

Food and Nutrition Guidelines for Healthy Older People

A background paper

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MANATŪ HAUORA

Foreword

Nutrition deserves special attention as people reach older age and is essential for good health. Healthy ageing is associated with physiological, cognitive, social and lifestyle changes that influence dietary intakes and nutritional status.

This policy advice is aimed at the majority of older New Zealanders who largely maintain physical, mental and social health and independence through most of their lifespan. However, even healthy older people are likely to have experienced some decline in physical function and with advancing age may experience a loss of independence. This background paper provides advice that recognises the higher burden of chronic disease that older people experience and incorporates advice on healthy eating and physically activity for those who are frail.

The paper brings together all the key areas of food and nutrition affecting the health of older people. It is intended for use by health practitioners, educators and caregivers, so they can provide sound advice and support to older people and their families in regard to maintaining a healthy lifestyle.

Food and Nutrition Guidelines for Healthy Older People: A background paper supports three of the key priorities in the New Zealand Health Strategy (Minister of Health 2000). These three priorities are: to improve nutrition, reduce obesity, and increase the level of physical activity. This paper is part of the series of population group-specific background papers that ensure food and nutrition messages are based on sound information.

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Susan Cook and Mary-Ann Carter from the Nutrition and Physical Activity Policy team at the Ministry of Health led the preparation of this paper.

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Introduction

Food and Nutrition Guidelines for Healthy Older Adults: A background paper is one of a series of papers aimed at specific population groups. The series covers healthy infants and toddlers, children, adolescents, adults, pregnant and breastfeeding women, and older people. This paper has been written to:

- provide up-to-date policy advice on the nutrition, physical activity, lifestyle and environmental determinants for achieving and maintaining the best possible health in healthy older people
- provide reliable and consistent information to use as a basis for programmes and education to support healthy older people (eg, District Health Board and regional public health programmes, and technical background for health education resources for healthy older people)
- guide and support health practitioners (including dietitians, nutritionists, doctors, nurses, primary health care providers, health promoters and physical activity providers) in the practice of healthy nutrition and physical activity, and provide them with a detailed source of information
- identify health inequalities relating to nutrition and physical activity so that support and education for healthy older adults can be targeted to reduce inequalities in health between population groups.

The policy advice in this paper is aimed at the majority of older New Zealanders who largely maintain physical, mental and social health and independence through most of their life span. With an age-associated decline in physical and mental functioning, and the social and lifestyle changes that are experienced with advancing age, it does become very difficult to separate healthy ageing from ill health. Even healthy older people are likely to have experienced some decline in optimal health or functioning. In recognition that the older population is more likely to experience some loss of health and independence, a part on 'Frailty in Older People' has been included. This part may be more relevant to those older people who require regular support to maintain their lifestyle in the community.

This paper has not been written for use in the clinical management of older adults with diagnosed disease or impairment, or for those older adults who are dependent on support from residential care facilities or programmes. Dietitians should adapt this advice if applying it to older people with specific nutritional and food requirements. Any work or advice resulting from the use of this background paper must also take into account the complex interactions of a specific population's health status and needs, lifestyle, and social and environmental factors to facilitate the best possible health for the older population. This paper provides detailed information for health practitioners. Educational resources on nutritional health are intended to be the primary means of communicating policy advice to the public.

Policy context

Food and nutrition guidelines for the New Zealand population are produced in the context of other policies and strategies, both specific to New Zealand and with international reach. This context includes work in the areas of Māori and Pacific health, reducing inequalities, and positive ageing, as well as World Health Organization (WHO) policies and plans and World Health Assembly resolutions.

New Zealand context

The New Zealand policy context for these guidelines is summarised in Figure 1. Some of the more significant plans and strategies are discussed in the following text.

Figure 1: Policy context for the *Food and Nutrition Guidelines for Healthy Older People: A background paper*



Most of these documents are available from:

- the Ministry of Health website <http://www.moh.govt.nz>
- Wickliffe Limited, PO Box 932, Dunedin; telephone: (03) 479 0979 or (04) 496 2277; email: moh@wickliffe.co.nz

He Korowai Oranga: Māori Health Strategy

He Korowai Oranga guides the health and disability sector's response towards improving Māori health and reducing inequalities for Māori (Minister of Health and Associate Minister of Health 2002). The strategy's framework helps to ensure interventions, services and programmes are accessible, effective and appropriate for Māori. *He Korowai Oranga* works towards this outcome by promoting a vision of whānau ora, whereby whānau are supported to achieve maximum health and wellbeing. The key pathways to achieving whānau ora are:

- whānau, hapū, iwi and community development
- Māori participation
- effective service delivery
- working across sectors.

If actions to promote and support nutrition and physical activity are to be implemented in a meaningful and sustainable way for Māori, it is important that outcomes, actions, interventions, programmes and services are aligned with these four pathways.

To view or download *He Korowai Oranga: Māori Health Strategy*, visit the Māori Health website <http://www.maorihealth.govt.nz>

Pacific Health and Disability Action Plan

The Ministry of Health has recently published *'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014* (Minister of Health and Minister of Pacific Island Affairs 2010). The new plan identifies what the Ministry will do, alongside others in the sector, to improve health services and health outcomes for Pacific peoples. It builds on work already completed under the 2002 Pacific Health and Disability Action Plan and the 2008 Joint Action Plan for the Ministries of Health and Pacific Island Affairs.

To view or download *'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014*, visit the Ministry of Health's website <http://www.moh.govt.nz/pacific>

Health Equity Assessment Tool

Reducing inequalities for different groups of New Zealanders is a key priority. Inequalities in health exist among different socioeconomic groups, different ethnic groups, and people living in different geographic areas, as well as between the genders. People living in the most deprived circumstances have been shown to have greater exposure to health risks, reduced access to health and disability services, and poorer health outcomes.

Health inequalities in New Zealand are greatest between Māori and those who are neither Māori nor Pacific peoples, and between Pacific peoples and those who are neither Pacific nor Māori. Programmes, resources, education and support should be planned and evaluated using the reducing inequalities tools: the *Intervention Framework* (Ministry of Health 2002c); the *Health Equity Assessment Tool* (HEAT); and the *Whānau Ora Health Impact Assessment* (Ministry of Health 2007c) (see Appendix 1).

The New Zealand Health Strategy and the Health of Older People Strategy

The *New Zealand Health Strategy* (Minister of Health 2000) sets the direction and priorities for the health system. *Food and Nutrition Guidelines for Healthy Older People: A background paper* provides a policy base for implementing actions to achieve six of the Strategy's objectives: improve nutrition, increase physical activity, reduce obesity, reduce the incidence and impact of cancer, reduce the incidence and impact of cardiovascular disease, and reduce the incidence and impact of diabetes (Ministry of Health 2003a). The 13 priority population health objectives are outlined in Appendix 2.

Priorities from the *New Zealand Health Strategy*, the *New Zealand Positive Ageing Strategy* (Ministry of Social Policy 2001) and the *New Zealand Disability Strategy* (Minister for Disability Issues 2001) are addressed in the *Health of Older People Strategy* (Ministry of Health 2002b). The *Health of Older People Strategy* identifies eight objectives to achieve the vision that 'older people participate

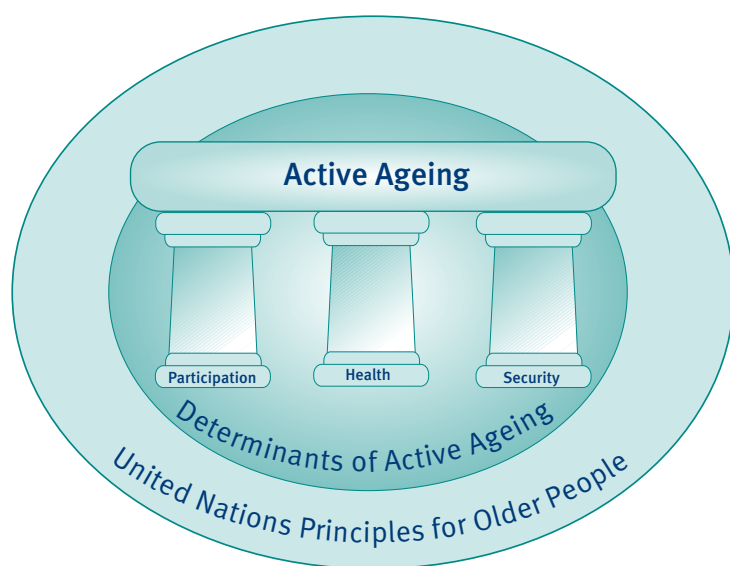
to their fullest ability in decisions about their health and wellbeing and in family, whānau and community life'. The policy context for the *Health of Older People Strategy* is illustrated in Appendix 3. *Food and Nutrition Guidelines for Healthy Older People: A background paper* provides a policy base for contributing to objective 5 of the *Health of Older People Strategy*: population-based health initiatives and programmes will promote health and wellbeing in older age.

International context

In 2002 the WHO's Ageing and Life Course Programme released *Active Ageing: A policy framework* as a contribution to the Second United Nations World Assembly on Ageing. This document was intended to inform discussion and the formulation of action plans that promote healthy and active ageing (WHO 2002a).

Active ageing is defined as 'the process of optimising opportunities for populations and individuals for health, participation and security in order to enhance quality of life as people age'. The policy framework requires action on three basic pillars: health, participation and security. The framework is guided by the United Nations' Principles for Older People, which are: independence, participation, care, self-fulfilment and dignity.

Figure 2: The three pillars of the WHO active ageing policy framework



Source: WHO 2002a

Older people in New Zealand

The 'older' population in this document is defined as those aged 65 years and older. This is consistent with how statistics in New Zealand and overseas are reported. It is also consistent with the age of entitlement to New Zealand Superannuation and the age at which people are eligible for many health services, or at which health policies are targeted (Ministry of Health 2006c).

Due to lower life expectancy and earlier experience of age-related illness among Māori, an age group of 50+ is sometimes used for comparison of statistics for older Māori (Ministry of Health 2006c). Some of the 1997 National Nutrition Survey (NNS97) data for Māori and Pacific peoples are presented as 45 years and over due to small sample sizes in the older age groups.

People aged 65 years and over make up a large and growing proportion of New Zealand’s population. In the 2006 Census of Population and Dwellings, people aged 65 years and over numbered 495,606 and made up 12.3 percent of the total usually resident population. Those aged 85 years and over numbered 56,667 and made up 1.4 percent of the population (Statistics New Zealand 2007a).

Table 1: Number and percentage of people aged 65 years and over in the 2006 Census of Population and Dwellings, by age group

	Age in years						Population aged 65 years and over
	65–69	70–74	75–79	80–84	85–89	90+	
Number	148,545	116,934	101,214	72,240	38,124	18,543	495,606
Percentage of the total population	3.7	2.9	2.5	1.8	0.9	0.5	12.3

Source: Statistics New Zealand 2007a

In the 2006 Census, women aged 65 years and over outnumbered men by a ratio of 124 women to 100 men. Life expectancy for women is greater than for men, at 81.9 years compared with 77.9 years (Statistics New Zealand 2007a). As well, women have a longer *healthy* life expectancy than men (Ministry of Health 2006c). Because women live longer than men, the predominance of women and the gender differential increase with advancing age (Statistics New Zealand 2007a).

The Māori, Pacific and Asian populations in New Zealand are much younger than the total population. In 2006 the proportion of Māori aged 65 years and over was 4.1 percent, the proportion of Pacific peoples was 3.8 percent, and the proportion of Asian people was 4.5 percent. Eighty-three percent of New Zealand’s population aged 65 years and over in the 2006 Census belonged to the ‘European’ ethnic group, and the proportion of Europeans aged 65 years and over was 15.2 percent (Statistics New Zealand 2007a).

The number of New Zealanders aged 65 years and over is projected to rise significantly in the coming decades as the large baby boom cohorts enter this age group from 2011. The population aged 65 years and over is expected to double by 2051, when they will make up one-quarter or more of all New Zealand residents. Furthermore the average age of the older population is itself increasing because of declining mortality and an increasing life span at advanced ages. The median age of the population aged 65 years and over has increased by almost three years since the 1950s, and is currently 74.2 years (Statistics New Zealand 2007a).

Food and nutrition during older age

Nutrition deserves special attention as people reach older age because good nutrition is essential for good health. Healthy ageing is associated with a number of physiological, cognitive, social and lifestyle changes that influence dietary intakes and nutritional status. Access to and consumption of healthy food for older people is influenced by the wider determinants of health. These determinants include cultural, social, historical and economic factors. A life course approach to ageing recognises that the effects of these determinants accumulate throughout the life span and have an impact on health. This cumulative impact also means that interventions that act to modify the determinants of health are important at all stages of life.

In this document the information on nutrients and the issues surrounding them are presented individually, but where possible links have been made to highlight the holistic nature of diet and lifestyle. The higher burden of chronic disease and greater risk of malnutrition for older people are recognised. The recommended number of servings and the key points given in each section are used as the basis for the health education resource *Eating for Healthy Older People*. That resource is the primary means of communicating the advice to the public, with this background paper acting as a source of more detailed information.

Availability of Ministry of Health publications

All Ministry of Health publications can be downloaded from the Ministry's website <http://www.moh.govt.nz> or ordered from Wickliffe Limited – email: moh@wickliffe.co.nz

Part 1: The New Zealand Food and Nutrition Guidelines

1.1 The New Zealand Food and Nutrition Guideline Statements, including Physical Activity, for Healthy Older People

The Food and Nutrition Guideline Statements, including Physical Activity, for Healthy Older People are as follows.

1. Maintain a healthy body weight by eating well and by daily physical activity.
2. Eat well by including a variety of nutritious foods from each of the four major food groups each day.
 - Eat plenty of vegetables and fruit.
 - Eat plenty of breads and cereals, preferably wholegrain.
 - Have milk and milk products in your diet, preferably reduced or low-fat options.¹
 - Include lean meat, poultry, seafood, eggs, nuts, seeds or legumes.
3. Drink plenty of liquids each day, especially water.
4. Prepare foods or choose pre-prepared foods, drinks and snacks:
 - with minimal added fat, especially saturated fat
 - that are low in salt (if using salt, choose iodised salt)
 - with little added sugar (limit your intake of high-sugar foods).
5. Take opportunities to eat meals with other people.
6. Eat three meals every day. Nutritious snacks are recommended, especially for those who are underweight or have a small appetite.
7. Purchase, prepare, cook and store food to ensure food safety.
8. If choosing to drink alcohol, limit your intake.
9. Be physically active by taking every opportunity to move, and include 30 minutes of moderate-intensity physical activity on most if not all days of the week.

These Guideline Statements for Healthy Older People are based on the Food and Nutrition Guideline Statements for Healthy Adults. Readers are referred to the *New Zealand Food and Nutrition Guidelines for Healthy Adults: A background paper* (Ministry of Health 2003a) as a companion document to this paper for healthy older people.

¹ Frail older people may require full-fat or standard milk and milk products to meet their energy requirements.

1.2 Food groups and the nutrients they provide

The Food and Nutrition Guideline Statements refer to the four food groups. Table 2 gives a description of each food group, advice on the recommended number of servings, serving sizes, and a broad indication of the main nutrients supplied.

Table 2: The four food groups: advice on servings and nutrients for healthy older people

Food group	Advice	Serving size examples	Nutrients provided
Vegetables and fruit (includes fresh, frozen, canned and dried)	<p>Eat at least 5 servings per day: at least 3 servings of vegetables and at least 2 servings of fruit.</p> <p>If consumed, only 1 serving of juice or 1 serving of dried fruit counts towards the total number of servings for the day*</p>	<p>Vegetables</p> <p>1 medium potato, kūmara or similar-sized root vegetable such as yam or taro (135 g)</p> <p>½ cup cooked vegetable (eg, pūhā, water cress, silverbeet, parengo, corn, broccoli, bok choy) (50–80 g)</p> <p>½ cup salad or mixed vegetables (60 g)</p> <p>1 tomato (80 g)</p> <p>Fruit</p> <p>1 apple, pear, banana or orange (130 g)</p> <p>2 small apricots or plums (100 g)</p> <p>½ cup fresh fruit salad</p> <p>½ cup stewed fruit (fresh, frozen or canned) (135 g)</p> <p>1 cup fruit juice (250 ml)*</p> <p>2 tablespoons dried fruit*</p>	<p>Carbohydrates</p> <p>Dietary fibre</p> <p>Vitamins: especially folate, vitamin A (yellow and green vegetables), and vitamin C (dark green vegetables and most fruit, potatoes)</p> <p>Minerals: magnesium, potassium</p>
Breads and cereals (includes breakfast cereals, breads, grains, rice and pasta), preferably wholegrain	<p>Eat at least 6 servings per day (choose wholegrain breads and cereals)</p>	<p>1 bread roll (50 g)</p> <p>1 muffin (80 g)</p> <p>1 medium slice rēwena</p> <p>1 medium slice bread (26 g)</p> <p>1 cup cornflakes</p> <p>½ cup muesli (55 g)</p> <p>½ cup cooked porridge (130 g)</p> <p>1 cup cooked pasta (150 g)</p> <p>1 cup cooked rice (150 g)</p> <p>1 cup cassava or tapioca (150 g)</p> <p>2 plain sweet biscuits (14 g)</p>	<p>Carbohydrates</p> <p>Dietary fibre</p> <p>Protein</p> <p>Vitamins: all B group (except B₁₂), E (rich in wheatgerm)</p> <p>Minerals (particularly in wholegrain breads and cereals): magnesium, calcium, iron, zinc and selenium</p>

Food group	Advice	Serving size examples	Nutrients provided
Milk and milk products (includes milk, cheese, yoghurt and ice-cream) and alternatives	Eat at least 3 servings per day (choose low- or reduced-fat options)	1 large glass milk (250 ml) 1 pottle yoghurt (150 g) 2 slices cheese (40 g) 2 scoops ice-cream (140 g) 1 large glass calcium-fortified soy milk (250 ml)	Protein Fats: higher proportion of saturated than poly- or mono-unsaturated fats, especially in full-fat products Vitamins: riboflavin, B ₁₂ , A, D Minerals: especially calcium, phosphorus, zinc and iodine
Lean meat, poultry, seafood, eggs, nuts and seeds, and legumes	Eat at least 1 serving per day	2 slices cooked meat (approximately 100 g) ¾ cup mince or casserole (195 g) 1 egg (50 g) 1 medium fillet of fish cooked (100 g) ¾ cup cooked dried beans, peas or lentils (135 g) 2 drumsticks or 1 chicken leg (110 g) ½ cup nuts or seeds	Protein Fats: both visible and marbled in meat (mostly saturated fat, cholesterol); mostly unsaturated fats in seafood, nuts and seeds Vitamins: B ₁₂ , niacin, thiamin Minerals: iron, zinc, magnesium, copper, potassium, phosphorus and selenium Iodine: particularly in seafood and eggs

Source: Modified from Department of Health 1991

Note:

* The Ministry of Health recommends most vegetables and fruit consumed are fresh, frozen and/or canned. However, if vegetable or fruit juice or dried fruit is consumed, it is counted as only one serving in this food group.

Note that not all of the foods within each group will contain all the nutrients shown in Table 2. Three-day sample meal plans have been provided as examples of how these guidelines can be achieved (see Appendix 4).

1.3 Nutrient reference values for Australia and New Zealand

The nutrient reference values (NRVs) for Australia and New Zealand (NHMRC 2006) are used in this background paper for healthy older people.

The NRVs are presented as a set of recommendations with a range of levels, including the recommended dietary intake (RDI). Each of these recommendations is defined in Table 3.

Table 3: Definition of NRV recommendations

RDI (recommended dietary intake)	The average daily dietary intake level sufficient to meet the nutrient requirements of nearly all healthy individuals (97–98%) in a life stage / gender group.
EAR (estimated average requirement)	The median usual intake estimated to meet the requirements of half the healthy individuals in a life stage / gender group. This value is usually used for populations.
AI (adequate intake)	Where an EAR (and therefore an RDI) for the nutrient cannot be determined because of limited or inconsistent data, then an adequate intake is determined. The AI can be used as a goal for individual intake, but is based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group of apparently healthy people maintaining a defined nutritional state.
EER (estimated energy requirement)	The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of defined age, gender, weight, height and level of physical activity, consistent with good health. In children and pregnant and lactating women, the EER is taken to include the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.
UL (upper level of intake)	The highest level of continuing daily nutrient intake likely to pose no adverse health effects in almost all individuals.
AMDR (acceptable macronutrient distribution range)	An estimate of the range of intake for each macronutrient for individuals (expressed as percent contribution to energy) that would allow for an adequate intake of all the other nutrients while maximising general health outcomes.

Source: NHMRC 2006

Readers are referred to the *Nutrient Reference Values for Australia and New Zealand Including Recommended Dietary Intakes* (NHMRC 2006) for detailed information on how the NRV values were derived. The RDIs (or AIs where no RDI exists) for older people aged 51–70 years and aged over 70 years are given in Appendix 5.

Part 2: Ageing, Nutrition and Health

Nutrition-related health status is influenced by a number of changes associated with normal ageing. These include physiological, physical, psychological and cognitive, social and environmental changes. Maintaining functional health and quality of life is a major challenge for ageing populations (Khaw 2008), and views on what ‘health’ is might be different for older people compared with younger adults. The presence of some degree of decline in health and function is inevitable in older people, and chronic disease is prevalent. A healthy older person may therefore have some decline in health but still be considered relatively healthy.

2.1 Active ageing

New Zealand’s *Health of Older People Strategy* focuses on improving health status, promoting quality of life where health cannot be restored, reducing inequalities, and promoting participation in social life and in decisions about their care and support (Ministry of Health 2002b). This focus on achieving a positive experience of ageing aligns with the WHO’s concept of ‘active ageing’: a process for optimising opportunities for health, participation and security (WHO 2002a).

‘Health’ refers to physical, mental and social wellbeing, as expressed in the WHO definition of health. Therefore, in an active ageing framework, policies and programmes that promote mental health and social connections are as important as those that improve physical health status (WHO 2002a). Active ageing benefits both the individual and society: health is improved; independence is increased; older people contribute as workers, volunteers and providers of care and support; and fewer health care resources are used (WHO 2002b; American Dietetic Association 2005b).

2.2 A life course approach

A life course perspective on ageing recognises that older people are a heterogeneous group and that individual diversity – in terms of health status, functional ability, social connectedness, lifestyle factors and socioeconomic factors – tends to increase with age (WHO 2002a). Health status and nutrition status in older age are influenced by the cumulative effects of exposure to various risk factors and determinants of health throughout the life span. Interventions that act to modify health determinants are therefore important at all stages of life.

These interventions will be different for older people because the issues that older people face can be very different to those faced by younger adults. Chronic or non-communicable diseases are essentially diseases of later life: as people age, these diseases become the leading causes of morbidity, disability and mortality (WHO 2002a). There is increasing evidence that these diseases are not just determined by risk factors in middle age, but also by exposure to risk factors in childhood and youth, and, potentially, even during foetal development (British Nutrition Foundation 2009).

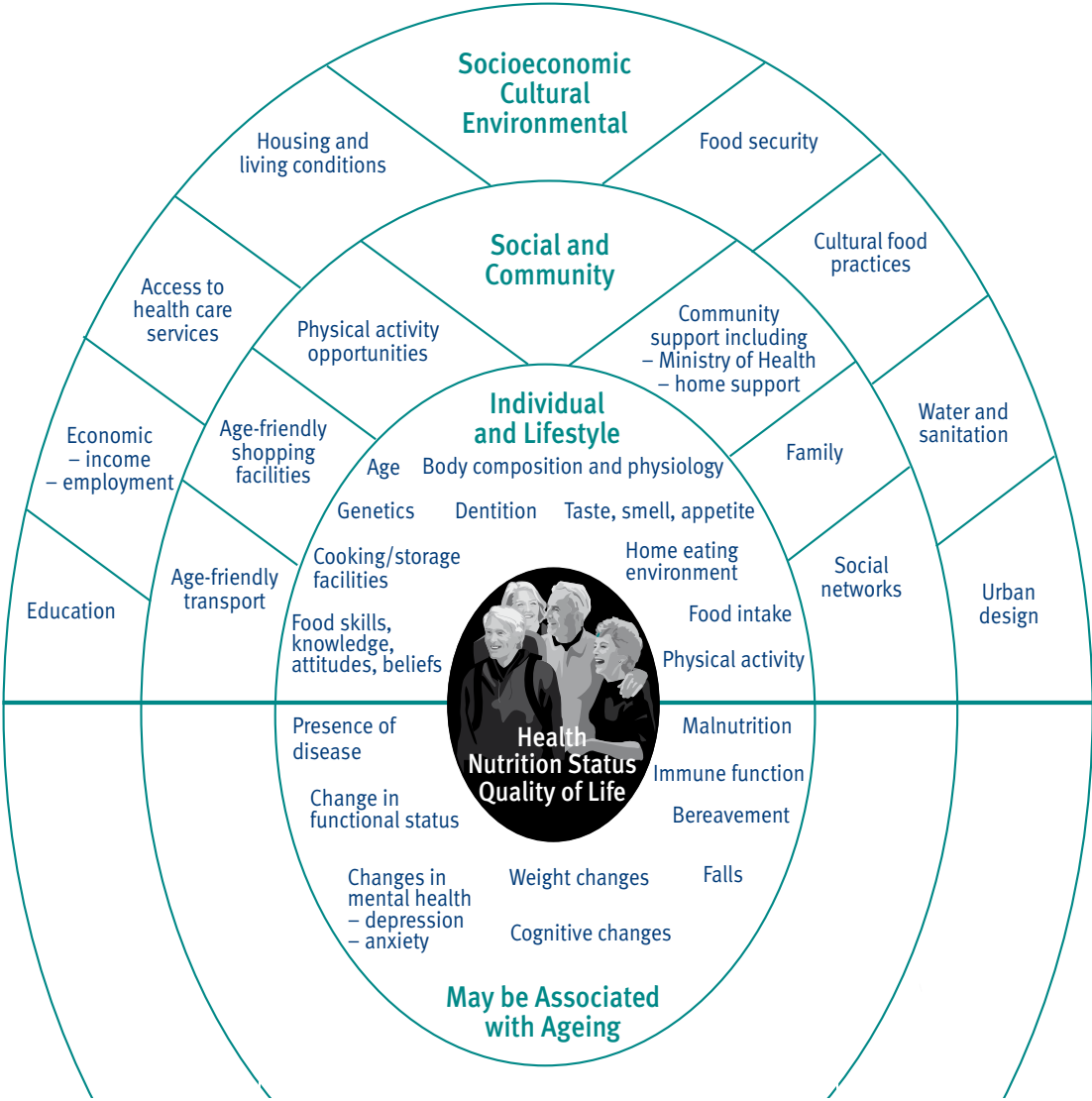
2.3 Ageing and health

It is increasingly accepted that the health of the population is primarily determined not by health services or individual lifestyle choices, but by social, cultural, economic and environmental influences (Public Health Advisory Committee 2005). Understanding the range of factors that contribute to the nutritional health of the older population can help to identify ways to develop policies and programmes that have a positive impact on the health and wellbeing of older people

(Public Health Advisory Committee 2005). Determinants that may affect the nutritional status of older people are shown in Figure 3.

Pathways to nutritional health in older people are complex and multi-factorial. Determinants of health may individually or in combination interact with the normal physiological and lifestyle changes associated with ageing to affect the nutritional status of older adults. The rates at which changes in health occur may depend on whether these factors occur individually or in unison.

Figure 3: Factors contributing to nutrition-related health



Source: Modified from the original diagram by Dahlgren and Whitehead (1992). Refer to Appendix 6 for a copy of the original

2.4 Nutrition and health in older people

Health status is closely related to the ageing process, and nutrition is one factor that has beneficial or negative effects on the rate of the ageing process (British Nutrition Foundation 2009).

Food has an important influence on physical health and independence, and also contributes to social, cultural and psychological quality of life (American Dietetic Association 2005b). In New Zealand in 1997 approximately 11,000 deaths, or 40 percent of all adult deaths, were estimated to be attributable to the combined effects of high total blood cholesterol, high systolic blood pressure, high body mass index (BMI), and inadequate vegetable and fruit intake. Approximately 8000 to 9000 of these deaths reflected poor diet and 2000 to 3000 reflected inadequate physical activity (Ministry of Health and University of Auckland 2003).

Overall, good nutrition in older people is associated with:

- preventing malnutrition
- supporting physical function
- reducing the risk of chronic disease
- supporting mental health
- preventing disability.

Many factors associated with ageing affect food and nutrient intake and may promote poor nutritional status. Although some factors associated with age are irreversible, such as sarcopenia (see Section 2.5) and dementia, other factors are modifiable, such as food skills and knowledge, living arrangements, and the physical and social environment. Targeting the modifiable factors at a population level may slow or even reverse a decline in health.

2.5 Individual and lifestyle factors that affect the nutritional status of older adults

Changes in body composition and physiology

The process of ageing involves changes in every tissue and all vital organs. These changes have a profound influence on the nutritional status of the ageing adult and affect:

- the body's metabolism
- nutrient intake
- absorption, storage, utilisation and excretion of nutrients
- nutrient requirements
- the ability to choose, prepare and eat a variety of foods.

Sarcopenia

Dramatic changes in body composition are seen with age, with an inevitable loss in lean body mass (skeletal muscle and bone) and a relative increase in fat mass over time (WHO 2002b). The term 'sarcopenia' describes an age-related decline in muscle mass (Rolland et al 2008). There is currently no worldwide consensus on a clinical definition of sarcopenia, but it appears to be different from other conditions that result in a loss of muscle mass, such as wasting due to

malnutrition or cachexia. Like many multi-factorial biological processes, it is likely to be a result of both genetic and environmental factors (British Nutrition Foundation 2009).

Skeletal muscle mass declines over the adult age span, a process that accelerates after the age of 80 years (WHO 2002b). Muscle mass declines by 1–2 percent a year after the age of 50 years (Rolland et al 2008) and at 5 percent each decade from the age of 40 years (Greenlund and Nair 2003). Men have a gradual decline in muscle mass and women have a sudden drop following menopause (Rolland et al 2008). The main effect of a loss of muscle mass is a reduction in muscle strength, which results in a decline in physical function (including fatigue), and impaired mobility and balance (Rolland et al 2008).

Because of the lack of consensus on a definition of sarcopenia it is difficult to estimate its prevalence. Depending on the definition used, anywhere from 6 to 40 percent of older people are sarcopenic, with a greater prevalence in those aged 75–80 years and over (Rolland et al 2008). It is clear that with a loss of muscle mass and physical function, sarcopenia is a key component of frailty (see Part 10: Frailty in Older People).

A loss of muscle mass leads to a fall in basal metabolic rate (BMR), which has been associated with age in a number of cross-sectional and longitudinal studies (Greenlund and Nair 2003). Physical inactivity also contributes to a decline in BMR (Greenlund and Nair 2003; Rolland et al 2008). The sarcopenic loss of muscle mass and strength and of physical function is associated with a decrease in energy expended in physical activity.

Although muscle mass and strength can be improved through a combination of physical activity and good nutrition, following such a regime will not actually reverse age-related sarcopenia.

Population-based, cross-sectional and longitudinal studies have demonstrated that weight loss is associated with ageing (MacIntosh et al 2000). However, sarcopenia does not necessarily result in weight loss *per se*: decreased muscle mass is offset by an increase in fat mass (Greenlund and Nair 2003), and can obscure the loss of skeletal muscle (Rolland et al 2008). There is an approximate doubling of body fat between the ages of 20 and 60 years (WHO 2002b). Also, the distribution of fat changes: more fat tends to accumulate in the central (abdominal) area, and less in the subcutaneous sites (Phillips 2003). This central distribution of fat has implications for morbidity and mortality, and for the risk of developing type 2 diabetes. Excess fat mass combined with loss of skeletal muscle is termed ‘sarcopenic obesity’ (Rolland et al 2008) (see also Part 9: Chronic Disease and Nutrition for Older People).

Arthritis

Arthritis is a group of diseases that involve inflammation of one or more joints. The inflammation may occur in response to injury to a joint, an infection, an autoimmune response at the joint, or accumulated wear and tear. Chronic arthritis occurs when prolonged inflammation results in long-term pain and deformity (Ministry of Health 2008a). Osteoarthritis is the most common type of arthritis and usually results from accumulated wear and tear. It is common in the elderly and usually affects the hip and knee joints. Osteoarthritis results in pain and disability, and can limit functional capacity. Consequently a person with osteoarthritis may become unable to shop, prepare food (including opening tins and packets, holding cooking equipment, etc) and cook. There is increasing research being conducted into the use of diet to prevent and manage arthritis (British Nutrition Foundation 2009).

Bone loss

Ageing is associated with a loss of bone and total body calcium (WHO 2002b). Substantial bone loss usually begins to occur at around 50 years of age in women and 65 years of age in men (WHO 2003) as bone minerals and the collagen matrix are removed from bone more rapidly than they are replaced. In the first five years following menopause women lose about half of the total of skeletal calcium that they lose over their lifetime (WHO 2002b). Older people are at increasing risk of developing osteoporosis and subsequent fractures as they age. Calcium absorption is known to decrease with age in both genders (NHMRC 2006). Adequate calcium and vitamin D status is essential for minimising bone loss following menopause and preventing fractures (see also Part 4: Nutrients, Food and Drinks; and Part 9: Chronic Disease and Nutrition for Older People).

Gastrointestinal and immune functions

Gastrointestinal digestive and absorptive functions decline with age. The intestinal wall loses its strength and elasticity and hormonal secretions change, resulting in slower intestinal motility. Atrophic gastritis – atrophy of the stomach mucosa, resulting in reduced secretions of gastric acid, intrinsic factor and pepsin from the stomach – can reduce the bioavailability of vitamin B₁₂, folate, calcium and iron (Phillips 2003; Horwath and van Staveren 2007). Although samples collected during the 1997 National Nutrition Survey (NNS97) showed only 6.7 percent of the older population had atrophic gastritis (Green et al 2005), overseas research has found that atrophic gastritis may affect from 10 to 30 percent of the older population (Johnsen et al 1991; Hurwitz et al 1997).

Fat and protein digestion may be affected by a reduction in pancreatic enzyme secretion if foods containing fat and/or protein are consumed in large amounts (Phillips 2003).

Finally, ageing is associated with altered regulation of the immune system, resulting in an increased incidence of infections and poor recovery from disease. Poor nutrition can both contribute to a decline in immune status and result from poor immune status (WHO 2002b) (see also Part 9: Chronic Disease and Nutrition for Older People).

Oral health and dentition

Oral health and dentition can influence, and be influenced by, nutrition. There are limited recent data available on the oral health status of older people in New Zealand. Although the overall standard of oral health has improved in the last 30 years and fewer older people now lose all their teeth, modelling suggests there are increasing rates of tooth decay among those older people with teeth remaining (Ministry of Health 2006b).

A key component of oral health is the ability to chew food, which relies on the presence of adequate teeth or dentures, and saliva flow. Those with either few or no natural teeth, or ill-fitting dentures, are more likely to eat a restricted variety of foods (Phillips 2003), and some older adults without their natural teeth experience pain when chewing (Marshall et al 2002). Such experiences may discourage the consumption of foods that are difficult to chew, such as some vegetables, fruit and nuts, and some meats. Chewing difficulties may also affect enjoyment of eating, possibly further limiting food and nutrient intakes. Research has shown that micronutrient intakes can be influenced by oral health, including vitamin B₁₂ (Elmadfa and Meyer 2008), vitamin C, vitamin E (British Nutrition Foundation 2009) and fibre (Hung et al 2003). Associations among absence of teeth, food selection, nutrient intake and markers of nutritional status have been reported in three large studies: the Veterans Administration Aging Study in Boston, and the UK and USA national surveys for adults aged 65 years and over (British Nutrition Foundation 2009).

Dry mouth (xerostomia) can result from advancing age (Hall and Wendin 2008) and from medication. Xerostomia interferes with the intake of food (Thomas 2005) due to problems ranging from chewing to swallowing difficulties, and can be a significant problem for oral functioning (Saunders and Friedman 2007). Dry mouth can also affect taste (British Nutrition Foundation 2009).

Older adults who retain their natural teeth are prone to dental caries. The development of dental caries is affected by the frequency with which sugars are consumed, which sometimes increases in older people through the use of high-energy snacks or supplements. The use of fluoride protects against dental caries. In addition, older people with functional limitations may find it more difficult to maintain good oral health. Toothbrushing less than twice a day is associated with poor oral health, as is smoking (Ministry of Health 2008a).

Sensory changes: taste and smell

Alterations in chemosensory perception are relatively common with ageing (British Nutrition Foundation 2009). Approximately one-quarter of older adults have a reduced ability to detect one or more of the four basic tastes (sweet, sour, salty and bitter) (WHO 2002b). Such changes are significant considering the importance of smell and taste in contributing to the enjoyment of eating. Food selection, food preparation methods, dietary variety and nutrient intake may be affected. These sensory changes may also lead to difficulty in discriminating between safe and spoiled food (see also Part 11: Food Safety). Certain medications and medical conditions may impair or change the senses of taste and smell, ultimately affecting food intake.

Food skills and knowledge

Food skills and knowledge affect food and nutrient intake and consequently nutritional status. Lack of practical cooking skills – or the confidence to use them – may be a barrier to widening food choices and improving dietary behaviours (Caraher et al 1999). Similarly, the functional capacity and cognitive/mental ability to shop, prepare and cook food influence choice and intake.

Traditionally, shopping, preparing food and cooking have been undertaken by women, and many older men may never have mastered cooking skills. A UK study found that single elderly men consumed less fruit and vegetables and were more likely to eat food that was easy to cook and prepare than married elderly men (Donkin et al 1998). Having cooking skills not only enables people to prepare meals, but may also provide a degree of knowledge about ready-prepared meals (Caraher et al 1999).

