>n.r.</td>
</tr>
<tr>
<td>Apricots, nectarines, peaches</td>
<td>If unripe, store in a paper bag until flesh softens then refrigerate.</td>
<td>3–5 days</td>
<td>Store until flesh softens then refrigerate</td>
<td>n.r.</td>
</tr>
<tr>
<td>Avocado</td>
<td>Allow to ripen at room temperature then refrigerate.</td>
<td>3–5 days</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Bananas</td>
<td>Allow to ripen at room temperature then refrigerate.</td>
<td>3–5 days</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Citrus fruit</td>
<td>Best stored at cool room temperature. Can be stored in refrigerator uncovered.</td>
<td>2 weeks</td>
<td>2 weeks</td>
<td>n.r.</td>
</tr>
</tbody>
</table>
**Table H.3** Storage conditions for selected fruits

<table>
<thead>
<tr>
<th>Food</th>
<th>Storage conditions</th>
<th>Storage in refrigerator</th>
<th>Storage at room temperature</th>
<th>Storage in freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapes</td>
<td>Ready to eat when purchased. Store in refrigerator in plastic bag or container. Wash only before serving.</td>
<td>3–5 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Kiwifruit</td>
<td>Allow to ripen at room temperature then refrigerate.</td>
<td>1–2 weeks</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Melon</td>
<td>Allow to ripen at room temperature then refrigerate. Wrap rockmelon and honeydew to prevent odour from spreading to other foods. Store cut melon in the refrigerator.</td>
<td>1 week</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Pears</td>
<td>Allow to ripen at room temperature then refrigerate.</td>
<td>3–5 days</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Pineapple</td>
<td>Will not ripen after purchase. Use as soon as possible as holding results in deterioration. Once cut, store in a container in the refrigerator.</td>
<td>1 week</td>
<td>2 days</td>
<td>n.r.</td>
</tr>
<tr>
<td>Plums</td>
<td>Ripe when sold.</td>
<td>3–5 days</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
<tr>
<td>Strawberries</td>
<td>Will not ripen after being picked. Store unwashed in the refrigerator. Wash only before serving.</td>
<td>1–2 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
</tbody>
</table>

n.r.: Not recommended.

**Table H.4** Storage conditions for selected vegetables

<table>
<thead>
<tr>
<th>Food</th>
<th>Storage conditions</th>
<th>Storage in refrigerator</th>
<th>Storage at room temperature</th>
<th>Storage in freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagus</td>
<td>Do not wash before storing. Keep in crisper in plastic bag or container.</td>
<td>1–2 days</td>
<td>n.r.</td>
<td>8 months</td>
</tr>
<tr>
<td>Broccoli</td>
<td>Store unwashed in crisper in plastic bag or container. Wash well before use.</td>
<td>3–5 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Brussels</td>
<td>Store in crisper in plastic bag or container.</td>
<td>3–5 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
</tbody>
</table>

Continued over page
### Table H.4  Storage conditions for selected vegetables  

<table>
<thead>
<tr>
<th>Food</th>
<th>Storage conditions</th>
<th>Storage in refrigerator</th>
<th>Storage at room temperature</th>
<th>Storage in freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>Store in crisper in plastic bag.</td>
<td>1–2 weeks</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Capsicum</td>
<td>Wash and dry, store in crisper in plastic bag.</td>
<td>1 week</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Carrot</td>
<td>Remove tops and store in plastic bag or container.</td>
<td>1–2 weeks</td>
<td>n.r.</td>
<td>8 months</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Store unwashed in crisper in plastic bags or containers. Wash well before use.</td>
<td>1 week</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Celery</td>
<td>Store in crisper or moisture-proof wrap.</td>
<td>1–2 weeks</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Corn</td>
<td>Highly perishable. Keep refrigerated.</td>
<td>1–2 days in husk</td>
<td>n.r.</td>
<td>8 months</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Wash and dry, store in crisper in plastic bag.</td>
<td>1 week</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Store in crisper in plastic bags or container.</td>
<td>1 week</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Store away from other vegetables.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Head—unwashed</td>
<td>5–7 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td></td>
<td>– Head—washed and drained</td>
<td>3–5 days</td>
<td>n.r.</td>
<td></td>
</tr>
<tr>
<td>Mushroom</td>
<td>Do not wash before storing. Store in paper bag. Wash well before use.</td>
<td>1–2 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Onion</td>
<td>Keep dry and away from sun.</td>
<td>n.r.</td>
<td>2 weeks</td>
<td>n.r.</td>
</tr>
<tr>
<td>Parsnip</td>
<td>Remove tops. Store in plastic bag or container.</td>
<td>1–2 weeks</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Potato</td>
<td>Keep dry in a cool place, away from sun.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Fresh white</td>
<td>n.r.</td>
<td>2 weeks</td>
<td>n.r.</td>
</tr>
<tr>
<td></td>
<td>– Sweet</td>
<td>n.r.</td>
<td>2–3 weeks</td>
<td>n.r.</td>
</tr>
<tr>
<td>Spinach</td>
<td>Wash thoroughly. Drain and store in crisper in closed bag or container.</td>
<td>3–5 days</td>
<td>n.r.</td>
<td>n.r.</td>
</tr>
<tr>
<td>Tomato</td>
<td>Flavour of tomatoes best at room temperature. Keep unripe tomatoes at room temperature away from direct sunlight until they ripen.</td>
<td>1–2 days.</td>
<td>Until ripe</td>
<td>n.r.</td>
</tr>
</tbody>
</table>

n.r. Not recommended.
REFERENCES


DIETARY GUIDELINES FOR OLDER AUSTRALIANS

APPENDIX I THE GLYCAEMIC INDEX OF CARBOHYDRATE FOODS: IMPLICATIONS FOR HEALTH

[This paper is the work of Associate Professor Janette Brand-Miller, PhD FAIFST, from the Human Nutrition Unit, Department of Biochemistry, University of Sydney. The author presented a paper of similar content but with a different title at the Asia–Pacific ILSI Seminar on Food-based Dietary Guidelines in Kuala Lumpur in July 1998; it will be published in Nutrition Research.