Polypharmacy

There is a high prescribing rate among New Zealand general practitioners (GPs) for the older population, and polypharmacy (the use of more than five medications concurrently) increases in the older age group. On average, older people fill almost five prescriptions, and an average of almost 20 medication items, per year (Martin et al 2002); women are prescribed more medications than men are. The most frequently prescribed items are for the cardiovascular system, the alimentary tract, the nervous system, blood and the blood-forming organs, and the respiratory system and allergies (Martin et al 2002).

Older people who use multiple medications are at high risk of food–drug interactions, which may affect their nutrient status or food intake. Side effects of medications that might influence the nutritional status of older adults include cognition changes, dry mouth, taste impairment, anorexia, depression, dehydration, electrolyte abnormalities, diabetes, osteoporosis and Parkinsonism.

Changes in food intake

A decline in food intake is common in older adults, even in healthy, ambulant, non-institutionalised people (MacIntosh et al 2000). Physiological changes in appetite regulation with age include:

- earlier satiety (from slow gastric emptying and a reduced stomach capacity)
- possible changes in gut peptide hormones that stimulate or inhibit food intake (including leptin, ghrelin, cholecystokinin, glucagon-like peptide 1, and peptide YY)
- an increase in the production of cytokines (including interleukin-1, interleukin-6, tumour necrosis factor- α , and serotonin, which are secreted by inflammatory cells in response to stress and have been shown to decrease food intake and body weight)
- changes to the central nervous system (ie, neurotransmitters) (MacIntosh et al 2000; Hickson 2006).

Age-associated changes in dentition, taste and smell also influence food intake. This physiological decline in food intake has been termed ‘anorexia of ageing’.

Research has found that older people consume less energy (up to 25 to 30% less than younger adults), have smaller meal sizes and slower rates of eating (MacIntosh et al 2000). Reduced energy intake usually leads to weight loss, depending on energy expenditure (which is also often decreased in older adults). Weight loss may also occur with sarcopenia and the presence of disease states (Donini et al 2003).

A reduction in food intake may contribute to sarcopenia (Morley 2001), but these relationships are complex. Lower energy intakes make it more difficult to achieve adequate intakes of micronutrients, and may lead to deficiencies. Malnutrition and weight loss are key components of frailty (see also Part 10: Frailty in Older People).

Changes in mental health and cognition status

Various psychological factors influence the nutritional status of older people. Depression is increasingly recognised as a major health issue for older people (Chapman and Perry 2008). As a result of their depression, people may become unable to perform basic physical tasks, including cooking and eating, and their appetite can change (Gonzalez-Gross et al 2001). Depression in older people is associated with risk factors for chronic disease, including obesity (Chapman and Perry 2008). Depression is also associated with the loss or deterioration of social networks. Depression and social isolation can reduce the motivation to eat (Donini et al 2003). Older people in New Zealand who feel in control of their future health are less prone to the features of depression (Campbell et al 1995).

Cognitive function, mental impairment, dementia and Alzheimer’s disease may all have a negative impact on the life of an older person, because they affect their autonomy and independence. Nutritional status may be affected by refusing or forgetting meals, poor or erratic eating habits, and safety issues where the use of kitchen equipment is not encouraged (Keller et al 2008) (see also Part 9: Chronic Disease and Nutrition for Older People).

The adverse effects of these individual-level physical and psychological changes experienced by older people are related to the wider determinants of health, such as social, economic, cultural and environmental factors. These wider determinants of health are theoretically modifiable, although not necessarily by the individual. Some individual-level physical and psychological factors are modifiable, although the result may be to delay the health effects rather than reverse them (Khaw 2008).

2.6 Social and community factors that affect the nutritional status of older adults

Living arrangements

Older people may experience a change in living arrangements – from living with a partner to living alone, moving in with extended family, or moving somewhere that provides appropriate support. Living arrangements are often influenced by partnership status. Food interaction within a family, particularly between marital partners, is shown to be associated with more favourable dietary patterns (Schafer et al 1999). Living alone, for both women and men, is associated with increased nutritional risk (American Dietetic Association 2000). Loneliness may lead to decreased food intake through forgetting to eat proper meals, decreased motivation to prepare meals, not wanting to eat a meal once it has been prepared, or wanting to eat with others rather than by oneself (Wylie et al 1999).

A lower food intake among those who live alone may be affected by both functional capacity (including fatigue and mobility) and loneliness. Other research has shown that older people living with their partners feel better, are healthier and live longer than those without partners (Barrett et al 2006).

Social networks

Social networks offer a sense of security, identity and predictable order in an older person's life (Erikson et al 1999). Litwin and Shiovitz-Ezra (2006) found that older adults with diverse networks had a lower risk of all-cause mortality than those with restricted networks. Social participation can have a positive influence on health and wellbeing through providing a sense of belonging and support; enhancing feelings of wellbeing; providing a reason to live; and encouraging preventive and therapeutic health behaviours (Avlund et al 1998).

Food and eating are parts of social life and contribute to establishing and maintaining social networks (Blane et al 2003). Loss or deterioration of social networks may result in loss of motivation to eat and a compromised food and nutrient intake (Donini et al 2003).

Sharing meals

Evidence indicates that eating meals with others enhances dietary variety and nutrient intake (American Dietetic Association 2005b). Research has shown that meals eaten in groups are up to 46 percent larger than meals eaten alone, and that the more people there are at the meal, the greater the intake (de Castro 2002).

Consumption of food, by all age groups, has been found to increase on weekend days versus weekdays (de Castro 2002). The author's explanation for this trend was that on weekend days people tend to eat later and with more people present, both factors that promote increased intake. Differences between weekend and weekday food intake are, however, less marked for the over-65 years group. Eating out in restaurants was also associated with increased food consumption in the over-65 years group (de Castro 2002).

Energy intake is also greater when a variety of food is provided than when a single food is available. A high dietary variety is positively associated with nutritional quality and positive health outcomes (Donini et al 2003).

2.7 Socioeconomic, economic, cultural and environmental factors that influence the nutritional status of older adults

Economic factors

Nutrition-related health is closely related to socioeconomic status. Socioeconomic variables such as income and home ownership have been associated with institutionalisation and mortality in older people (Martikainen et al 2008). Many older adults see their savings decrease over time and their incomes dwindle. Limited money may mean older people delay seeking medical care, cannot afford safe, warm and healthy housing, and choose foods they would prefer not to eat. The ability to access resources such as mobility or safety aids, physical activity opportunities, and health care services and support may also be reduced. Being unable to afford suitable transport limits access to shopping (including obtaining a variety of healthy food) and social networks.

In New Zealand, the NNS97 indicated that most older people believe they can always afford to eat properly (Russell et al 1999a). Nevertheless, a lack of adequate income is an established cause of inadequate food intake and a cause for concern in some older adults (Barrett et al 2006). Older Māori are more likely than the rest of the older population to face material hardship: about 15 percent of older Māori face some financial difficulty, and a further 20 percent face severe difficulties (Cunningham et al 2002).

Food security

‘Food security’ is an internationally recognised term that encompasses the ready availability of nutritionally adequate and safe foods, and the ability to acquire acceptable foods in a socially acceptable way. The Rome Declaration on World Food Security affirmed the ‘right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger’ (FAO 1996). Food insecurity is characterised by anxiety about not having enough food to eat, running out of food, and having no money to purchase more (Hamilton et al 1997; Nord 2003; McKerchar 2007).

In New Zealand, income has been shown to be the single most important modifiable determinant of health, and to be strongly related to health and wellbeing (National Health Committee 1998). Households with low income often compromise food quality and quantity because the food budget is one of the major unfixed components of the budget (McPherson 2006). The *Hidden Hunger* report (New Zealand Network Against Food Poverty 1999) found that actual food costs were much higher than most low-income households could afford after meeting their basic expenses, such as for housing, power and transport.

There is very little New Zealand research that looks specifically at food security in older people. In the NNS97 older people were the group that reported the lowest level of food insecurity. However, these results may have underestimated food insecurity in the older population because the questions used to determine food insecurity may not have been relevant to older people’s lifestyles and specific issues (Parnell et al 2001).

The US National Health and Nutrition Examination Survey (1999–2002) showed that, after controlling for age and sex, low-income older adults consumed 526 kJ less than medium-income older adults, and more than 1000 kJ less than high-income older adults. Low-income older people tended to eat less fruit, vegetables, milk, meat, poultry and fish than high-income adults (Bowman 2007). Older people who are anxious about lack of food may try to avoid running out of food by cutting the size of

meals, skipping meals or even going without food for one or more days (Klein 1996).

Older people may also experience food insecurity despite adequate funds. Lack of ability (both physical and mental/cognitive) to prepare meals, living alone, transport limitations and poor proximity to food outlets can all contribute to food insecurity. Access to food outlets is an important factor: when older people are unable to get to or safely move around larger supermarkets or shops, they may have to shop at smaller shops, where food purchases are often more expensive and lacking in variety, and may be of inferior quality due to low turnover (Larson 2006).

Although there is a growing body of literature about the prevalence of food security, there is less evidence of a causal link between food insecurity and ill health. However, two large US surveys have clearly indicated that food-insecure older adults have poorer dietary intake, nutritional status and health status than do food-secure older adults (Lee and Frongillo 2001). The food-insecure older people in these studies were twice as likely to report fair or poor self-reported health status than food-sufficient older people.

Key points on ageing, nutrition and health

- Health and nutritional status in older people is influenced by the ageing process and the cumulative effects of exposure to various risk factors and determinants of health throughout the life span.
- Interventions that act to modify health determinants are important at all stages of life, including for older people.
- The health of the population is mostly determined by social, cultural, economic and environmental influences. The process of ageing reflects the interactions between these factors and progressive biological changes.
- Sarcopenia is an age-related loss of muscle mass, and results in decreased muscle strength, decreased functional capacity and reduced physical activity.
- Poor oral health, ill-fitting dentures and dry mouth can result in a limited dietary variety, lower nutrient intakes and a decreased enjoyment of food.
- Changes in taste and smell may affect food selection, food preparation methods, dietary variety and nutrient intakes.
- A lack of food knowledge and practical cooking skills, and/or a change in the ability to cook and prepare food, may result in limited dietary variety and lower nutrient intakes.
- Medications may alter food intake and may cause reactions that interfere with normal nutrient metabolism and requirements.
- Being part of a social network contributes to good health. Food and eating are part of social life, and social isolation is associated with increased nutritional risk. Sharing meals with family or friends may increase the amount and variety of food consumed.
- Nutrition-related health is closely related to socioeconomic status. Limited money may mean older people cannot respond to their needs and may not be able to access safe and healthy food, physical activity opportunities and social networks.
- Older people with adequate income may still be at risk of food insecurity if they experience difficulty accessing a variety of healthy food, and preparing and eating meals.

Part 3: Dietary Patterns of Older People in New Zealand

3.1 Background

New Zealanders obtain energy and nutrients from a wide variety of foods and beverages. Food consumption patterns and the dietary composition of the diet may change with age. Dietary recommendations should take into account overall food choices and the combinations of different food items that people choose to eat (Naska et al 2006).

3.2 Sources of data

The 1997 National Nutrition Survey (NNS97) is the major source of data for this document. There are limited data on dietary patterns in older people in New Zealand, especially for older people from smaller ethnic groups. Data sources for this part are listed in reverse chronological order below. Further information about these studies is provided in Appendix 7.

- **2006/07:** The New Zealand Health Survey provides data on vegetable and fruit consumption of older people (Ministry of Health 2008a).
- **2002/03:** The Auckland Diabetes, Heart and Health Study provides comparisons of food intakes and food preparation methods among Māori, Pacific, Asian, and New Zealand European people in the Auckland region. Data are not analysed separately for older people (Metcalf et al 2008).
- **1997:** The National Nutrition Survey provides data on consumption by food group, macronutrient and micronutrient intakes, and frequently eaten foods for older people living in the community. The NNS97 also provides information on changes in the patterns of dietary behaviour. Small sample sizes for Māori and Pacific older people mean that the data for those aged 45 years and over are ‘indicative’ only (Russell et al 1999a).
- **1988/89:** The Mosgiel Community Study of Health and Nutrition in Old Age (Part 1) and 1995/96 (Part 2) provides a small amount of data on consumption by food group and dietary behaviour changes for older people living in the community (Horwath et al 1992; Fernyhough et al 1999).

3.3 Dietary patterns of older New Zealanders

The NNS97 showed that nearly all (94%) New Zealanders eat a regular (omnivorous) diet. A slightly higher proportion of adults aged 65 years and over eat an omnivorous diet than younger adults. Older adults consume similar types of food and proportions of protein, carbohydrate and fat in their diets to younger adults in New Zealand. It appears that older people are likely to continue similar eating patterns to those they have established earlier in life. Like the rest of the population, older people appear interested in and able to make dietary changes where they see a benefit.

Food groups and food types

Vegetables and fruit

The most recent data on vegetable and fruit consumption are from the 2006/07 New Zealand Health Survey (NZHS). These data indicate that older people are more likely to eat the recommended servings of vegetables and fruit than the total population and women were significantly more likely than men to eat two or more servings of fruit a day. Nevertheless, 25 to 30 percent of older people do not meet the recommended servings of vegetables, and 25 to 40 percent do not eat the recommended servings of fruit. These data are similar to the NNS97 data.

Table 4: Percentage of older adults who consumed adequate vegetable and fruit intakes, by age group and gender, and compared with the total population

Indicator (self-reported)	Women			Men		
	65–74 years	75+ years	Total adult population	65–74 years	75+ years	Total adult population
3+ servings of vegetables per day	77.2	75.0	70.0	69.5	70.1	57.6
2+ servings of fruit per day	75.6	73.6	68.8	57.2	60.9	50.5
3+ servings of vegetables per day and 2+ servings of fruit per day	61.0	59.7	52.5	41.8	46.6	33.1

Source: Ministry of Health 2008a

Data from the 2006/07 NZHS for vegetable and fruit consumption are not available for older Māori, Pacific, Asian and European people. For the total adult population (ie, all those aged 15 years and over), Pacific and Asian people were less likely to meet the vegetable recommendations compared to the total population. Māori women were less likely to meet both the vegetable and fruit recommendations compared to the total population, and Asian women were less likely to meet the fruit recommendations compared to the total population.

Breads and cereals

The NNS97 showed that the percentage of people consuming at least six servings of bread and cereals per day, as recommended, declined with increasing age. Women aged 65–74 years were the least likely to meet the recommended number of servings, with 6 percent doing so. Eight percent of women aged 75 years and over, 15 percent of men aged 75 years and over, and 22 percent of men aged 65–74 years met the recommended number of servings per day.

Men of all ages consumed greater amounts of bread than women. The older population were more likely to consume three to four servings of bread per day than any other number of servings. Just over 65 percent of women aged 65 years and over consumed three *or more* servings of bread a day, and just over 75 percent of men aged 65 years and over consumed three *or more* servings of bread a day. The percentage of older people who consumed cooked porridge and savoury biscuits/crackers at least once a week was higher than that in the total population. Pasta and rice are generally not a popular choice for older adults. Older people are more likely to add butter and margarine to bread than younger adults. Fifty percent used butter and 47 percent used polyunsaturated margarines on their bread.

In the NNS97 and the Auckland Diabetes, Heart and Health Study, Māori and Pacific peoples were more likely to consume more servings of bread than the European population, while Asian people consumed fewer servings of bread.

Milk and milk products

The NNS97 did not report on the percentage of people who consumed the recommended two servings of milk and milk products per day.

Approximately a quarter of those aged 65–74 years consumed milk as a beverage at least once a week, and one in five women and one in ten men consumed milk as a hot beverage. The proportion of women aged 75 years and over consuming milk as a beverage rose slightly, but for men aged 75 years and over it fell. In the follow-up Mosgiel Community Study of Health and Nutrition in Old Age, only 1 percent of women and 8 percent of men never had milk.

Older people aged 65–74 years more frequently chose trim milk than any other age group. The frequency dropped in the 75 years and over age group. Older women more frequently chose lower-fat milk and milk products, including trim milk, yoghurt and lower fat cheeses, than older men did.

More older women consumed yoghurt than older men, and a higher proportion of older people consumed ice-cream more than once a week than the total adult population. Soft, energy-dense foods such as cream/sour cream, custard/dairy food, and milk puddings were more frequently consumed by older adults, particularly those 75 years and over, compared with the total population. In the 75 years and over age group, 29 percent of women and 20 percent of men consumed these items at least once a week.

The Auckland Diabetes, Heart and Health Study found that Europeans had more servings of cheese than all other ethnic population groups, and more servings of milk than Pacific and Asian peoples. Low-fat milks were preferred by a higher proportion of European people, followed by Māori, Asian and then Pacific peoples.

Lean meat, poultry, seafood, eggs, nuts and seeds, and legumes

The NNS97 did not report on the percentage of people who consumed the recommended one or more servings of lean meat or alternatives per day.

Similar to the total adult population, the most common types of meat consumed at least once a week were beef/veal and beef mince dishes. Chicken and fish were consumed by a higher proportion of older women than older men. Women aged 65–74 years were the most likely population group to consume canned, steamed, baked, grilled or raw fish at least once per week. Of those older people who ate eggs, over 50 percent ate two to three eggs per week.

Processed meats, including bacon/ham, sausages and luncheon meat were consumed at least once a week by slightly smaller proportions of older people than younger age groups. Nevertheless, around a quarter of people aged 65–74 years consumed these products at least once a week.

The Auckland Diabetes, Heart and Health Study found that Māori, Pacific and Asian peoples had more servings of fish than Europeans, and Pacific and Asian peoples had more servings of chicken.

Other foods

There was a large difference in the number of older people consuming foods such as hamburger, pizza and potato crisps, with consumption decreasing with age. Chocolate consumption was also lower in older age groups than in younger adults. Men aged 65–74 years were the most likely group to consume puddings/desserts and plain sweet biscuits, and older people were slightly more likely to consume cakes, scones or pikelets than younger adults.

Energy and macronutrients

Data from the NNS97 showed that median energy intake was lower in people aged 65 years and over than in younger adults. There was no marked difference in the percentage of energy from protein, carbohydrate or fat with age. Dietary fibre intake was similar for younger and older adults. These data from the NNS97 are consistent with earlier data from the Mosgiel Community Study of Health and Nutrition in Old Age, which found that dietary intakes of macronutrients were generally similar to those of younger adults. Total fat, saturated fat, refined carbohydrate and sodium intakes were generally above recommended levels, whereas complex carbohydrate and fibre intake were below recommended levels (Horwath et al 1992).

Micronutrients

In the NNS97, for people aged 65 years and over usual daily median dietary intakes of zinc (for women only), vitamin B₁₂, vitamin A, vitamin C, thiamin, niacin, iron, riboflavin (for men) and phosphorus met the 2006 recommended dietary intake (RDI) levels outlined in the nutrient reference values (NRVs) (NHMRC 2006). Usual daily median dietary intakes that did not meet the RDIs were vitamin B₆, folate, calcium, magnesium, zinc (for men), riboflavin (for women), selenium and manganese (see also Appendix 5 for nutrient reference values).

Data from early New Zealand studies have shown that low vitamin C intakes appear to be a problem for Meals on Wheels recipients, the housebound and institutionalised older adults, but intakes are generally adequate among free-living older populations (Horwath 1989; van der Wielen et al 1994). A Christchurch study found that low blood folate levels in community-living older people were uncommon (at 3%), but 7.3 percent had low blood vitamin B₁₂ levels (Hanger et al 1991).

Dietary behaviour change

The NNS97 included some questions about participants' current and intended dietary changes, and barriers to dietary change. Of those aged 65–74 years, 18 percent of women and 17 percent of men were currently trying to change the amount and/or type of food they ate. The proportion of people aged 75 years and over trying to change dietary habits was smaller, at 6 percent of women and 8 percent of men.

The most common attempted dietary change for all age groups, including older age groups, was to alter the amount and type of high-fat foods consumed. Trying to eat less high-fat food was more common than trying to change the type of fat eaten. This dietary change was slightly more likely in women than men aged 65–74 years (13% compared with 11%), but slightly more likely in men than women aged 75 years and over (5% compared with 3%). For people aged over 75 years, depending on the overall diet, limiting fat intakes may result in insufficient energy and nutrient intakes. Consuming adequate micronutrients is difficult with low energy intakes. Low energy intakes may also result in weight loss (see also Part 4: Nutrients, Food and Drinks).

There are anecdotal reports in New Zealand that older people continue to try to limit energy and fat intakes in older age because they (or sometimes their partner) had been told to when they were younger. They may also have picked up health promotion messages intended for the general adult population (Dennison 2004).

In the follow-up to the Mosgiel Community Study of Health and Nutrition in Old Age, Fernyhough et al (1999) reported that from 1988/90 to 1995/96, older adults had made changes in the types of fat consumed by using less butter and lard (high saturated fat), and using more margarine as spread and vegetable oils to cook meat (more unsaturated fat). Significant dietary changes included a move from whole-fat milk to reduced-fat milk, and, for women, an increase in the proportion who ate breakfast cereals at least once a week. It is interesting to note that this study did not find a decrease in energy intakes with age, as commonly reported in other studies, nor was there a significant difference in micronutrient intakes.

Key points on dietary patterns of older people in New Zealand

- There are limited data available on the dietary patterns of older people in New Zealand. The nationally representative NNS97 provides the most recent data on older people.
- There are some differences in dietary patterns and behaviours among Māori, Pacific, Asian and European New Zealanders.
- Almost all older New Zealanders eat an omnivorous diet, according to the NNS97.
- Energy intake was lower in people aged 65 years and over. Protein, carbohydrate and fat intakes declined with age, but as a proportion of total energy intake all met dietary recommendations.
- Older people were more likely to eat the recommended number of servings of vegetables and fruit than the total population.
- Few older people ate the recommended number of servings of breads and cereals. However, bread was commonly consumed by older people: three or more servings of bread were consumed by approximately 65 percent of women and just over 75 percent of men aged 65 years and over.
- People aged 65–74 years more frequently chose trim milk over standard milk than any other age group. However, soft, energy-dense foods such as ice-cream, cream/sour cream, custard/dairy food, and milk puddings were more frequently consumed by those aged 75 years and over than the total population.
- Some older people attempted to change their diets. The most common dietary change was to alter the amount and type of high-fat foods consumed.

Part 4: Nutrients, Food and Drinks

4.1 Background

Older people's nutritional needs change as they age. A number of physiological, psychological, social, economic and environmental changes influence their ability to choose and prepare healthy food, and these changes may affect their nutritional status (see also Part 2: Ageing, Nutrition and Health). This part looks at selected nutrients and outlines background information, current levels of intake, recommended levels of intake, and food and drink sources. The nutrients included are: energy, water, protein, carbohydrate, fat, calcium, vitamin D, iodine, folate, zinc, vitamin B₁₂ and sodium.

Information on specific nutrients is based on the *Nutrient Reference Values for Australia and New Zealand, Including Recommended Dietary Intakes* (NHMRC 2006). Not all nutrients measured in the National Nutrition Survey 1997 (NNS97) have been included in this background paper – only those with specific relevance to older people. For general information on other nutrients not included here, refer to the *Food and Nutrition Guidelines for Healthy Adults: A background paper* (Ministry of Health 2003a). Information on the principal dietary sources of nutrients for older women and men comes from the NNS97. The dietary sources (ie, food and drink) are presented in descending order of the amount of the nutrient each provides. Note that the NNS97 term 'dairy foods' has been replaced by 'milk products' in this document.

4.2 Energy

Background

Energy is not a nutrient but is required in the body for metabolic processes, physiological functions, muscular activity, heat production, growth, and the synthesis of new tissues. Food components release energy through oxidation during the digestive process. Protein, carbohydrate and fat (the macronutrients) and alcohol from foods and drinks are the only sources of energy for humans.

Energy requirements can vary widely according to gender, body size and physical activity, but they generally decrease with advancing age. This decrease can be explained by the reduction in basal metabolic rate with age as a result of a reduction in muscle mass.

Despite this decrease in energy requirement, some older people may still find it difficult to eat enough to meet their energy and other nutrient requirements. Age-associated physiological changes (anorexia of ageing) and changes in health status and lifestyle contribute to a decline in food intake which may affect the intake of macronutrients and micronutrients. If energy intake from food declines too much it can be very difficult to meet micronutrient requirements. Meeting these requirements is particularly difficult for those adults showing characteristics of frailty (see also Part 10: Frailty in Older People).

Energy intake

Macronutrients and alcohol are broken down in the body to provide energy, measured in kilojoules, in the amounts shown in Table 5. These energy factors were used in the NNS97 to determine the energy content of the total diet.

Table 5: Energy factors used in the NNS97 to determine the energy provided by different food source

Food source	Energy (kJ) provided by 1 g
Protein	16.7
Carbohydrate	16.7
Fat	37.0
Alcohol	29.0

Source: Russell et al 1999a

Energy expenditure

There are three components of energy expenditure:

- the basal metabolic rate (BMR) – the energy required to sustain metabolism
- the thermic effect of food (TEF) – the energy expended in converting food to nutrients
- the energy required for physical activity.

There is a recognised decrease in total energy expenditure with age (Roberts and Dallal 2005). The BMR accounts for 45–70 percent of daily energy expenditure. This includes energy for cell metabolism, synthesis and metabolism of enzymes and hormones, transport of substances around the body, maintenance of body temperature, ongoing functioning of muscles (including the heart), and brain function (NHMRC 2006). BMR declines with age at an estimated 1 to 2 percent a decade due in part to the change in body composition. Some research suggests that the decline in BMR may not be linear, and that there may be a threshold of around 50 years in women and 40 years in men, after which there is a more rapid decline in BMR (Roberts and Dallal 2005).

The TEF accounts for a further (fairly constant) 10 percent of daily energy expenditure. Energy expenditure for physical activity is defined as the increase in metabolic rate above BMR and TEF, and this is the most variable component of energy expenditure. It is also the component that people have most control over. Energy is expended through both planned and incidental physical activity, and older people generally have lower physical activity levels than younger adults (see also Part 8: Physical Activity – A Partner to Nutrition).

Energy balance

Energy balance is achieved when the energy intake from food and drinks equals the energy expended for metabolic processes (BMR and TEF) and during physical activity. A change in energy intake or output leads to a positive or negative energy balance. A positive energy balance results in body tissue being deposited as fat and an increase in body weight. A negative energy balance results in body tissue being mobilised and a loss of body weight. A change in body weight, particularly in body fatness, may have important implications for the health and functional status of older adults.

Physical activity has an important role in maintaining energy balance, and consequently a healthy body weight. In older people physical activity is also valuable for its role in maintaining muscle mass and strength, stimulating appetite, and maintaining social connections (see also Part 8: Physical Activity – A Partner to Nutrition).

Energy intakes of older New Zealanders

The usual daily median energy intakes of older New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Table 6.

Table 6: Energy intakes of older New Zealanders aged 65 years and over

Usual daily median energy intake (kJ/day)	
Women	6449
Men	9161

Source: Russell et al 1999a

Median energy intakes were lower in older people compared with the total adult population. Older women consumed 1252 kJ/day less (16.2% less) than the total adult female population, and older men consumed 2470 kJ/day less (21.2% less) than the total adult male population.

In the NNS97 older women reported an energy intake that was almost 30 percent less than that reported by older men. However, a study examining dietary reporting patterns of the NNS97 found that, for the total adult population, 21 percent of women and 12 percent of men were under-reporters (Pikholz et al 2004). Therefore, the intake data for older women reported here may be lower than actual intake.

Macronutrient contribution to energy intake

Data on the contribution of macronutrients to total energy intake provide information about dietary patterns and dietary quality. Table 7 shows median macronutrient intakes, expressed as a percentage contribution to total energy intakes, among New Zealanders aged 65 years and over, as measured by the NNS97. The percentage of energy consumed as macronutrients by older people was very similar to that of the total adult population.

Table 7: Percentage contribution to total energy intake from macronutrients

Nutrient	Adults aged 65 years and over		Total adult population	
	Women	Men	Women	Men
Protein	16	15	15	15
Carbohydrate	49	47	47	45
Fat	33	34	34	36

Source: Russell et al 1999a

Recommended energy intakes for older New Zealanders

Recommendations for energy intakes are more difficult to determine than the equivalent recommendations for most nutrients. They are based on estimations of the average energy requirements of a group of comparable individuals. Equations for estimating basal metabolic rate may result in overestimations for older people (NHMRC 2006).

Among individuals there is a wide variation in energy expenditure, even among apparently similar individuals. Men generally have a greater average proportion of lean body mass compared with women. This characteristic, combined with a greater average body size, means men have higher energy requirements. (The estimated energy requirements for older people in Australia and New Zealand are provided in Appendix 8.)

Although energy requirements decrease with age, macronutrient and micronutrient requirements generally do not decrease with age, and some (eg, for protein and calcium) actually increase with age. Consuming a variety of foods from the four food groups will ensure macronutrient and micronutrient recommendations are met, and energy balance is more likely to be achieved.

Some older people may find it difficult to consume enough energy to meet their requirements. Eating at least three meals a day and, where possible, suitable snacks that are energy- and nutrient-dense, is considered to be a healthy eating pattern and will be required to meet nutrient requirements. This pattern of consumption is particularly important for frail older people (see also Part 10: Frailty in Older People).

Acceptable macronutrient distribution range

The NRVs estimate a recommended range of intake for protein, carbohydrate and fat (expressed as a percentage contribution to total energy intake) that would allow for an adequate intake of all the other nutrients while maximising general health outcomes (see Table 8). These ranges are applicable to all adults, including older people.

Table 8: Acceptable macronutrient distribution ranges for all adults

Nutrient	Lower end of recommended intake range	Upper end of recommended intake range
Protein	15% of energy	25% of energy
Carbohydrate	45% of energy	65% of energy
Fat	20% of energy	35% of energy

Source: NHMRC 2006

Sources of energy in the diet

The principal sources of energy in the diet of older women are: bread (including rolls and speciality breads), butter and margarine, fruit, milk, potatoes and kūmara, and cakes and muffins. The principal sources of energy in the diet of older men are: bread (including rolls and speciality breads), potatoes and kūmara, butter and margarine, milk, cakes and muffins, fruit, and sugar/sweets.

Bread (including rolls and speciality breads) is the principal energy source for the total adult population. Older people consume a slightly greater proportion of total energy from this source than younger adults. Fruit, butter and margarine also made a greater contribution to the total energy intakes of older people than to those of the total adult population.

Alcoholic beverages contributed more to the energy intake of older men (at 5%) than older women (2%), and older men were also more likely than older women to have sugar/sweets making a greater contribution to total energy intake.

4.3 Water

Background

Water is defined as an essential nutrient because it is required in amounts that exceed the body's ability to produce it. All biochemical reactions occur in water. It fills the spaces in and between cells and helps form the structures of large molecules such as proteins and glycogen. Water is also required for digestion, absorption, transportation, dissolving of nutrients, elimination of waste products and thermoregulation (NHMRC 2006).

Water accounts for 50 to 80 percent of body weight, depending on lean body mass (muscle and bone). On average, men have a higher lean body mass than women and a higher percentage of body mass as water than women. The relative mass of water decreases in both women and men with age. Human requirements for water are related to metabolic needs and are highly variable, and depend to some extent on individual metabolism (NHMRC 2006). Older people tend to have a reduction in lean body mass, with a concurrent reduction in percentage weight from water.

Older people may be at greater risk of dehydration than younger adults because:

- the thirst mechanism may diminish with age
- medications common in older populations, such as diuretics and laxatives, can cause excessive loss of fluids
- renal function may deteriorate with age
- incontinence issues and cognitive changes can result in inadequate fluid intake
- they may be more sensitive to heat stress and subsequent water depletion, leading to heat exhaustion, loss of consciousness and heat stroke (Davidhizar et al 2004; NHMRC 2006).

Fluid intake can also affect saliva production, which is essential for the maintenance of oral health. Decreased body water has been associated with salivary dysfunction, especially in older adults (NHMRC 2006).

Fluid intakes of older New Zealanders

The usual daily median fluid intakes of New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Table 9.

Table 9: Fluid intakes of older New Zealanders aged 65 years and over

Usual daily median fluid intake (L)	
Women	2.07
Men	2.40

Source: Russell et al 1999a

Recommended fluid intakes for older New Zealanders

The recommended intakes for fluids for older New Zealanders are expressed as adequate intakes (AIs) and are shown in Table 10.

Table 10: Adequate intakes for fluids for older people

	Age (years)	AI (L/day) total water ¹	AI (L/day) fluids ²
Women	51–70	2.8	2.1
	> 70	2.8	2.1
Men	51–70	3.4	2.6
	> 70	3.4	2.6

Source: NHMRC 2006

Notes:

1 Total water = all fluids plus water from foods.

2 Fluids = plain water, milk and other drinks.

Solid food (especially vegetables and fruits) contributes approximately 20 percent of total water intake, and an additional 250 ml or so of water is made available to the body from metabolism (NHMRC 2006). The remainder of the water needs to come from fluids such as water, milk, tea, coffee and other beverages.

Sources of fluid in the diet

The NNS97 showed that water was consumed regularly (at least three times per week) by 91 percent of women aged 65–74 years, 89 percent of women aged 75 years and over, and 77 percent of men aged 65 years and over.

For older women, tea was the second most regularly consumed drink, at 82 percent and 86 percent for women aged 65–74 and 75 years and over, respectively. In older men, tea was the most regularly consumed drink, ahead of water, at 81 percent and 89 percent for men aged 65–74 and 75 years and over, respectively. Other popular drinks regularly consumed were coffee and fruit juice. Milk, either as a cold or hot drink, was also consumed at least once a week by up to 30 percent of women and 25 percent of men aged 65–74 years.

Some fluids – such as soft drinks, fruit juices and energy drinks – contain added sugar, and it is common practice to add sugar to tea and coffee. The addition of sugar to tea and coffee can add significantly to an individual’s daily energy intake. Some herbal teas may interact with prescription drugs (Huxtable 1992).

There is some evidence that a high caffeine intake is a risk factor for fracture frequency or bone loss, but in general the evidence is contradictory. High intakes of caffeine increase urinary calcium excretion (Goulding 2007). Several large cohort studies have reported small but significant increases in either fracture frequency or bone loss associated with increased caffeine intake (Barrett-Connor et al 1994; Cummings et al 1995). Other studies have found no association (Johansson et al 1992; Lloyd et al 1997).

Moderate caffeine intake is not associated with increased bone loss, and so a prudent recommendation would be for adequate dietary calcium intake together with a moderate caffeine consumption in older adults (Massey 2001). A ‘moderate’ level of caffeine intake seems likely to be 300 mg or less of caffeine, which is equivalent to approximately: one large long black; three cappuccinos; four cups of plunger coffee; or six cups of tea.

Wine, beer and spirits make a small but significant contribution to the fluid intake of older people in New Zealand (see also Section 4.15: Alcohol).

Macronutrients

4.4 Protein

Background

Protein occurs in all living cells and has both functional and structural properties. Amino acids, assembled in long chains, are the building blocks of protein. Of the 20 amino acids found in proteins, some can be made by the body while others are only provided through the diet. The latter are known as indispensable (or essential) amino acids. Amino acids are used for the synthesis of body proteins and other metabolites and can also be used as a source of dietary energy. The proteins of the body are continually being broken down and resynthesised in a process called protein turnover.

Proteins are necessary to build and repair tissue, in hormone, enzyme and antibody synthesis, and for many other body functions. Inadequate protein intake in older people is associated with increased skin fragility, decreased immune function, poorer healing, and longer recuperation from illness (Chernoff 2004). Protein requirements for people aged over 70 years are 25 percent higher than for younger adults (NHMRC 2006). Although muscle mass decreases in older people, the formation of muscle protein can be stimulated by higher availability of protein, and so it is imperative that an adequate protein intake is maintained.

Protein intakes of older New Zealanders

Table 11 shows the usual daily median protein intake, and the median percentage contribution to total energy intake, of New Zealanders aged 65 years and over, as measured by NNS97.

Table 11: Protein intakes of older New Zealanders aged 65 years and over

	Usual daily median protein intake (g)	Percentage contribution to energy
Women	61	16
Men	83	15

Source: Russell et al 1999a

Median protein intakes were lower in older people compared with the total adult population. Older women consumed 10 g/day less than women aged 45–64 years, and older men consumed 20 g/day less than men aged 45–64 years. The median percentage contribution of protein to total energy intake for older women was 1 percent higher than for the total female population. For older men the median percentage contribution of protein to total energy intake was no different to that of the total male population.

Recommended protein intakes for older New Zealanders

The recommended dietary intakes (RDIs) for protein for older New Zealanders are shown in Table 12. With increasing age the protein requirement increases.

Table 12: Recommended dietary intakes for protein for older people

	Age (years)	RDI (g/day)	RDI (g/kg)*
Women	51–70	46	0.75
	> 70	57	0.94
Men	51–70	64	0.84
	> 70	81	1.07

Source: NHMRC 2006

Note: * RDI expressed as grams of protein per kilogram of body weight.

Sources of protein in the diet

The principal sources of protein in the diet of older women are beef and veal, milk, bread, poultry, fish/seafood, breakfast cereals and vegetables. The principal sources of protein in the diet of older men are beef and veal, bread, milk, fish/seafood, poultry, breakfast cereals and potato/kūmara.

Meat, fish and poultry together contribute the greatest proportion of protein in the diets of older people. Staples such as bread and milk also contribute a significant amount. Good sources of protein not listed above include eggs, milk products, legumes, cereals and cereal-based foods, nuts, and meat alternatives (eg, soy protein in tofu).

4.5 Carbohydrate

Background

The primary role of dietary carbohydrate is to provide energy to cells. Carbohydrate provides the largest single source of energy in the diet, and is (in the form of glucose) an easily available form of energy. It maintains blood glucose levels and has a role in gastrointestinal health and functioning. Carbohydrate is also necessary to avoid ketoacidosis. A nutrient-dense diet is relatively high in unrefined carbohydrate and low in fat.