ABSTRACT

The glycaemic index (GI) of foods is a physiologically based classification of carbohydrate foods according to their blood glucose–raising potential. It has important implications for the prevention and treatment of the major causes of morbidity and mortality—among them non–insulin dependent diabetes, coronary heart disease and obesity—in developed and developing nations. The recent FAO–WHO Consultation on Carbohydrates recommended that ‘the glycaemic index of foods be used in conjunction with information about food composition, to guide food choices’. Current nutrition guidelines largely ignore the GI differences between carbohydrate foods and use older classifications based on starch, sugar and fibre that do not reflect physiological effects on glycaemia or insulinemia. Many types of bread and breakfast cereal have both high- and low-GI varieties and we need to guide people in the best choice and encourage industry to develop new low-GI foods. Foods containing sugar, whether naturally occurring or refined, have low to intermediate GI values and moderate amounts can help to reduce the overall GI of the diet. Nutrition recommendations need to recognise major developments in sciences: the GI of foods is one of these.

Keywords: glycaemic index, diet, glucose and insulin responses, carbohydrate, diabetes

INTRODUCTION

The glycaemic index of foods has important implications for the prevention and treatment of the major causes of morbidity and mortality—among them non–insulin dependent diabetes, coronary heart disease and obesity—in developed and developing countries. The recent FAO–WHO Consultation on Carbohydrates recommended that ‘the glycaemic index of foods be used in conjunction with information about food composition, to guide food choices’. Specifically, the Consultation recommended that at least 55 per cent of energy be derived from carbohydrate and that the bulk of carbohydrate foods be those rich in dietary fibre (non-starch polysaccharide) and with a low glycaemic index. The aims of this
paper are to show how foods are classified according to their GI, to briefly discuss the health benefits and criticisms of the GI, and to consider the implications of the GI for nutrition recommendations.

**WHAT IS THE GLYCAEMIC INDEX?**

The GI is an established, physiologically based method used to classify foods according to their blood glucose–raising potential.\(^1\) It compares foods on an equal-carbohydrate basis and ranks them relative to a standard food (usually glucose or white bread). In the past two decades the GI concept has been subjected to extensive research, confirming its reproducibility, application to mixed meals, and clinical usefulness in the treatment of diabetes and hyperlipidemia.\(^2,3,4\) Even in healthy individuals, regular consumption of slowly digested carbohydrate leads to improvements in glucose and lipid metabolism beyond those produced by typical high-carbohydrate diets. Many of the concerns about recommending high-carbohydrate diets (because of adverse effects on triglycerides and high-density lipoprotein cholesterol levels) do not apply when the carbohydrate intake is based on low-GI food choices.

Contrary to popular belief, the foods that produce the highest glycaemic responses are not those containing the most sugars and the least fibre. In fact, many of the starchy foods eaten by people in developed countries—such as bread, breakfast cereals and potatoes, whether high or low in fibre—have high GI values.\(^5\) This is because the starch is fully gelatinised and can be rapidly digested and absorbed\(^6\) (see Table I.1). In contrast, sugary foods usually cause lower levels of glycaemia per gram of carbohydrate than the common starchy staples of Western diets.\(^6\) This is because up to half the weight of carbohydrate is fructose, a sugar that has little effect on glycaemia. Among the foods with the lowest GI values are legumes, relatively unprocessed cereal foods, pasta, dairy products, and many types of fruit and vegetables.

We are now able to appreciate that the old separation of carbohydrates into starches and sugars had little physiological significance, not only in terms of glycaemic effect but in other ways such as satiating capacity and ability to lower dental plaque pH.\(^1\) In fact, the FAO–WHO Consultation recommended against the terms ‘extrinsic’ and ‘intrinsic’ sugars and ‘complex’, ‘available’ and ‘unavailable’ carbohydrate. Instead, it advocated use of the term ‘glycaemic carbohydrate’ (meaning ‘providing carbohydrate for metabolism’) and consumption of low-GI foods. To some degree, the low-GI versus high-GI distinction seeks to replace the starch versus sugar distinction, but it is important to recognise that the types of foods within each category are not the same; that is, starch does not equate with low GI and sugar does not equate with high GI.

The blood glucose–raising potential of foods has important implications for nutrition recommendations because many starchy, high-fibre foods—such as potatoes, wholemeal bread and brown rice—that are highly recommended have a high GI. On the other hand, many foods containing added sugars—such as
sweetened breakfast cereals, fruit and dairy products—have GI values similar to or lower than their unsweetened counterparts. In fact, the overall GI of the diet has been shown to have an inverse correlation with total sugars (refined plus naturally occurring) expressed as a proportion of total carbohydrate; that is, the higher the total sugars, the lower the overall GI. This comes about because most starchy foods in Western diets have a high GI and most sugary foods have a low GI. Thus, the dilemma for many nutritionists is that, in recommending low-GI food choices, they will appear to contradict previous dietary advice—bread and potatoes are no longer the ‘best’ and sugary foods are no longer the ‘worst’.

Table I.1 The glycaemic index of foods using a scale where glucose = 100

<table>
<thead>
<tr>
<th>Food type</th>
<th>GI</th>
<th>Food type</th>
<th>GI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breads</td>
<td></td>
<td>Legumes</td>
<td></td>
</tr>
<tr>
<td>White bread</td>
<td>70</td>
<td>Lentils</td>
<td>28</td>
</tr>
<tr>
<td>Wholemeal bread</td>
<td>69</td>
<td>Soybeans</td>
<td>18</td>
</tr>
<tr>
<td>Pumpernickel</td>
<td>41</td>
<td>Baked beans (canned)</td>
<td>48</td>
</tr>
<tr>
<td>Dark rye</td>
<td>76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sourdough</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy mixed grain</td>
<td>30-45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast cereals</td>
<td></td>
<td>Fruits</td>
<td></td>
</tr>
<tr>
<td>Cornflakes</td>
<td>84</td>
<td>Apple</td>
<td>38</td>
</tr>
<tr>
<td>Rice Krispies</td>
<td>82</td>
<td>Orange</td>
<td>44</td>
</tr>
<tr>
<td>Cheerios</td>
<td>83</td>
<td>Peach</td>
<td>42</td>
</tr>
<tr>
<td>Puffed Wheat</td>
<td>80</td>
<td>Banana</td>
<td>55</td>
</tr>
<tr>
<td>All Bran</td>
<td>42</td>
<td>Watermelon</td>
<td>72</td>
</tr>
<tr>
<td>Porridge</td>
<td>46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Bran</td>
<td>42</td>
<td>Milk, full fat</td>
<td>27</td>
</tr>
<tr>
<td>Porridge</td>
<td>46</td>
<td>Milk, skim</td>
<td>32</td>
</tr>
<tr>
<td>Puffed Wheat</td>
<td>30-45</td>
<td>Icecream, full fat</td>
<td>61</td>
</tr>
<tr>
<td>Snack foods</td>
<td></td>
<td>Yogurt, low fat, fruit</td>
<td>33</td>
</tr>
<tr>
<td>Mars Bar</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jelly beans</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate bar</td>
<td>49</td>
<td>Fanta</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gatorade</td>
<td>78</td>
</tr>
</tbody>
</table>

Note: These values represent averages.
THE HEALTH BENEFITS OF LOW-GI FOODS

Many well-designed experimental and epidemiological studies highlight the health benefits of slowly digested and absorbed carbohydrate. Short-term studies in lean healthy people, obese people, and people with diabetes show consistently higher daylong insulin levels on diets based on high-GI foods in comparison with low-GI diets of similar nutrient composition\(^8^,\,^9^,\,^10\) (see Figure I.1). Even small physiological increases in insulinemia for as little as three to five days can induce severe insulin resistance in healthy young subjects with normal glucose tolerance and no family history of non-insulin dependent diabetes mellitus.\(^11\) Higher daylong insulin levels are believed to promote carbohydrate oxidation at the expense of fatty acid oxidation, thereby promoting fat storage in adipose tissue and very low density lipoprotein cholesterol synthesis in the liver.\(^12\)

Long-term studies in rats show that high-GI starch increases fasting insulin levels and promotes insulin resistance, in comparison with identical diets based on low-GI starch.\(^13^,\,^14\) In animal models, high-GI diets promote faster weight gain, higher body fat levels\(^15\), higher adipocyte volume and hypertriglyceridaemia\(^16\); that is, all the components of the insulin-resistance, or ‘metabolic’, syndrome.

\(\text{Figure I.1} \quad \text{Meals based on high-GI foods produce significantly higher daylong insulin levels compared with low-GI foods in lean, healthy subjects} \quad \text{8}\)
In subjects with type 1 and type 2 diabetes and/or hyperlipidemia, low-GI diets, in comparison with high-GI diets of similar nutrient composition lead to improvements in glucose and lipid metabolism. An overview of 11 long-term studies using a cross-over design\textsuperscript{4} showed that, on average, low-GI diets reduced glycosylated haemoglobin by 9 per cent, fructosamine by 8 per cent, urinary C-peptide by 20 per cent and daylong blood glucose by 16 per cent. Cholesterol was reduced by an average of 6 per cent and triglycerides by 9 per cent. In most of these studies the GI of the overall diet was reduced by 15–30 per cent. Although these results have been criticised as only modest, they are similar in magnitude to improvements induced by oral hypoglycaemic drugs.

Recent epidemiological studies suggest that the GI of the diet is probably the most significant dietary factor in precipitating non–insulin dependent diabetes mellitus. Two large-scale prospective studies—one in nurses\textsuperscript{17} and one in male health professionals\textsuperscript{18}—showed that diets with a high glycaemic load (GI x carbohydrate content) increase the risk of developing non–insulin dependent diabetes mellitus after controlling for known risk factors such as age and body mass index (see Figure I.2). The only other dietary factor that increased risk was lack of cereal fibre. Importantly, the total carbohydrate and refined sugar content and the amount and type of fat were not risk factors. A similar picture emerged with acute coronary heart disease in the nurses’ study.\textsuperscript{19} The underlying mechanism postulated by these authors is the demand for insulin generated by high-GI foods. Since hyperinsulinaemia is linked with all the facets of the ‘metabolic’ syndrome (insulin resistance, hyperlipidaemia, hypertension and visceral obesity), the GI of foods may eventually be linked with all so-called diseases of affluence.

**Figure I.2** Diets with a high glycaemic load (glycaemic index x carbohydrate content) increase the risk of developing non–insulin dependent diabetes after controlling for known risk factors\textsuperscript{17}

<table>
<thead>
<tr>
<th>Relative risk of NIDDM</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
<th>High GI and low cereal fibre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1.28</td>
<td>1.51</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Note: The combination of high glycaemic load and low cereal fibre content increases risk by 2.5 times.
In healthy people as well as those with non-insulin dependent diabetes mellitus, high-carbohydrate diets have been shown to worsen aspects of the blood lipid profile, including the triglycerides, very low density lipoprotein, high-density lipoprotein and lipoprotein a. Individuals with insulin resistance are more susceptible to these adverse effects. This effect of high-carbohydrate diets is, however, almost certainly linked to the rate of absorption of the carbohydrate: strategies that slow down digestion and absorption (high soluble fibre, low GI, alpha-glucosidase therapy) improve these parameters. The concerns with usual high-carbohydrate diets have led some experts to recommend high intakes of mono-unsaturated and poly-unsaturated oils in place of carbohydrate, but high-fat, energy-dense diets of any sort will be prone to overconsumption.