Sugars

The term ‘sugars’ is used to describe the mono-, di- and oligo-saccharides. Sugars occur naturally in fruits, honey and milk. ‘Sugar’, by contrast, is used to describe the most common disaccharide, purified sucrose which is extracted from sugar cane and sugar beet; other terms used for this product are ‘refined sugar’ and ‘added sugar’. Sugars are present in variable amounts in vegetables and fruits. Sugar and many sugar-containing foods are energy-dense but not nutrient-dense.

Older people may consume more sugar as a way of making food palatable in response to age-associated declines in taste and smell. This change in diet may increase the risk of dental problems as there is a strong link between dental health and frequent sucrose intake. Although there is no direct evidence to support the hypothesis that a high sucrose intake causes obesity, the Food and Agriculture Organization (FAO) and World Health Organization (WHO) Expert Consultation has reiterated that excess energy in any form could contribute to the accumulation of body fat (FAO 1998).

Classification of carbohydrates is based primarily on molecular size, and is outlined in Table 13.

Table 13: Classification of the major dietary carbohydrates

Class (number of carbons in the molecule)	Subgroups	Examples
Sugars (1–2)	Monosaccharides	Glucose, galactose, fructose
	Disaccharides	Sucrose, lactose, trehalose
	Polyols	Sorbitol, mannitol
Oligosaccharides (3–9)	Malto-oligosaccharides	Maltodextrins
	Other oligosaccharides	Raffinose, stachyose, fructo-oligosaccharides
Polysaccharides (> 9)	Starch	Amylose, amylopectin, modified starches
	Non-starch polysaccharides	Cellulose, hemicellulose, pectins, hydrocolloids

Source: Adapted from FAO 1998

Polysaccharides

The carbohydrate polymers that originate from plant-cell walls are collectively called non-starch polysaccharides (NSPs). They provide structure to plant tissues, and are chiefly responsible for the texture of vegetable foods. NSPs are found in legumes (peas, dried beans, lentils), wholegrain cereals (barley, wheat, rye, oats, brown rice), and vegetables and fruits. NSPs are classified as to whether they are soluble or not soluble in water. The concentration of cell-wall components is highest in the outer layers of plant foods. They may perform a protective function for the endosperm, which is rich in starch and protein. Peeling vegetables and fruits or milling cereals significantly lowers their NSP content.

Water-insoluble NSPs are the most important contributors to faecal weight. Increasing consumption of foods rich in these (such as wheat bran, cereals and vegetables) is an effective means of preventing and treating constipation, haemorrhoids, diverticular disease and anal fissures. High intakes of NSPs may also protect against gallstones.

Water-soluble NSPs are found in peas, oats, dried beans, lentils, barley, pasta and fruits. They reduce the glycaemic index of carbohydrate foods, increase bile acid excretion and may reduce low-density lipoprotein (LDL) cholesterol levels (Baghurst et al 1996). Soluble and viscous NSP components in diets may delay the absorption of sugars from food and improve the metabolic control of glucose. NSP and resistant starch are fermented in the colon, where they stimulate the proliferation of bacteria, resulting in bulky stools. They also have a laxative-promoting effect.

Resistant starch is naturally occurring. It can also be produced by the modification of starch during the processing of foods (Institute of Medicine 2002). Resistant starch is defined as ‘starch and starch degradation products not absorbed in the small intestine in healthy humans’. Most of the health benefits of resistant starch relate to its impact on the colon, where it increases bowel action due to its mild laxative effect. Foods that are high in resistant starch are cereals, potatoes, green bananas and legumes.

Dietary fibre

There is no single definition of dietary fibre, which is a component of all plant materials. ‘Dietary fibre’ refers to NSP in New Zealand, although the North American definition not only refers to the NSP component of dietary fibre but also includes non-carbohydrates such as lignin and psyllium (Institute of Medicine 2002).

Cereals, legumes, vegetables and fruit are the main sources of dietary fibre. Some older people may not consume some foods that are good sources of dietary fibre due to problems with dentition (see also Part 2: Ageing, Nutrition and Health).

Adequate dietary fibre is essential for proper functioning of the gut and has also been associated with risk reduction for a number of chronic diseases, including heart disease, certain cancers and type 2 diabetes (see also Part 9: Chronic Disease and Nutrition for Older People).

Carbohydrate intakes of older New Zealanders

Table 14 shows the usual daily median carbohydrate intake, and median percentage contribution to total energy intake, and Table 15 shows dietary fibre intakes of New Zealanders aged 65 years and over, as measured by the NNS97.

Table 14: Carbohydrate intakes of older people aged 65 years and over

	Usual daily median carbohydrate intake (g)	Percentage contribution to energy
Women	184	49
Men	247	47

Source: Russell et al 1999a

Table 15: Dietary fibre intakes of older people aged 65 years and over

	Usual daily median fibre intake (g)
Women	19
Men	22

Source: Russell et al 1999a

The NNS97 also reported intake of total sugars. The usual daily median intake for women aged 65 years and over was 87 g, and for men it was 112 g.

Recommended carbohydrate intakes for older New Zealanders

There is no recommended dietary intake or adequate intake set for carbohydrate because there are limited data on which to base estimated requirements. This lack of a specific recommendation in no way reflects a lack of value of carbohydrate as a key component of the diet (NHMRC 2006).

Sources of carbohydrate in the diet

The principal sources of carbohydrate in the diet of older women are: bread (including rolls and speciality breads), fruit, potatoes and kūmara, sugar/sweets and breakfast cereals. The principal sources of carbohydrate in the diet of older men are: bread (including rolls and speciality breads), potatoes and kūmara, sugar/sweets, fruit, breakfast cereals, and cakes and muffins. The principal dietary sources of fibre for older people are: bread (including rolls and speciality breads), vegetables, fruit, potatoes and kūmara, and breakfast cereals.

Bread (including rolls and speciality breads) is the principal energy source for the older population, and is also a significant source of carbohydrate (at 20–24%) and fibre (21–23%) for older people. Good sources of carbohydrates and dietary fibre not listed above include cereal grains other than breakfast cereals (eg, barley, wheat and rye products, and rice), other vegetables, legumes and seeds.

Processed foods frequently contain added sugar, usually sucrose. The principal sources of sugar in the diet of older people are non-alcoholic beverages (eg, carbonated soft drinks, cordial and powdered drinks), sugar/sweets, and fruit.

4.6 Fat

Background

Fats are the most concentrated form of energy for the body. They also aid in the absorption of the fat-soluble vitamins A, D, E and K, and other fat-soluble biologically active components. Fat carries food's flavour components, assists with satiety and enhances palatability.

Chemically, most of the fats in foods are triglycerides, made up of a unit of glycerol combined with three fatty acids, which may be the same or different. The differences between one triglyceride and another are largely due to the fatty acid content. Other dietary lipids include phospholipids, phytosterols and cholesterol (NHMRC 2006).

The structure of the fat molecule determines whether it is classed as saturated or unsaturated. Unsaturated fats (fatty acids) can be further divided into monounsaturated and polyunsaturated fatty acids. Therefore, there are three major types of naturally occurring fatty acids: saturated, cis-monounsaturated and cis-polyunsaturated. A fourth form, the trans fatty acids, is produced by partial hydrogenation of polyunsaturated oils in food processing, and it also occurs naturally, in ruminant animal foods (NHMRC 2006).

Some fatty acids are essential in the diet and also can affect the development of chronic disease. The type of fat consumed is important in certain chronic disease conditions, notably cardiovascular disease (NHMRC 2006).

Saturated and trans fatty acids

Saturated and trans fatty acids have been shown to have adverse effects on the lipid profile. Saturated fatty acids raise both total cholesterol and low-density lipoprotein (LDL) cholesterol. Trans fatty acids raise LDL cholesterol and lower the beneficial high-density lipoprotein (HDL) cholesterol (NHMRC 2006).

Saturated fatty acids contain no double bond; in other words, they are fully 'saturated' with hydrogen. They are the main type of fatty acids found in milk, cream, butter and cheese, meat fat, palm oil and coconut oil, as well as in products such as pies, biscuits, cakes and pastries. Saturated fatty acids have both physiological and structural functions. They can be synthesised by the body so are not required in the diet. Palm oil and coconut oil are different to other plant fats in being a source of saturated fat, whereas other plants are predominantly sources of unsaturated fatty acids (NHMRC 2006).

Trans fatty acids are produced during the manufacture of margarine and shortening, but are also found in manufactured foods that contain partially hydrogenated fat as an ingredient, such as biscuits, cakes, chocolates and convenience foods (NHMRC 2006).

Mono- and poly-unsaturated fatty acids

Unsaturated fatty acids include monounsaturated and polyunsaturated fatty acids. They lower blood total cholesterol and low-density lipoprotein (LDL) cholesterol (National Heart Foundation 1999). Polyunsaturated fatty acids, predominantly linoleic acid, are associated with a reduced incidence of and mortality from coronary heart disease (NHMRC 2006).

The main monounsaturated fatty acid is oleic acid, with one double bond. Olive, canola and peanut oils are rich in oleic acid. Nuts, including macadamia, pistachios, hazelnuts and almonds, are other rich sources of monounsaturated fatty acids. The monounsaturates are also synthesised by the body and are thus not essential in the diet (NHMRC 2006).

Polyunsaturated fatty acids contain two or more double bonds. Polyunsaturated fatty acids with double bonds in the n-3 position are sometimes referred to as omega-3 fatty acids. Omega-6 fatty acids have double bonds in the n-6 position. Essential polyunsaturated fatty acids are required in the diet because the body cannot synthesise them. They are essential for the structural integrity of all cell membranes, and also because they are the precursors to the biologically active eicosanoids that have roles in physiological processes such as reproduction, blood pressure, haemostasis and inflammation (Mann and Skeaff 2007).

The essential polyunsaturated fatty acids are:

- linoleic acid (an n-6 fatty acid), found in seed oils (eg, sunflower, safflower and corn, and soybean oil), which is the precursor of arachidonic acid
- alpha-linolenic (α -linolenic) acid (an n-3 fatty acid), found in plants, including legumes, canola oils and margarines, linseed oils and products, certain nuts such as walnuts, and in small amounts in leafy vegetables.

There are also several other biologically important n-3 fatty acids, called the long-chain (LC) fatty acids: eicosapentaenoic fatty acid (20:5), docosahexaenoic acid (22:6), and docosapentaenoic fatty acid (22:5) (NHMRC 2006). These LC fatty acids are found predominantly in oily fish such as mackerel, herrings, sardines, salmon, tuna and other seafood, and can be synthesised by humans from dietary α -linolenic acid, although the rate of synthesis may not be adequate (Lunn and Theobald 2006). It is therefore recommended that good sources of these fatty acids are included in the diet.

Fat intakes of older New Zealanders

The usual daily median fat intakes of New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Table 16.

Table 16: Fat intakes of older people aged 65 years and over

	Usual daily median fat intake (g)	Percentage contribution to energy
Women	58	33
Men	85	34

Source: Russell et al 1999a

Although absolute median fat intake is 9 g/day lower in older women and 16 g/day lower in older men compared with women and men aged 45–64 years, fat intake remains relatively stable as a proportion of total energy intake. The contribution to energy intake from fat for all New Zealand adults is 35 percent, which has fallen from 37 percent in 1989/90 (Russell et al 1999b).

The usual daily median intakes of each of the different types of fatty acids consumed by older New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Tables 17, 18 and 19.

Table 17: Saturated fat intakes of older people aged 65 years and over

	Usual daily median intake (g)	Percentage contribution to energy
Women	25	14
Men	36	14

Source: Russell et al 1999a

Table 18: Monounsaturated fat intakes of older people aged 65 years and over

	Usual daily median intake (g)	Percentage contribution to energy
Women	19	10
Men	27	11

Source: Russell et al 1999a

Table 19: Polyunsaturated fat intakes of older people aged 65 years and over

	Usual daily median intake (g)	Percentage contribution to energy
Women	8	5
Men	12	5

Source: Russell et al 1999a

Recommended fat intakes for older New Zealanders

There is no recommended dietary intake or adequate intake set for total fat intake for the adult population because it is the type of fat consumed that is crucial to many of the physiological and health outcomes. AIs have been set for some fatty acids. These do not necessarily reflect optimal intake but are the values found in a population with no apparent fatty acid deficiency. The AIs per day for some fatty acids for older New Zealanders are shown in Table 20.

Table 20: Adequate intakes for fatty acids for older people aged 65 years and over

	Linoleic acid (g/day)	α -linolenic acid (g/day)	Total LC n-3 (mg/day) (DHA + EPA + DPA)
Women	8	0.8	90
Men	13	1.3	160

Source: NHMRC 2006

Notes: DHA = docosahexanoic acid, EPA = eicosapentaenoic acid, DPA = docosapentaenoic acid

Dietary intakes of linoleic and α -linolenic acid were not assessed in the NNS97 because there are insufficient food composition data for these fatty acids.

In the NNS97 the median total fat intake in older New Zealanders was 33 to 34 percent of total dietary energy intake, which is near the upper end of the acceptable macronutrient distribution range (AMDR). To achieve the recommended unsaturated fat intakes and to reduce saturated fat intakes, it is necessary to consume plant sources of fats, including nuts and seeds and their oils and margarines (particularly canola, sunflower and safflower), legumes and oily fish (such as mackerel, herrings, sardines, salmon and tuna). A concurrent reduction in animal fats, and foods manufactured with palm and coconut oils would reduce saturated fat intakes.

Sources of fat in the diet

The principal sources of total fat in the diet of older women are butter and margarine, milk, cakes and muffins, beef and veal, cheese and biscuits. The principal sources of total fat in the diet of older men are butter and margarine, milk, beef and veal, cakes and muffins, dairy products, potatoes and kūmara, sausages and processed meats, fats and oils, and biscuits.

Older people consume a greater proportion of their total fat intake from butter and margarine compared with the total adult population. In women aged 75 years and over, butter and margarine contributed a quarter of their total energy intake, compared with 16 percent in the total population. Older people are more likely than younger adults to add discretionary butter and margarine to their food (Simpson et al 2002). In the total adult population, the discretionary addition of fat to food (ie, after preparation but prior to consumption) contributed 23 percent of the total fat intake of adult New Zealanders (Simpson et al 2002). Butter (a saturated fat) and table margarine (predominantly an unsaturated fat) made the largest contribution to discretionary fat intake (44%), followed by milk (20%). Most (83%) of the discretionary butter and margarine was added to bread, followed by potatoes and kūmara, cakes and muffins. Butter – but not margarine – was more likely to be added to vegetables (Simpson et al 2002).

Key points on macronutrients

- Energy requirements can vary widely according to gender, body size and physical activity, but generally decrease with advancing age due to an age-associated loss of lean body mass (sarcopenia).
- Fat, protein, carbohydrate (macronutrients) and alcohol from food and drinks are the sources of energy in the diet.
- Energy balance is achieved when energy intake from food and drinks equals energy expended for metabolic processes and during physical activity.
- Median energy intakes were lower in older adults compared with the total adult population in the NNS97.
- If energy intake is too low it can be difficult to consume adequate intakes of micronutrients.
- Water is an essential nutrient. Older people may be at greater risk of dehydration than younger adults.
- Protein requirements increase with age. Usual daily median protein intakes in the NNS97 met the RDI.
- Carbohydrates provide the largest single source of energy in the diet. Usual daily median carbohydrate intakes in the NNS97 were at the lower end of the acceptable macronutrient distribution range.
- Usual daily median fat intakes in the NNS97 were at the higher end of the acceptable macronutrient distribution range.
- Saturated and trans fatty acids have adverse effects on cardiovascular health, and polyunsaturated fatty acids, predominantly linoleic acid, are associated with reduced incidence of and mortality from coronary heart disease.
- To increase unsaturated fatty acid intakes and reduce saturated fatty acid intakes, it is necessary to consume plant sources (including seeds and nuts and their oils, and legumes) and fish sources (including oily fish) in place of animal sources of fat and foods made with coconut and palm oils.
- Bread was the principal source of energy in the NNS97, and it is also a major source of protein and carbohydrate in the diets of older people.
- Discretionary fat intake may be a useful way of manipulating fat intake, and it is closely related to bread consumption. Increasing butter intake, a saturated fat, is not recommended.
- Consuming a variety of foods from the four food groups will ensure energy and micronutrient recommendations are met, and is more likely to lead to energy balance.
- Some older people may find it difficult to consume enough energy to meet their requirements. Eating at least three meals a day, and adding snacks that are both energy- and nutrient-dense, is considered to be a healthy eating pattern.

Micronutrients

4.7 Calcium

Background

Calcium is required for the normal development and maintenance of the skeleton, as well as for the proper functioning of neuromuscular and cardiac function. It is stored in the bones and teeth, where it provides structure and strength. Low intakes of calcium have been associated with low bone density – osteoporosis. Osteoporosis often results in bone fracture and is a major cause of morbidity among older New Zealanders, particularly post-menopausal women. Calcium intake throughout life is a major factor affecting the incidence of osteoporosis, but other factors, notably adequate vitamin D status and exercise, also affect the incidence of osteoporosis (NHMRC 2006).

Calcium metabolism

All of the body's calcium reserve is stored in the skeleton. The size of the reserve is directly affected by the body's external calcium balance, which depends on the relationship between calcium intake and absorption on the one hand, and losses of calcium through the skin, kidney and bowel on the other.

The total body calcium content differs among individuals because people develop different amounts of bone tissue as the skeleton matures (Goulding 2007). Substantial bone loss usually begins to occur at around 50 years of age in women and 65 years of age in men (WHO 2003). From about these ages, age-related loss of bone has been estimated at about 0.5 to 1.0 percent each year (NHMRC 2006). The loss of calcium in women is associated with menopause and the following five years, where there is a decline in intestinal calcium absorption and/or an increase in urinary calcium excretion (NHMRC 2006). Regular weight-bearing physical activity (such as walking) promotes calcium retention in bone at all ages (see also Part 8: Physical Activity – A Partner to Nutrition; and Part 9: Chronic Disease and Nutrition for Older People).

Calcium balance involves the gut, bones and kidneys, as well as the hormones parathyroid hormone, calcitriol (1,25-dihydroxyvitamin D) and calcitonin. Blood calcium levels can be maintained despite inadequate dietary intakes due to the amount of calcium stored in bone. Bone mass, and subsequent fracture risk, are associated with calcium and vitamin D status.

Calcium requirements are affected by sodium and protein intakes. Sodium intake can adversely affect calcium balance through the promotion of urinary calcium loss (WHO 2002b). High intakes of protein and caffeine also increase urinary calcium excretion (Goulding 2007).

In older people, calcium bioavailability may be reduced by the presence of atrophic gastritis – atrophy of the stomach mucosa, resulting in reduced secretions of gastric acid, intrinsic factor and pepsin from the stomach (see Section 2.5).

Calcium intakes of older New Zealanders

The usual daily median calcium intakes of New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Table 21.

Table 21: Calcium intakes of older New Zealanders aged 65 years and over

Usual daily median calcium intake (mg)	
Women	636
Men	751

Source: Russell et al 1999a

Median calcium intakes were lower in older people compared with adults aged 45–64 years by approximately 40–60 mg/day. It appears that many older people have difficulty consuming the recommended intakes of calcium.

Recommended calcium intakes for older New Zealanders

The recommended dietary intakes for calcium for older New Zealanders are shown in Table 22.

Table 22: Recommended dietary intakes for calcium for older people

	Age (years)	RDI (mg/day)
Women	51–70	1300
	> 70	1300
Men	51–70	1000
	> 70	1300

Source: NHMRC 2006

The higher RDI for women aged 51–70 years compared with that for men reflects the increased requirements for calcium following menopause.

Sources of calcium in the diet

The principal sources of calcium in the diet of older women are: milk, cheese, vegetables, bread, dairy products, and fruit. The principal sources of calcium in the diet of older men are: milk, vegetables, cheese, bread, dairy products and breakfast cereals. Since 1996 some foods may be fortified with calcium (eg, reduced-fat milk) and this may have increased the calcium intake of New Zealanders. Fortified reduced-fat milk, milk products and calcium fortified milk substitutes (eg, soy milks) are good sources of calcium.

Other good sources of calcium not listed above include canned fish with bones, legumes, nuts, leafy vegetables, dried fruit and tofu (Goulding 2007). For natural food sources of calcium, calcium content is of equal or greater importance than bioavailability. The efficiency of calcium absorption varies across foods because calcium may be poorly absorbed from foods rich in oxalic acid (eg, spinach, rhubarb, beans) or phytic acid (seeds, nuts, grains, certain raw beans and soy isolates). Absorption from soy beverages can be – but is not always – as high as that from milk. Compared with milk, calcium absorption from dried beans is about 50 percent and from spinach, 10 percent (NHMRC 2006).

Calcium supplementation

Supplemental calcium is another source of calcium, and may be appropriate if dietary restrictions or lactose intolerance limit intake of milk and milk products, or if the person is at high risk of osteoporosis. In the NNS97, the usual daily dietary median intake of calcium for women aged over 65 years was 636 mg, and the current RDI is 1300 mg. Older women aged 65–74 years were the highest users of calcium supplements, at 9 percent. Only 1 percent of men aged 65–74 years, and no men aged 75 years and over, used calcium supplements.

Caution may be needed with respect to future calcium supplement recommendations. Data from a recent New Zealand study on healthy older women, randomised to receive calcium supplementation, showed increased rates of myocardial infarction among those who received calcium citrate supplements. These preliminary data suggest that the use of calcium supplementation in healthy older women may increase the incidence of cardiovascular events (Bolland et al 2008). This possible risk should be balanced against the likely benefits of calcium supplementation for bone health, especially in older women. In general, cardiac health may need to be considered as an area of concern relating to calcium supplementation use, and should be assessed carefully before supplements are recommended.

4.8 Vitamin D

Background

Vitamin D is a hormone with roles in bone metabolism, calcium homeostasis and parathyroid gland secretion. Deficiency of vitamin D results in inadequate mineralisation and demineralisation of the skeleton. In adults, deficiency can lead to increased bone turnover and osteoporosis and osteomalacia (porous bone, resulting in bone and muscle pains, and weakness), and may be associated with a higher number of falls (NHMRC 2006).

The relatively recent discovery of vitamin D receptors located in organ tissues throughout the body (eg, brain, heart, breast, skin and sex organs) has inspired research into other possible roles for this nutrient, including in some cancers (Lappe et al 2007), heart disease (Giovannucci et al 2008) and diabetes (Pittas et al 2007). Further research is required to understand the effects of vitamin D insufficiency and deficiency on health outcomes.

Vitamin D metabolism

Vitamin D occurs in two forms. One is produced by the action of sunlight on skin (D_3 or cholecalciferol) and the other is found in a limited range of foods (D_2 or ergocalciferol). Vitamin D in foods is fat soluble. In the blood, vitamin D appears as 25-hydroxyvitamin D (25(OH)D), which is the measure of vitamin D status. This is converted by the kidneys and other organs into 1,25-dihydroxyvitamin D ($1,25(OH)_2D$, or calcitriol), its biologically active form (NHMRC 2006).

Vitamin D maintains serum calcium concentrations. Calcitriol directly mediates the effect of parathyroid hormone to reabsorb calcium in the intestine, and assists the resorption effects of parathyroid hormone on the kidney and bone (Goulding 2007).

Vitamin D status

Vitamin D status is generally maintained by exposure to sunlight (NHMRC 2006), specifically ultraviolet B radiation. Vitamin D can also be consumed in smaller quantities from the diet, although not at levels to meet vitamin D requirements. Dietary vitamin D intakes were not

measured in the NNS97. In comparison with sun exposure, dietary sources of vitamin D are likely to make a relatively small contribution to the overall vitamin D status of older New Zealanders, although there are no recent data to demonstrate this link.

There is evidence that the vitamin D status of New Zealand adults may be suboptimal (Rockell et al 2006). Analysis of blood samples collected during the NNS97 showed that 3 percent of the adult population were vitamin D deficient ($25(\text{OH})\text{D} < 17.5 \text{ nmol/L}$) and 48 percent were vitamin D insufficient ($25(\text{OH})\text{D} < 50 \text{ nmol/L}$). Māori and Pacific peoples had lower levels of $25(\text{OH})\text{D}$ in the blood than New Zealand European/Other adults.

There is a lack of consensus internationally about what the optimal level of serum $25(\text{OH})\text{D}$ is for normal metabolism and maximum bone health, particularly for older people (NHMRC 2006). There are some suggestions that levels of up to 75–100 nmol/L are optimal; at a cut-off of 80 nmol/L, 80 percent of the New Zealand adult population would have insufficient blood levels of vitamin D (Rockell et al 2006).

In New Zealand adults, blood $25(\text{OH})\text{D}$ declines with age in women, but not in men, and women generally have lower vitamin D levels than men (Rockell et al 2006). Older people are particularly at risk of vitamin D insufficiency if they have limited exposure to sunlight; for instance, those who have limited mobility, are house-bound, or live in a residential care institution. Those with dark skin or who always cover their skin and/or wear a veil are also at higher risk of suboptimal vitamin D.

Ageing also influences the capacity to synthesise vitamin D in the skin. A 70-year-old person exposed to the same amount of sunlight as a 20-year-old makes about 25 percent of the vitamin D that the younger person does (Holick 2004). A decline in renal function, gut function and malabsorption may also influence vitamin D status in older people (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005).

Vitamin D and sun exposure

In New Zealand, although ultraviolet B radiation through sun exposure contributes to vitamin D status, ultraviolet B also accounts for 90 percent of skin cancers (Australian and New Zealand Bone and Mineral Society et al 2007). Therefore, it is important to try to strike a balance between safe sun exposure for maintaining adequate vitamin D status and minimising the risk of skin cancer.

A sufficient and safe amount of sun exposure required to synthesise vitamin D while preventing skin cancer depends on the season, time of day, geographical location (that is, latitude), skin type, sunscreen use and ageing (Cancer Society of New Zealand 2008). *The Risks and Benefits of Sun Exposure in New Zealand* position statement (Cancer Society of New Zealand 2008) recommends spending time outside each day to prevent a reduction in vitamin D levels.

Recommended vitamin D intakes for older New Zealanders

The recommended intakes for vitamin D assume no, or minimal, exposure to sunlight. Recommended intakes, expressed as adequate intakes for older New Zealanders, are shown in Table 23.

Table 23: Adequate intakes for vitamin D for older people

	Age (years)	AI (µg/day)
Women	51–70	10
	> 70	15
Men	51–70	10
	>70	15

Source: NHMRC 2006

The increased AI for older women and men aged over 70 years reflects the reduced capacity of the skin to produce vitamin D and low body stores associated with ageing (NHMRC 2006).

Sources of vitamin D in the diet

Vitamin D can be consumed in small quantities from the diet, where it occurs naturally in oily fish, fish liver oils, milk and milk products, and eggs (LINZ Activity and Health Research Unit 1992). Vitamin D can also be consumed from vitamin D-fortified foods. Since 1996 voluntary fortification of margarine, fat spreads and their reduced-fat counterparts has been permitted. Margarine contributed approximately 30 percent of total vitamin D intake for people aged 65 years and over in the 1992 Life in New Zealand Survey (LINZ Activity and Health Research Unit 1992). Vitamin D may also be added to reduced-fat milk and milk products, dried milk, cheese, yoghurt, soy beverages and food drinks.

Vitamin D supplementation

Supplementation with vitamin D may be necessary if vitamin D status is suboptimal, or if regular and adequate sun exposure is unlikely (see above). Health practitioners should be aware that the vitamin D status of older people in New Zealand may be suboptimal and identify those at risk of vitamin D deficiency.

The NRV recommendations for supplementation with 10–25 µg (400–1000 IU) per day of vitamin D are primarily aimed at institutionalised or bed-bound elderly who have very restricted exposure to sunlight, often accompanied by reduced food intake (NHMRC 2006). However, in winter there may not be sufficient ultraviolet radiation to maintain optimal levels of vitamin D among older people, particularly in the south of New Zealand. Therefore, older people are likely to benefit from supplementation with vitamin D (Cancer Society of New Zealand 2008). In the United Kingdom, the Scientific Advisory Committee on Nutrition (2007) considers older people will only achieve recommended vitamin D intakes through supplementation.

Based on available randomised controlled trials and meta analyses, there is some evidence to support vitamin D supplementation above 10 µg for fracture prevention (Bischoff-Ferrari et al 2009a), especially in combination with calcium (Zhang 2007; American Dietetic Association 2009; The DIPART Group 2010). There is little evidence for the effectiveness of vitamin D below this dose, or for vitamin D supplementation alone. Further research is needed to determine the role of vitamin D₃ and D₂ supplementation alone in reducing the incidence of fractures (American Dietetic Association 2009).

According to a review from the American Dietetic Association, the evidence is inconsistent regarding the effect of supplemental vitamin D₂ or D₃ on reduction of falls in older men and women (American Dietetic Association 2009). However, a recent meta analysis of randomised controlled trials (Bischoff-Ferrari et al 2009b) reported a 19 percent reduction in falls with vitamin D supplementation of 17.5–25 µg (700–1000 IU) per day. Further research is required to determine the role of vitamin D in preventing falls.

4.9 Iodine

Background

Iodine is an essential component of the thyroid hormones thyroxine (T_4) and 3,5,3'-tri-iodothyronine (T_3). These hormones are required for normal growth and development of tissues, such as the central nervous system, and have a broader role in maturation of the body as a whole. They are important for energy production and oxygen consumption in cells, thereby helping to maintain the body's metabolic rate (NHMRC 2006).

Iodine deficiency leads to a wide range of problems collectively known as 'iodine deficiency disorders' (IDD) (Hetzel 2000). Internationally, IDD is a common health problem. According to the WHO, in 2007 nearly 2 billion individuals had insufficient iodine intake (de Benoist et al 2008). The nature and severity of IDD can vary widely, and depend on the severity and duration of the iodine deficiency and the life stage of the population affected (Delange and Hetzel 2006). As the iodine status of a population deteriorates, the health impact across the population worsens. Further, the lower the iodine status of the group, the greater the risk of there being individuals with very low iodine status.

Iodine deficiency may result in goitre, with its complications of hypothyroidism, impaired mental function and iodine-induced hyperthyroidism (ICCIDD et al 2001).

Iodine status in New Zealand

Most soils in New Zealand are low in iodine, resulting in low concentrations in locally produced foods (Thomson 2002). In the early 1900s goitre was endemic in many parts of New Zealand before the introduction of iodised salt in 1924 (Hercus et al 1925). The level added to iodised table salt was raised in 1938 to 40–80 mg of iodine per kilogram of salt, and by 1953 the proportion of children with enlarged thyroid glands fell to around 1 percent (Purves 1974).

Studies from the mid-1960s to the mid-1980s indicated that iodine intake throughout this period was adequate due to continuing iodised table salt usage, and the use of iodine-containing sanitising agents (iodophors) by the dairy industry, increasing the iodine content of cows' milk products (Cooper et al 1984; Simpson et al 1984).

Iodine deficiency has since re-emerged in New Zealand. Mild iodine deficiency was reported after assessing iodine status from urine samples of adults in the 1990s. In a 1997/98 study, lower iodine status was reflected in enlarged thyroid glands and elevated serum thyroglobulin levels, suggesting the re-emergence of mild iodine deficiency and goitre in New Zealand (Thomson et al 2001).

Iodine intakes of older New Zealanders

Neither dietary iodine intakes nor urinary iodine excretion were assessed in the NNS97. The 2008/09 adult nutrition survey is collecting urine samples to assess iodine status.

Estimated iodine intakes in the New Zealand Total Diet Surveys from 1982 to 2003/04 support the findings of Thomson et al (2001) that the iodine intake of New Zealanders is decreasing in all age–sex groups. The Total Diet Surveys estimate iodine intake based on simulated typical diets, which do not include discretionary salt use.

There are several reasons for the declining iodine intake. One of the major contributors is that the dairy industry has replaced iodophors with other sanitising compounds, resulting in lower iodine

concentration in milk products (Sutcliffe 1990). Other contributions are dietary changes such as the use of more ready-to-eat and pre-prepared foods, in which food manufacturers do not use iodised salt, and a lower discretionary salt use (ie, in cooking and at the table) (Thomson 2002).

Mandatory fortification of bread with iodine

Mandatory fortification of bread with iodine (as iodised salt) was introduced in September 2009. All bread (except organic and unleavened bread) is required to contain iodine to address the re-emergence of iodine deficiency in New Zealand.

Mandatory fortification is expected to increase average daily iodine intakes by 30–70 µg/day if two to three slices of fortified bread (depending on the thickness) are eaten (Food Standards Australia New Zealand 2008). Approximately 65 percent of older women aged 65 years and over and just over 75 percent of men aged 65 years and over consume three or more servings of bread a day. Older people who regularly eat commercially produced bread will have improved iodine status from September 2009, but other food sources of iodine are still required to meet the RDI.

The voluntary permission for iodine in iodised salt has been retained at the current range of 25–65 mg per kg, to be consistent with the mandatory requirement (Food Standards Australia New Zealand 2008).

Recommended iodine intakes for older New Zealanders

The recommended dietary intakes for iodine for older New Zealanders are shown in Table 24.

Table 24: Recommended dietary intakes for iodine for older people

	Age (years)	RDI (µg/day)
Women	51–70	150
	> 70	150
Men	51–70	150
	> 70	150

Source: NHMRC 2006

Sources of iodine in the diet

Marine animals and plants concentrate iodine from seawater, so seafoods (including seameal, seaweed and kelp) are rich sources. Iodine is secreted into milk, so milk and milk products are a useful source. Other sources of iodine include eggs, some meat and cereals, and bread (when fortified with iodised salt). Iodised salt is readily available (Thomson 2004).

If required, iodine supplementation should be managed by a medical practitioner. Kelp tablets are not recommended as their iodine content is highly variable and an excessive iodine intake can be harmful to health.

4.10 Folate

Background

'Folate' is a generic term for a group of over 100 compounds that have a common vitamin activity. Folic acid (pteroyl glutamic acid, or PGA) is a synthetic form of folate and is most often used in fortified foods and supplements because of its stability and high bioavailability. Folate functions as a coenzyme in single-carbon transfers in the metabolism of nucleotides and amino acids. It is essential for the formation of thymidylate for DNA synthesis, and without folate living cells cannot divide (NHMRC 2006).

Bioavailability of folate in food varies from 50 to 60 percent, whereas that of the folic acid used to fortify foods or as a supplement is about 85 percent. Folic acid as a supplement is almost 100 percent bioavailable on an empty stomach (NHMRC 2006).

The term dietary folate equivalent (DFE) is used to address the issue of varying bioavailability (NHMRC 2006):

1 µg DFE	= 1 µg food folate
	= 0.5 µg folic acid (on an empty stomach)
	= 0.6 µg folic acid (with meal/as fortified food)

Inadequate intakes of folate and vitamin B₁₂ can both result in megaloblastic anaemia. Secondary folate deficiency may result from impaired absorption due to diseases involving the small intestine (such as coeliac disease and Crohn's disease) as well as chronic alcohol consumption (Donnelly 2001).

Smokers are also at risk for folate deficiency. It is thought that smoking impairs absorption, although more recent evidence suggests that smoking is not the causal factor. Rather, the deficiency may be caused by smokers consuming fewer folate-containing foods, such as vegetables and fruit (Vardavas et al 2008).

Folate intakes of older New Zealanders

The usual daily median folate intakes of New Zealanders aged 65 years and over, as measured by the NNS97, are shown in Table 25.

Table 25: Folate intakes of older New Zealanders aged 65 years and over

	Usual daily median folate intake (µg)
Women	217
Men	256

Source: Russell et al 1999a

In the NNS97 there was some difficulty in establishing accurate food composition data for folate, so these data should be used and interpreted with care (Russell et al 1999a).

Recommended folate intakes for older New Zealanders

The recommended dietary intakes for folate, expressed as dietary folate equivalents, for older New Zealanders are shown in Table 26.

Table 26: Recommended dietary intakes for folate (expressed as dietary folate equivalents) for older people

	Age (years)	RDI (µg/day)
Women	51–70	400
	> 70	400
Men	51–70	400
	>70	400

Source: NHMRC 2006

Sources of folate in the diet

The principal sources of folate in the diet of older women are: vegetables, bread (including rolls and specialty breads), breakfast cereals, fruit and non-alcoholic beverages (including fruit juice). The principal sources of folate in the diet of older men are: vegetables, bread (including rolls and specialty breads), breakfast cereals, potatoes and kūmara, non-alcoholic beverages (including fruit juice) and fruit.

Folate is widely distributed in food, especially in green leafy vegetables, legumes and liver. Good sources of folate not listed above are fruit juices, nuts and seeds. Heat and oxidation during cooking and storage can destroy as much as half the folate in foods. Therefore, uncooked vegetables and fruits are better sources of folate than cooked forms.

The Australia New Zealand Food Standards Code permits voluntary addition of folic acid to some food products, including breakfast cereals and bread. In New Zealand, mandatory fortification of bread with folic acid has been deferred until May 2012.

Other micronutrients

4.11 Zinc

Zinc is a component of various enzymes that help maintain the structural integrity of proteins and regulate gene expression. Zinc deficiency can result in impaired immune responses (NHMRC 2006). Zinc may help prevent the age-related decline in immune system function (Bogden 2004; Smorgon et al 2004; Islam et al 2007) (see also Part 9: Chronic Disease and Nutrition for Older People).

Table 27 shows the usual daily median zinc intakes of older New Zealanders aged 65 years and over, as measured by the NNS97, and recommended dietary intakes.