The GI has largely unrecognised implications for weight control. In many studies, slow digestion of carbohydrate is associated with higher satiety, possibly because the prolonged presence of food in the gut stimulates chemical and pressure receptors that signal satiety. Low insulinaemic diets have been shown to increase the rate of weight loss on energy-restricted diets through the mechanism of lower insulin levels. Thus low-GI diets may promote weight control by both enhancing satiety and promoting fat oxidation.

Finally, the GI has implications for dental health. High-GI starchy foods can be rapidly hydrolysed by salivary alpha-amylase, yielding fermentable carbohydrates that increase the risk of dental caries. The fall in plaque pH resulting from bacterial fermentation of different carbohydrates correlates with the GI of the food. Cornflakes, for example, produce the same pH drop as a sucrose solution. Thus low-GI starchy foods are likely to be preferable to high GI-starchy foods for prevention of dental caries. The impact of any carbohydrate on dental caries is, however, dependent on the stickiness of the food, the frequency of consumption, the quality of oral hygiene, availability of fluoride, salivary function and genetic factors.

**CRITICISMS OF THE GLYCAEMIC INDEX**

The GI approach has been criticised because some foods have been rated as ‘good’ or ‘bad’ simply on the basis of their GI. Indeed, it is not appropriate to compare the high GI of boiled potatoes with the lower GI of potato crisps. Large amounts of fat and/or protein in a food tend to lower the glycaemic response by slowing down gastric emptying and increasing insulin secretion. Thus high-fat foods (GI=49) may be seen in a ‘falsely favourable’ light if the GI is the only criterion for selection. The total amount of carbohydrate, the amount and type of fat, and the fibre, micronutrient and salt content of a food are also important. But within groups of foods of similar nutrient profile, the low GI ones may be preferable.

Another criticism of the GI is that it does not work in ‘mixed meal’ situations or when there is added fat or protein. In fact, at least a dozen studies have shown that the GI of single foods predicts the response to mixed meals. Some early ‘negative’ studies have since been dismissed on methodological grounds. Typical
amounts of fat and protein are not as important as the physical state of the starch in determining the glycaemic response.

The use of 50-gram carbohydrate portion sizes in GI testing has also been criticised because it may not reflect a normal serving size. But even in 1000-kilojoule portion sizes (instead of 50-gram carbohydrate portions), the blood sugar response and the GI are highly correlated (see Figure I.3). Among other criticisms are ‘too complex’, ‘too many variables’, a ‘burden’ on people with diabetes, ‘restricts food variety’, and too many foods with unknown GI values. In Australia we have not found this to be the case: the GI concept can be simplified and people with diabetes have welcomed it.

Another concern with the GI is that the insulin response to a food may be more relevant than the glycaemic response. Our laboratory is one of the few that have measured both responses concurrently and, in general, we find that insulin responses in healthy people tend to follow the rank order of the glycaemic responses. High-protein and high-fat foods, however, stimulate greater insulin responses than predicted by the level of glycemia. More exaggerated insulin responses are seen when people with underlying insulin resistance consume high-GI foods. Hyperinsulinaemia has recently been shown to be an independent risk factor for coronary heart disease. In our study of insulin responses to 1000-kilojoule portions of common foods, ordinary bread showed among the highest scores of any of the foods tested. Thus, an insulin index of foods may eventually be needed to supplement GI tables.

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**Figure I.3** The glycaemic response to a 1000-kilojoule serve of a food correlates with the published glycaemic index based on 50-gram carbohydrate portions.
THE GLYCAEMIC INDEX IN DIETARY GUIDELINES

At present no country explicitly recommends low-GI foods to the general public as part of its dietary guidelines. Nevertheless, the clear intention of the FAO–WHO Consultation\(^1\) is that the GI be applied to dietary guidelines. Specifically, the document recommends as follows:

- that, for healthy food choices, both the chemical composition and physiologic effects of food carbohydrates be considered, because the chemical nature of the carbohydrate in foods does not completely describe their physiological effects;
- that, in making food choices, the glycaemic index be used as a useful indicator of the impact of foods on the integrated blood glucose response;
- that the glycaemic index be used to compare foods of similar composition within food groups;
- that published glycaemic response data be supplemented with tests of local foods as normally prepared;
- that ‘the bulk of carbohydrate-containing foods consumed be those rich in nonstarch polysaccharides and with a low glycaemic index’.

In the Australasian region there are particularly important reasons for promoting low-GI foods in dietary guidelines. One such reason is that many people of Indigenous Australian, Asian or Pacific Island origin are at increased risk of developing non–insulin dependent diabetes mellitus and show greater insulin resistance than Caucasians, even when young, lean and healthy.\(^{33,34}\) This insulin resistance is thought to be of genetic origin and may be related to dietary selection pressures during evolution.\(^{35}\) Consumption of high-GI foods therefore results in more exaggerated glycaemic and insulin responses, which may lead to worsening insulin resistance and non–insulin dependent diabetes mellitus in susceptible individuals.\(^{36}\)

Another reason is that the trend to adopt Western food habits with increasing economic development will result in displacement of staple low-GI foods such as high-amylose rice or root vegetables with high-GI foods such as bread and potatoes. The dietary guidelines as they stand encourage the consumption of bread and potatoes, especially those that are high in fibre. But potatoes show a glycaemic response almost as high as a similar glucose load, and wholemeal bread is not far behind. A recent large-scale study of 10 000 people in China provides support for discouraging the adoption of wheat-flour products.\(^{37}\) In this study, population groups relying on wheat flour as the source of carbohydrate were found to have higher levels of sex hormone–binding globulin and other risk factors for the metabolic syndrome than groups that had rice as the staple carbohydrate. The authors speculated that the difference related to the lower glycaemic and insulin response to the rice diet compared with the wheat diet. But rices are not all the same: some are high GI and some are low, depending on
genotype. There is a need therefore to recommend rice varieties with a low GI; for example, basmati and doongara. This advice may be more important than recommending brown rice or wholemeal wheat products simply because of their high fibre content.