Table 27: Zinc intakes and recommended dietary intakes for older New Zealanders aged 65 years and over

	Usual daily median zinc intake (mg) ¹	RDI (mg/day) ²
Women	8.9	8
Men	11.6	14

Sources: ¹Russell et al 1999a; ²NHMRC 2006

Zinc is widely distributed in foods. Meat, fish and poultry are good sources, and highly bioavailable. Cereals, milk and milk products are also good sources. Some nuts are high in zinc, including peanuts, almonds, cashew nuts and sesame seeds (Athar 2006). In general, dark red meat has a higher zinc content than white meat and fish (Samman 2007). The NNS97 data show that older New Zealanders obtain most of their zinc from beef and veal, milk, bread, poultry and vegetables.

4.12 Vitamin B₁₂

Vitamin B₁₂ is required for the synthesis of fatty acids in myelin and, in conjunction with folate, for DNA synthesis. Adequate intake of vitamin B₁₂ is essential for normal blood and neurological function (NHMRC 2006). Total body stores of vitamin B₁₂ are estimated to be at a sufficient level to last several years.

Secretions of gastric acid, intrinsic factor and pepsin from the stomach are required for absorption of vitamin B₁₂. In older people with atrophy of the stomach mucosa, or atrophic gastritis, these secretions are reduced, thus reducing the bioavailability of vitamin B₁₂ (Truswell 2007). Vitamin B₁₂ deficiency can produce haematological, neurological or gut symptoms. The haematological effects (megaloblastic anaemia) usually precede neurological symptoms and are indistinguishable from folate deficiency. They include a range of effects generally associated with anaemia, such as skin pallor, lowered energy and exercise tolerance, fatigue, shortness of breath and palpitations (NHMRC 2006). Because of the similarities in the presentation of vitamin B₁₂ and folate anaemia, biochemical tests must be used to distinguish between them (Truswell 2007).

Neurological complications are present in about 75 to 90 percent of people with frank deficiency. They include sensory disturbances in the extremities, motor disturbance, and cognitive changes ranging from memory loss to dementia, with or without mood change. There may also be visual disturbances, impotency and impaired bowel and bladder control (NHMRC 2006). Even in the absence of anaemia, suboptimal vitamin B₁₂ status may place older people at increased risk of neurological abnormalities (Green et al 2005).

Table 28 shows the usual daily median vitamin B₁₂ intakes of older New Zealanders aged 65 years and over, as measured by the NNS97, and recommended dietary intakes.

Table 28: Vitamin B₁₂ intakes and recommended dietary intakes for older New Zealanders aged 65 years and over

	Usual daily median vitamin B ₁₂ intake (µg) ¹	RDI (mg/day) ²
Women	2.9	2.4
Men	4.0	2.4

Sources: ¹Russell et al 1999a; ²NHMRC 2006

In two studies of older New Zealanders, approximately 10 percent of the study populations had suboptimal serum vitamin B₁₂ concentrations (de Jong et al 2003; Green et al 2005).

Almost all dietary sources of vitamin B₁₂ come from animal foods, meat, milk and milk products, eggs, and seafood. There are some plant-based sources of vitamin B₁₂, such as certain algae and plants exposed to bacterial action or contaminated by soil or insects. As the bioavailability of vitamin B₁₂ may be lower in older people with atrophic gastritis, they may require vitamin B₁₂ supplements or intramuscular injections. Strict vegans (who eat no animal products) will require vitamin B₁₂ supplementation (NHMRC 2006).

4.13 Sodium

Sodium is found in most foods as sodium chloride – generally known as salt. Each gram of salt contains 17.1 mmol of sodium. Sodium is also present in the diet as sodium bicarbonate and food additives, including monosodium glutamate, sodium phosphate, sodium carbonate and sodium benzoate (NHMRC 2006).

Sodium is an important component of extracellular fluid and is important for the active transport of molecules across cell membranes. It is also a key factor in retaining body fluids. Although sodium is an essential nutrient, intakes of sodium in developed countries greatly exceed those required to meet daily requirements. There is strong, consistent evidence of an association between dietary salt intakes and blood pressure. High blood pressure is an important risk factor for cardiovascular disease, particularly stroke and coronary heart disease, and for renal diseases (NHMRC 2006). Blood pressure increases progressively in a dose-dependent relationship with sodium chloride excretion across the range seen in populations around the world (NHMRC 2006). Sodium intake can also adversely affect calcium balance through the promotion of urinary calcium loss, with implications for bone mass and osteoporosis (WHO 2002b).

In Western countries up to 60–85 percent of the salt consumed is found in processed foods (Young and Swinburn 2002; Ni Mhurchu et al 2003; Chisholm and Mann 2006). Bread is the greatest source of sodium in the diet of New Zealanders, accounting for one-quarter of all dietary sodium (Ministry of Health and University of Auckland 2003). Other manufactured foods found to make large contributions are processed meats (10%), sauces (7%), breakfast cereals (6%) and cakes, muffins, biscuits and crackers (5%) (Ministry of Health and University of Auckland 2003). Other foods that are often high in salt include pre-prepared meals, soups and seasonings, and takeaways.

In older people the age-associated decline in taste may mean that they use more salt or salt-based products (eg, powdered stock, gravy mixes and soups, prepared sauces, soy sauce, and flavour sachets) to flavour their food. Older people on a budget may also purchase lower cost foods and budget-label foods, which tend to have higher sodium content than branded equivalents (Monro et al 2004).

The recommended intakes for sodium, expressed as adequate intakes for older New Zealanders, are shown in Table 29.

Table 29: Adequate intakes for sodium for older people

	Age (years)	AI (mg/day)
Women	51–70	460–920*
	>70	460–920
Men	51–70	460–920
	>70	460–920

Source: NHMRC 2006

Note: *460–920 mg = 20–40 mmol

Dietary intakes of sodium were not assessed in the NNS97. The 2008/09 adult nutrition survey will measure urinary sodium excretion. Obtaining accurate sodium intake data is difficult because of discretionary salt intake – when people choose to add salt to their food during cooking or at the table. New Zealand studies suggest that daily sodium intake for all adults is approximately 150 mmol, or 9 grams of salt (Ministry of Health and University of Auckland 2003). This amount is higher than the AI. Reducing sodium intake could substantially lower blood pressure (Ministry of Health and University of Auckland 2003).

Key points on micronutrients

- A low energy intake may result in inadequate intakes of essential micronutrients.
- Consuming a variety of foods from the four food groups will provide a range of micronutrients.
- Low intakes of calcium and poor vitamin D status are risk factors for osteoporosis. Osteoporosis is a major cause of morbidity among older people in New Zealand.
- The RDI for calcium is higher for older men aged over 70 years and for women aged over 51 years than for younger adults.
- It appears that many older people have difficulty consuming the recommended intakes of calcium.
- Calcium supplementation may benefit bone health in older people, but must be weighed against possible risks, including cardiac health.
- Vitamin D is essential for bone health, and vitamin D status is also associated with a number of other possible roles in the body.
- The vitamin D status of older New Zealanders may be suboptimal.
- Most of the body's vitamin D is obtained from sun exposure. Older people at risk of suboptimal vitamin D status include those who do not have regular and adequate sun exposure (eg, those who have limited mobility, are house-bound, or live in a residential care facility).
- There is evidence that vitamin D supplementation above 10 µg/day (400 IU) in combination with calcium may help to prevent fractures. There is less clear evidence that vitamin D supplementation alone, or lower doses (less than 10 µg/day) of vitamin D supplementation, prevents fractures.
- There may not be sufficient ultraviolet radiation to maintain optimal levels of vitamin D, particularly in the south of New Zealand and among older people. Older people are likely to benefit from supplementation with vitamin D.
- Older people with atrophic gastritis may require vitamin B₁₂ supplements or intramuscular injections. Strict vegans (who eat no animal products) will require vitamin B₁₂ supplementation.
- Consuming foods with zinc and vitamin B₁₂ is important, as older people may be at higher risk of deficiency than younger adults.
- A reduction in sodium intake is beneficial for older people.
- Older people should choose foods low in salt, and use minimal added salt when preparing food.
- When using salt, iodised salt is recommended.

4.14 Supplementation

Background

A healthy eating pattern for all New Zealanders should be focused on consuming a wide variety of foods in recommended serving sizes. This reduces the risk of both inadequate and excessive nutrient intakes (American Dietetic Association 2005a). With the growing worldwide trend of increasing supplement use, it is increasingly likely that New Zealanders are obtaining nutrients both from foods and from dietary supplements (Parnell et al 2006).

Dietary supplements discussed in this section include prescribed and self-selected supplements from a variety of sources: tablets, powders or liquid preparations of vitamins and/or minerals, herbal and botanical preparations, and combinations of these substances. This definition was used to gather and analyse data on supplements in the NNS97.

Research on supplement use in the general adult New Zealand population shows that those who take supplements have similar or higher nutrient intakes than those who do not. This suggests that supplement users are those who are the least likely to need them (Smith et al 2005). Similarly, older people in Australia are unlikely to use supplements for nutrients that are inadequately supplied in their diets; for example zinc, folate and vitamin B₆ (Horwath and Worsley 1989).

Dietary supplement use may be of concern in older people because of:

- adverse effects related to the continued use of large amounts of certain vitamins and minerals in excess of the upper level of intake (UL) (eg, vitamin A and iron)
- interactions among minerals and trace elements when one supplemental nutrient intake exceeds the UL (eg, excess consumption of zinc is associated with reduced copper status)
- the risk of supplements interfering with prescription and over-the-counter medicines
- reliance on dietary supplements being associated with an artificial sense of security about nutrient adequacy or health, thus potentially impairing the adequacy of food intake or delaying the person from seeking effective treatment (American Dietetic Association 2005a; Smith et al 2005; Parnell et al 2006; Sebastian et al 2007).

Supplement intakes among older people in New Zealand

The NNS97 showed that the prevalence of supplement use was higher among older females than older males for vitamin and/or mineral supplements and ‘other’ supplements (including garlic, oils and botanical products). Older people were more likely to use these products regularly (at least once per week during the last year) than occasionally (no more than three times per month during the last year).

The types of supplements used most commonly by older people over the previous year were multivitamin and/or mineral supplements, garlic and oils (eg, evening primrose and codliver oils). The next most common supplements for older women were bran/ fibre, calcium and bee products. The next most common supplements for older men were bee products, bran/fibre, and antioxidants and other multinutrients (see also Section 4.7: Calcium and Section 4.8: Vitamin D above). Table 30 summarises these findings.

Table 30: Consumption frequency of supplement use in the last year among older New Zealanders

	Age (years)	Consumption frequency (%)			
		Vitamin and mineral		Other supplements	
		Regular	Occasional	Regular	Occasional
Women	65–74	35	15	28	10
	75+	26	8	29	6
Men	65–74	21	4	24	3
	75+	19	5	15	5

Source: Russell et al 1999a

Note: Regular = at least once per week during the last year; occasional = no more than three times per month during the last year.

In the NNS97 the prevalence of supplement use when people reported use over the last 24 hours was different from their reported use over the previous year. Reporting use over the last 24 hours may underestimate overall use, as a number of people use supplements on an irregular basis (Parnell et al 2006).

The prevalence of supplement use was lower in older people compared with younger adults when reporting for the previous year, but prevalence of use increased with age when reporting for the previous 24 hours. This finding is similar to patterns of reporting elsewhere (Parnell et al 2006). Older people are more likely than younger adults to be regular users, and younger adults are more likely to take supplements on an episodic or trial basis (Smith et al 2005; Parnell et al 2006). For the general adult population, the diets of both supplement users and non-supplement users were similar; in other words, the supplements did not displace any food and the supplement users were not likely to be in need of a supplement compared with the non-users (Smith et al 2005).

Data for older Māori and Pacific populations are lacking from the NNS97. However, in the general population (aged 15 years and over) the prevalence of Māori and Pacific peoples reporting supplement use was lower than that for Europeans. These ethnic differences were independent of income and education, and may reflect cultural differences in attitudes towards the sufficiency of food (Smith et al 2005).

Implications of supplement use

It is difficult to judge what contribution these supplements make to nutrient intakes and health outcomes for older people in New Zealand. Not only is there no internationally agreed method of measuring and assessing dietary supplement intakes or accurate data, but individuals can use different supplements at different life events, and may use supplements irregularly, or regularly from month to month or week to week (Parnell et al 2006). As well, in the NNS97 there was insufficient information to identify approximately a quarter of the supplements reported (Parnell et al 2006). It is difficult to know whether older people taking a multivitamin and/or mineral supplement are doing so to target a perceived inadequate intake or specific nutrient deficiency. However, if older people use supplements in the same way as the total population, they are generally not taking supplements for those nutrients that are most likely to be inadequately supplied through the diet.

There is some evidence that a range of nutrients could have benefits for reducing chronic disease at levels above the recommended dietary intake or adequate intake (NHMRC 2006). However, the evidence suggests that it is whole foods rather than isolated food components that are associated with good health. Therefore, taking nutrients in supplement form may not be as beneficial as consuming the foods (eg, vegetables and fruit) themselves (WHO 2002b). A dietary approach to consuming increased levels of nutrients is encouraged rather than using supplements, so that nutrient balance is maintained and benefits are optimised (NHMRC 2006) (see also Part 9: Chronic Disease and Nutrition for Older People).

There have been a number of studies assessing the relationship between antioxidant nutrients (including vitamin A and carotenoids, vitamin C, vitamin E and selenium) and chronic disease outcomes, mainly cancer and coronary heart disease. Results are inconsistent, and in some studies adverse effects have been shown. Most diet–disease risk intervention studies have, for pragmatic reasons, used supplements rather than dietary change. In many instances supplement mixes (eg, of antioxidant micronutrients) have been used and there is some evidence that these may be more effective than single nutrient approaches (NHMRC 2006).

Supplementation is not recommended except under medical supervision due to experiences of adverse outcomes (eg, with beta-carotene and cancer risk). Any supplementation should be based on individual requirements (NHMRC 2006). Doctors, pharmacists and other health practitioners need to be aware of the risks and benefits associated with supplement use in older people and of the most appropriate types and doses of supplements for this group.

Key points on supplements

- People who choose to take supplements generally do not have dietary intakes that differ from those not taking supplements.
- Dietary supplementation may be associated with a range of adverse effects in older people.
- Multivitamins and minerals are the most common type of supplement taken by older people in New Zealand.
- Older people are more likely to be regular than occasional users of supplements.
- Māori and Pacific peoples are less likely than Europeans to use supplements.
- There is some evidence that a range of nutrients could have benefits for chronic disease at levels above the RDI or AI. However, overall the evidence suggests that it is whole foods, rather than isolated food components (ie, as in supplements) that are associated with good health.
- To achieve recommended nutrient intakes, older people should be encouraged to consume a variety of foods from the four food groups.

4.15 Alcohol

Background

Alcohol is not a nutrient, but is a source of energy. It provides 29 kJ per gram of alcohol. Alcohol is the most commonly used recreational drug in New Zealand. In the 2006/07 New Zealand Health Survey (NZHS) 84 percent of all adult New Zealanders reported consuming alcohol in the previous year (Ministry of Health 2008a).

Alcohol causes a range of adverse effects on health, including cirrhosis of the liver, pancreatitis, endocrine disorders, cardiomyopathy, gastritis, high blood pressure, haemorrhagic stroke, and cancers of the mouth, pharynx, larynx, oesophagus, breast and liver. It also contributes to death and injury on the roads, drowning, suicide, assaults and domestic violence, other non-traffic-related mortality and morbidity, and some mental health disorders and sexual health problems. High levels of alcohol use are also associated with alcohol dependence and abuse (Ministry of Health 2008a). Moderate alcohol consumption may have some benefits for older people, but further research is needed to fully understand the potential benefits.

Alcohol and nutrition

Alcohol is the second highest source of energy on a per gram basis, and provides little further nutrition except for (depending on the type of drink) very small amounts of carbohydrate, protein and some micronutrients. Energy consumed from alcohol is likely to be in addition to an individual's usual dietary energy intake (ie, individuals are unlikely to reduce their energy intake from food to compensate for their alcohol intake) (Foster and Marriott 2006). Alcohol may also act as an appetite stimulant, although the duration and magnitude of this effect varies (Foster and Marriott 2006). It is well recognised that chronic and excessive drinking affects an individual's nutrient intake and nutrient status. Even moderate alcohol intake may interfere with the digestion, absorption and utilisation of some nutrients. Thiamin and folate deficiencies are common among chronic heavy drinkers, and there is some evidence that vitamin B₁₂ status may be adversely affected (Foster and Marriott 2006).

Alcohol and older people

Older people are more prone to the adverse effects of alcohol because of changes in the way the body metabolises alcohol with age. The liver becomes less efficient at breaking down alcohol as people age and, due to a decline in body water content with age, older people tend to have a higher blood alcohol concentration after a standard dose of alcohol compared with younger people (Lang, Guralnik et al 2007). Alcohol's effects are also influenced by chronic illness such as impaired cognitive function, and through adverse interactions with medication; older people particularly are at higher risk of these factors (Lindberg and Amsterdam 2007). Drinking alcohol also slows down reactions and weakens judgement, balance and self-control. In older people this may increase the risk of falls and accidents (ALAC 2008).

Alcohol and chronic disease

The relationship between alcohol consumption and cardiovascular health has been investigated for many years. Despite the apparent benefits of regular, light to moderate alcohol consumption for cardiovascular mortality in older people, the risks and benefits of alcohol consumption are still not well understood. It is now thought that the cardiovascular benefits of alcohol consumption have been overstated. Methodological issues and uncontrolled confounding have called previous evidence into question (Jackson et al 2005; Middleton Fillmore et al 2007) (see also Part 9: Chronic Disease and Nutrition for Older People).

Due to the possible benefits of alcohol consumption and vascular health, there is an increasing amount of research being done on the effects of alcohol consumption on cognitive decline, dementia and Alzheimer’s disease – conditions that are related to vascular health. In a systematic review of largely epidemiological population cohort studies, low to moderate alcohol intake in subjects aged 65 years and over was associated with a significantly reduced risk of incident dementia and Alzheimer’s disease, and a reduced risk of vascular dementia and cognitive decline (Peters et al 2008). In an analysis of two large-scale prospective studies of older people, moderate alcohol consumption showed no increase in risk for physical disability or cognitive function measures (Lang, Guralnik et al 2007). In one of these studies, moderate alcohol consumption was associated with better subjective wellbeing and fewer depressive symptoms than with never having drunk any alcohol (Lang, Wallace et al 2007). The authors noted that the results should be interpreted with caution, however, and these studies are subject to the same methodological concerns regarding the validity of the findings on the cardiovascular benefits of alcohol consumption.

Prevalence of alcohol consumption

In the 2006/07 NZHS approximately 70 percent of women aged 65–74 years had consumed alcohol in the last 12 months, along with 60 percent of women aged 75 years and over. Just over 80 percent of men aged 65 years and over had consumed alcohol in the last 12 months.

Hazardous drinking, defined as an Alcohol Use Disorders Identification Test score of 8 or more, was reported by 2.2 percent of women aged 65–74 years and 1.6 percent of women aged 75 years and over, and by 12.7 percent of men aged 65–74 years and 6.5 percent of men aged 75 years and over (Ministry of Health 2008a).

The 2006/07 NZHS results are consistent with a study of 141 older people living in the community in Christchurch (Khan et al 2002). In this study 83 percent of participants had consumed alcohol in the last 12 months. Almost 10 percent of the participants were classified as having a hazardous or harmful drinking pattern, most of whom were male. Approximately 3 percent of drinkers consumed five or more drinks per episode. Those with hazardous drinking patterns were twice as likely to have been admitted to hospital but significantly less likely to have visited their GP in the last 12 months (Khan et al 2002).

Alcohol intakes of older adults in New Zealand

The median intake of alcohol from the NNS97 does not provide very useful information because alcohol was consumed by only some individuals on the day of the 24-hour diet recall. Nevertheless, the usual daily mean alcohol intake, as measured by the NNS97, is shown for reference in Table 31.

Table 31: Alcohol intakes for older adults aged 65 years and over

	Usual daily mean alcohol intake (g)	Percentage contribution to energy
Females 65–74 years	5	2
Females 75 years and over	4	2
Males 65–74 years	13	4
Males 75 years and over	11	4

Source: Russell et al 1999a

Note: Each standard drink contains 10 g of alcohol.

In the NNS97 the mean alcohol intake for women was highest in the group aged 19–24 years and thereafter intake fell with increasing age. For men, mean alcohol intake peaked in the 45–64 years age group and dropped by half in the 65 years and over age group. The 90th percentile of intake for women was 18 g for those aged 65–74 years and 15 g for those aged 75 years and over. For older men, the 90th percentile was 41 g and 43 g in these age groups, respectively; this equates to approximately four standard drinks. Wine was the most common drink for older women and beer the most common drink for older men.

Forty percent of men aged 65–74 years consumed beer at least once a week, and approximately a quarter consumed white wine and spirits/liqueurs at least once a week. Nineteen percent of women aged 65–74 years consumed white wine, and 14 percent consumed spirits/liqueurs at least once a week. Very few older women drank beer. Regular consumption of alcohol was lower in the 75 years and over age group, although 24 percent of men drank beer and 32 percent drank spirits/liqueurs at least once a week. For women aged 75 years and over, spirits/liqueurs remained the most significant alcoholic drink: 17 percent drank these at least once per week.

Although the frequency of alcohol consumption was not reported in the NNS97, in the Christchurch study almost 45 percent of the sample consumed alcohol at least twice a week, and most (70%) episodes of drinking involved consumption of one or two drinks (Khan et al 2002).

Reasons for alcohol consumption in older New Zealanders

The reasons for alcohol consumption in older people were investigated in a follow-up study on 100 current drinkers of the 141 participants in the Christchurch study described above (Khan et al 2006). Most of the drinkers reported consuming alcohol for social reasons. Sixty percent drank before meals and 53 percent drank with meals. A few participants said they drank for health (4%) and because it was a habit (3%). Of those that had reduced their alcohol intake over the past 12 months, most did so for health reasons. Other reasons included family or peer pressure, financial reasons, a change in personal circumstances, and no longer enjoying alcohol. Reasons for increased drinking were: encouragement from friends, loneliness, as an alternative to smoking, and enjoying drinking. Depression and a lack of social support are other factors that may result in older people drinking alcohol (Khan et al 2006).

Upper limits for responsible drinking

There is no level of drinking that can be called safe for all people at all times. An individual's tolerance to alcohol varies depending on their age, gender, body size, food intake and general health. The Alcohol Advisory Council (ALAC) has developed guidelines for upper limits for responsible drinking for the general population (ALAC 2002), as summarised in Table 32. These guidelines are probably too high for most older people due to their lower tolerance of alcohol with age (ALAC 2008), and older people should be encouraged to drink less than the amounts indicated.

The guidelines are based on a measurement called the 'standard drink'. Each standard drink contains 10 g of alcohol, which roughly equates to one measure of spirits or fortified wine, one average-sized glass of table wine (100 ml), or a 250 ml glass of beer.

Table 32: Upper limits for responsible drinking for the general population*

In any one week, drink no more than:	On any one drinking occasion, drink no more than:	If drinking every day, drink no more than:
14 standard drinks for women	4 standard drinks for women	2 standard drinks for women
21 standard drinks for men	6 standard drinks for men	3 standard drinks for men

Source: ALAC 2002

Note: * These guideline limits are probably too high for older people.

It should be noted that these guidelines for responsible drinking are not recommendations to consume alcohol. A recommendation for older people to increase their alcohol consumption to achieve any health benefit is not warranted. Current evidence does not suggest that non-drinking older people should be encouraged to take up regular moderate drinking to see potential cardiovascular benefits (Gulbransen and McCormick 2007).

Key points on alcohol

- Alcohol is not a nutrient, but is a source of energy. It provides 29 kJ per gram of alcohol.
- Drinking alcohol causes a range of adverse physical and mental health effects, and has social and economic costs.
- Even moderate alcohol intake may interfere with the digestion, absorption and utilisation of some nutrients.
- Thiamin and folate deficiencies are common among chronic heavy drinkers, and there is some evidence that vitamin B₁₂ status may also be adversely affected.
- Older people are more prone to the adverse effects of alcohol because of changes in the way the body metabolises alcohol with age and the influences of chronic illness.
- Alcohol intake is generally higher in men than in women, and generally declines with age. In the NNS97 the usual daily mean alcohol intake for older people was approximately one half to one standard drink.
- Just over 10 percent of men aged 65–74 years display hazardous drinking patterns.
- It is now thought that the cardiovascular benefits of alcohol consumption have been overstated. A recommendation for older people to increase their alcohol consumption to achieve any health benefit is not warranted.
- The ALAC guidelines for upper limits for responsible drinking are probably too high for most older people, and older people should be encouraged to drink less than the amounts specified. These guidelines for responsible drinking are not recommendations to consume alcohol.

Part 5: Considerations for Māori Older People and their Whānau

Understanding and recognising different world views is important for developing policy (Waldon 2004), and subsequently interventions to improve health. This part discusses some aspects of a Māori world view of health, illness and kai (food) in an attempt to enhance the cultural competence of health practitioners working with older Māori and their whānau. It is important for practitioners to realise that Māori are a heterogeneous group, and that Māori do not all share the same cultural understandings. This part also provides some context for nutrition-related Māori health by identifying nutrition-related health inequalities, providing information about food and nutrition practices, and identifying relevant public health strategies.

5.1 Background

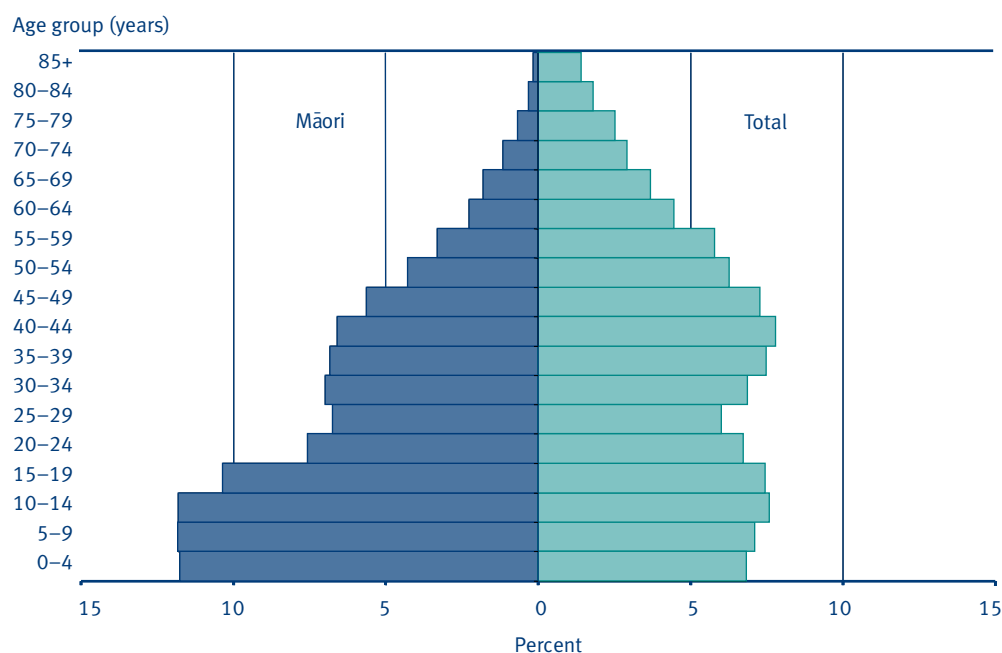
Māori hold a unique position as tāngata whenua, the indigenous people of New Zealand. Although there is a shared experience of colonisation and socioeconomic disadvantage among indigenous peoples, many believe the most defining element of indigeneity is a strong sense of unity with the environment (Durie 2004). In New Zealand, for example, land, lakes, mountains and rivers have spiritual significance for Māori. Some consider connection with tribal lands integral to identity and fundamental to a sense of wellbeing (Durie 1998).

It is widely accepted that people with lower incomes suffer more ill health. This link is true for Māori in New Zealand, who are overrepresented in the lower socioeconomic groups and high deprivation areas. The causes of this health inequality are complex, but much of it is linked to the uneven distribution of the determinants of health, such as income, housing, education and employment. These determinants can have both direct and indirect impacts on health, are inter-related, and can influence health and nutrition status through the cumulative effects of exposure throughout the life span.

Significantly, Māori in New Zealand have poorer health regardless of socioeconomic position. Māori whānau at all educational, occupational and income levels have poorer health status than non-Māori. There is compelling evidence to suggest that Māori are receiving lower levels of health services and a poorer quality of service, even when the service is accessed. Māori do not receive comparable health management across a range of chronic conditions, including surgical and specialist services, hospital care, diabetes and cardiac interventions, and in cancer diagnosis, referral and treatment processes. One of the overarching aims of the health and disability sector is to improve Māori health and disability outcomes and to reduce health inequalities (Ministry of Health 2007c).

The Māori population is a young population. At the 2006 Census the whole Māori ethnic population made up 14.6 percent of the total New Zealand population, but only 4.1 percent of the population group aged over 65 years were Māori. Furthermore, less than 4 percent of Māori in this population group were older than 85 years (see Figure 4) (Statistics New Zealand 2007a). Although youthful, the Māori population is also ageing. This trend is thought to be due to some increase in life expectancy and a decreasing birth rate. The older Māori population is projected to increase from 23,000 in 2006 to 56,000 in 2021, and make up 7 percent of the 65 years and over population in 2021 (Statistics New Zealand 2007a).

Figure 4: Age profiles of the Māori and total populations, 2006 Census



Source: Statistics New Zealand 2007b

In 2006 the majority of Māori (87%) lived in the North Island and just under one-quarter (24.3%) lived in the Auckland region. Most Māori (84.4%) lived in urban areas. Note that the Māori ethnic population includes those people who stated Māori as their sole ethnic group or one of several other ethnic groups (ie, Māori and European, or Māori and Pacific Island, etc) (Statistics New Zealand 2007b).

5.2 The health status of older Māori people

Māori have a lower life expectancy, and chronic disease is a major health concern. In 2001 life expectancy at birth was more than eight years less than for non-Māori, for both genders. In the 2006/07 New Zealand Health Survey (NZHS) Māori adults were 1.7 times more likely to be obese, and were more likely to have been diagnosed with diabetes than the total population. Mortality rates for cardiovascular disease were more than 2.5 times higher for Māori adults than for non-Māori in 2000–02. Cancer registrations were slightly higher among Māori compared with non-Māori, but all-cancer mortality rates were twice as high in 2000–02.

The 1997 National Nutrition Survey (NNS97) had insufficient sample sizes to identify eating patterns and nutrient intakes of older Māori, or to compare data with the total population. However, in the total adult population, more Māori than New Zealand European and Other ethnicities reported issues with household food security, including sometimes being unable to afford eating properly, running out of food, and limiting the variety of foods due to a lack of money. About a quarter of Māori women over 45 years living in Māori households reported ‘food running out’, ‘stress about lack of money for food’ and ‘stress when there was no food for social occasions’ (Russell et al 1999a). Not being able to follow tikanga relating to food practices can lead to feelings of misery and depression (McKerchar 1999).

For older Māori in New Zealand, their health as it relates to nutrition and physical activity may be affected by a number of factors, including:

- social and cultural attitudes and behaviours around the role of food
- access (physical and economic) to safe, nutritious, and culturally and socially acceptable foods
- access (physical and economic) to appropriate physical activity opportunities
- the caregiving role and status of older people within the whānau
- the impacts of colonisation and urbanisation on Māori, including the adoption of a European diet and the loss of mahinga kai (traditional food-gathering areas) through land loss and the pollution of coasts and waters; for many kaumātua, koroua and kuia (older Māori men and women), the growing, gathering, preparing and eating of traditional foods is an essential part of identity and overall wellbeing.

Low socioeconomic status and neighbourhood deprivation are linked to negative health outcomes. The proportion of Māori living in very deprived areas is significantly higher than that of non-Māori: over half of the Māori population is represented in the most deprived deciles (Robson and Harris 2007). In a study investigating ethnic inequalities in mortality among older adults, Jatrana and Blakely (2008) demonstrated that levels and patterns of old age mortality vary considerably by ethnicity and age. Older Māori had a higher mortality than any other population group, except for the 85 years and over group, where Pacific and Māori mortality rates merge.

Further information on Māori health status in New Zealand can be accessed in:

- the *Māori Health Chart Book*, see <http://www.moh.govt.nz/moh.nsf/pagesmh/3395?Open>
- *Hauora: Māori Standards of Health IV: A study of the years 2000–2005* (Robson and Harris 2007).

5.3 Perceptions of health and illness

Māori approaches to health are primarily based on the view that hauora, or holistic health, is a product of wellbeing at a physical, spiritual, psychological and social level. Culture is hugely relevant to health and sickness. In his book *Whaiora Māori Health Development*, Mason Durie (1998) describes how perceptions of illness as an infringement against tapu still have meaning for Māori. Māori health perspectives seek to widen traditional Western understandings of health, to ‘translate health into terms which were culturally significant and to balance physical and biological approaches with cultural and sociological views’ (Durie 2004).

Older Māori consider that wellbeing is an interaction between personal health and participation in key elements of Māori society; for example, land, language and marae (Waldon 2004). Wellbeing is closely linked to an ability to fulfil a cultural role. Although useful, this Waldon study cannot be considered representative of all older Māori as the participants were Māori who were more likely to participate in traditional or customary Māori society (Waldon 2004).

5.4 Māori models of health

There are a number of Māori models being utilised as frameworks for public health and development in Aotearoa New Zealand. Using Māori models of health provides an understanding of an issue from a Māori perspective, and improves the likelihood that public health programmes will be relevant and appropriate for Māori. Following are some examples of models of health that encompass a hauora approach.

Te Whare Tapa Whā

Te Whare Tapa Whā has strong foundations and four equal sides:

- taha tinana – physical health
- taha wairua – spiritual health
- taha whānau – family health
- taha hinengaro – mental health.



The symbol of the wharenui (large house) illustrates the four dimensions of Māori wellbeing. Should one of the four dimensions be missing or in some way damaged, a person, or a collective, may become ‘unbalanced’ and subsequently unwell. In a traditional Māori approach the inclusion of the wairua, the role of the whānau and the balance of the hinengaro are as important as the physical manifestations of illness.

Te Pae Mahutonga

Te Pae Mahutonga (the Southern Cross star constellation) brings together elements of modern health promotion. The four central stars of the Southern Cross represent four key tasks of health promotion: mauriora – cultural identity; waiora – physical environment; toiora – healthy lifestyles; and te oranga – participation in society. The two pointers are regarded as necessary to undertake tasks and roles: ngā manukura – community leadership; and te mana whakahaere – autonomy.



Te Wheke

The concept of Te Wheke, the octopus, is to define family health. The head of the octopus represents te whānau, the eyes are waiora (total wellbeing for the individual and family), and each of the eight tentacles represents a specific dimension of health (wairuatanga – spirituality; hinengaro – the mind; taha tinana – physical wellbeing; whanaungatanga – extended family; mauri – life force in people and objects; mana ake – unique identity of individuals and family; hā a koro ma, a kui ma – breath of life from forebears; whatumanawa – the open and healthy expression of emotion). The dimensions of health are interwoven, as represented in the close relationship of the tentacles.



For further information on these models of health, see the Ministry of Health’s Māori health website: <http://www.maorihealth.govt.nz/>.

Whether or not an identified model is used to guide initiatives, common Māori themes apparent in health and wellbeing programmes are:

- whanaungatanga, including relationships, roles and responsibilities
- tino rangatiratanga, including the authority to determine and drive issues, priorities, and solutions, and the development of aspirations
- Māori knowledge and resources, including the validation of Māori processes and knowledge, setting appropriate measures of success, and an acknowledgement of diverse Māori perspectives and realities (Conway et al 2000; Moewaka Barnes 2000).

5.5 Traditional foods and practices

A number of traditional foods still form part of the diet for many Māori (Parker et al 2001). Traditional vegetables include kūmara, kamokamo (marrow), pūhā, watercress, pikopiko (fern fronds) and kāngawai (steeped corn/maize). Kaimoana (seafood) forms a significant part of traditional diets in coastal areas, and includes kina (sea urchin), pipi, kōura (crayfish), ngaeti (periwinkles), parengo (a type of seaweed), pāua, tuna (eel), pātiki (flounder), inanga (whitebait) and kuku (mussels). Tītī (mutton bird) and rēwena (bread) are other highly regarded foods. Kūmara is a special food, which is believed to offer spiritual sustenance not found in other foods (Department of Health 1991; Parker et al 2001).

Traditional Māori foods are generally compatible with the Food and Nutrition Guidelines (Pōmare and de Boer 1988), and their inclusion in the diet should be promoted within the Māori and general communities (Smith 1995). Foods that have added salt, sugar or fat (eg, kāngawai with cream and sugar added), or that are naturally high in them (eg, tītī), should be consumed only occasionally or prepared in a way that removes most of the fat.

Connected to the spiritual and cultural significance of food for Māori is the social function of food, such as in the practices of manaakitanga (honouring manuhiri or visitors) and mana-ā-iwi (food provision demonstrating the mana of the hosting group) (Durie 1985; Pihema 1998). Historically, significant effort was required to gather, process and store food. Practices were developed for gathering and conserving foods – practices that served as protective health measures and at the same time were grounded in the spiritual value of food to Māori society.

5.6 Working with older Māori and their whānau

Culture influences how behaviours and symptoms are perceived, understood and responded to, by both whānau and the health workforce, and how outcomes are defined and measured (Durie 1998). Cultural identity depends not only on having access to that culture and heritage, but also on being able to express one's culture and have it endorsed within social institutions such as health services. There is growing evidence of the importance of culture in health, and it is increasingly recognised that clinical competence for health workers cannot be separated from cultural competence. To improve the effectiveness of services for Māori it is, therefore, important to strengthen the cultural and clinical competence of the sector.

To improve Māori health, effective interventions will need to focus on achieving whānau ora. They will also need to recognise that the collective wellbeing and individual wellbeing of Māori are equally important. Effective interventions will also look beyond healing physical symptoms to understanding and working with people in their whānau and social context. The ways in which health interventions are organised, resourced and delivered can substantially affect health outcomes for Māori.