The GI concept has been widely adopted in Australia, New Zealand, South Africa, France, Canada, the United Kingdom and other parts of Europe as a means of classifying carbohydrate foods and specifying which foods are optimal for diabetes control. The Diabetes and Nutrition Study Group of the European Association for the Study of Diabetes notes that the most beneficial foods are those that are high in soluble fibre (legumes, lentils, some fruits, oats and barley), all of which are low-GI foods. The GI approach in diabetes management remains particularly controversial in the United States, where it is perceived as too complex for both health professionals and lay people and not worth the trouble. American starchy foods, in general, have a high GI, so following a low-GI diet may indeed restrict food choices. In practice, however, the GI approach is not complex, and it is very amenable to simple ‘take-home’ messages.

In Australia many breads and breakfast cereals have been identified as low GI, thus widening food choices. Because these two food groups (breads and breakfast cereals) make a large contribution to the glycaemic load, low-GI alternatives are especially useful. In practice, a system of ‘this for that’, as shown in Table I.2, makes lowering the GI of the diet simple and ‘user friendly’. There is no need for complicated mathematical calculations aimed at determining the GI of mixed meals. Furthermore, it is not necessary to avoid all high-GI foods because exchanging only half the carbohydrate from high to low GI will lower the GI of the whole diet by about 15 units, which is sufficient to bring about clinical improvements in glucose metabolism in people with diabetes. Widening the current limited choice of low-GI foods will, however, increase food variety and should be a goal for the food industry in the next decade.

<table>
<thead>
<tr>
<th>High-GI food</th>
<th>Low-GI alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread, wholemeal or white</td>
<td>Bread containing a high proportion of whole grains</td>
</tr>
<tr>
<td>High-GI rices (low amylose)—for example, sticky rice,</td>
<td>Low-GI rices (high amylose)—for example, basmati</td>
</tr>
<tr>
<td>waxy rice</td>
<td></td>
</tr>
<tr>
<td>Processed breakfast cereal</td>
<td>Unrefined cereal such as oats (muesli or porridge)</td>
</tr>
<tr>
<td></td>
<td>or processed cereals with a low GI factor—for example,</td>
</tr>
<tr>
<td></td>
<td>Kelloggs All Bran, Guardian</td>
</tr>
<tr>
<td>Plain biscuits and crackers</td>
<td>Biscuits made with dried fruit and whole grains such as oats</td>
</tr>
<tr>
<td>Cakes and muffins</td>
<td>Look for those made with fruit, oats, whole grains</td>
</tr>
<tr>
<td>Tropical fruits such as bananas</td>
<td>Temperate-climate fruits such as apples and stone fruit</td>
</tr>
<tr>
<td>Potato</td>
<td>Pasta or legumes</td>
</tr>
</tbody>
</table>

Note: Changes in the type of bread and breakfast cereal have the biggest impact in the Western diet. Changes in the type of rice are more important in Asian diets.
What is the best way to integrate the GI into nutrition education? One approach we have found useful is to teach people with diabetes that all high-carbohydrate, low-fat foods are ‘good’, but some are ‘better’ and some are ‘best’, making the distinction on the basis of GI and fibre content (see Table I.3). All high-carbohydrate, low-fat foods may be regarded as useful or ‘good’ because carbohydrate is quantitatively the most limiting nutrient in Western diets—we eat only 40–45 per cent of our energy as carbohydrate, instead of the recommended 55 per cent—but some of them may be ‘better’ or ‘best’, depending on the context. Kellogg Australia has produced a coloured pyramid-style food guide in which the largest component (‘eat most’) is divided into two, the bigger segment being low-GI, high-carbohydrate, low-fat foods, the smaller segment being the high-GI counterparts. The message is simple and effective.

**Table I.3** The ‘good, better, best’ system of choosing high carbohydrate foods

<table>
<thead>
<tr>
<th>Good</th>
<th>Better</th>
<th>Best</th>
</tr>
</thead>
<tbody>
<tr>
<td>White bread</td>
<td>Wholemeal bread</td>
<td>Grainy breads (high kibbled grain:flour ratio)</td>
</tr>
<tr>
<td>Soft drink</td>
<td>Fruit juice</td>
<td>Piece of fruit</td>
</tr>
<tr>
<td>Potatoes</td>
<td>Rice (high amylose)</td>
<td>Pasta</td>
</tr>
</tbody>
</table>

An important finding of GI research is that foods containing refined sugars often have less glycaemic impact than starchy staples such as bread. Furthermore, a moderate intake of refined sugars (10–12 per cent of energy) is not associated with obesity, micronutrient deficiency or undesirable effects on blood lipids or insulin sensitivity. Indeed, even higher intakes may be advisable for active individuals with high energy needs because low-GI starchy foods are often bulky and too satiating. Low sugar intake has been associated with higher intake of saturated fat, higher body weight and a diet with a higher GI. Early humans ate large quantities of honey, a nutritionally equivalent food source. Although controversial, it is my opinion that sugar should be removed from the dietary guidelines and replaced with advice about low-GI food choices. Concerns about dental caries can be better dealt with by advice such as ‘brush your teeth everyday with flouridated toothpaste’.