The positive promotion of Māori identity, and world views and aspirations, has been shown to be effective in reaching Māori and in improving the adherence and access to and the quality of nutrition services provided to Māori (Pihema 1998). In the early 1990s initiatives to improve Māori nutrition focused on getting people to reduce the amount of fat in their meals and increase their intakes of vegetables, fruits, breads and cereals. However, dietary behaviour changes were difficult to identify. Services were usually delivered outside traditional Māori society – the whānau, hapū and iwi framework – and there was little recognition of cultural values, beliefs and practices (Pihema 1998).

Subsequent Māori community projects set up by iwi and Māori organisations in collaboration with health agencies have achieved better outcomes, including Māori community involvement, empowerment and a sense of local ownership, a significant increase in awareness of nutrition issues, and some changes in eating habits and in the kind of food provided at social gatherings. There were also spin-off benefits, such as the extension of smokefree initiatives and safer food-handling practices. The following factors were identified as contributing to successful initiatives:

- tikanga Māori must be an integral part of any nutrition programme for Māori
- there must be clear definitions of roles
- support networks are necessary for the success of the programme
- adequate funding is essential
- relevant information must be recorded (Pihema 1998).

Resources available to specifically support work with older Māori and their whānau are discussed in the Introduction, and are set out in Appendix 1.

Key points on considerations for Māori older people and their whānau

- Inequalities in health, including nutrition-related health, exist between Māori and non-Māori people.
- Māori have a lower life expectancy, and chronic disease is a major health concern.
- Older Māori have a higher mortality than any other population group.
- There are limited data on the dietary and physical activity patterns of contemporary older Māori.
- In the NNS97 more adult Māori than non-Māori reported issues with household food security.
- About a quarter of Māori women over 45 years living in Māori households reported ‘food running out’, ‘stress about lack of money for food’ and ‘stress when there was no food for social occasions’.
- Social and cultural attitudes and behaviours relating to the role of food, and access to safe and healthy food, will influence nutrient intakes.
- Māori approaches to health are primarily based on the view that hauora, or holistic health, is a product of wellbeing at a physical, spiritual, psychological and social level.
- Traditional foods and practices have cultural significance. Use culturally appropriate foods and physical activity opportunities when available.
- Not being able to follow tikanga relating to food practices can lead to feelings of misery and depression.
- Ensure dietary variety by eating the recommended servings from the four food groups.

Part 6: Considerations for Pacific Older People and their Families

6.1 Background

‘Pacific peoples’ is a collective term used to describe the diverse cultures of peoples from Polynesia, Melanesia and Micronesia (Ministry of Health 2008c). In New Zealand this term is usually applied to the seven largest Pacific ethnic groups: Samoan, Cook Islands, Tongan, Niuean, Fijian, Tokelauan and Tuvaluan (Statistics New Zealand 2007a). However, other Pacific nations are also included under the term ‘Pacific peoples’, such as those from French Polynesia, Kiribati, Papua New Guinea and Solomon Islands. It should also be remembered that ‘Pacific peoples’ could include people with more than one ethnicity (Ministry of Health 2008c).

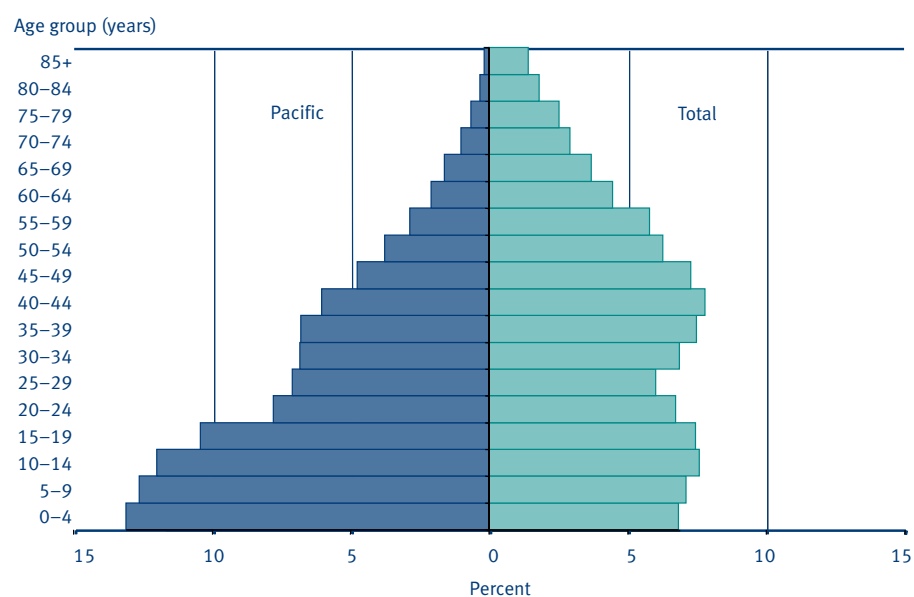
Although most groups have similarities with others, each has its own cultural beliefs, values, traditions, language, social structure and history. Moreover, within each group there are subgroups; there are differences among those born or raised in New Zealand, those born or raised overseas, and those who identify with multiple ethnicities (Tiatia 2008).

The Pacific population in New Zealand is young. At the 2006 Census the whole Pacific population made up 6.9 percent of the total New Zealand population. Of the population group aged over 65 years, only 3.8 percent were Pacific. Furthermore, less than 5 percent of Pacific peoples in this population group were older than 85 years (see Figure 5) (Statistics New Zealand 2007a). The older Pacific population is projected to increase from 10,000 in 2006 to 26,000 in 2021, and to make up 6 percent of the 65 years and over population in 2021 (Statistics New Zealand 2007a).

The low number of older Pacific peoples is partly due to higher mortality at younger ages. In part, too, it is a reflection of recent migration patterns of Pacific peoples to New Zealand, with a predominance of younger immigrants and return migration for some older Pacific peoples (Ministry of Health 2002a).

Pacific peoples are concentrated mainly within the Auckland region (67% of the total Pacific population in New Zealand) and the Wellington region (13%) (Statistics New Zealand 2007c). At the time of the 2006 Census 60 percent of Pacific peoples were New Zealand-born and 40 percent were born overseas. Of those born overseas, 60 percent had arrived to live in New Zealand fewer than 20 years before (that is, since 1986).

Figure 5: Age profiles of the Pacific and total populations, 2006 Census



Source: *Quick Stats about Pacific Peoples*, Statistics New Zealand 2007c

6.2 Health status of older Pacific peoples in New Zealand

Compared with the total New Zealand population, Pacific peoples have poorer health status, are more exposed to risk factors for poor health, and experience more barriers to health services (Ministry of Health 2004d). Beliefs, values and preferences also influence how Pacific peoples view health and health care (Tiatia 2008).

Pacific peoples have a lower life expectancy, and chronic disease is a major health concern (Ministry of Health 2004d). In the 2006/07 New Zealand Health Survey (NZHS), Pacific adults were at least 2.5 times more likely to be obese, and had three times the prevalence of diagnosed diabetes than women and men in the total population (Ministry of Health 2008a). Pacific mortality rates for cardiovascular disease are significantly higher than those of the total population (Ministry of Health 2004d).

The 1997 National Nutrition Survey (NNS97) had insufficient sample sizes to identify eating patterns and nutrient intakes of older Pacific peoples, or to compare data on them with the total population. However, in this survey more Pacific peoples than New Zealand European and Other ethnicities reported issues with household food security, including sometimes being unable to afford eating properly, running out of food, and limiting the variety of foods due to a lack of money.

For older Pacific peoples in New Zealand, their health as it relates to nutrition and physical activity may be affected by a number of factors, including:

- for migrants, changes in the amount and types of foods available, as well as changes in climate, language, housing and living arrangements
- language barriers, which may limit older people’s confidence to participate in the community
- social and cultural attitudes and behaviours relating to the role of food
- access (physical and economic) to safe, nutritious, and culturally and socially acceptable foods

- access (physical and economic) to appropriate physical activity opportunities
- the role of older people within the family
- older people often being cared for by family members.

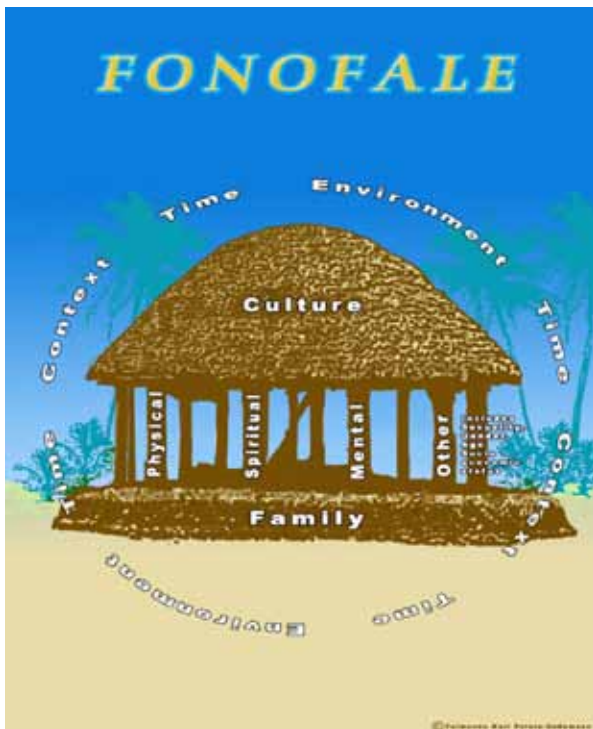
Further information on Pacific health status in New Zealand can be found in *'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014* (Minister of Health and Minister of Pacific Island Affairs 2010) at: www.moh.govt.nz/pacific

6.3 Pacific models of health

In general, Pacific culture and beliefs about health and illness are different from those of mainstream New Zealand culture (Tukuitonga 1999). There are two well-documented health fundamentals that Pacific peoples share: a holistic notion of health, and health as a family concern rather than an individual matter (Tukuitonga 1990; Bathgate 1994; Laing and Mitaera 1994). Furthermore, understanding Pacific peoples both as New Zealand-born and as migrant people is important because of the contact and interaction between the two groups, with each contributing to the life and health of the other (Finau and Tukuitonga 2000). Also, views may vary widely between these two broad Pacific groups (Ministry of Health 2008c).

Pacific models of health care that recognise Pacific world views and beliefs about health have been developed. The Fonofale model was created for use in the New Zealand context (see Figure 6). This model incorporates the values and beliefs that many Samoans, Cook Islanders, Tongans, Niueans, Tokelauans and Fijians express (Ministry of Health 2008c). These Pacific groups consider the most important values and beliefs for them are family, culture and spirituality.

Figure 6: The Fonofale model of health



Source: Fuimaono Karl Pulotu-Endemann

The Fonofale model is based on the metaphor of a fale (house), with a roof and foundations, floor and posts. The fale is encapsulated in a context, time and environment, and overall the model promotes the philosophy of holism and continuity,

- The roof represents the cultural values and beliefs that shelter life, including traditional methods of healing.
- The foundation represents the family – the foundation of the Pacific culture.
- The pou, or posts, connect the roof to the foundations, representing the connection between the family and culture and the dimensions of spiritual wellbeing, physical wellbeing, mental and emotional wellbeing and other variables, such as gender, sexual orientation, age and social class.

This model reflects what is most important for Pacific peoples – family, culture and spirituality – and identifies important components of the health of Pacific peoples.

6.4 Perceptions of health and illness

Within Pacific communities themselves there are diverse perceptions of health and illness and how they come about (Pande et al 2003). In the Pacific Health Research study, Samoans, Tongans, Cook Islanders and Niueans, particularly if they were older and/or Pacific-born, reported using traditional healing and medicine (Pacific Health Research Centre 2003). Many of the Samoans in the study divided illness into Samoan illness and Palagi (European) illness. If sick with a ‘Samoan illness’, Samoan patients would visit a traditional healer, but if sick with a ‘Palagi illness’ they would go to a Western-trained doctor (Pacific Health Research Centre 2003). The same study reported that for Cook Islanders the predominant perception of health was that it is an individual responsibility (Pacific Health Research Centre 2003).

Pacific perceptions of body size and beauty have relevance for health professionals, as do other views relating to the health and wellbeing of Pacific peoples (Ministry of Health 2008c). Overweight and obesity were uncommon in traditional Pacific communities and up until the 1960s were rarely noted. It has been acknowledged in recent times that some Pacific peoples may prefer body sizes at around the size that the World Health Organization (WHO) has identified as the cut-off indicating obesity (Coyne 2000).

A study comparing the perceptions of Tongans and Europeans about diabetes in New Zealand found that Tongan people believed their diabetes to be a more cyclical, acute illness, whereas Europeans tended to view their illness as chronic (Barnes et al 2004). Tongans were more likely to attribute their illness to external factors, including that poor medical care in the past, environmental pollution or God’s will caused their diabetes. They were more emotionally distressed by their diabetes and had less confidence their treatment would control their illness. Tongans saw less necessity for diabetes medication than Europeans did, and were less likely to adhere to dietary advice (Barnes et al 2004).

6.5 Traditional foods and practices

The traditional diet of many Pacific peoples was composed of coconuts, starchy root vegetables and other staples (yams, taro, cassava, kūmara/sweet potato, pandanus and sago); fruit when in season (mangos, pawpaw, breadfruit, bananas, plantain); fresh fish or seafood; and occasionally pork and chicken. These foods were supplemented with leaves and other green vegetables, such as taro leaves, pele (edible hibiscus leaves), kūmara leaves and fern shoots, and were often cooked with coconut cream in an umu (earth oven) (Hughes 2003). Pacific cultures emphasised starchy foods, but a meal without animal protein was seen as less desirable, or kai kovi (a Tongan term for unhealthy and lacking substance).

The acts of giving and receiving food are important for Pacific peoples. When food is shared it demonstrates respect, love and appreciation; it expresses hospitality and brings people together. Food is also used to show kinship and identity, is a standard of wealth and a barometer of social status, and is a significant part of feasting and celebration (Moata'ane et al 1996; S Muimui-Heata, personal communication, April 2009). The provision of food helps to fulfil family and community commitments and church obligations. For migrants and their families, food may be seen as a symbolic way of helping Pacific peoples maintain their identity (Pollock 1992).

Health does not necessarily determine food choice. Pacific peoples tend to value food through the amount and status of the food and as something to enjoy, rather than as a source of nutrients (S Muimui-Heata, personal communication, April 2009). Individuals generally choose food based on what is available, affordable, tasty and convenient, and in accordance with habits and traditions.

Some foods are associated with wealth and prestige, such as taro, yams, pork, fish and povi or pulu masima (salted brisket). Feasting is an important cultural ritual in Pacific communities, serving as a focus and a venue for family, community and social exchange. Foods such as cassava, kūmara, bananas (ripe and green), mangos, other seasonal fruits and green leafy vegetables are not generally considered to be prestigious. Some older people may attend family and community events relatively frequently.

Migration, urbanisation and adaptation to Western diets prevalent in New Zealand have come at the expense of an often nutritionally superior traditional diet for Pacific peoples. These factors have led to the introduction of an abundance of poor-quality meat, processed foods, and foods high in fat, sugar and salt; and a decrease in the variety and consumption of traditional fruit and vegetables. Many Pacific peoples may prefer their traditional diets, but their food choices may be affected by the accessibility, cost and availability of traditional foods and by unfamiliarity with New Zealand foods.

Cultural practices relating to food may vary greatly between cultures and individuals and may depend on whether people are Pacific- or New Zealand-born. Health practitioners should be aware of and sensitive to cultural practices of older people and their families before giving dietary or health advice.

6.6 Working with Pacific peoples

Cultural competence

For older Pacific peoples, who are likely to have been born in the Pacific Islands and speak English as a second language, culturally competent care is crucial to achieving better health outcomes (Tiatia 2008). Acknowledging Pacific values, principles, structures, attitudes and practices and integrating them into the care and delivery of service to Pacific clients, their families and communities will enhance Pacific cultural competence.

Successful initiatives for Pacific peoples have:

- been specifically designed for and delivered by Pacific peoples within the context of cultural values, beliefs and social environment
- been community-based
- incorporated multiple interventions (Tiatia 2008).

Key points on considerations for older Pacific peoples and their families

- Inequalities in health, including nutrition-related health, exist between Pacific and non-Pacific New Zealanders.
- Acknowledging cultural features shared by Pacific peoples, as well as differences among the various Pacific groups, is important.
- There are limited data on the dietary and physical activity patterns of older Pacific peoples in New Zealand.
- Nutrient intakes are influenced by social and cultural attitudes and behaviours around the role of food, and access to safe and healthy food.
- Cultural practices relating to food may vary greatly between cultures and individuals and may depend on whether people are Pacific- or New Zealand-born.
- Traditional foods and practices have cultural significance. Use culturally appropriate foods and physical activity opportunities when available.
- Avoid banning foods, particularly foods of high cultural significance, as a total ban may cause social or cultural isolation. Support the use of cultural foods that are superior food choices instead.
- It should be possible to maintain an adequate nutritional intake within most Pacific cultural practices.
- Ensure dietary variety by eating the recommended servings from the four food groups.

Part 7: Considerations for Asian Older People and their Families

7.1 Background

The definition of ‘Asian’ used in this background paper includes people with origins in the Asian continent, from Afghanistan in the west to Japan in the east, and from China in the north to Indonesia in the south. It excludes people originating from the Middle East, Central Asia (except Afghanistan) and Asian Russia. This definition of ‘Asian’ therefore incorporates peoples with very diverse cultures, languages and religions, and includes more than half the world’s population. It was developed by Statistics New Zealand in 1996, and has been used in previous Ministry of Health reports, including the *Asian Health Chart Book 2006* (Ministry of Health 2006a).

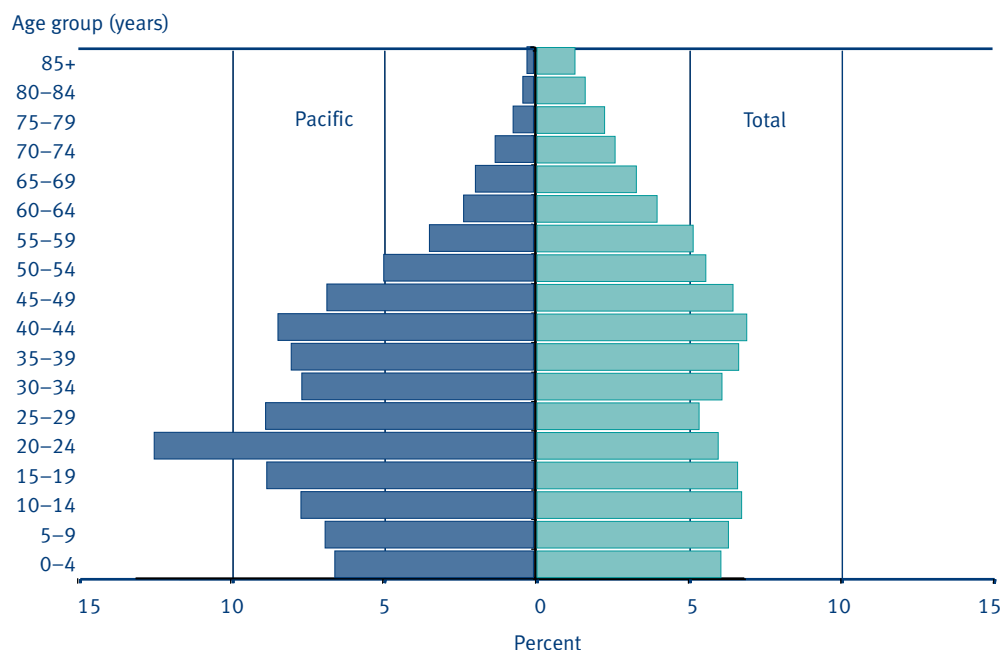
‘Asian’ is widely used as an ethnic descriptor in New Zealand today, and is generally used alongside ‘European’, ‘Māori’ and ‘Pacific’ as a broad ethnic grouping. Reflecting this usage, services have emerged over the last decade to meet the health needs of Asian New Zealanders. Data from the 2002/03 New Zealand Health Survey (NZHS) have been analysed in three ethnic groups – Chinese, Indian, and Other Asian – for the *Asian Health Chart Book 2006* (Ministry of Health 2006a). However, data from the 2006/07 NZHS are currently presented as a single ‘Asian’ grouping.

In using the term ‘Asian’ to describe an ethnic group with specific health needs, the diversity within this group must be borne in mind. Asian New Zealanders differ widely not only in language and culture, but also in socioeconomic status, English-language ability and settlement history in New Zealand. Because all of these factors can have an impact on health, there are limitations to using ‘Asian’ as a catch-all ethnic descriptor. In particular, smaller ethnic minorities may be lost by averaging within the group, and their specific health needs rendered invisible as a result.

At the 2006 Census the Asian ethnic group was New Zealand’s fourth largest major ethnic group after European, Māori and Other ethnicities, totalling 354,552 people, or 9.2 percent of the population. Only 4.5 percent of those aged 65 years or over were Asian. Less than 5 percent of Asians in the population group aged 65 years and over were 85 years and over (see Figure 7) (Statistics New Zealand 2007a). Two-thirds of people who identified with one or more Asian ethnic group(s) usually lived in the Auckland region. Asian people were also concentrated in the Wellington, Canterbury and Waikato regions (Statistics New Zealand 2007a). The older Asian population is projected to increase by over 400 percent between 2006 and 2021 (from 11,000 to 56,000), and will make up 8 percent of the population aged 65 years and over in 2021. This will be the largest increase among all older ethnic minority groups (Statistics New Zealand 2007a).

The seven largest Asian ethnic groups aged 65 years and over represented in the New Zealand population are: Chinese, Indian, Korean, Sri Lankan, Filipino, Cambodian and Japanese. The Chinese and Indian communities are the two largest Asian ethnic groups. ‘Chinese’ and ‘Indian’ are not necessarily singular ethnic identities – both may contain many ethnicities – but there are many similarities among the people they describe. Overseas research on these communities in other Western countries has shown that they have similar factors that affect their health (Ministry of Health 2006a). In line with this finding, the *Asian Health Chart Book* analyses data for ‘Chinese’, ‘Indian’ and ‘Other Asian’ categories.

Figure 7: Age profiles of the Asian and total populations, 2006 Census



7.2 Health status of older Asian people in New Zealand

When considering the health of the Asian population it is important to recognise the impacts of migration and duration of residence on health status. On one hand, the migration experience may negatively affect health in the short term. Conversely it appears that migrants are typically healthier than those in their native country (once acute stresses related to the migration process have passed) (Ministry of Health 2006a). This effect declines the longer the migrant stays in their new country and disappears in future generations as they move towards a health status similar to that of the total population. For almost all health indicators in the 2002/03 NZHS, recent or first-generation migrants do better than long-standing migrants or the New Zealand-born. At the same time, acculturation processes are occurring, which may enhance or worsen the health of the ethnic minority group, depending on a wide range of political, social, cultural and economic circumstances involving both the group itself and the host population. There is also evidence that the health status of migrant populations is affected by the ‘unhealthy emigrant’ effect – whereby older people return to their home country to die (Ministry of Health 2006a).

Chinese people in New Zealand have a much longer life expectancy at birth, and Indian people have a moderately longer life expectancy, than the total New Zealand population. At least in part this difference may reflect selection processes – the so-called ‘healthy immigrant’ and ‘unhealthy emigrant’ effects (Ministry of Health 2006a). In the 2006/07 NZHS Asian adults were less likely than the total population to be obese, but 2.5 times more likely than the total population to have been diagnosed with diabetes (Ministry of Health 2008a). Older Chinese people have significantly lower mortality rates for cardiovascular disease than the total population, and cancer registration rates are significantly lower for older Asians of all ethnic groups except for Other Asian females. Cancer mortality is lower than for the total population of all ethnic groups.

Nationally and internationally there is growing concern over the health status of Indian people. In the 2002/03 NZHS Indian adults had three times the prevalence of diagnosed diabetes compared with the total population. This higher prevalence may partly explain the high cardiovascular

mortality among the Indian ethnic group: cardiovascular mortality is significantly higher for Indian females aged 65 years and over than for the total population, and is significantly greater for the Indian ethnic group compared with the Chinese ethnic group.

There are limited data on nutrition and physical activity for older Asian people because survey sample sizes are generally too small. In the 2006/07 NZHS Asian adults were less likely to eat the recommended servings of vegetables and fruit compared with the total population. Asian adults were less likely than the total population to report regular physical activity, and more likely to be sedentary compared with adults in the total population.

The 1997 National Nutrition Survey did not include an Asian ethnic group for coding and analysis of data. These data will be available from the 2008/09 adult nutrition survey.

For older Asian people in New Zealand, their health as it relates to nutrition and physical activity may be affected by a number of factors, including:

- for migrants, changes in the amount and types of foods available, as well as changes in climate, language, housing and living arrangements
- language barriers, which may limit older people's confidence to participate in the community
- social and cultural attitudes and behaviours around the role of food
- access (physical and economic) to safe, nutritious, and culturally and socially acceptable foods
- access (physical and economic) to appropriate physical activity opportunities
- the role of older people within the family.

Further information on Asian health status in New Zealand is available in the *Asian Health Chart Book* (Ministry of Health 2006a) at: www.moh.govt.nz/moh.nsf/indexmh/asianhealth

7.3 Traditional foods and cultural practices

Each Asian ethnic group has its own traditional foods and practices, and some of these will still form an important part of current diets. There is limited information available about lifestyle behaviours, and eating habits and nutritional adequacy among older people within the Asian ethnic groups living in New Zealand. Factors that may determine ethnic food choices are origin of birth, length of time in New Zealand, age, food availability, personal preference, cultural adherence and location (Smith 1995).

There are some data on food consumption patterns of Chinese people in New Zealand, although not for older people specifically. In a small Dunedin study, about 70 percent of the participants reported that the yin and yang philosophy played a part in their family's eating habits (Soh et al 2000). The traditional Chinese diet is designed to achieve an optimal balance between the two energies, yin and yang. Food is classified as 'hot' or 'heaty' (yang), or neutral, 'cold' or 'cooling' (yin) depending on the energy that is released when the food is metabolised (Lodge 1991).

Over 70 percent of the participants also reported that there were fewer varieties of vegetables, meat and fish available in New Zealand than in their country of origin. Some vegetables and fruit found in New Zealand were not recognised by these participants. The Dunedin study found that while some New Zealand foods were integrated into the diets of Chinese immigrants, a traditional way of eating was still prevalent. This way of eating includes rice and noodles as staple foods, fish, chicken and pork as the most common meats, and vegetables being consumed at each meal (courgettes, carrots, eggplants, green peppers, cabbage, mushrooms, bok choy, bean sprouts and cauliflower are common) (Soh et al 2000).

7.4 Working with Asian people

Cultural practices relating to food may vary greatly between cultures and individuals, and may depend on whether people are Asian- or New Zealand-born. Health practitioners should be aware of and sensitive to the cultural practices of older people and their families before giving dietary or health advice. Barriers to receiving information or participating in healthy lifestyle behaviours and nutrition in New Zealand may include inadequate income, language difficulties, embarrassment, cultural factors, and lack of awareness of suitable replacement options for foods traditionally eaten in their home of origin. Support systems may also be diminished for those with fewer social contacts (Soh et al 2000).

Similarly, those families who have recently immigrated may have weaker support systems (Soh et al 2000), and they may be less likely to receive income support. Their food security may also be at higher risk, affecting their health and nutritional status.

Key points on considerations for older Asian people and their families

- Asian New Zealanders differ widely, not only in language and culture, but also in socioeconomic status, English-language ability and settlement history in New Zealand.
- For almost all health indicators in the 2002/03 New Zealand Health Survey, recent or first-generation migrants do better than long-standing migrants or the New Zealand-born.
- Chinese people in New Zealand have a longer life expectancy and a lower cardiovascular mortality than the total population.
- Indian people in New Zealand have a moderately longer life expectancy, but three times the prevalence of diabetes and significantly higher cardiovascular mortality compared with the total population.
- There are limited data on the dietary and physical activity patterns of older Asian people in New Zealand.
- Social and cultural attitudes and behaviours around the role of food will influence nutrient intakes.
- In the 2006/07 New Zealand Health Survey, Asian adults (aged 15 years and over) were less likely than the total population to consume three or more servings of vegetables a day, less likely to report regular physical activity, and more likely to be sedentary.
- Barriers to receiving information or participating in healthy lifestyle behaviours and nutrition in New Zealand may include inadequate income, language difficulties, embarrassment, cultural factors, limited support networks, and lack of awareness of suitable replacement options for foods traditionally eaten in their home of origin.
- Traditional foods and practices have cultural significance. Use culturally appropriate foods and physical activity opportunities when available.

Part 8: Physical Activity – A Partner to Nutrition

8.1 Background

Increasing physical activity is a priority population health objective in the New Zealand Health Strategy. Regardless of age, older people should be encouraged to be physically active in as many ways as possible. Physical activity refers to all movement produced by skeletal muscles that increases energy expenditure, whether it is incidental, occupational, leisure, structured or supervised. Regular physical activity is essential for healthy ageing (WHO 2002b; Nelson et al 2007).

8.2 Benefits of physical activity

The benefits of regular physical activity for older people are well established (Fiatarone Singh 2002). In New Zealand, regular physical activity is defined as at least 30 minutes of physical activity per day on five or more days of the week. Regular physical activity in older people has substantial benefits for the musculoskeletal and cardiovascular systems, for weight management, and for improved functioning of the metabolic, endocrine and immune systems (Nelson et al 2007). Research over the past decades has reduced the number of changes considered to be due to ageing and increased those that are attributed to age-related disuse, inactivity and degenerative diseases (WHO 2002b). Adaptation through physical activity can markedly reduce or avoid reductions in physical capacity that would otherwise occur with ageing (Fiatarone Singh 2002). If physical activity is not maintained into older age, the age-related loss of muscle mass and subsequent physiological changes related to disuse can result in older people functioning at or below the level required to live independently (Young 1992).

Older people need to participate in regular physical activity to protect against a loss in physical function, maintain independence and reduce the risk of falls. For all adults, including older people, regular physical activity reduces the risk of health conditions such as:

- heart disease
- hypertension
- type 2 diabetes
- certain cancers (colon, post-menopausal breast and endometrial)
- stroke
- osteoporosis
- osteoarthritis
- depression
- mobility impairment
- falls
- disability
- obesity (Fiatarone Singh 2002; WHO and FAO 2003; Nelson et al 2007; World Cancer Research Fund and American Institute for Cancer Research 2007).

Physical activity also has a positive impact on risk factors associated with chronic disease, disability and ageing. It can:

- prevent or reduce weight gain and fat mass
- improve motor co-ordination
- improve body composition (decrease adipose tissue; increase skeletal muscle and bone density)
- improve muscle strength, power and endurance
- improve cardiac output
- improve neural reaction time
- decrease blood pressure
- improve balance
- improve blood cholesterol
- improve gait stability
- decrease insulin resistance
- reduce the effects of stress
- increase self-efficacy
- increase social engagement
- improve sleep (US Department of Health and Human Services 1996; Fiatarone Singh 2004; Nelson et al 2007; Ministry of Health 2008a).

Recent evidence suggests that physical activity also positively influences other risk factors for chronic disease, particularly dietary intake. Participating in physical activity is useful for preventing or managing chronic disease and disability. Physical activity can also reduce disability without altering the disease itself, such as for Parkinson's disease, chronic obstructive pulmonary disease and chronic renal failure (Reuter et al 1999; Fiatarone Singh 2002; Nelson et al 2007). Less vigorous types of physical activity are appropriate for people with disease or disability (Vogel et al 2009).

8.3 Physical activity and sedentary behaviours among older New Zealanders

In the 2006/07 New Zealand Health Survey (NZHS) (Ministry of Health 2008a) New Zealanders reported relatively stable physical activity patterns until they reached the older age groups. Forty-three percent of women and 51 percent of men aged 65–74 years were regularly physically active. (Being physically active was defined as meeting the physical activity guidelines of at least 30 minutes of physical activity per day on five or more days of the week). Among those aged over 75 years, 26 percent of women and 40 percent of men were regularly physically active. There is a decline in regular physical activity in women over 65 years; for men this decline is seen in those aged over 75 years.

Results from the Active New Zealand Survey 2007/08 (SPARC 2008) showed only 34 percent of people aged 65 years and over met the physical activity guidelines compared with 55 percent of those aged 35–49 years and 52 percent of those aged 50–64 years. The 10 most popular sport and recreation activities for older New Zealanders were: walking (73%), gardening (66%), swimming (15%), equipment-based exercise (14%), bowls (14%), fishing (11%), golf (11%), dance (8%), callisthenics (6%) and cycling (6%).

The 2006/07 NZHS defined sedentary as less than 30 minutes of physical activity in the last week (Ministry of Health 2008a). The survey found that the proportion of women who were sedentary was relatively stable until the age of 65 years, and then increased sharply to nearly a quarter of women aged 65–74 years and half of women aged 75 years and over. The proportion of men who were sedentary was relatively stable until it increased to one in three of those aged 75 years and over. Asian and Pacific women and men were significantly more likely to be sedentary than men and women in the total population.

New Zealand data suggest that older people are the population group least likely to be meeting the physical activity guidelines, meaning they are not sufficiently active to achieve maximum health benefits. They are also the most likely group to be sedentary compared with the total New Zealand population.

8.4 Guidelines for promoting physical activity to adults (including older people)²

Significant health benefits can be obtained from doing at least 30 minutes of moderate-intensity physical activity on all or most days of the week (eg, brisk walking, cycling, climbing stairs). Additional benefits can be achieved by including some vigorous activity. Sport and Recreation New Zealand (SPARC) and the Ministry of Health suggest that adults (including older people):

- view movement as an opportunity, not an inconvenience
- be active every day in as many ways as possible
- put together at least 30 minutes of moderate-intensity physical activity on most if not all days of the week
- if possible, add some vigorous exercise for extra health and fitness.

Moderate physical activity will cause a slight, but noticeable, increase in breathing and heart rate. Vigorous activity is activity that makes you ‘huff and puff’, such that talking in full sentences between a breath is difficult.

Context in which physical activity takes place

Physical activity can take place anywhere. It may be part of leisure or relaxation time, structured or incidental activities, occupation or transportation, and may happen at home or in the community.

There are many different ways that older people can be physically active, including:

- **incidental activity**, which includes moderate-intensity activities that can be performed as part of everyday life (such as housework, vacuuming, gardening, and walking to collect the mail), and which is important for older people because it reduces the amount of time spent in sedentary activities and helps maintain functionality and independence
- **leisure activities**, such as, golf, lawn bowls or dancing
- **active transport**, such as walking to the local shops or a friend’s house
- **structured activities**, such as walking groups, group exercise activities, tai chi, exercise in water or strength training

2 The Ministry of Health plans to develop guidelines for promoting physical activity to older people (65 years and older). The guideline recommendations for older people, once completed, will replace the guidelines for promoting physical activity to older people in this document.

- **supervised physical activity** (supervised by a physiotherapist or exercise physiologist), such as rehabilitation from heart surgery or stroke, or specific activity for people with severe arthritis or respiratory problems.

Older people should be encouraged to be active with friends or whānau, or at cultural gatherings, but most importantly they should always have fun. Any physical activity is preferable to none, and it is never too late to be more active.

Modes of physical activity

There are four modes, or types, of physical activity: aerobic, resistance, balance and flexibility. Older people will obtain the most benefit from physical activity by participating in all four modes and by including a range of activities within each of these modes. For the best health outcomes it is important that older people choose at least two to three different modes of activity each week.

1. Aerobic activities

Aerobic (or cardiovascular endurance) activities require continuous and rhythmic use of large muscles for at least 10 minutes. Brisk walking, dancing and swimming are good examples. Aerobic activity improves cardio-respiratory endurance, blood pressure and blood lipid concentrations. Aerobic activity can also improve mood states, depression, quality of sleep, mobility and posture (Vogel et al 2009).

2. Resistance activities

Resistance or strength activities involve creating resistance to help build muscle mass and increase muscle strength. Weight training, digging in the garden, and climbing stairs are examples of resistance or strength activities. When combined with balance training (see below), these activities help to reduce falls and maintain functional strength for daily living. With prolonged resistance training, moderate increases in muscle size are possible. Resistance or strength activity helps improve mobility and the ability to perform daily tasks, reduces falls, improves gait stability, reduces symptoms of arthritis, and helps prevent osteoporotic fractures (Seguin et al 2002). Weight-bearing activities also help maintain bone density and decrease osteoporosis.

3. Balance activities

Balance activities are often done in combination with strength training. They may be simple activities that can be performed in the home, such as standing on one leg unsupported or walking heel to toe. Improvement in balance can reduce the risk of falls, and will improve mobility and confidence as well as quality of life (Steadman et al 2003). Tai chi can greatly improve balance in older people, and in healthy older people it has been shown to reduce falls (Tsang and Hui-Chan 2004) (see Section 8.7 on falls prevention for more information).

4. Flexibility

Flexibility declines markedly with ageing and has been shown to be associated with disability (Laukkanen et al 1994). Flexibility activities involve stretching and holding a position. Yoga, bowls and household chores (such as mopping, vacuuming and gardening) are examples of flexibility activities. Increases in active ranges of motion and improvement in balance have been found through stretching and progressive resistance activities in older adults. Maintaining an active range of movement in older adults is important for maintaining functional ability for day-to-day living (Takeshima et al 2007).

Table 33 provides useful information on the modes of physical activity associated with reduced risk of chronic disease or disability.

Table 33: Choice of physical activity modality for reduced risk of chronic disease or disability in older people

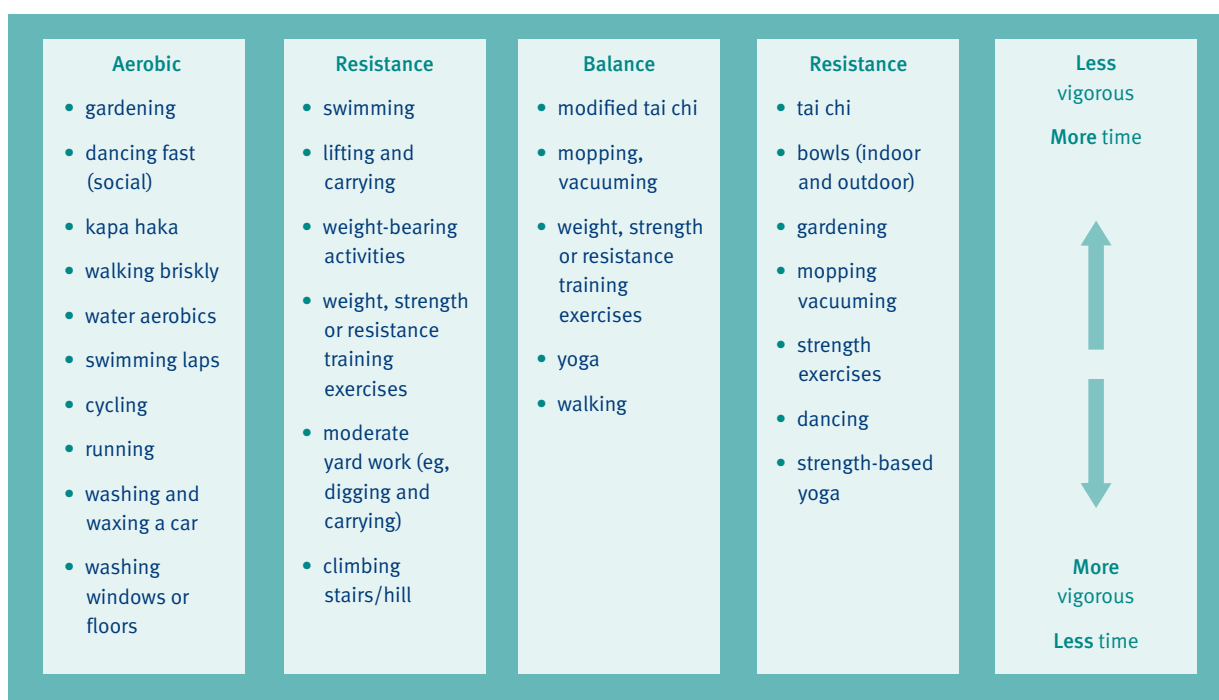
	Recommended physical activity		
	Aerobic	Progressive resistance	Balance and flexibility
Arthritis	✓ Low impact	✓ Strength	
Cancer (breast, colon, prostate)	✓ Moderate with extra vigorous intensity		
Congestive heart failure	✓ Moderate intensity	✓ Endurance	
Coronary artery disease	✓ Moderate intensity	✓ Endurance	
Depression	✓ Moderate to high intensity	✓ Endurance	
Frailty, disability	✓ Low to moderate impact	✓ Core strength	
Mobility impairment, falls	✓ Low to moderate intensity	✓ Core strength	✓ Progressive strength- based Low intensity
Osteoporosis	✓ Weight bearing	✓ High-impact, high- velocity loading (eg, jumping)	✓ Preventing falls
Stroke	✓ Moderate, with some vigorous intensity	✓ Endurance	
Type 2 diabetes mellitus	✓ Sufficient energy expenditure Regular moderate intensity	✓ During weight loss maintains lean tissue More feasible for complex co-morbidity	
Urinary stress incontinence		✓ Pelvic floor isometric strengthening	✓ Improved posture

Source: Fiatarone Singh 2002

Dimensions of physical activity

In addition to the four modes of physical activity, there are three dimensions of physical activity that influence health benefits: the frequency, intensity and duration of physical activity. Older people should participate in various activities of different dimensions, depending on previous physical activity levels, ability, knowledge, balance and stability. The intensity of the activity will be influenced by the duration. Figure 8 indicates the modes and dimensions of physical activity that may be suitable for older people.

Figure 8: Modes of activity guide for older people



Note: Some activities will include two or more dimensions of physical activity.

If an older person has been inactive, it is important to start with lower-intensity physical activity for a short duration and gradually build up (eg, walking slowly around the block for 10 minutes). As the older person adapts, this activity could easily be repeated several times throughout the day to build up to 30 minutes a day. Once the older person becomes stronger and more aerobically fit, they will be able to increase the intensity from slow to faster walking or try alternative modes of activity.

Refer to Section 8.8 on safety considerations for more information on the most appropriate types of activity. If older people are at specific risk of disease or disability, or have pre-existing conditions, they need to do physical activity and specific exercises that are appropriate and meet their needs.

8.5 Increasing the physical activity levels of older New Zealanders

Participating in physical activity is influenced by both environmental and individual factors. The wider environment provides both opportunities and barriers to physical activity through the presence or absence of age-friendly urban design and safety, the availability of parks, access to recreational facilities, and transport. Older people's physical activity levels may be influenced by preferences and constraints such as perceived enjoyment, social environment, skill, income,

social/cultural attitudes, family commitments or support, functional capacity, or physical and mental health status. Barriers to physical activity for sedentary older people living in New Zealand include education and motivation, the physical environment (including lack of transport to facilities or events), family environment, physical and health limitations, and cultural barriers (Kolt et al 2006). Approaches to increase physical activity must take into account a range of both environmental and individual factors.

Co-ordinated initiatives to support physical activity are required across a range of sectors and settings, including health, transport, local government, recreation, sport and fitness, the workforce, health care settings, and local community settings such as clubs, churches and marae. Older people are the group most likely to be sedentary, and will benefit from targeted interventions to increase their physical activity levels. Physical activity for older people needs to be easy, accessible and enjoyable.

Not all older people have the freedom, knowledge, prior experiences or resources to participate in physical activity and a healthier lifestyle, and often feel they are a burden to others (Grant 2008).

Older people who are currently active should be encouraged to maintain and/or increase their activity levels throughout their lives. Regardless of age, those who are inactive should be encouraged to increase their activity levels by participating in regular physical activity. Even if someone has never been active, it is never too late to be more active, and the benefits from being active are instantaneous and improve older people's lives substantially (Vogel et al 2009).

8.6 Reducing sedentary behaviours

Sedentary behaviours are activities that do not increase energy expenditure substantially above the resting level.³ People who are considered sedentary are those who spend less than 30 minutes per week participating in physical activity. The 2006/07 NZHS indicated that half of women and one-third of men over 75 years of age were sedentary. Older people spend more time in sedentary behaviours such as sleeping, sitting, reading, watching television and doing other screen-time activities than younger adults.

To maintain functional independence and mobility, older people need to increase their physical activity levels and reduce their time spent in sedentary behaviours. The old adage 'use it or lose it' is pertinent to achieving the aim of older people maintaining their functionality and independence, with a number of diseases and disability being attributed to age-related disuse and/or inactivity. Sedentary behaviours, in particular, lead to a decline in bodily functions and to further sarcopenia (loss of muscle mass) and muscle weakness. The decline of the health and wellbeing of older people is cyclical, with declines in bodily functions leading to further increases in sedentary behaviour (reliance on technical devices, such as using a lift instead of the stairs), which results in further complications or disability. For example, inactivity could potentially lead to loss of muscle strength, gait abnormalities and loss of bone mass, and result in gait instability and even a hip fracture (for women in particular). Inactivity may also result in older people becoming less able to perform activities of daily living, such as carrying packages, opening jars and climbing stairs.

Evidence shows that physical activity plays an important role in maintaining physical function and independence, and in reducing the risk of falls. In general, active older people tend to weigh less, have greater flexibility and strength, more endurance, better balance and better health than their sedentary counterparts (Brown 2008).

³ The energy expenditure for activities such as lying or sitting is at the level of 1.0–1.5 metabolic equivalents (METs), which is considered resting level.

8.7 The role of physical activity in the prevention of falls

Falls are common in people aged 65 years and over and are the leading cause of injury in this age group. Around one-third of generally healthy people aged over 65 years fall each year, and half of those in their eighties fall at least once a year (Gardner et al 2000; ACC 2003; Pereira et al 2008). It is further estimated that 82 percent of hospital admissions for adults over 75 years are falls related (ACC 2005). Falls often occur while the person is doing usual activities in the home (Pereira et al 2008). The rate of falls and the severity of the resulting complications increase dramatically with age (ACC 2003; Pereira et al 2008). It is common for those who fall to subsequently restrict their activities due to soft tissue injuries and fractures, and the psychological fear of falling again (Pereira et al 2008). Functional decline, feelings of helplessness, social isolation, loss of independence and autonomy, and a loss of quality of life can result (ACC 2003, 2005; Pereira et al 2008).

Most falls are preventable, and physical activity has an important role in reducing the risk of falls. Strength and balance training improve muscle strength, flexibility, balance, co-ordination, reaction time and gait, thereby reducing the risk of falls (Carter et al 2002; Kannus et al 2005). Even people who are frail, have chronic disease or are in their nineties can improve their strength and balance to achieve stability and avoid falls (Kannus et al 2005; Pereira et al 2008).

It should be recognised that other risk factors can influence falling in older people. The following should be considered when recommending physical activity for older people:

- hazards in the home
- weather, traffic and the external environment generally
- deficient vision
- neurological pathologies
- the influence of medications
- functional capacity (eg, the impact of a chronic disease).

Earlier trials of exercise interventions have produced mixed results on falls (Gregg et al 2000; Kannus et al 2005). The equivocal outcomes may be due to a number of factors, including:

- the physical activity was of an inadequate intensity or type
- the influence of non-physical risk factors
- definitions and analysis of fall outcomes
- the presence of risks not addressed in the programme
- lack of compliance to the programme
- inadequate power to detect an effect (Gardner et al 2000; Gregg et al 2000; Sherrington et al 2004; Kannus et al 2005).

It is now clear that a variety of interventions should be considered, particularly for those at high risk of falls (ie, those over 80 years of age and those who have had a previous fall). All types of physical activity/exercise (aerobic, resistance, balance, flexibility) help reduce falls, but a careful selection of relevant components – including risk assessments, physical activity (particularly strength and balance training), medication review, and prevention and treatment of osteoporosis – is recommended (Sherrington et al 2004; Kannus et al 2005; Pereira et al 2008). Care should be taken when working in residential care facilities, because there is some evidence that interventions in these settings increase the risk of falls (Kannus et al 2005).

8.8 Safety considerations

There are risks associated with older people participating in some modes and intensities of physical activity. Appropriate screening and ongoing management by appropriately skilled health practitioners or physical activity experts are important for high-impact and intensive activities to ensure that older people remain safe. Despite the benefits of physical activity, it is important to note that physical activity may aggravate some pre-existing conditions such as angina, arthritis, osteoporosis, severe hypertension and pre-existing injuries (Mazzeo and Tanaka 2001). If aggravation of an existing condition occurs while participating in a particular activity, often a suitable alternative activity can be performed with approval from the older person's general practitioner (GP).

If older people have chronic diseases, geriatric conditions or disability, or have been sedentary for some time, they should be checked by their GP (or a Sport Science New Zealand-approved physiologist) before they undertake an exercise programme or strenuous physical activity. It is safe for older people with co-morbidities (multiple chronic conditions) or disability to participate in physical activity/exercise, but it is best to start with lower-intensity activities and gradually progress onto moderate- or higher-impact activities.

Older people should stop physical activity if their breathing becomes very difficult or if they feel dizzy or experience any chest pain. Older people with disabilities should delay high-impact or weight-bearing aerobic activities until adequate balance and strength have been achieved. A simple test to check whether an older person is ready for moderate-intensity aerobic or higher-impact activities is to get the older person to rise from a chair, stand with their eyes closed, open their eyes, and then walk across the room (Fiatarone Singh 2002). If the older person has difficulty with this exercise they probably need to participate in resistance and balance training before undertaking moderate aerobic or higher-impact activities.

Key points on physical activity – a partner to nutrition

- Good nutrition and physical activity provide strong, simultaneous and continuous benefits to health.
- In the 2006/07 NZHS the prevalence of regular physical activity declined in women from the age of 65 years and in men from the age of 75 years. Older people were also more likely to be sedentary than younger adults.
- Regardless of age, older people should be encouraged to be physically active in as many ways as possible.
- There are four modes, or types, of physical activity: aerobic, resistance, balance and flexibility. For the best outcomes it is recommended older people participate in at least two to three different modes each week.
- Falls are common in people aged 65 years and over and are the leading cause of injury in this age group. Physical activity has an important role in reducing the risk of falls. Strength, flexibility, balance and reaction time are important modifiable risk factors in preventing falls
- There are risks associated with participating in physical activity. It is advisable for older people to be checked by their GP or other approved specialist prior to beginning physical activity.
- To increase the physical activity levels of older New Zealanders, support older people to be active, understand the principles of working with older people and help them to overcome the common barriers to participation.
- Older people should be active for at least 30 minutes on most days of the week.

Part 9: Chronic Disease and Nutrition for Older People

Obesity, cardiovascular disease, diabetes, cancer and osteoporosis

9.1 Background

With increasing life expectancy and exposure to a lifetime of risk factors, the older population is experiencing a greater burden of chronic, non-communicable diseases than ever before. Nutrition-related chronic conditions are of public health importance because they are a major cause of morbidity and mortality in New Zealand and internationally. Morbidity from chronic disease includes a decline in functional capacity, mobility limitations, a lower level of physical activity, an inability to look after oneself, frailty, and a poorer quality of life.

The nutrition-related chronic diseases discussed in the first section of this part are obesity, cardiovascular disease, diabetes, cancer and osteoporosis. Other chronic or long-term conditions commonly experienced by older people, including dementia, eye disease and impaired immunity, are discussed in the second section of this part.

Chronic disease in older age groups reflects an accumulation of exposures to risk factors throughout the life course, and it is in the older age groups that most chronic diseases will become apparent (WHO and FAO 2003). Although the burden from these nutrition-related chronic diseases is large, the potential benefits from modest improvements in nutrition and physical activity are also considerable (Ministry of Health and University of Auckland 2003). Previously it was thought that older adults would not benefit from risk reduction in the same way that younger adults do, or that they ‘deserved’ aspects of unhealthy lifestyles because they had reached old age (WHO and FAO 2003). However, at 65 years old New Zealanders still have an estimated 16–20 years of life remaining (for men and women respectively), and risk factors for chronic disease remain influential and modifiable even in older age (WHO and FAO 2003). It is clear that there is benefit for the older population in reducing their risk of chronic disease through the adoption of health-promoting behaviours, including a healthy lifestyle. Interventions in older age to prevent or postpone nutrition-related chronic diseases could have a significant effect on quality of life, morbidity and mortality (WHO and FAO 2003; Rivlin 2007).

For all New Zealand adults, cancer and ischaemic heart disease were the leading causes of death from 1987 to 2005. In 2005 cancer accounted for 29.4 percent of deaths while coronary heart disease accounted for 21.4 percent (Ministry of Health 2009). For non-Māori, stroke was the third leading cause of death, while for Māori it was chronic obstructive pulmonary disease (COPD) (Ministry of Health 2009). In 2005 the Māori age-standardised rate of death from all causes was 1.9 times that of the non-Māori rate; the largest difference was in diabetes mellitus, where the Māori rate was nearly 4.7 times higher than the non-Māori rate (Ministry of Health 2009).

For New Zealanders aged 65 years and over, the five leading causes of death from 2000 to 2002 were chronic diseases. Coronary heart disease was the leading cause of death in all age categories over 65 years, and stroke was the second cause of death for both women and men aged 75–84 years and 85 years and over. COPD, various cancers and other forms of heart disease were other major causes of death for those in age categories over 65 years (Ministry of Health 2006c).

In older age groups the prevalence of co-morbidity (multiple chronic conditions) increases. In 2002/03 only 15 percent of people aged 65 years and over had no chronic conditions, significantly

lower than the 30 percent of those aged 50–64 years who had no chronic conditions. Older age groups were much more likely to have four or more chronic conditions compared with those aged 50–64 years. Those aged 75–84 years were approximately three to four times more likely to have four or more chronic conditions (Ministry of Health 2006c).

As well as the morbidity and mortality associated with chronic diseases, nutrient absorption, transportation, metabolism and excretion may be affected. Such effects may be exacerbated by medications used to control these chronic diseases. People experiencing one or more chronic diseases may also have a reduced appetite, difficulty with activities of daily living and mobility, dementia and depression (Nowson 2007).

In the New Zealand population as a whole the prevalence of ill health is generally higher for Māori than for non-Māori, and there are inequalities in health service utilisation between these two groups. Māori also experience age-related ill health at a younger age than do non-Māori, and have a lower life expectancy. Because of this lower life expectancy, ‘older’ is defined as 50 years and over when comparing data on the health of older Māori (Ministry of Health 2006c).

This part discusses those chronic diseases where nutrition is a major modifiable risk factor, but it is important to recognise that there are other modifiable factors that influence the development and progression of chronic disease at a population or societal level. These influences include genetics, global and national food systems, and the physical, social, cultural, political and economic determinants of health (WHO and FAO 2003) (see also Part 2: Ageing, Nutrition and Health).

Sources of data

Data on risk factors and the prevalence of diseases have come from the most recent national health survey, the 2006/07 New Zealand Health Survey (NZHS) (Ministry of Health 2008a). Age-specific prevalence of disease in each ethnic group from the 2006/07 NZHS has not been calculated. Therefore, where comparisons have been made concerning the prevalence in Māori, Pacific, Asian and European/other populations, they are based on age-standardised rates. Data describing the differences in the age groups 65–74 years, 75–84 years and 85 years and over have come from the *Older People’s Health Chart Book*, which analysed data from the 2002/03 NZHS (Ministry of Health 2006c). For further information on the sources of data for this part, see Appendix 9.

Risk factors for chronic diseases

Age, sex and genetic susceptibility are non-modifiable risk factors for all the chronic diseases discussed in this part. Nutrition is a major modifiable determinant of chronic disease, with scientific evidence increasingly supporting the view that dietary changes have both positive and negative effects on health throughout life (WHO and FAO 2003). Other major modifiable determinants of chronic disease include tobacco use, physical activity and alcohol consumption.

Behavioural risk factors, including diet, physical activity and tobacco use, influence biological risk factors such as obesity, cholesterol levels, blood pressure and insulin sensitivity. Both biological and behavioural risk factors can influence an individual’s health throughout the life course (WHO and FAO 2003). For example, obesity is both a risk factor for developing other chronic diseases and a disease in its own right. With obesity, the risk of cardiovascular disease, diabetes and high blood pressure increases continuously, and so there is a large overlap between the prevention of obesity and the prevention of other chronic diseases (WHO and FAO 2003).

Nutrition behaviours contributing to these chronic diseases include vegetable and fruit intake, types of fat consumed, fibre and sodium intakes, and intake of energy-dense, micronutrient-poor foods and beverages. See Table 34 for established risk factors related to nutrition and lifestyle for each chronic disease.

Table 34: Convincing or probable associations between food, nutrition and lifestyle factors and risk for some chronic diseases

Risk factors for chronic disease	Obesity	CVD	T2DM	Cancer ¹	Osteoporosis
Food-based factors					
Vegetables and fruit		✓		✓	
Wholegrain cereals		✓			
Fish and fish oils		✓			
Nuts		✓			
Preserved meat				x	
Salt-preserved foods				x	
Energy-dense, micronutrient-poor foods	x				
Sugar-sweetened soft drinks and juices	x				
Nutrient-based factors					
Dietary fibre	✓	✓	✓		
Saturated fats		x			
Trans fatty acids		x			
Linoleic acid, A-linolenic acid and oleic acid		✓			
Myristic and palmitic acids		x			
Plant sterols/stanols		✓			
Dietary cholesterol		x			
Sodium (salt)		x			
Potassium		✓			
Vitamin D					✓
Calcium					✓
Folate		✓			
Lifestyle factors					
Overweight / obesity		x ²	x	x	
Voluntary weight loss			✓		x ³
Regular physical activity	✓	✓	✓	✓	✓
Sedentary lifestyle	x		x		
Alcohol		✓ x		x	x

Source: WHO and FAO 2003

Notes:

CVD = cardiovascular disease, T2DM = type 2 diabetes mellitus.

✓ = associated with a decreased risk of chronic disease; x = associated with an increased risk of chronic disease.

1 These risk and preventive factors vary for different types of cancer.

2 For type 2 diabetes, risk is greater for abdominal obesity.

3 For osteoporosis, a low body weight is associated with increased risk.

9.2 Obesity

Background

Obesity is a major contributor to the global burden of morbidity and mortality. It is a complex disorder with multiple interactive causes. Thus although obesity is a consequence of an individual's energy imbalance over time (energy intake exceeding energy expenditure), environmental factors are also important in promoting obesity through influencing an individual's behaviour. Eating behaviour and physical activity are the results of complex physiological, psychological and cultural factors, including habits, emotions, conditioning and attitudes. In older people body weight is influenced by changes in body composition and metabolism, dietary intakes and physical activity, and changes in physical, social, cultural and economic environments. Some people are more genetically susceptible to gaining weight than others (WHO 2004).

Obesity is defined as a condition of abnormal or excessive fat accumulation in adipose tissue to the extent that health may be impaired (WHO 2004). The amount of excess fat stored, and the distribution of the stored fat, differ among individuals. These two factors influence the risk of developing adverse health outcomes associated with obesity (WHO 2004). The classification of obesity according to body mass index (BMI) is described in the section on anthropometry below.

Risk factors for obesity

The development of obesity is related to a chronic imbalance between energy intake and energy expenditure. The NNS97 showed that usual daily median energy intakes were lower in older people than in the total adult population. This finding agrees with other studies of dietary patterns in older people (Villareal et al 2005). However, although older people generally eat less as they age, they are also likely to be less physically active and more sedentary. Older people may expend less energy as a result of loss of lean muscle mass and strength, and because of chronic disease and functional incapacity. Physical activity is the most variable component of energy expenditure, and is the component that people have most control over. There is convincing evidence that regular physical activity and a reduction in sedentary lifestyle protect against obesity in the general adult population (WHO and FAO 2003) (see also Part 4: Nutrients, Food and Drinks; and Part 8: Physical Activity – A Partner to Nutrition).

Key dietary factors that are associated in the general population with a reduced risk of developing obesity are a low intake of energy-dense, micronutrient-poor foods and a high intake of dietary fibre (WHO and FAO 2003). In observational studies, diets that are high in fat are associated with higher total energy intake, and those that are low to moderate in fat and high in carbohydrate are associated with a lower total energy intake and a lower BMI (Ministry of Health and University of Auckland 2003). The increase in prevalence of obesity in New Zealand has coincided with a change in dietary patterns that include more processed foods, more meals eaten away from home, larger portions, and snacking (Ministry of Health and University of Auckland 2003).

Anthropometry

Height and weight measurements are used to calculate body mass index. BMI is often used as an indirect measure of body fatness because it is simple to measure and is correlated with total body fat. Because BMI does not distinguish between weight associated with muscle and weight associated with fat (which varies according to age, gender, ethnicity and other factors), it provides only a crude measure of body fatness in individuals. BMI does not provide information on body fat distribution.

BMI is commonly used to classify people into body size categories such as underweight, overweight and obese. These BMI classifications are intended to highlight people or populations with an increased risk of health conditions associated with either a low BMI or a high BMI – not to measure body fatness *per se*. The World Health Organization (WHO) cut-off points are shown in Table 35.

Table 35: Principal BMI cut-off points for adults aged 18 years and over

New Zealand classification	BMI value (kg/m ²)	Risk of health conditions*
Underweight	< 18.50	Low risk
Normal range	18.50–24.99	Average risk
Overweight	25.00–29.99	Increased risk
Obese:	≥ 30.00	Substantially increased risk:
class I	30.00–34.99	moderate risk
class II	35.00–39.99	severe risk
class III	≥ 40.00	very severe risk

Source: Adapted from WHO 2000

Note: * Only those health conditions associated with increasing BMI.

In the 1997 National Nutrition Survey (NNS97) and the 2002/03 New Zealand Health Survey, the WHO BMI cut-off points were used to classify overweight and obesity (25 and 30 respectively) in European/Other and Asian adults. Higher BMI cut-off points were used to classify Māori and Pacific adults as overweight and obese (26 and 32 respectively). Although the WHO BMI cut-off points were developed primarily using data from populations of European origin, the health risks associated with increasing BMI are continuous and graded, and begin at a BMI below 25 in all population groups. Therefore, the most recent WHO Expert Consultation recommended that principal BMI cut-off points be retained as the international classification for all adults (WHO 2004).

Waist circumference is the simplest and most convenient indicator of abdominal obesity. Abdominal fat can vary within a narrow range of total body fat or BMI (WHO 2004). There is good evidence that excess fat in the abdominal (visceral) compartment is more metabolically active and more strongly linked to diabetes and cardiovascular disease than total fat mass (Ministry of Health 2008b).

Anthropometry for older adults

Anthropometry is one tool that provides an indicator of nutritional status and body fatness in older adults. However, there is some evidence to suggest that the BMI cut-off points used to classify underweight, overweight and obesity in adults may not accurately reflect the risk of health conditions in the older population.

For older people BMI may be inaccurate due to changes in body composition with ageing. People become shorter with advancing age due to spine shrinkage through vertebral bone loss and curving of the spine. Some studies show height losses of up to 2–5 cm per decade (Perissinotto et al 2002). Also, the relationship between BMI and body fat may be altered due to changes in body composition with ageing. These changes include a loss of lean (skeletal muscle and bone) body mass, an increase in fat mass and a redistribution of body fat (to a central, or abdominal, distribution) with ageing (Villareal et al 2005). Therefore, for any given BMI, a loss of height would overestimate body fatness whereas a change in body composition would underestimate body fatness (Villareal et al 2005). Despite these factors, some studies have demonstrated that the correlation between BMI and body fat percentage remains reasonably high in older people (McTigue et al 2006). BMI remains a cost-effective method of estimating disease risk.

The ideal BMI range for adults (including older people) is based on evidence of associations between BMI levels and the risk of adverse health outcomes in the general adult population. There are no reference ranges specifically for older people, and there is a lack of consensus about what the ideal BMI for older people is. There is evidence that adverse health outcomes – such as mortality, chronic disease and decreased functional capacity – are mostly seen in BMI levels above 30 kg/m². This level is categorised as ‘obese’ according to the WHO definitions for adults. In older adults, BMIs in the ‘overweight’ category are not consistently associated with adverse outcomes – in contrast with the situation for younger people (Heiat et al 2001).

The waist circumference (WC) index may be a better alternative for determining obesity in older adults, because it reflects abdominal adipose tissue deposits (Inelman et al 2003). In adults, high WC values (over 102 cm for men and over 88 cm for women) are related to an increased risk of hypercholesterolaemia, hypertension, respiratory failure and disability (WHO 2004). WC measures might be expected to be higher in older individuals compared with younger individuals due to the central redistribution of body fat (Villareal et al 2005), and some studies have demonstrated a stronger correlation between WC and body fat in older populations than that shown for BMI (McTigue et al 2006). WC has also been shown to be a stronger indicator of functional disability in obese older women than BMI (Chen and Guo 2008).

Obesity outcomes

Obesity in all ages is associated with increased risk of cardiovascular disease (including coronary heart disease and high blood pressure), various types of cancer, type 2 diabetes and insulin resistance, gallbladder disease, osteoarthritis, hyperuricaemia and gout, polycystic ovarian syndrome, breathlessness and sleep apnoea, lower back pain, complications in surgery, and psychological and social problems (WHO 2004). Overweight and obesity are also markers for dietary and physical activity patterns that independently lead to poor health (World Cancer Research Fund and American Institute for Cancer Research 2007).

Mortality

There are few well-conducted studies demonstrating the relationship between BMI and mortality in older populations (McTigue et al 2006). In two systematic reviews of the literature, the risk of mortality appears to be highest in those with the highest BMI (ie, a BMI of 30 kg/m² and over), at least until the age of 75 years, and then the relationship lessens in strength or disappears with increasing age (Heiat et al 2001; McTigue et al 2006). A further study of 7000 individuals found that obesity had little effect on life expectancy in those aged over 70 years (Reynolds et al 2005). The reasons for the lack of association between BMI and mortality in those aged 75 years and over are unknown (Villareal et al 2005). It may be that there are simply fewer obese older people due to a higher mortality rate in middle/old age, or that the effects on mortality are difficult to show in a shortened future lifetime (Villareal et al 2005). Also, this effect may be due to a cohort effect associated with the middle age groups, among whom the obesity epidemic is thought to have begun (Ministry of Health 2008d).

There are limited studies on cause-specific mortality. For cardiovascular mortality the relationship with BMI is unclear. The two systematic reviews of the literature found that where there was a positive association it did not persist after 75 years (Heiat et al 2001; McTigue et al 2006). Two studies in the systematic reviews showed a stronger association between WC and cardiovascular mortality than for BMI (McTigue et al 2006). There was little evidence for obesity-related cancer mortality (McTigue et al 2006). However, cardiovascular disease and cancers are the leading causes of death in New Zealand, are clearly associated with obesity, and are most prevalent in older age groups. As well, risk factors for obesity, such as a reduction in physical activity, are independently associated with mortality in older age groups (WHO 2004).

Morbidity

The relationship between morbidity and obesity is clearer: in adults aged 65 years and over, obesity is associated with a reduction in physical function and quality of life (Inelman et al 2003; Villareal et al 2005; Reynolds et al 2005; Chen and Guo 2008). The Australian Longitudinal Study of Ageing found overweight or obesity in adults 70 years and over predicted a 69 to 90 percent increase in risk of limitation in both physical function and mobility at two years follow-up. A high waist-to-hip ratio did not predict limitation (Bannerman et al 2002). Other studies demonstrate that disability in older people appears 10 years earlier in obese compared with normal-weight people (Inelman et al 2003). Both cardiovascular and cancer-related morbidity risk increased significantly with increased BMI (McTigue et al 2006).

A reduced risk of osteoporosis appears to be one benefit of overweight in older age groups. Studies have demonstrated a direct correlation between both body fat and fat-free mass and bone mineral density, and an association between obesity and decreased osteoporosis and hip fracture (Villareal et al 2005; Brown et al 2007). These associations have been attributed to increased mechanical burden on bones, hormonal factors stimulating bone growth and inhibiting bone remodelling, and the effect of extra cushioning around femur bones in the event of falls (Villareal et al 2005).

Malnutrition and obesity may co-exist: a high intake of energy-dense, micronutrient-poor foods may result in obesity and malnutrition secondary to inadequate nutrient intakes (Nowson 2007).

Prevalence of obesity

In New Zealand in 2006/07, the prevalence of obesity in adults increased with increasing age until a peak in middle age: for women in the 55–75 years age group and for men in the 55–64 years age group. The prevalence of obesity starts to decline in women from 75 years and in men from 65 years of age. Among all adults 15 years and over, Māori and Pacific peoples were more likely to be obese than the general adult population. Between 1977 and 2003, the prevalence of obesity increased by 116 percent in adult women and 100 percent in adult men (Ministry of Health 2004c).

Prevalence of overweight

Being overweight is more common in New Zealand than being obese. In the 2006/07 NZHS 29 percent of all adult women and 41 percent of all adult men were overweight. From 1977 to 2003 there was only a slight increase in the prevalence of overweight among adult women, and almost no change among men. Note that these figures include only overweight, not obese, New Zealanders.

9.3 Cardiovascular disease

Background

Cardiovascular diseases (CVDs) are diseases that affect the heart and circulatory system. At the severe end of the disease spectrum, CVD manifests as symptomatic coronary heart disease, stroke, hypertensive disease and peripheral vascular disease. Age-adjusted mortality rates from CVD have decreased significantly in New Zealand during the past 30 years. Nevertheless, CVD remains a leading cause of death in older New Zealanders. In 2004, out of all CVD deaths, 22 percent were due to coronary heart disease, 10 percent to stroke and 8 percent to other vascular causes.

Coronary heart disease

Coronary heart disease (CHD) is the narrowing or blocking of the coronary arteries that supply blood and oxygen to the heart. Over time it can cause heart attack and angina and lead to heart failure.

The risk of CHD increases substantially with age (Asia Pacific Cohort Studies Collaboration 2006). Analysis from the Asia Pacific Cohort Studies Collaboration found that the excess CHD risk with ageing was explained by the presence of cardiovascular risk factors of blood pressure, total cholesterol, triglycerides and diabetic status. These risk factors explained approximately one-half of the excess CHD risk in ageing Australian and New Zealand women, and one-quarter of the excess CHD risk in ageing men. The gender difference may arise because BMI values are higher in women, and because high blood pressure is a greater risk to women (Asia Pacific Cohort Studies Collaboration 2006).

Stroke

Stroke is the most common cause of adult disability in New Zealand and imposes a significant burden on carers (Ministry of Health 2007a). 'Stroke' refers to a sudden interruption of the blood supply to the brain, which can cause permanent damage. The interruption of the blood supply can be caused by either blood clots (ischaemic stroke) or bleeding in the brain (haemorrhagic stroke). Most strokes are ischaemic strokes, but these contribute to all stroke mortality. Risk factors for ischaemic stroke are similar to those for CHD, whereas the dominant risk factor for haemorrhagic stroke is blood pressure (Ministry of Health and University of Auckland 2003).

Prevalence of cardiovascular disease

Coronary heart disease

In 2006/07 CHD diagnosis increased with age in both men and women. Men were significantly more likely to be diagnosed with CHD than women, and the increase with age occurred earlier in men than in women. The highest prevalence is in the age group of 75 years and over for both men (28.4%) and women (24.2%). Adult Māori women were twice as likely to be diagnosed with CHD than women in the total population.

Stroke

In 2006/07 the prevalence of stroke increased with age to being highest among men (12.8%) and women (10%) aged 75 years and over (Ministry of Health 2008a). Half of all strokes in New Zealand occur in those aged 75 years or over (Ministry of Health 2007a). Due to large sample errors created by the small number of people with stroke in the survey sample, no statistically significant differences were found by ethnic group.

Risk factors for cardiovascular disease

The biological risk factors that contribute to cardiovascular disease include obesity and central obesity, diabetes, high blood pressure, high cholesterol and low cardio-respiratory fitness. Two biological risk factors – high blood pressure and high total cholesterol – are major determinants of cardiovascular disease risk and are directly modifiable through nutrition. Both these risk factors increase with age in younger and then middle-aged adults. High blood pressure continues to increase in older age, but total cholesterol stabilises or declines in people over 65 years (Asia Pacific Cohort Studies Collaboration 2006).

High blood pressure

High blood pressure is an important risk factor for cardiovascular disease, particularly stroke (Ministry of Health and University of Auckland 2003).

In the Asia Pacific Cohort Studies Collaboration (2006) meta-analysis, high systolic blood pressure was the largest contributor to the modifiable CHD risk in both men and women, especially in older age groups. High systolic blood pressure is also strongly associated with stroke, and there is an approximately linear relationship between the two (Ministry of Health and University of Auckland 2003). However, although the relative association between blood pressure and stroke is weaker in older populations, their overall higher rate of stroke means that a reduction in blood pressure will be more likely to have a greater absolute beneficial effect (Lawes et al 2004). It has been estimated that a decrease of 10 mmHg in systolic blood pressure may reduce CHD by 15–20 percent and stroke by 35–40 percent (Ministry of Health and University of Auckland 2003).

Major modifiable risk factors for high blood pressure are obesity, alcohol intake, sodium intake and physical activity. As a result of the cumulative effects of these factors, blood pressure usually rises steadily with age.

High total cholesterol

Cholesterol is a key component in the development of atherosclerosis – the accumulation of fatty deposits on the inner lining of arteries. Total cholesterol is an important modifiable risk factor for cardiovascular disease, particularly coronary heart disease. The risk of CHD increases with increasing total cholesterol (Ministry of Health and University of Auckland 2003). The risk of ischaemic stroke – but not haemorrhagic stroke – also increases with increasing total cholesterol (Ministry of Health and University of Auckland 2003).

In the Asia Pacific Cohort Studies Collaboration (2006) meta-analysis, high total cholesterol was a more important contributor to the modifiable CHD risk in women than in men. This greater contribution may be due to the increase in total cholesterol that coincides with the onset of menopause, and subsequent hormonal promotion of an unfavourable lipid profile.

Blood cholesterol levels are determined by a number of non-modifiable factors, such as genetics, and modifiable factors, including nutrition, physical activity and body weight (Ministry of Health and University of Auckland 2003). Dietary fats are the most important modifiable determinant of blood cholesterol concentrations (Ministry of Health and University of Auckland 2003). There is convincing evidence of an association between a reduction in trans and saturated fatty acids and decreases in blood cholesterol and the risk of CVD. Replacing these fatty acids with monounsaturated and/or polyunsaturated fatty acids further lowers the risk of CVD (WHO and FAO 2003). Dietary fibre has also been shown to lower blood cholesterol (Ministry of Health and University of Auckland 2003) (see also Part 4: Nutrients, Food and Drinks).

Prevalence of cardiovascular risk factors

High blood pressure

In 2006/07 the prevalence of taking medication for hypertension increased with age in both men and women. Nearly half of those aged 75 years and over (50% of women and 45% of men) were currently taking medication for high blood pressure. Among all adults, Māori men and women, Pacific women and Asian men were more likely to be treated for high blood pressure.

High total cholesterol

In 2006/07 the prevalence of taking medication for cholesterol increased with age up to 65 years, in both men and women. From the age of 65 years the prevalence of taking medication for cholesterol stabilised at just over one in five adults. After adjusting for age, Pacific women and Asian men were more likely to be taking medication for high cholesterol compared with women and men in the total population.