We need to emphasise that all carbohydrate foods (even those containing refined sugars) are good, that coarsely ground flours are preferable to fine flours (whether white or wholemeal), and that the consumption of slowly digested carbohydrate foods such as grainy breads, pasta, low-GI breakfast cereals and high-amylose varieties of rice is particularly beneficial. Fruits that have a low GI and are more acidic will help to lower the overall GI. The use of salad dressings containing vinegar and unsaturated oils should be encouraged because this results in further reductions in glycaemic and insulin responses.

40
41
42
43
44
45
CONCLUSION

The mounting evidence that the high GI of the modern diet carries some health risk means that dietary guidelines need to be updated. The FAO–WHO Consultation recommends that ‘the bulk of carbohydrate foods be those rich in dietary fibre (non-starch polysaccharide) and with a low glycaemic index’. To lower the GI, we need to concentrate on reducing the GI of starchy foods rather than finding alternatives to sugar. The food industry has the ability to lower the GI of many carbohydrate foods in a number of ways:

- by keeping foods as much as possible in their natural physical state;
- by reducing the degree of gelatinisation through increasing particle size and lowering temperature and pressure during processing;
- by prolonging fermentation time in bread making;
- by increasing the amylose:amylopectin ratio in cereal grains through genetic manipulation;
- by increasing acidity through the addition of approved food acids and sour-dough fermentation;
- by increasing viscosity through the addition of viscous fibres such as psyllium;
- by using amylase inhibitors in small amounts in starchy foods.

The real challenge to the food industry is to produce new and palatable low-GI foods because there is no doubt many people see some of the current low-GI foods (beans and ‘birdseed’ breads) as unacceptable. This will not only have public health ramifications; it will also give astute food manufacturers a marketing advantage in years to come.

The rewriting of nutrition recommendations with GI in mind will be painful for some. Bread and potatoes have been the ‘staff of life’ for many people for a long time. But we would do well to remember that the production of fine flours and domesticated varieties of cereals, fruits and vegetables is a product of the past few thousand years. Improvements in palatability inadvertently corresponded with increases in glycemia. For most of human evolution—that is, for over 2 million years—cereal foods were absent, and when they were introduced 10 000 years ago they were in a coarse, low-GI (stoneground) form. Foods producing high glycaemic and insulin responses were not likely to have been available in large amounts until relatively recently. It should not be surprising therefore to find that many people’s glucose homeostatic mechanisms will be exceeded by a lifetime intake of high-GI carbohydrate foods.

REFERENCES


## ATTACHMENT I.1 GLYCAEMIC INDEX VALUES OF SELECTED CEREAL FOODS

<table>
<thead>
<tr>
<th>Cereal food</th>
<th>Glycaemic index (glucose=100)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grains</strong></td>
<td></td>
</tr>
<tr>
<td>Pearl barley</td>
<td>25</td>
</tr>
<tr>
<td>Rye kernels</td>
<td>34</td>
</tr>
<tr>
<td>Wheat kernels</td>
<td>41</td>
</tr>
<tr>
<td>Buckwheat</td>
<td>54</td>
</tr>
<tr>
<td>Brown rice</td>
<td>55</td>
</tr>
<tr>
<td>White rice, high amylose</td>
<td>59</td>
</tr>
<tr>
<td>Couscous</td>
<td>65</td>
</tr>
<tr>
<td>White rice, low amylose</td>
<td>88</td>
</tr>
<tr>
<td>Instant rice</td>
<td>91</td>
</tr>
<tr>
<td><strong>Breads</strong></td>
<td></td>
</tr>
<tr>
<td>80% barley kernel</td>
<td>34</td>
</tr>
<tr>
<td>50% kibbled grain</td>
<td>43</td>
</tr>
<tr>
<td>Pumpernickel</td>
<td>50</td>
</tr>
<tr>
<td>Rye</td>
<td>65</td>
</tr>
<tr>
<td>High-fibre white</td>
<td>68</td>
</tr>
<tr>
<td>Wholemeal</td>
<td>69</td>
</tr>
<tr>
<td>White</td>
<td>70</td>
</tr>
<tr>
<td><strong>Breakfast cereals</strong></td>
<td></td>
</tr>
<tr>
<td>All-Bran</td>
<td>42</td>
</tr>
<tr>
<td>Oat bran</td>
<td>55</td>
</tr>
<tr>
<td>Oat porridge</td>
<td>61</td>
</tr>
<tr>
<td>Muesli</td>
<td>66</td>
</tr>
<tr>
<td>Wheat biscuits</td>
<td>70</td>
</tr>
<tr>
<td>Cornflakes</td>
<td>84</td>
</tr>
<tr>
<td>Puffed rice</td>
<td>88</td>
</tr>
<tr>
<td><strong>Crackers</strong></td>
<td></td>
</tr>
<tr>
<td>Rye crispbreads</td>
<td>65</td>
</tr>
<tr>
<td>Water crackers</td>
<td>72</td>
</tr>
<tr>
<td>Rice cakes</td>
<td>91</td>
</tr>
<tr>
<td><strong>Pastas</strong></td>
<td></td>
</tr>
<tr>
<td>Wholemeal spaghetti</td>
<td>37</td>
</tr>
<tr>
<td>White spaghetti</td>
<td>41</td>
</tr>
<tr>
<td>Macaroni</td>
<td>45</td>
</tr>
</tbody>
</table>

APPENDIX J  FLUID INTAKE PYRAMID

The fluid intake pyramid is based on the recommendation to consume approximately 2 litres of fluid each day. The foundation of the pyramid is water, since this is the preferred drink for older Australians. Drinking smaller amounts from other areas of the pyramid will provide an ample intake of fluid that is high in antioxidants, adequate in calcium, low in saturated fat, and with no empty calories.