The mean total serum cholesterol of the total adult population in the NNS97 was 5.7 mmol/L. The current National Heart Foundation recommendation is that 4.0 mmol/L is an 'optimal' total cholesterol level. Mean total cholesterol increased steadily with increasing age for both men and women until the age of 65 years, after which the mean total cholesterol stabilised. This relationship between total cholesterol and age is comparable with findings from the Asia Pacific Cohort Studies Collaboration, where cholesterol declined after 65 years of age.

Although total blood cholesterol levels are declining over time in New Zealand, they are still considerably higher than the recommended 'optimal' level (Ministry of Health and University of Auckland 2003).

9.4 Diabetes mellitus

Background

Diabetes is a metabolic condition that results in raised blood glucose. It is an important cause of morbidity and mortality in New Zealand. Diabetes can lead to cardiovascular disease, blindness, kidney disease and vascular insufficiency at all ages.

Diabetes is characterised by raised blood glucose due to insulin deficiency, insulin resistance, or both. There are two main types of diabetes.

- **Type 1 diabetes** is an autoimmune disease in which the insulin-producing pancreatic beta cells are destroyed. It typically has an abrupt and symptomatic onset, and usually (but not always) presents in children and young adults aged under 30 years.
- **Type 2 diabetes** is much more common than type 1 diabetes. It has a more insidious onset, and it is commonly asymptomatic for several years before being diagnosed. Type 2 diabetes is caused by reduced insulin secretion, together with insulin resistance (resistance to the action of insulin by the body tissues), leading to a relative insulin deficit.

The incidence of type 2 diabetes increases with increasing age, and usually presents in adults or older adults. Where older adults are obese and experience adverse accelerated physiological changes in most organs and cells of the body associated with diabetes, they have an increased risk of a subsequent decline in physical function and poorer quality of life (Gambert and Pinkstaff 2006).

Risk factors for type 2 diabetes

A combination of genetic and modifiable lifestyle factors contributes to the development of type 2 diabetes (WHO and FAO 2003). Obesity is the most important modifiable risk factor for the development of type 2 diabetes. It has been estimated that obesity accounts for approximately one-third of the increasing number of New Zealanders with type 2 diabetes (Ministry of Health 2007a). There is convincing evidence that excess adiposity that is centrally distributed is

associated with an increased risk of type 2 diabetes, and that waist circumference or waist-to-hip ratio are more powerful determinants of risk than BMI (WHO and FAO 2003). Central adiposity is also an important determinant of insulin resistance, the underlying abnormality in most cases of type 2 diabetes (WHO and FAO 2003).

Dietary intakes of saturated and polyunsaturated fatty acids are also important determinants of type 2 diabetes. A high intake of saturated fat has been associated with increased risk of developing impaired glucose tolerance and diabetes; unsaturated fatty acids, particularly n-3 polyunsaturated fatty acids, have been inversely associated with the risk of developing diabetes (Mann 2002). High intakes of dietary fibre and low-glycaemic-index foods are also associated with a lower risk of developing type 2 diabetes (Mann 2006). Physical activity contributes to determining body fat and weight, and is an independent risk factor in the development of type 2 diabetes (Mann 2002).

Older adults may be at increased risk of type 2 diabetes due to a number of factors, including:

- the change in body composition with age, including an increase in fat mass and its subsequent central abdominal redistribution
- reduced physical activity levels
- a decline in the secretion of the adipose-tissue hormones leptin and adiponectin with age (leptin decreases appetite and adiponectin reduces insulin resistance)
- changes in the secretion of insulin with age-related dysfunction of the pancreatic β cells (Gambert and Pinkstaff 2006).

Prevalence of type 2 diabetes

Type 2 diabetes accounts for the majority of diabetes in New Zealand. In 2006/07, in both men and women, the prevalence of diagnosed diabetes increased with age. Five percent of all adults reported diabetes diagnosed by a doctor, and in adults over 65 years, 15 percent of women and 12 percent of men reported diabetes diagnosed by a doctor. There was no difference in the prevalence of diabetes for adults aged 65–74 years and those aged 75 years and over. After adjusting for age, men were slightly more likely than women to be diagnosed with diabetes. The prevalence of diabetes in Māori, Pacific and Asian populations is greater than in the general population. The prevalence of diagnosed type 2 diabetes is projected to increase by approximately 45 percent over the decade 2001–2011 (Ministry of Health 2007b).

The actual prevalence of type 2 diabetes is likely to be greater than that reported in the New Zealand Health Survey. Up to about 2004 it had been estimated that almost half of type 2 diabetes was undiagnosed (New Zealand Guidelines Group 2003), but the proportion of people in the community with undiagnosed diabetes appears to have been falling in recent years. An overseas study of 600 older adults (mean age 70.6 ± 6.9 years) found that 13 percent had undiagnosed type 2 diabetes, and that these subjects had fewer co-morbidities than those with diagnosed diabetes (Dankner et al 2008).

Type 2 diabetes is preceded by intermediary states of impaired glucose tolerance and impaired fasting glucose (Rose et al 2004). As well as an increase in the prevalence of type 2 diabetes with age, evidence suggests that these ‘pre-diabetes’ states increase in prevalence with age (Rose et al 2004).

9.5 Cancer

Background

‘Cancer’ is a generic term used to describe a group of over 100 diseases that occur when malignant forms of abnormal cell growth develop in one or more body organs (Ministry of Health 2003b). Although cancer occurs in people of every age, it is fundamentally a disease of ageing. Cancers are gaining relative importance as a cause of death, partly because there are increasing numbers of people growing older and partly because of improved care resulting in fewer deaths from other causes, such as cardiovascular diseases (WHO and FAO 2003).

Risk factors for cancer

Food, nutrition, obesity and physical activity can influence fundamental cellular processes, which may promote or inhibit cancer development and progression (World Cancer Research Fund and American Institute for Cancer Research 2007). Dietary factors are estimated to account for approximately 30 percent of cancers in industrialised countries (WHO and FAO 2003). Consuming a healthy diet, being physically active, maintaining a healthy weight and, importantly, not smoking tobacco have the potential over time to reduce much of the global burden of cancer (World Cancer Research Fund and American Institute for Cancer Research 2007; WHO and FAO 2003).

The World Cancer Research Fund and the American Institute for Cancer Research (2007) judged that there are convincing causal relationships between:

- red meat and processed meat and increased risk of colorectal cancer
- body fatness and increased risk of oesophageal, pancreatic, colorectal, breast (post-menopausal), endometrial and kidney cancers
- abdominal fatness and increased risk of colorectal cancer
- alcoholic drinks and increased risk of mouth, pharynx, larynx, oesophageal and breast (both pre- and post-menopausal) cancers
- physical activity and decreased risk of colon cancer.

These relationships have been established for the global population, not specifically the New Zealand population.

There are several theoretical reasons why cancer incidence increases in older adults. These include age-related alterations in the immune system, the accumulation of random genetic mutations, lifetime carcinogen exposure, hormonal alterations or exposure, and long latency periods for the development of many cancers (Gilcrest 2000).

New Zealand prevalence

Cancer is a leading cause of death in New Zealand, accounting for 29 percent of deaths from all causes in 2005 (Ministry of Health 2009). With the exception of breast and cervical cancer, the registration and mortality rates for all types of cancer in New Zealand are significantly higher in older age groups (65 years and older), especially older men (Ministry of Health 2006c). Among females aged 85 years and over, all-cancer mortality rates are nearly seven times higher than among those aged 50–64 years. Among males in the same age group, mortality rates are 12 times higher than among those aged 50–64 years (Ministry of Health 2006c).

All cancer mortality rates are about twice as high for Māori as for non-Māori. It appears that Māori with cancer may be more likely to die from their cancer than non-Māori (Ministry of Health 2009).

9.6 Osteoporosis

Background

Bone is living, growing tissue made mostly of an organic matrix (protein collagen), bone cells and bone minerals. The 'peak bone mass' is the amount of bone tissue present at the end of skeletal maturation. It is the point at which bones have their maximum strength, and is a major determinant of the risk of future fracture due to osteoporosis. Peak bone mass usually occurs around the third decade of life (Brown et al 2007). With higher peak bone mass the impact of subsequent bone loss is lessened, and therefore the risk of fracture is reduced (WHO 2003). Substantial bone loss usually begins to occur at around 50 years of age in women and 65 years of age in men (WHO 2003).

Osteoporosis is the thinning of the bones (or 'porous' bones) resulting from a loss of bone density. It occurs when not enough new bone is formed, too much bone is reabsorbed, or both. Osteoporosis causes bones to become brittle and fragile, which can lead to fractures even in the absence of injury or falls. Osteoporosis usually develops slowly and is most common in older people.

The burden from osteoporosis is due to fractures because of reduced bone density and other factors seen in older age groups, such as increased risk of falling (WHO 2003). From middle age onwards, osteoporotic fractures cause significant morbidity because musculoskeletal damage is more likely to result in long-term disability (Brown et al 2007). The most common fractures associated with low bone mass occur in the hip, spine and wrist (WHO 2003). Fractures can result in pain, loss of physical function, deformity, hospitalisation and sometimes the need for ongoing care and loss of quality of life (Brown et al 2007). Fractures may also lead to a reduced level of activity due to the fear of further fracture. Hip fractures are estimated to account for 5 percent of all fractures and cause the greatest reduction in quality of life. In New Zealand, older people with hip fractures have 'a dramatic decline in physical function' and 20 percent of older people who sustain a hip fracture die within a year (Brown et al 2007).

Women aged 80 years and over, and men aged 85 years and over, should be considered at high risk of hip fracture. Living in institutional care is associated with a doubling of the risk of hip fracture compared with living independently, even after controlling for potential confounding factors (Norton et al 1999). Significant cognitive impairment is associated with twice the risk of hip fracture (Guo et al 1998).

Risk factors for osteoporosis

There are a number of non-modifiable risk factors for osteoporosis. Up to 50 percent of the variance in peak bone mass and other aspects relevant to bone strength may be determined genetically (WHO 2003). Loss of bone is influenced by endocrine factors, including oestrogen deficiency, and may also result from age-related conditions such as reduced calcium absorption from the gut and secondary hyperparathyroidism (WHO 2003). The risk of fracture is increased as a result of a previous fracture or a new trauma.

Nutrition-related factors can influence osteoporosis through peak bone mass, age-related bone loss and fracture risk. There is evidence that for older people a sufficient intake of vitamin D and calcium together reduces the risk for osteoporosis (WHO and FAO 2003). A sufficient calcium supply is necessary at all stages in life, and current nutrient reference values are higher for adults aged over 70 years to account for the changes in calcium metabolism with age. Low levels of vitamin D in older New Zealanders are not uncommon, and may contribute to increased fracture rates.

Sodium intake can adversely affect calcium balance through the promotion of urinary calcium loss (WHO 2002b). High intakes of protein can also increase urinary calcium excretion (NHMRC 2006), but low protein intakes are associated with low peak bone mass and under-nutrition. Other nutrients, including phosphate, vitamin K, magnesium and other trace elements, have been identified as possible factors in bone health and the prevention of osteoporosis (WHO 2002b).

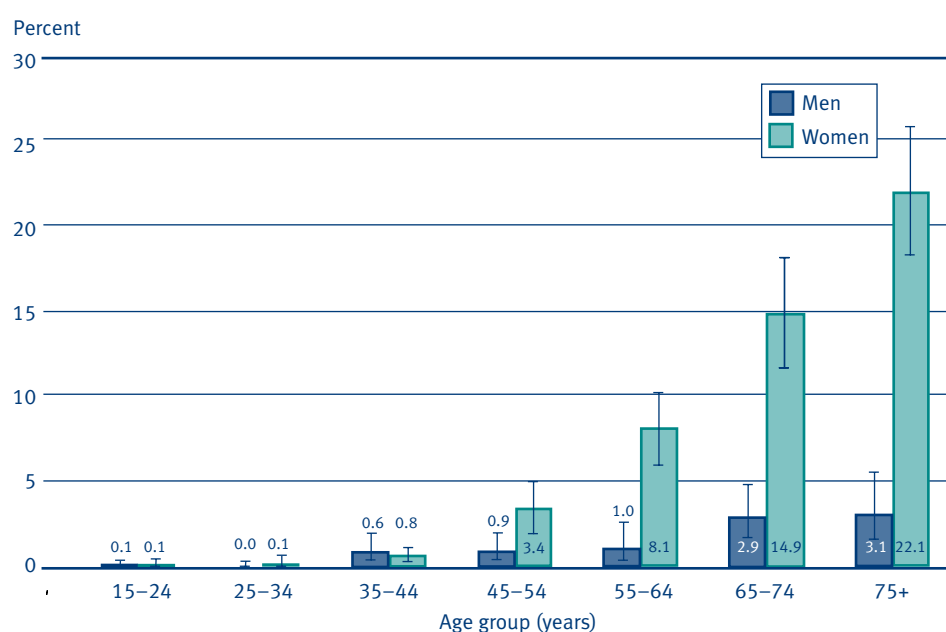
Other modifiable determinants of bone density include a lack of physical activity (particularly weight-bearing resistance training), smoking, low body weight, heavy alcohol consumption, and the long-term use of some medications, including oral steroids. Immobility is an important cause of bone loss, and bone density increases in response to physical loading and mechanical stress (WHO 2003). Studies indicate that high-impact physical activity results in higher bone density than low-impact physical activity. Physical activity is also associated with increased muscle strength and reduced risk of falling, which has an indirect effect on some types of osteoporotic fractures. Low body mass index is associated with lower peak bone mass and a negative effect on bone loss.

Prevalence of osteoporosis

In 2006/07 one in 34 adults (90,000 adults) reported they had been told by a doctor that they have osteoporosis. The prevalence of osteoporosis was much higher in women (3.5%) than in men (0.8%). In women the risk of osteoporosis increased rapidly as age increased (Figure 9). One in five women (22%) aged 75 years and over had been diagnosed with osteoporosis. In men the relationship between osteoporosis and age was not statistically significant. Osteoporosis is more prevalent in European/Other New Zealanders than in Māori, Pacific or Asian New Zealanders.

In 2007 Brown et al conducted a study estimating the incidence of osteoporosis using Census and hospitalisation information, and observed ratios of fracture rates from other studies. This study estimated that 84,000 New Zealanders would experience osteoporotic fractures in 2007, 92 percent of whom would be New Zealand European, and 62 percent of these will be women. Osteoporosis was estimated to cost New Zealanders 12,000 years of life due to mortality and disability in 2007, and the treatment and management of osteoporotic fractures in excess of \$300 million. Taking into account other conditions influenced by osteoporosis, the costs to the health system are significantly higher (Brown et al 2007).

Figure 9: Osteoporosis in adults, by age and gender (unadjusted prevalence)



Source: 2006/07 New Zealand Health Survey

9.7 Nutrition recommendations for chronic disease

Healthy eating – including eating a variety of nutritious foods, eating the recommended number of servings from the four major food groups (see Table 2 in Part 1: The New Zealand Food and Nutrition Guidelines), and following the Food and Nutrition Guideline Statements – is essential for both maintaining good health and reducing the risk of chronic disease.

Plenty of vegetables, fruit and wholegrain cereals, moderate amounts of lean meats, fish, poultry and reduced-fat milk and milk products, small amounts of polyunsaturated or monounsaturated fats and oils, as well as plain water, should provide all the recommended levels of nutrients within the energy requirements (NHMRC 2006). For older people, the recommended dietary intakes (RDIs) for most nutrients are the same, or higher for some nutrients, compared with younger adults, but energy and food intakes are usually lower. A nutrient-dense diet, including dietary variety, should be a high priority for older people.

Increased physical activity makes dietary choices more flexible and assists in the maintaining an acceptable body weight and reducing a range of chronic diseases (NHMRC 2006). Physical activity among older people is associated with greater energy intakes, improved nutrient intakes and a better quality of life (WHO 2002b).

There is some evidence that a range of nutrients could have benefits for reducing chronic disease at levels above the RDI or adequate intake (AI) (NHMRC 2006). People consuming food sources of antioxidant nutrients at or above the top quintile of the population intake generally have lower risk of a range of chronic diseases. A suggested dietary target of the 90th centile of the current population intake of the antioxidant nutrients has been set in order to lower chronic disease risk (NHMRC 2006). An approach to consuming this level of nutrients using food sources is encouraged rather than using supplements, so that nutrient balance is maintained and benefits are optimised (NHMRC 2006). There is also concern over the risks associated with supplement use (see Section 4.14 on supplements in Part 4: Nutrients, Food and Drinks).

There is also a growing body of evidence that a major imbalance in the relative proportions of macronutrients can increase the risk of chronic disease and may adversely affect micronutrient intake. The form of fat (eg, saturated, monounsaturated or polyunsaturated, or specific fatty acids), carbohydrate (eg, starches or sugars, high or low glycaemic) or protein (plant or animal based) is also a major consideration in chronic disease risk (NHMRC 2006) (see also Part 4: Nutrients, Food and Drinks).

Increasing dietary fibre intakes has been linked to lower rates of obesity, cardiovascular disease, diabetes and certain cancers. The intakes of dietary fibre that appear to bring meaningful health benefits appear achievable through dietary change (NHMRC 2006). A suggested dietary target of the 90th centile of the current population intake (26 g/day for women and 30 g/day for men aged 65 years and over) has been set to lower chronic disease risk (NHMRC 2006). Increasing fibre intake through additional vegetables, legumes and fruits in the diet would also increase the natural intake of antioxidant vitamins and folate (see also Part 4: Nutrients, Food and Drinks).

Some of the specific nutritional and lifestyle factors that have been shown to be determinants of the major biological risk factors for chronic disease are discussed in further detail below. Although it is clear that risk factors for chronic diseases are influential and modifiable at all stages of life, a step-wise approach that takes account of specific risk factors and lifestyles for the older population is always recommended when giving advice or developing programmes.

Maintain a healthy weight

There is a lack of consensus over the ideal body mass index for optimal health in older people, and whether older people should be counselled to lose weight. For example, it has been suggested that the healthy BMI range of 18.5–24.99 kg/m² for the general adult population is too restrictive and does not reflect health and mortality outcomes in the older population (Heiat et al 2001; Sergi et al 2005).

In older people, being underweight is associated with physical, functional and psychological impairment, and increased hospitalisation risk and time spent recovering from illness, with subsequent costs to the health system (Sergi et al 2005). A systematic review of 13 studies of older people found that a low BMI was more consistently associated with greater risk of mortality than a high BMI (Heiat et al 2001). Being underweight is also used as an indicator of being at risk of or having poor nutritional status. A BMI of 18.5 kg/m², which marks the lower end of a healthy weight range for adults, may be too low for older people. A BMI of 20 kg/m² has been shown to be a reliable threshold below which the risk of mortality increases in older people, and this may therefore be a more appropriate definition for underweight in this population (Sergi et al 2005).

Consequently, health practitioners may also consider that older people with a BMI of 20 to 22 kg/m² are at high risk of becoming underweight, and should intervene to maintain a healthy weight at this stage (Sergi et al 2005). An American study of 130 community-living older people with a BMI less than 24 kg/m² found that they were generally unaware of what a normal weight was, or of the risk factors and implications of weight loss, despite regular visits to their main health care provider. There is a role for health practitioners in monitoring weight, and in ensuring older people have timely and relevant knowledge about maintaining a healthy weight and avoiding unintentional weight loss (Thompson Martin et al 2008).

The current evidence suggests that the risk of morbidity and mortality associated with excess body weight generally becomes significant at levels of approximately 30 kg/m² (Heiat et al 2001; McTigue et al 2006). This risk weakens or disappears at around 75 years of age. Excess weight in older people is associated with a reduction in physical function and mobility, and in quality of life. Obese older adults may benefit from weight loss if they have a high risk of cardiovascular disease and/or functional impairment. It is best if weight loss techniques minimise muscle and bone losses (Villareal et al 2005; McTigue et al 2006), and avoid malnutrition by emphasising the importance of eating a variety of foods from the four food groups. Interventions in obese older people have demonstrated that sustained modest weight loss is possible with intensive interventions, including diet, physical activity and behavioural components (McTigue et al 2006). In older people at high risk of osteoporosis, the balance of benefits and harms must be considered, and physical activity is important to minimise bone loss (McTigue et al 2006).

There is little evidence for an increased risk of mortality for older people with a BMI in the range of 25 to 29.99 kg/m², the overweight category according to the WHO definitions for adults (Heiat et al 2001). The mortality risk appears to be strongest in people younger than 50 years of both genders (Inelman et al 2003). Weight maintenance is recommended for overweight older people without chronic diseases (Inelman et al 2003). Weight maintenance may also be beneficial in older age for the prevention of functional decline (Bannerman et al 2002).

Further research is needed to determine appropriate BMI thresholds for identifying the need for weight management intervention in the older population in New Zealand.

Increase vegetable and fruit consumption

Vegetable and fruit consumption is protective against cardiovascular disease and some common cancers (Ministry of Health and University of Auckland 2003). People who consume vegetables and fruit frequently are also likely to have other health-promoting behaviours such as having low

saturated fatty acid intakes, being physically active and avoiding tobacco (Ministry of Health and University of Auckland 2003). Vegetables and fruit are high in fibre, low in energy and contain many micronutrients (nutrient-dense). Consuming them in place of nutrient-poor, high-energy foods may contribute to weight loss and associated health outcomes, including reduced risk of type 2 diabetes, high blood pressure and some cancers (WHO and FAO 2003). Although each of the micronutrients present in vegetables and fruit may play a role in the prevention of disease, their effect in combination within whole foods may confer a greater health benefit (Ministry of Health and University of Auckland 2003).

Modelling using New Zealand data showed that one additional serving per day of vegetables and fruit may be associated with a lowered risk of coronary heart disease, through the effects on blood pressure and total cholesterol, of about 5 to 8 percent in adults aged 65 years and over, and a lowered risk of ischaemic stroke of about 3.5 to 4 percent (Ministry of Health and University of Auckland 2003). The World Cancer Report states that vegetables and fruit are a ‘probable’ protective factor for cancers of the mouth, larynx, pharynx, oesophagus and stomach, and fruit probably protects against lung cancer (World Cancer Research Fund and American Institute for Cancer Research 2007). New Zealand modelling showed that a reduction in cancer risk may range up to about 5 percent for stomach, 3.5 percent for lung, 5 percent for oesophageal and 0.8 percent for colorectal cancers with one additional serving per day of vegetables and fruit (Ministry of Health and University of Auckland 2003).

In New Zealand, about one-third of older females and half of older males do not meet the minimum recommended intake of at least three servings of vegetables and two servings of fruit per day (Ministry of Health 2008a).

Reduce total and saturated fat

There is a range of total fat intakes that is consistent with good health. The acceptable macronutrient distribution range (AMDR) for total fat is 20–30 percent of total dietary energy intake (NHMRC 2006). In developed countries, intakes near the upper end of the range may be consistent with good health in highly active people with a good intake of vegetables and fruit, legumes and wholegrain cereals (WHO and FAO 2003). In older New Zealanders the median total fat intake is 33–34 percent of total dietary energy intake, but one-third to one-half of older women and men do not meet the recommended intakes of vegetables and fruit and few meet the recommended intakes of breads and cereals. In addition, only 43 percent of women and 51 percent of men aged 65–74 years are regularly physically active.

The dietary replacement of saturated fatty acids with unsaturated fatty acids is recommended as one way to reduce the adverse health effects of saturated fat intake, and to gain health benefits from unsaturated fat intakes. These benefits include improvements in lipid profile, blood pressure, cardiac function, arterial compliance, endothelial function, vascular reactivity, cardiac electrophysiology, and anti-platelet and anti-inflammatory effects (WHO and FAO 2003).

Increased consumption of fish and fish oils, and an emphasis on plant sources of fats (with the exception of coconut and palm oils) instead of animal sources, will alter the types of fats consumed (WHO and FAO 2003). Population studies have shown that regular consumption (one to two servings per week) of fish is associated with a reduced risk of total and CHD mortality, particularly in high-risk groups (WHO and FAO 2003). Nuts are high in unsaturated fatty acids and low in saturated fatty acids and also contribute to improving the lipid profile (WHO and FAO 2003). Due to their high energy content, they should be included in diets in small amounts.

Dietary saturated fatty acids can also be replaced with carbohydrates, preferably those rich in non-starch polysaccharides. This change results in a small decrease in energy intakes and body weight, which also has a favourable impact on lipid profiles. Replacing 1 percent of energy from saturated

fatty acids with carbohydrate lowers total blood cholesterol by 0.052 mmol/L (Ministry of Health and University of Auckland 2003). Where foods high in saturated fatty acids cannot be replaced with carbohydrates rich in non-starch polysaccharides, they should be replaced with unsaturated fatty acids or low-fat equivalents (Ministry of Health and University of Auckland 2003).

Increase dietary fibre

Good sources of dietary fibre are vegetables and fruit, legumes and wholegrain cereals. High intakes of dietary fibre are associated with weight loss, possibly through the effect of lower levels of total energy and fat, and a greater satiation effect.

Increasing dietary fibre has also been associated with lower rates of cardiovascular disease. Soluble fibre improves lipid profiles, and diets high in vegetables and fruit help to lower blood pressure. Total cholesterol (one component of the lipid profile) and blood pressure are major modifiable risk factors for cardiovascular disease. New Zealand estimates predict a daily increase of approximately 4 grams of soluble fibre would reduce the average total cholesterol by 1 percent (Ministry of Health and University of Auckland 2003). A 1 percent reduction in total cholesterol is generally thought to be associated with a 2 percent reduction in CHD (NHMRC 2006).

The effects of dietary fibre in promoting weight loss contribute to the reduction in risk of developing type 2 diabetes. In people with type 2 diabetes, dietary fibre has been shown to be associated with reduced blood glucose levels (WHO and FAO 2003).

The World Cancer Report states that dietary fibre probably protects against colorectal cancer, and that there is some evidence for a protective effect against oesophageal cancer (World Cancer Research Fund and American Institute for Cancer Research 2007). The mechanisms for protection against colorectal cancer are not clear, but dietary fibre has several functions in the gastrointestinal tract. Notably, it reduces transit time, increases faecal weight, improves laxation, and dilutes luminal contents, which have been linked to a reduction in colon cancer risk.

Decrease dietary sodium and increase dietary potassium

Sodium

Sodium chloride (salt) is the principal source of sodium in the diet. Sodium is also present in the diet as sodium bicarbonate and food additives, including monosodium glutamate, sodium phosphate, sodium carbonate and sodium benzoate (NHMRC 2006). Although sodium is an essential nutrient, intakes of sodium in developed countries greatly exceed daily requirements. There is strong, consistent evidence of an association between dietary salt intakes and blood pressure.

The Dietary Approaches to Stop Hypertension (DASH) trial found that diets rich in vegetables, fruit and low-fat dairy products lowered systolic blood pressure by 2.8 mmHg. Modelling using New Zealand data showed that reducing systolic blood pressure by 1 mmHg could be associated with a 1 to 2.5 percent lower risk of CHD for those aged over 65 years, and 2 percent lower risk of stroke (Ministry of Health and University of Auckland 2003). A smaller risk reduction in older adults is seen because the association between systolic blood pressure and cardiovascular disease outcomes attenuates with age (Ministry of Health and University of Auckland 2003). Also, sensitivity to salt increases with age and with increasing body fat (NHMRC 2006).

A follow-up study examining the effects of a DASH diet combined with dietary salt reduction showed greater reductions in blood pressure than either of the interventions alone (NHMRC 2006). In trials with older people, both salt reduction and weight loss, and a combination of the two, resulted in hypertensive older people coming off their medication (NHMRC 2006).

Potassium

Potassium can blunt the effect of sodium chloride on blood pressure and so help regulate blood pressure (Ministry of Health and University of Auckland 2003; NHMRC 2006). The Intersalt study found a negative relationship between potassium intake and systolic blood pressure (Intersalt Co-operative Research Group 1988). Vegetables and fruit are a good source of potassium, which may contribute to the relationship between diets high in vegetables and fruit and lowered risk of cardiovascular disease (Ministry of Health and University of Auckland 2003).

Limit alcohol intakes

The relationship between alcohol consumption and all-cause mortality is usually described as a J-shaped or U-shaped curve, where light to moderate drinkers have a lower mortality risk than those who abstain or drink heavily (Wells et al 2004). This benefit to light and moderate drinkers is attributed mostly to a reduction in coronary disease (Wells et al 2004). In 2003 the WHO judged that there was convincing evidence that low to moderate alcohol consumption reduces the risk of cardiovascular disease, but could not make a general recommendation for its use, due to other cardiovascular and health risks associated with alcohol (WHO and FAO 2003). It is now thought that the benefits of alcohol consumption have been overstated.

There are biological mechanisms that allow a plausible explanation for how alcohol might both reduce the risk of cardiovascular disease (through an increase in high-density lipoprotein cholesterol and improved thrombolytic factors) and increase the risk of cardiovascular disease (through increased blood pressure with heavy drinking) (Jackson et al 2005; Emberson and Bennett 2006; Foster and Marriott 2006). There is some debate over the relationship between alcohol consumption and blood pressure. Some studies have produced evidence showing a J-shaped relationship whereas others have pointed to a threshold effect, probably due to methodological differences (Foster and Marriott 2006). Drinking is associated with a positive, linear risk of haemorrhagic stroke (Foster and Marriott 2006). There is some evidence that light to moderate alcohol consumption may reduce the risk of ischaemic stroke – perhaps not surprising considering the relationship with vascular health. However, evidence for ischaemic stroke is not consistent. Again the differences in evidence are likely to be due to methodological issues (Emberson and Bennett 2006; Foster and Marriott 2006).

Methodological issues that suggest the protective effects of alcohol on cardiovascular health may have been overestimated include:

- difficulties categorising amounts and patterns of drinking, and in choosing an appropriate reference category to measure drinking against (Emberson and Bennett 2006)
- the inclusion of people reducing or stopping their alcohol intake (often associated with ageing or illness) in the ‘abstainer’ category for data analysis, which may have overestimated the protective effect of alcohol, as it is not the absence of alcohol that increases the risk of cardiovascular disease but ill health (Fillmore et al 2007)
- uncontrolled confounding of healthy lifestyle factors among light to moderate drinkers, such as healthy eating and physical activity (Jackson et al 2005; Rimm and Moats 2007).

There is convincing evidence that alcohol of all types is a cause of numerous cancers (World Cancer Research Fund and American Institute for Cancer Research 2007). Notably, alcohol is associated with cancers of the upper digestive tract, including the mouth, pharynx and larynx, and oesophagus. The evidence does not show a level of consumption below which there is no increase in the risk of cancer. This means that even small amounts of alcohol will increase the risk of cancer, and therefore should be avoided (World Cancer Research Fund and the American Institute

for Cancer Research 2007). Heavy intakes of alcohol are also associated with increased risk of weight gain and obesity, although evidence does not consistently demonstrate this association for moderate alcohol intakes (Foster and Marriott 2006).

It should be noted that the Alcohol Advisory Council guidelines for responsible drinking (see Part 4: Nutrients, Food and Drinks) are not recommendations to consume alcohol. Despite the uncertainty around the evidence for a protective effect of low to moderate alcohol consumption on cardiovascular disease risk, the adverse effects on physical, behavioural, mental and social health of higher alcohol consumption mean that population advice is to limit alcohol consumption (World Cancer Research Fund and the American Institute for Cancer Research 2007). A recommendation for older people to increase their alcohol consumption to achieve any health benefit is not warranted.

Increase physical activity

Physical activity is an essential part of achieving energy balance and is an important determinant of body weight. Regular physical activity is protective against unhealthy weight gain, and sedentary lifestyles promote unhealthy weight gain in the general adult population (WHO and FAO 2003). At any BMI level, physical activity is independently associated with reduced risk of cardiovascular disease and type 2 diabetes, and all-cause mortality (WHO and FAO 2003).

In the older obese population, physical activity, in combination with dietary and behavioural modifications, can result in sustained modest weight loss. For older people without chronic conditions, weight maintenance is important to maintain functional capacity. Although health benefits, such as a reduction in cardiovascular disease and mortality, can be achieved with 30 minutes of physical activity on most days, there is evidence in the general adult population that a greater amount of exercise is probably required to prevent weight gain (WHO and FAO 2003).

Key points on obesity, cardiovascular disease, type 2 diabetes, cancer and osteoporosis

- Nutrition and physical activity are well established as major modifiable determinants of chronic disease.
- The older population experiences a greater burden of chronic diseases than young and middle-aged adults. In older age groups the prevalence of co-morbidity (multiple chronic conditions) increases.
- Older people have been exposed to risk factors for chronic diseases throughout the life course but can experience health benefits from adopting a healthy lifestyle.
- For New Zealanders over the age of 65 years, the five leading causes of death from 2000–2002 were all chronic diseases: coronary heart disease, stroke, chronic obstructive pulmonary disease, various cancers and other forms of heart disease.
- The morbidity burden of chronic disease includes a decline in functional capacity, mobility limitations, a lower level of physical activity, an inability to look after oneself, frailty, and a poorer quality of life.
- The BMI cut-off points used to classify underweight, overweight and obesity in adults may not accurately reflect the risk of health conditions in the older population.
- High blood pressure continues to increase in older age, but total cholesterol stabilises or declines in age groups over 65 years. Both blood pressure and cholesterol levels are major determinants of cardiovascular disease risk.
- Although total blood cholesterol levels are declining over time in New Zealand, they are still considerably higher than the recommended ‘optimal’ level.
- Older adults may be at increased risk of type 2 diabetes due to a number of factors, including changes in body composition, reduction in physical activity levels, and changes in hormone secretions.
- The prevalence of cancer increases with age. Food, nutrition, obesity and physical activity can influence fundamental cellular processes, which may promote or inhibit cancer development and progression.
- Osteoporosis usually develops slowly and is most common in older people. Bone fractures can result in pain, loss of physical function, deformity, hospitalisation and sometimes the need for ongoing care, and loss of quality of life. Nutrition-related factors can influence osteoporosis through peak bone mass, age-related bone loss and fracture risk.
- Nutritional recommendations to reduce chronic disease risk include:
 - maintain a healthy weight
 - increase vegetable and fruit consumption
 - reduce total and saturated fat consumption
 - increase dietary fibre
 - decrease dietary sodium and increase dietary potassium
 - limit alcohol intakes
 - obtain your vitamins and minerals from foods rather than supplements
 - increase physical activity.

Dementia, eye disease and immunity

9.8 Dementia, including Alzheimer's disease

Background

Ageing is usually associated with a decline in memory performance (Connor 2001). Memory disability is defined as having a long-lasting condition or health problem that causes the person to have ongoing difficulty in remembering things (Ministry of Health 2004a). The prevalence of memory disability is higher among older New Zealanders, and higher in men than women. The prevalence of memory disability among women over 75 years of age was twice as high as among those aged 45–64 years, and among men over 75 it was nearly four times higher than among men aged 45–64 years.

Dementia is defined as a significant memory impairment and loss of intellectual function that interferes with a person's relationships, work and social life. A diagnosis of dementia is made when cognitive impairment is greater than that found in normal ageing (Solfrizzia et al 2005). Mild cognitive impairment (MCI) is a term used to account for aged people with a mild memory or cognitive impairment. Both MCI and dementia have a significant impact on the health and quality of life of older adults, and are becoming a greater public health problem as the population ages.

Alzheimer's disease is the main cause of dementia in older people and accounts for 70 percent of prevalent dementias. The onset of Alzheimer's disease is insidious, and disease progression includes memory loss and loss of physical function and independence (Gillette-Guyonnet et al 2007).

Dietary factors in dementia

A number of studies have investigated the role of dietary factors in the prevention of dementia, but few beneficial results have been seen. Most of the data relating to diet and Alzheimer's disease are from observational studies. Results have been inconsistent. Investigations have largely focused on the role of antioxidants from food and supplements in reducing the risk of Alzheimer's disease by lowering oxidative stress, because reactive oxygen species are associated with neuronal damage (Luchsinger and Mayeux 2004). Several studies have investigated the relationship between plasma concentrations of antioxidants and cognition, but the results are conflicting. Similarly, inconsistencies are found in studies that have investigated the association between intake of antioxidants and Alzheimer's disease (Luchsinger and Mayeux 2004). In a prospective cohort study of older people without cognitive impairment at baseline, the use of supplemental vitamins E and C, alone or in combination, did not reduce the risk of Alzheimer's disease or overall dementia (Gray et al 2007).

Micronutrient status can affect cognitive function at all ages. Although vitamin B₆ is involved in the regulation of mental function, a Cochrane review found no evidence that vitamin B₆ supplementation provided a short-term benefit related to cognitive decline or dementia (Malouf and Grimley-Evans 2003). Similarly, a Cochrane review found no evidence that older people with any type of dementia or cognitive impairment benefited from supplements of folic acid, with or without vitamin B₁₂ (Malouf and Grimley-Evans 2008). As well, a randomised controlled trial in Scotland found no evidence that daily multivitamin and multi-mineral supplements had a beneficial effect on people aged 65 years and over who were living in the community (McNeill et al 2007).

Epidemiological studies on the association between diet and cognitive decline suggest a possible role for intakes of polyunsaturated and monounsaturated fatty acids in maintaining cognitive function and preventing or delaying the onset of dementia (Solfrizzia et al 2005). Weekly fish consumption (providing an important source of omega-3 polyunsaturated fatty acids) has been linked to a lower risk for Alzheimer's disease (Solfrizzia et al 2005). It is not possible to make any definitive dietary recommendations on consumption of fish and unsaturated fatty acid in relation to the risk of dementia and cognitive decline, due to a lack of double-blind clinical trials. In the Rotterdam study of more than 5000 people aged 55 years or older, fat intake of any type was not found to be related to dementia or Alzheimer's disease (Engelhart et al 2002; Luchsinger and Mayeux 2004). Nevertheless, it is suggested that relatively high levels of consumption of fats from fish, vegetable oils and vegetables should be encouraged because this dietary advice is consistent with recommendations for lowering the risk of chronic disease (ie, cardiovascular disease, obesity, diabetes and hypertension) (Solfrizzia et al 2005).