### Australian Nutrition Screening Initiative

#### 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 in the box. Total your nutritional score.

<table>
<thead>
<tr>
<th>Statement</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have an illness or condition that made me change the kind and/or amount of food I eat.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>I eat at least 3 meals per day.</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>I eat fruit or vegetables most days.</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>I eat dairy products most days.</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>I have 3 or more glasses of beer, wine or spirits almost every day.</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>I have 6 to 8 cups of fluids (e.g. water, juice, tea or coffee) most days.</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>I have teeth, mouth or swallowing problems that make it hard for me to eat.</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>I always have enough money to buy food.</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>I eat alone most of the time.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>I take 3 or more different prescribed or over the counter medicines every day.</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Without wanting to, I have lost or gained 5 kg in the last 6 months.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>I am always able to shop, cook and/or feed myself.</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

**TOTAL**

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

- **0-3** Good! Recheck your nutritional score in 6 months.
- **4-5** You are at moderate nutritional risk. See what can be done to improve your eating habits and lifestyle. Your Council on the Ageing or health care professionals can help. Recheck your nutritional score in 3 months.
- **6 or more** You are at high nutritional risk. Bring this checklist the next time you see your doctor, dietician 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.

Remember that warning signs suggest risk, but do not represent diagnosis of any condition. Turn the page to learn more about the Warning Signs of poor nutritional health.
AUSTRALIAN NUTRITION SCREENING INITIATIVE (CONT.)

The Nutrition Checklist for the older person is based on the Warning Signs described below. Use the word DETERMINE to remind you of the Warning Signs.

DISEASE
Any disease, illness or chronic condition which causes you to change the way you eat, or makes it hard for you to eat, puts your nutritional health at risk. Four out of five adults have chronic diseases that are affected by diet. Confusion or memory loss that keeps getting worse affects one in twenty older adults over 65 and one in five over 85 years. This can make it hard to remember what, when or if you’ve eaten. Feeling sad or depressed, which happens to about one in seven older Australians, can cause big changes in appetite, digestion, energy level, weight and well-being.

EATING POORLY
Eating too little and eating too much both lead to poor health. Eating the same foods day after day or not eating fruit, vegetables, and milk products daily also cause poor nutritional health. In a survey in 1992, 14% of older adults aged 70 and over stated that their appetite was only fair, poor or very poor in the last month. Nearly 10% of older adults do not eat the recommended amount of fruit and vegetables. One in seven older adults drink too much alcohol. Many health problems become worse if you drink more than one or two alcoholic drinks per day.

TOOTH LOSS/MOUTH PAIN
A healthy mouth, teeth and gums are needed to eat. Missing, loose or rotten teeth or dentures which don’t fit well or cause mouth sores make it hard to eat. In a 1992 survey 43% of older adults aged over 70 stated that they had eating problems caused by ill fitting dentures and missing teeth.

ECONOMIC HARDSHIP
About three quarters of people over 65 are dependant on pensions and of those two thirds are full pensioners. A single pensioner earns $9,360* per year which is only a quarter of average weekly earnings and marginally above the poverty line. On such a low income, it is hard to buy the food you need to stay healthy.

EDUCED SOCIAL CONTACT
Over one third of all older people live alone. While it is recognized that you may have social reasons for eating alone, being with people daily has a positive effect on morale, well-being and eating.

MULTIPLE MEDICINES
Many older Australians must take medicines for health problems. Almost one third of older Australians take 3 or more daily. Growing old may change the way we respond to drugs. The more medicines you take, the greater the chance for side effects such as increased or decreased appetite, change in taste, constipation, weakness, drowsiness, diarrhoea, nausea, and others. Vitamins or minerals when taken in large doses act like drugs and can cause harm. Alert your doctor to everything you take.

INVOLUNTARY WEIGHT LOSS/GAIN
Losing or gaining a lot of weight when you are not trying to do so is an important warning sign that must not be ignored. Being overweight or underweight also increases your chance of poor health.

EEDS ASSISTANCE IN SELF CARE
Although most older people are able to eat, one in ten over 65 have trouble walking, shopping, buying and cooking food, especially as they get older.

OLDER YEARS ABOVE AGE 80
Most older people lead full and productive lives. But as age increases, risk of frailty and health problems increase. Checking your nutritional health regularly makes good sense.

The Australian Nutrition Screening Initiative, PO Box 1363, Neutral Bay, NSW 2089.
The Australian Nutrition Screening Initiative is funded in part by a grant from Abbott Australi
CHECKLIST OF NEEDS ASSESSMENT FACTORS WHICH ARE RELATED TO NUTRITIONAL RISK
Date:.................................................................

- Has food run out in the past week with no $ to get more?
- Less than $30 for food for each adult person every week?
- Social problems?
- Personal and food hygiene problems?
- Mental health?
- More than three different medications?
- Nausea and vomiting, gastritis?
- Diarrhoea? Constipation?
- Regurgitation? Rumination?
- Incontinence?
- Breathing problems?
- Medical problems?
- Alcoholism? Substance abuse?
- Irregular meals or less than 3 meals a day?
- Doesn't take 1 2 3 4 5+ food plan most days (elderly)?
- Doesn't take 1 2 3 4 5+ food plan most days (younger adults)
- Omitted to have one or more major food groups yesterday?
- Excessive use of sweet or savoury foods
- 2+ alcoholic drinks daily?
- Housebound? No direct skin exposure to sunlight?
- Highly dependent person needing food and fluid texture modification?
- Tube (enteral) feeding is required?
- Eats inedible objects eg dirt, soap (pica)?
- Inappropriate and challenging behaviours which involve food?
- Unable to access o storage and preparation area?
- Rummaging, foraging, begging or stealing food?

• YES to one or more questions means that nutritional risk exists.
• Nutritional risk increases when the person is affected by an increasing number of general needs assessment factors.
• In particular, deterioration in health and loss of independence can result from undernutrition and perhaps malnutrition.
• Try TWO weeks of simple intervention strategies (less time if severe weight loss). If no response refer to a specialist.
• Monitoring at monthly intervals (or more frequently) is then recommended by one of the team members, to ensure that the most effective intervention has been implemented.

*Victorian Department of Human Services and the Dietitians Association of Australia (Victoria) Identifying & planning assistance for home based adults who are nutritionally at risk (1998)
Obvious underweight – frailty?

- The underweight client has little body energy and nutrient reserves for use in times of emergency such as illness and/or reduced food and fluid intake.
- This is even more critical to health if underweight is not the normal situation.
- Even a short bout of poor food intake and/or increased need for nourishment can precipitate severe weight loss in the vulnerable person.
- Prevention of underweight is highly desirable.

Unintentional weight loss?

- When a person loses a lot of weight without trying (say 5 kg in less than six months), it is a serious sign of decline which is more rapid and worse if the person was underweight before the weight loss began.
- Severe weight loss is a factor clearly associated with relatively higher rates of morbidity and mortality. It is not a sign to be ignored.
- Review food intake and implement simple intervention strategies.
- Always consider referral to a specialist.

Reduced appetite or food and fluid intake?

- In the underweight person, more than one or two days of reduced food and fluid intake can rapidly lead to severe weight loss.
- Many medical conditions affect food intake and the need for food and can be risk factors for malnutrition.
- Loss of appetite can sometimes be related to a change in medication.

Mouth or teeth or swallowing problem?

- It is very difficult to ingest enough food if teeth or dentures are loose, broken or missing, or if the tongue or gums are sore, or if there are any swallowing difficulties.
- As a result of these problems, major food groups may be omitted and the person may avoid socialisation.
- Severe deficiencies of some of the micronutrients can actually cause mouth problems.

Follows a special diet?

- A person is put at nutritional risk by any acute or chronic illness which causes change in their usual diet.
- Nobody should be on a modified or special diet, unless the aim and benefit of the diet is clearly known to them.
- If a special diet is required for specific treatment, then it becomes very important to follow it properly.

Unable to shop for food?

- The vulnerable person may only buy foods which are easy to carry or easy to prepare and cook.
- A person who is unable to shop may not eat enough because of reduced food choice (no ideas or prompts), and a reduced level of independence.

Unable to prepare food?

- A person may not be physically capable of preparing and cooking food.
- This lack of independence can have serious effects on their intake.
- There may also be problems organising their food into nourishing meals and snacks, and possibly dislike of foods and fluids.

Unable to feed self?

- A person who requires feeding may not eat enough.
- This may be because of embarrassment, or insufficient assistance and care, or not enough time to eat and drink.
- It might be due to inappropriate presentation and types of items offered, or dislike of the foods and fluids offered.

- A good body weight is a protective factor in the vulnerable person.
- Body fat provides an energy store in times of stress (infections, trauma) or reduced appetite and food or fluid intake or unintentional weight loss.
- An overweight person who is on a very restricted diet is at risk of muscle wasting, falls, infection and illness.
- If weight loss is essential, always refer to a specialist.

*Victorian Department of Human Services and the Dietitians Association of Australia (Victoria) Identifying & planning assistance for home-based adults who are nutritionally at risk (1998)*
Enjoy a variety of foods every day
## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMR</td>
<td>basal metabolic rate</td>
</tr>
<tr>
<td>BMI</td>
<td>body mass index</td>
</tr>
<tr>
<td>CARE</td>
<td>Cholesterol and Recurrent Events Trial</td>
</tr>
<tr>
<td>CHD</td>
<td>Coronary heart disease</td>
</tr>
<tr>
<td>FAO</td>
<td>United Nations Food and Agriculture Organization</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard analysis and critical control point system</td>
</tr>
<tr>
<td>LDL-cholesterol</td>
<td>Low density lipoprotein cholesterol</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NIDDM</td>
<td>Non-insulin dependent diabetes mellitus</td>
</tr>
<tr>
<td>RDI</td>
<td>recommended dietary intake (Australia)</td>
</tr>
<tr>
<td>TAIM</td>
<td>Trials of Antihypertensive Intervention and Management study</td>
</tr>
<tr>
<td>UNU</td>
<td>United Nations University</td>
</tr>
<tr>
<td>WHO</td>
<td>Word Health Organisation</td>
</tr>
</tbody>
</table>
THE NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

The National Health and Medical Research Council (NHMRC) is a statutory authority within the portfolio of the Commonwealth Minister for Health and Aged care, established by the National Health and Medical Research Council Act 1992. The NHMRC advises the Australian community and Commonwealth; State and Territory Governments on standards of individual and public health, and supports research to improve those standards.

The NHMRC advises the Commonwealth Government on the funding of medical and public health research and training in Australia and supports many of the medical advances made by Australians.

The NHMRC also develops guidelines and standards for the ethical conduct of health and medical research.

The Council comprises nominees of Commonwealth, State and Territory health authorities, professional and scientific colleges and associations, unions, universities, business, consumer groups, welfare organisations, conservation groups and the Aboriginal and Torres Strait Islander Commission.

The Council meets four times a year to consider and make decisions on reports prepared by committees and working parties following wide consultation on the issue under consideration.

A regular publishing program ensures that Council's recommendations are widely available to governments, the community, scientific, industrial and educational groups.

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