Malnutrition is a common problem in older adults with dementia, and weight loss may occur throughout the disease process (Keller et al 2008). Although the exact cause of weight loss is difficult to identify, appetite, food preferences, sensory changes, swallowing difficulties and self-feeding difficulties lead to compromised nutritional status in older people with Alzheimer's disease and related dementias (Keller et al 2008). Malnutrition (namely under-nutrition) contributes to the lowering of general health status, to the frequency and severity of complications (especially infections), and to a faster loss of independence (Guérin et al 2005) (see also Part 10: Frailty in Older People). Studies suggest that nutrition education programmes for the caregivers of people with Alzheimer's seem to be the best way to prevent weight loss and improve their nutrition status (Gillette-Guyonnet et al 2000; Keller et al 2008).

In summary, the evidence relating diet and Alzheimer's disease is inconclusive for any nutrient (Luchsinger and Mayeux 2004). Based on the current evidence, no specific dietary recommendations for the prevention of dementia can be made. However, a prudent approach would be to eat a variety of foods from the four food groups.

9.9 Eye disease

Background

Of all the tissues in the human body, the retina consumes the greatest amount of oxygen. It is the site of elevated levels of ultraviolet light, which causes oxidative damage. Radiation, ageing and inadequate antioxidant status contribute to this damage, and membrane lipids, nucleic acids, carbohydrates and proteins are affected. Risk for retinal damage by the reactive oxygen species depends on age and geography (Rhone and Basu 2008).

Age-related macular disorder (AMD) results in a loss of vision in the centre of the visual field (the macula) because of damage to the retina and is a major cause of irreversible blindness in older adults (McCullough 2005). The macula pigment, which consists mostly of antioxidants lutein and zeaxanthin, may serve as 'natural sunglasses', filtering the blue light (a cause of oxidative damage to the retina) (Rehak et al 2008; Rhone and Basu 2008).

Dietary factors in eye disease

Decreasing oxidative damage in the retina can help to protect from AMD. Antioxidants, acting as free radical scavengers, provide a protective mechanism against oxidative damage in the retina (Janisch et al 2005). Lutein and zeaxanthin are the two carotenoids that contribute to the yellow colour of the lens and the macular pigment of the retina, and evidence for a protective effect has

been seen in epidemiological studies and some clinical trials (Krinsky et al 2003; Stahl 2005; Roberts 2006; Trumbo and Ellwood 2006; Rhone and Basu 2008). However, there are no results from randomised controlled studies to confirm that lutein and zeaxanthin supplementation reduces the risk of AMD (Rehak et al 2008). Indeed, an evidence-based review undertaken by the American Food and Drug Administration concluded that there is insufficient evidence for a health claim about the intake of lutein or zeaxanthin (or both) and the risk of AMD (Trumbo and Ellwood 2006).

Antioxidants such as vitamin C, vitamin E and pre-formed vitamin A have a role to play in relation to reactive oxygen species and the eye. Phytochemicals of emerging interest such as anthocyanins (found in berries), resveratrol (found in red wine) and green tea catechins appear to be promising for reversing oxidative stress (Rhone and Basu 2008). The omega-3 fatty acids found in fatty fish may also have a protective effect in AMD, while total fat intake may be a risk factor (Whitney and Rolfes 2008). However, additional research is needed to establish the efficacy of the preventive effects of these antioxidant vitamins and phytochemicals. Incorporating dark-green leafy vegetables daily (including spinach), leeks, peas, brussels sprouts and capsicum, as well as fruit such as kiwifruit, oranges, nectarines, berries and grapes, may be considered a healthy dietary choice.

9.10 Immunity

Background

The immune system undergoes age-associated alterations that may result in an inability to respond to infections and lead to a higher mortality rate in older people. Whether the decline in the immune response is an inevitable consequence of ageing or is an age-related secondary result in older adults is unclear (Ahluwalia et al 2004).

Lesourd (2006) classifies the influence of nutrition on immune response in older adults as follows.

- **Primary immune ageing** – where healthy older adults have no nutritional deficits – may be termed successful ageing. However, any antigenic challenge could induce a reduction in muscle protein in these older adults and lead to a more frail state.
- **Secondary immune ageing** – where micronutrient deficit influences immune responses – may be termed common ageing. Among apparently healthy older adults, correcting these micronutrient deficits by the use of micronutrient supplements may enhance immune response.
- **Tertiary immune ageing** – where impaired immune responses are observed in malnourished and/or diseased older adults – may be termed pathological ageing. Malnutrition among older adults living in the community may be associated with chronically low food intakes, creating a stress response. Repeated bouts of disease can lead to loss of body reserves and progressively lower nutritional status, and result in greater frailty. This may lead to infections and in turn a further increase in frailty (Lesourd 2006). A vicious cycle may result, but could be interrupted at any point (Wahlqvist 2002; Aw et al 2007).

Nutrition plays an important role in maintaining the strength of the immune system, and nutritional deficiencies or under-nutrition may further aggravate the already compromised immune system in older people (Wahlqvist 2002; Ahluwalia et al 2004; Lesourd 2006; Trinh 2007). Dietary proteins, carbohydrates, fats and micronutrients all interact with various immune cells systemically, either in the blood, lymph nodes or the specialised immune cells in the gastrointestinal tract (Ahluwalia et al 2004). Both deficiencies and imbalances of nutrients may impair the immune system.

Certain types of fatty acids have been shown to influence the immune response, in particular marine omega-3 fatty acids (WHO 2002b). In older adults who are living independently, micronutrient deficiencies may be present with deficits of folic acid, vitamin B₆ or zinc (Ahluwalia et

al 2004), which may affect the immune system. It has been suggested that higher vitamin B₆ levels might be needed to achieve optimal immune responsiveness in older adults (WHO 2002b). Severe zinc deficiency may cause substantially impaired immunity that could be life-threatening (Bogden 2004). The general consensus is that zinc supplementation is most likely to affect immunity positively in zinc-deficient subjects. Care is needed because at high doses zinc may have adverse rather than beneficial effects, and so routine supplementation is not advised (Bogden 2004). Vitamin E and selenium have also been shown to boost immune responses in older adults, but the mechanisms are unclear (High 2001; WHO 2002b; Thomson 2004; Brown and Arthur 2007). Immunity may be altered in vitamin A deficiency, and antibody responses to antigens may be modified.

Inevitably, the prevalence of malnutrition and micronutrient deficiencies is greater in frail, homebound older adults (Ahluwalia et al 2004). Maintaining optimal nutritional status can contribute to positive healthy ageing and extend the lifespan (Lesourd 2006). A balanced diet and healthy lifestyle habits (including moderate activity, limited alcohol intake and being happy) are key to successful ageing (Trinh 2007).

Key points on dementia, eye disease and immunity

- Both mild cognitive impairment and dementia have a significant impact on the health and quality of life of older adults and are becoming a greater public health problem as the population ages.
- Malnutrition is a common problem in older adults with dementia, and weight loss may occur throughout the disease process.
- There is a lack of evidence for the role of nutrition intervention in preventing dementia.
- Age-related macular disorder (AMD) results in a loss of vision in the centre of the visual field (the macula). It is a major cause of irreversible blindness in older adults.
- The carotenoids lutein and zeaxanthin have shown some protection against AMD in epidemiological studies and limited clinical trials. However, there is a lack of data from randomised clinical trials to support a benefit from lutein and zeaxanthin supplementation.
- The immune system undergoes age-associated alterations, which may result in an inability to respond to infections and lead to a higher mortality rate in older people.
- Nutrition plays an important role in maintaining the strength of the immune system, although the mechanisms are unknown.
- There is a lack of evidence for nutritional supplementation for protecting against depression, dementia, Alzheimer's disease and eye disease, or for improved immunity.
- Consuming a variety of foods from the four food groups will ensure that energy, macronutrient and micronutrient recommendations are met.

Part 10: Frailty in Older People

10.1 Background

Many older people living in the community are fit and well for their age, and are able to live independently as they choose. However, there are some older people in the community who are less able to function independently.⁴ The Positive Ageing Strategy's 'ageing in place' policy means that older people are supported to continue living in their own homes for as long as they can and wish to (Barrett et al 2006). Previously some of these people may have moved into residential care facilities.

'Frailty' is a term that is widely used but difficult to define. It is a concept used to identify those who are at high risk of: adverse health outcomes (including falls), becoming dependent, co-morbid illness, admission to an institution and mortality (Fried et al 2001; Morley et al 2002; Barrett et al 2006). 'Frailty' is often used to describe an overall state of vulnerability of a person, and usually encompasses a continuum of degrees of vulnerability. It is part of the process of declining health towards adverse health outcomes and, eventually, death. It is recognised that frailty is a dynamic concept, and an older person may experience frailty periodically, and frail older people may become non-frail (Abellan Van Kan et al 2008). As different individuals progress through the continuum at their own pace, they will be able to cope with stressors in different ways.

A frail older person living in the community has different and more complex nutritional and physical activity needs than a healthy older individual. Public health messages regarding nutrition and physical activity for healthy older people may not be relevant for frail older people. Achieving adequate energy intake and physical activity for functional capacity and maintaining weight become much more important in the frail older population.

There is growing interest in whether frailty is reversible: it is possible that both public and personal health interventions may have a significant impact on health and quality of life for these vulnerable older people. This part provides some context and information about frailty and its components and relevance to older people.

10.2 A definition of frailty

Key features of frailty

Although the concept of frailty is well researched, there is no consensus on how to classify frail older people. However, there is general agreement on two key features of frailty. First, frailty is more than simply an age-related decline in functional status, and the core feature of frailty is that multiple and inter-related systems affect an individual's ability to cope with and resist stressors (Campbell and Buchner 1997; Bergman et al 2007). Second, the concept of frailty is separate from disability, although the two concepts overlap and frailty can cause disability (eg, in terms of activities of daily living or mobility) (Fried et al 2001; Bergman et al 2007). Disability indicates a loss of function, whereas frailty indicates a vulnerability towards and increased risk of loss of function (Campbell and Buchner 1997).

⁴ It is not appropriate to use the information in this part as a replacement for individual clinical advice for frail older people.

Age is not the defining feature of frailty. However it is accepted that the prevalence of frailty increases with age, and that both the ageing process and frailty are linked through progressive changes in physical, social, mental and environmental domains. Chronological age alone does not predict an individual's vulnerability to adverse outcomes (Bergman et al 2007). A person may be frail at 65 years, or may not reach a frail state until 90 years of age.

Chronic disease can also be a component of frailty. It is clear that acute and chronic disease can move a person along the continuum from frailty to adverse health outcomes, and that frailty is strongly associated with chronic disease (Fried et al 2001). However, the relationship between frailty and chronic disease is complex and not well understood (Bergman et al 2007). Although many older people who are frail have chronic disease, an older person may be frail and also free from any disease state.

Along with the physical domains of frailty, there is also strong evidence that psychological (cognition and mood), social and environmental domains are important components of frailty (Barrett et al 2006; Bergman et al 2007; Abellan Van Kan et al 2008).

Tools to define frailty

The Fried et al definition (2001), developed in the USA, is an example of an assessment tool to identify frail older people using physical criteria. Fried and colleagues judged that a person needs three or more of the following components in order to be classified as frail: unintended weight loss, exhaustion, poor endurance, weakness (grip strength), slow walking speed, and low physical activity.

Using a different approach, Rockwood et al (2005) developed a multi-domain (including physical and psychological) assessment tool that stratifies older people into relative degrees of vulnerability. Based on data from the Canadian Study of Health and Ageing (CSHA), the CSHA Clinical Frailty Scale uses clinical judgement to interpret items such as co-morbidity, cognitive impairment and physical function. The scale ranges from 1 (robust health, very fit) through 4 (apparently vulnerable although not dependent), to 7 (severely frail, complete functional dependence on others). Various other assessment tools have used markers such as balance, body mass index (BMI), incontinence, presence of disease, sleep difficulties, neuromotor performance, nutrition, mood, endocrine and immune system changes, and social and environmental changes (Abellan Van Kan et al 2008).

In New Zealand, Barrett et al (2006) looked at physical domains of frailty within social and environmental contexts. They defined frailty as a complex or syndrome of underlying problems contributing to vulnerability to environmental challenge. Those who experience environmental challenge are those who report difficulty carrying out practical and social activities (eg, light housework, dressing, using the phone, visiting, shopping, keeping records, and maintaining relationships with friends, family and partner). It is worth noting that this definition does not focus on an older person's ability to carry out the physical functions necessary for living, but includes their ability to carry out roles in their families, social networks and communities.

In 2007 an expert European, Canadian and American Geriatric Advisory Panel (GAP) did not agree on a definition of frailty, but did note that because adverse outcomes of frailty (eg, disability) should be distinguished from frailty itself, any tools or definitions (including functional impairment) will be out of date (Abellan Van Kan et al 2008). The GAP also noted that gait speed may be a valid, quick and inexpensive single tool to assess frailty in a clinical setting. Gait speed has been demonstrated to be a strong predictor of mortality, hospitalisation and disability (Abellan

Van Kan et al 2008). The GAP recommended that research be conducted around the following, five-domain, case-finding tool (FRAIL), which may prove useful as a first step in identifying a frail older person:

- Fatigue
- Resistance (the ability to climb stairs)
- Ambulation
- Illnesses
- Loss of weight (over 5%) (Abellan Van Kan et al 2008).

10.3 Frailty among older people in New Zealand

Using data from the 2001 Living Standards of Older New Zealanders survey (Fergusson et al 2001), Barrett et al (2006) estimated the prevalence of frail older people in New Zealand. The survey involved face-to-face interviews with 2931 people 65 years and over living in permanent private dwellings in the community.

Of the 2931 subjects, 8.1 percent (or 237) were classified as frail due to ‘a complex or syndrome of underlying problems’ contributing to vulnerability. The prevalence of frailty increased with age, and was slightly higher in females (8.9%) than males (7%) as shown in Table 36. The higher prevalence in those aged 85 years and over likely reflects the increasing burden of disease people experience as they age. The prevalence of frailty among Māori (11.5%) was higher than for non-Māori (7.9%): the prevalence of frailty among Māori in the 65 to 70 years age group was the same as that among non-Māori in the 81 to 84 years age group. The authors note that Māori who survive into their mid seventies and eighties probably do so with a higher number of health problems and conditions than non-Māori. The prevalence of frailty was higher in those who lived alone compared with those who did not, reflecting increasing age and increasing likelihood of loss of spouse (Barrett et al 2006).

Table 36: Prevalence of frailty, by age and ethnicity, in the 2001 Living Standards of Older New Zealanders survey population

	Total sample (n)	Frail subgroup (n)	Proportion in frail subgroup (%)
Age group (years)			
65–69	912	57	6.2
70–74	785	45	5.7
75–79	614	49	8
80–84	392	41	10.4
85–89	178	32	18
90+	50	13	26
	2931	237	8.1
Ethnicity			
Non-Māori	2818	224	7.9
Māori	113	13	11.5

Source: Adapted from Barrett et al 2006

The prevalence of frailty in the New Zealand older population reported by Barrett and colleagues is consistent with the prevalence of 6.9 percent from the Cardiovascular Health Study as reported by Fried et al (2001). Using the Fried et al definition, Woods et al (2005) reported a 16.3 percent prevalence of frailty in just over 40,000 women aged 65 to 70 in the Women's Health Initiative Observational Study. Prior to the Fried et al definition, Strawbridge et al (1998) used physical, nutritional, cognitive and sensory criteria to find a prevalence of frailty of 26.1 percent among 574 older people living in the community. Numerous other authors have reported various rates as they attempt to define frailty, thus demonstrating the uncertainty about what frailty means and how to measure it (Rockwood et al 2005; Abellan Van Kan et al 2008).

10.4 Characteristics of frail older populations

In New Zealand, frailty was found to be greater in those with:

- lower levels of income and few assets
- lower self-rated standards of living
- housing problems, including those concerning safety, maintenance and heating
- mobility problems, including those concerning cost, availability and safety issues with transport, and being limited by health problems
- difficulty shopping and visiting friends (Barrett et al 2006).

In recognition of the many factors that are implicated in the development of frailty, including social and environmental factors, and in an attempt to identify key factors from the literature, Morley et al (2002) used the following three categories to explain frailty.

1. intrinsic factors:

- sarcopenia and related metabolic pathogenic factors
- atherosclerosis
- cognitive impairment
- malnutrition

2. social factors that determine the severity of frailty:

- low income
- low education
- lack of family or societal supports

3. potentially treatable precursor conditions that can lead to these major determinants of frailty:

- anorexia
- pain
- inactivity
- diabetes
- depression
- fear of falling
- delirium.

Some components or predictors of frailty are discussed in further detail below.

Sarcopenia

Sarcopenia is described in Part 2: Ageing, Nutrition and Health. Briefly, it is the age-associated change in body composition towards a loss of lean (muscle) mass. Because muscle mass is the most metabolically active body tissue, and muscle mass and strength are required for physical activity, sarcopenia has implications for both energy metabolism and functional capacity. With the sarcopenic loss of muscle mass there is an increase in body fat mass. Furthermore, the changes in fat mass distribution from visceral to abdominal increase the risk of cardiovascular disease.

The maintenance of skeletal muscle depends on a number of factors, including genetic, hormonal, inflammatory, neurological, nutritional and physical activity factors (Walston et al 2006). As a result, sarcopenia may result in changes to multiple physiological systems (Morley et al 2006; Walston et al 2006).

A bi-directional cause-and-effect relationship between the loss of muscle mass and physical inactivity means that it is difficult to separate the effect of each of these factors in the overall physical decline of the older population. It is clear that reduced energy expenditure, lower energy requirements and a decline in physical activity result. Aspects of physical capacity, including aerobic endurance, strength, balance and flexibility, have been variously reported to be associated with frailty (Fried et al 2001; Morley et al 2002). A lack of physical activity further contributes to the gain in fat mass.

Malnutrition

Malnutrition is defined as the state of being poorly nourished, either through a lack of nutrients or an excess of nutrients (Hickson 2006). It is possible for people to be underweight and malnourished, or overweight or obese and malnourished. Although there are many factors influencing food intake and nutrient requirements in older age (see Part 2: Ageing, Nutrition and Health), malnutrition is not a predictable and inevitable part of ageing.

In older people malnutrition is more commonly associated with being underweight and having inadequate intakes, rather than with being overweight (Nowson 2007). Low energy intake often means inadequate intakes of macronutrients and micronutrients. Under-nutrition is associated with poor health outcomes, including: increased risk of mortality, prolonged and more frequent hospitalisation, falls, and increased risk of osteoporosis (Australia and New Zealand Society for Geriatric Medicine 2007). Overweight or obese older people may become malnourished due to the accumulated effect of consuming energy-dense but nutrient-poor foods, resulting in a micronutrient intake that is inadequate overall.

Malnutrition is a strong determinant of frailty (Morley et al 2002), and indicators of malnutrition have been used in various definitions of frailty. For instance, in the Fried et al definition, the criteria of unintended weight loss, exhaustion, weakness and slow walking speed may all reflect a relationship with nutritional status or malnutrition. Other indicators of frailty, such as presence of chronic disease, are also clearly linked to nutrition.

Data on the prevalence of malnutrition in New Zealand are limited. Only three New Zealand studies have investigated the nutritional status of (mostly) older people living in the community. Of 66 older people admitted to Christchurch hospital with hip fractures, 42 percent had protein energy malnutrition, defined using two or more of the following indicators: triceps skinfold thickness, corrected arm muscle area, serum albumin and pre-albumin (Hanger et al 1999). In 71 patients admitted to Middlemore Hospital's Assessment, Treatment and Rehabilitation Unit, 24 percent were malnourished and 44 percent were at risk of malnutrition (Van Lill 2002). In a third study, 23 percent of 152 older people living in the community in Christchurch demonstrated nutrition

‘risk’ and a further 31 percent demonstrated ‘high risk’. Nutrition risk precedes malnutrition, and, in this study, the common risk factors contributing to the prevalence of those at high risk were: unintentional weight change, eating alone, perception of own weight being more or less than it should be, and low milk product intake (S Watson, personal communication, June 2009). Better data on the prevalence of malnutrition in older New Zealanders are required before the scope of the health implications can be identified.

Malnutrition is difficult to diagnose because there is no one best measure, and it too has been described as encompassing a continuum (Nowson 2007). It is almost always caused by a number of factors, including:

- a change in nutrient and/or energy requirements
- stress
- burden of disease
- a lack of appetite or motivation to eat
- an inability to shop, prepare food, and eat
- confusion
- dementia
- depression
- pharmaceutical factors
- social, cultural or economic factors.

Weight and weight loss

Unintentional weight loss has been described as a ‘cardinal symptom of frailty’ (Morley 2003). In the European multi-centre SENECA study, older participants with a weight loss of 5 kg had a significantly shorter survival rate than those without weight loss (Haveman-Nies et al 2003). Underweight is associated with physical, functional and psychological impairment, hospitalisation risk, and delay from recovery (Sergi et al 2005).

Unintentional, ongoing weight loss in the older person can be attributed to three causes, which are often inter-related and in frail older people sometimes seen together (Hickson 2006):

- anorexia of ageing – an involuntary decline in food intake
- sarcopenia – a change in body composition
- cachexia – a catabolic disease-state.

Age-associated decline in food intake (anorexia of ageing) and body composition (sarcopenia) that often result in weight loss is discussed in Part 2: Ageing, Nutrition and Health. Cachexia is a catabolic immune response to significant stress, resulting in a loss of both fat and muscle mass. It is associated with diseases such as cancer, congestive heart failure, rheumatoid arthritis, infections, trauma and pressure sores.

Any weight loss in older people will result in a loss of muscle mass (Rolland et al 2008). If unintentional weight loss does occur, it is very difficult for frail older people to restore usual muscle mass and return to normal weight, even after re-feeding (Donini et al 2003; Hickson 2006).

Despite its association with such difficulties, using weight loss to define frailty may be misleading: it may underestimate the prevalence of frailty because studies indicate that a substantial

proportion of the frail population are also obese (Bergman et al 2007). Woods et al (2005) reported a U-shaped relationship between BMI and frailty, such that both underweight and obese older women were more likely to be defined as frail than normal-weight older women. In a small study of matched subjects, frailty in obese older people was associated with low relative muscle mass and poor muscle quality (Villareal et al 2004).

In both the Women's Health Initiative Observational Study (Woods et al 2005) and the National Health and Nutrition Examination Survey 1999–2004 (Chen and Guo 2008), frail older people were more likely to have one or more chronic diseases. The relationships among chronic disease, sedentary behaviour, obesity and a decline in functional ability are complex and intertwined; it is possible that obesity and chronic disease contribute to frailty, but it is also possible that frailty leads to sedentary behaviours, obesity and chronic disease (Chen and Guo 2008). However, Chen and Guo (2008) found that BMI and waist circumference were associated with physical disability independently of chronic disease.

The adverse health outcomes associated with weight loss and underweight strongly suggest that unintentional weight loss should be avoided for any older person with physical, functional, psychological or social indicators of frailty. It is important that health practitioners regularly monitor the weight of older people, inform them of healthy weight parameters, and intervene to prevent unhealthy weight loss (see also Part 9: Chronic Disease and Nutrition for Older People). Prevention, early identification and treatment of weight loss are crucial to good health in older people.

There are limited data on the safety and effectiveness of weight loss in obese elderly. However, for obese older people, particularly those with high waist circumference, there may be some benefit in intentional weight loss to improve physical function (Villareal et al 2004; McTigue et al 2006). Weight loss may also have some benefits for cardiovascular health (McTigue et al 2006). Intentional weight loss in older people should be closely monitored and controlled, however, and should include diet, physical activity and behavioural components (McTigue et al 2006). Further research is required on the risks and benefits of intentional weight loss in obese frail older people (see Part 9: Chronic Disease and Nutrition for Older People).

Psychological factors

Psychological factors are 'critically important' in frailty (Walston et al 2006). Depression, impaired cognition and mood may be affected by the same processes that lead to the manifestations of physical components of frailty (Morley et al 2002, Rockwood et al 2005; Barrett et al 2006; Abellan Van Kan et al 2008). Depression, impaired cognition, and mood may result in decreased food intakes, and there is a complex and interdependent association between malnutrition and depression (Morley et al 2002). There is also a strong association between physical activity, cognition and mood (Fiatarone Singh 2002) (see Part 8: Physical Activity – A Partner to Nutrition; and Part 9: Chronic Disease and Nutrition for Older People).

Physical activity

Physical activity is important for older people to improve their functional ability and quality of life (Bergman et al 2007) without causing injury. It is important for both the prevention and management of frail older people. The primary benefits should be maintaining strength and muscular function, and preventing disability (Vogel et al 2009). Activities must be adapted to meet the population's needs. For example, aerobic activities can be difficult for frail older people, so low-intensity resistance activities, such as water aerobics and chair-based resistance exercises, are often chosen (see also Part 8: Physical Activity – A Partner to Nutrition).

10.5 Implications of frailty

Frailty is the precursor to functional deterioration and is strongly associated with adverse health outcomes, including risk of disability, hip fracture, hospitalisation and death. Frailty involves a complex, multiple and inter-related decline in a number of physical, psychological and social systems, such that an individual is unable to cope with external stressors. It is a fluctuating state, where life processes and health issues change over time.

Primary prevention for older people at risk of frailty should therefore focus on preventing progression into and along the frailty continuum. It is possible that implementing secondary interventions for people near the start of the continuum may reverse this progression and prevent functional decline (Abellan Van Kan et al 2008).

In drawing attention to the association between frailty and socioeconomic factors, Barrett et al (2006) highlight the need to consider these factors – and in particular a life-long accumulation of these factors – when addressing frailty. Events that affect the social environment of older people include death of a spouse, decline in mobility and function, and the loss of social roles and responsibilities. A number of indicators and risk factors for frailty are similar to factors associated with food insecurity; namely, socioeconomic factors, living alone, a lack of mobility and transport limitations, and depression and low cognitive function. Frail older people may be at greater risk of food insecurity than non-frail older people.

It is obvious that the complex and inter-related physical, psychological, social and environmental components of frailty will not be reversed through nutrition or physical activity alone. However, there is a role for good nutrition and increased physical activity in preventing, slowing or possibly even reversing some components of frailty.

10.6 Nutritional support

Preventive measures that ensure a variety of food is easily available and that encourage healthy food choices should be implemented before nutritional complications arise. Maintaining healthy eating patterns and sufficient energy intake within the context of healthy social, socioeconomic and physical environments will help to ensure optimal health status. Frequent meals and snacks are key to ensuring dietary variety and optimal energy and micronutrient intake.

Nutritional support available for frail older people living in the community may include food preparation, cooking, shopping, sharing of meals, Meals on Wheels, and dietetic support. In some areas, lunch clubs and cooking classes are available. Some companies specialise in producing easy-to-prepare or ready-to-eat meals. Restricted mobility can impair an older person's ability to walk around supermarkets, push trolleys, reach and bend for items, and carry bags (Wylie et al 1999). Total food intake and variety may be restricted. Nutritional support services for grocery shopping and meal preparation are believed to assist older people living in the community to achieve adequate nutrition (Keller 2006).

However, simple food provision or food aid for many frail elderly may be insufficient as a method to combat undernourishment. Eating alone has been associated with lower dietary intakes than eating with friends or family. Frail older people may have less social contact and fewer social networks than non-frail older people. Energy intake is also greater when a variety of food is provided than when a single food is available. Efforts to improve nutritional status should focus on increasing dietary intake and dietary variety, and improving the social aspects of eating.

A three-day sample meal plan for frail older people has been provided in Appendix 10 as an example of how the Food and Nutrition Guidelines, including the recommended dietary intakes, can be achieved.

Key points on frail older people

- The frail older person has different and more complex nutritional and physical activity needs than the healthy older person.
- Frailty involves a decline in multiple and inter-related systems that have an impact on an individual's ability to cope with and resist stressors.
- Frailty is a fluctuating state in which life processes and the wider determinants of health change over time. Older people progress through the continuum towards adverse health outcomes, disability and eventually death at a different pace.
- There are a number of physical, psychological, social and environmental domains of frailty. A number of factors in each domain affect nutritional requirements and food intake.
- Gait speed may be a valid, quick and inexpensive single tool to assess frailty in a clinical setting.
- The prevalence of frailty in the older population living in the community in New Zealand has been estimated at about 8 percent.
- Malnutrition (inadequate energy and/or nutrient intakes) is not a predictable and inevitable part of ageing but is a strong determinant of frailty.
- Frailty is associated with both underweight and obesity.
- The adverse health outcomes associated with weight loss and underweight strongly suggest that unintentional weight loss should be avoided for any older person with physical, psychological, social and environmental indicators of frailty. Prevention, early identification and treatment of weight loss are crucial to good health in older people.
- For obese older people there may be some benefit in weight loss to improve physical function, although data supporting such benefits are limited.
- It is important that health practitioners regularly monitor the weight of older people and intervene to prevent unhealthy weight loss.
- A number of indicators and risk factors for frailty are similar to factors associated with food security. Frail older people may be at risk of food insecurity.
- Providing food, without any other support, is unlikely to be a sustainable solution to preventing poor nutrition and subsequent frailty, or for rehabilitation from frailty.
- Efforts to improve nutritional status may need to focus on increasing dietary intake and dietary variety, and on improving the social aspects of eating.
- Physical activity is important for frail older people and should aim to improve functional ability and quality of life without causing injury.

Part 11: Food Safety

11.1 Background

Foodborne and waterborne illnesses are not uncommon in New Zealand. Infectious intestinal diseases are caused by a wide range of microbiological pathogens and their toxins, some of which may be transmitted by food (Lake et al 2000). The health effect most commonly associated with foodborne illness is acute gastrointestinal disease, with varying degrees of severity (ESR 2007). For a small proportion of cases, longer-term illness may follow the initial infection and may also result in death (ESR 2007).

Ageing is associated with altered regulation of the immune system (WHO 2002b). Older people are at increased risk for both infections and death from infections, including foodborne illnesses, as a result of a decrease in immune function, chronic diseases and factors such as malnutrition (Kendall et al 2006). Older people with low immunity may include those who have an ongoing illness, are on medication, have recently stayed in hospital, or are very frail (New Zealand Food Safety Authority 2006). Poor nutritional and hydration status can compromise immune status (WHO 2002b), which may be exacerbated by an episode of foodborne illness (Lesourd 2006).

Factors that may contribute to an increased risk of foodborne illness in older people include:

- failing eyesight, which may mean that older people fail to see signs of food spoilage while shopping for food, or while preparing and storing food (Hudson and Hartwell 2002)
- a gradual decline in taste – approximately 25 percent of adults over 65 have a reduced ability to detect one or more of the four basic tastes (sweet, sour, salty and bitter) at threshold concentrations (WHO 2002b), which may lead to difficulty in discriminating between safe and spoiled food
- certain medical conditions, and some drugs, which can impair the senses of taste and smell (Phillips 2003)
- impaired neurological and cognitive function (Kendall et al 2006)
- a decrease in intestinal motility and mucosal immune function, which can increase susceptibility to systemic infection via the gut (Kendall et al 2006)
- a loss of mobility, impairing immune function (Kendall et al 2006)
- prolonged use of antibiotics (Kendall et al 2006).

11.2 Foodborne illness

Some foodborne illnesses are ‘notifiable’, which means medical practitioners must report any such incidence to public health services. The overwhelming majority of the 19,383 disease notifications in 2007 were intestinal diseases (ESR 2008). It should be noted that various factors influence whether notifiable diseases are actually reported, including severity of the disease, access to and availability of health practitioners, diagnosis (including laboratory confirmation) and compliance with reporting, and public awareness of the disease (ESR 2008). True rates of foodborne illness in the community are much greater than notified rates, although there are no New Zealand data for estimated under-reporting for each foodborne illness. A study of Auckland general practitioners (GPs) found that approximately 78 percent of the total number of cases were reported (ESR 2007).

An Australian study found that rates reported in surveillance data were, respectively, seven, eight and ten times lower than the actual number of cases of salmonella, *Escherichia coli* and campylobacter reported in the community (Hall et al 2008).

Symptoms of foodborne illness include:

- nausea and vomiting
- stomach cramps
- diarrhoea
- fever or chills
- headache
- muscle pain (New Zealand Food Safety Authority 2006).

It can take from as little as 20 minutes through to several weeks to become sick with foodborne illness after eating food that is contaminated by pathogens. Often the illness is not caused by the last food that was eaten (New Zealand Food Safety Authority 2006). People with foodborne illnesses who are generally healthy usually recover by themselves. If treatment is required it should focus on rehydration, pain relief and anti-diarrhoeal medicine (ESR 2007).

Following are brief descriptions of the more common foodborne pathogens.

Campylobacter

Campylobacter is a bacterial organism that causes campylobacteriosis, a gastrointestinal disease. The bacteria lodge in the walls of the intestine and can cause damage to the gut. The two types of bacteria that affect the greatest number of people in New Zealand are *Campylobacter jejuni* and *Campylobacter coli*. Campylobacteriosis contributed 66 percent of all disease notifications in 2007 (ESR 2008). The reported incidence of campylobacteriosis in New Zealand is high compared with other developed countries, and has generally been increasing over the last 10–15 years (ESR 2006b). However, the 2007 rate was significantly lower than the 2006 rate (ESR 2008).

Contaminated food is the dominant known cause of campylobacteriosis in New Zealand. *Campylobacter* bacteria are found in poultry, raw milk, offal and a variety of other foods. Poultry is well recognised as a major source of *Campylobacter*. Exposure has also been reported through contact with pets, birds, other animals, infected people and untreated water.

Salmonella

The salmonella family of bacteria causes mild to severe gastroenteritis. Salmonella mainly lives in the gut. Foods implicated in salmonella outbreaks have included raw meats, poultry, unpasteurised milk and dairy products, seafoods, fresh produce (including sprouts), and foods handled by infected food handlers (eg, kebabs and sandwiches).

Escherichia coli

Escherichia coli (*E. coli*) are bacteria found in the intestines of some healthy cattle, sheep, pigs, deer and seagulls. The bacteria may be present in undercooked meat (usually minced meat) contaminated during slaughtering. Other sources of *E. coli* may be raw vegetables, untreated water, unpasteurised milk, and contact with farm animals. Poor hand hygiene practices can also spread these bacteria.

Listeria monocytogenes

Listeria monocytogenes is a bacterium that is widespread in the environment, and can be found around the home and in the intestines of wild animals and farm livestock (eg, cattle). Listeriosis is rare, but the consequences of infection can be severe. Chilled food products, foods with a long shelf life or ready-to-eat foods that are consumed without further cooking have been associated with listeriosis. Once food is contaminated with *Listeria* the bacteria multiply quickly, even at refrigeration temperatures (2–4°C). They are hardy and survive in semi-dried delicatessen foods such as salami, on frozen foods, in salty foods (foods that are up to 10% salt), or in foods packaged in modified atmospheres or vacuums.

Bacillus cereus

Most illnesses from *Bacillus cereus* are foodborne, caused by eating infected rice or starchy foods such as potato flakes and pasta. The bacteria multiply when these foods have been cooled too slowly or not correctly stored in a refrigerator.

Norovirus

Noroviruses are very contagious and hardy viruses that cause severe stomach upsets (gastroenteritis). Foodborne infections occur as a result of consuming food that has been exposed to sewage in some way, such as oysters eaten raw that were taken from polluted or contaminated water.

Further information about these and other foodborne illnesses is available on the New Zealand Food Safety Authority website, under ‘Foodborne illnesses: what they are and how to avoid them’ <http://www.nzfsa.govt.nz/consumers/foodborne-illness-stomach-bugs/>

11.3 Domestic food safety

A significant proportion of foodborne illness is thought to be caused by unsafe food-handling practices in the home (Lake and Simmons 2001; ESR 2006a). In a New Zealand survey of 326 adults on domestic meat and poultry handling practices, the possibility of cross-contamination or infection following poor kitchen hygiene practices was apparent in some areas, such as hand washing and cleaning of surfaces and knives (Gilbert et al 2007). Overseas research has shown that older people are more careful than younger adults with some, but not all, food-handling practices (Gettings and Kiernan 2001; Kendall et al 2006). Older men and individuals living alone may be more likely to practise unsafe food-handling behaviours than women and people living with others (Kendall et al 2006). Older people may also have difficulty seeing, reading and understanding ‘use by’ and ‘best before’ dates (Johnson et al 1998; Hudson and Hartwell 2002).

Everyone, including older people and their families, should purchase, prepare, cook and store food to ensure food safety. Improper food-handling practices that may put older adults at risk of infections include:

- incorrect holding temperatures of foods
- poor personal hygiene
- contaminated food preparation equipment
- inadequate cooking times (Brown 2008).

Older people should follow these general food safety precautions.

- All foods should be safely handled, stored and protected from cross-contamination.
- Keep cooked food and ready-to-eat foods separate from raw and unprocessed foods to avoid cross-contamination.
- Eat freshly cooked foods as soon as possible after cooking.
- Use cooked or prepared foods that have been stored in the refrigerator within two days.
- Reheat cooked food thoroughly so that it is steaming hot (ie, about 70°C).
- Take special care to heat food thoroughly when using a microwave oven.
- Wash raw vegetables and fruit thoroughly.
- Wash your hands and utensils and chopping boards before using them for a different food to avoid cross-contamination.

The temperatures of home-delivered meals, such as from Meals on Wheels, may be a concern for foodborne illnesses, particularly if the older person is frail (Almanza et al 2007; Roseman 2007). Care should be taken to minimise risks in the production and delivery of these meals, and to communicate appropriate heating (or storage) instructions effectively to the meal recipient.

Although it is important to follow food safety advice, it is equally important that older people do not limit their dietary intake due to unnecessary food safety concerns. For good immune function and nutritional adequacy, older people should consume a variety of foods from the four food groups every day.

The New Zealand Food Safety Authority is the government agency responsible for food safety. Information for the consumer can be found on its website <http://www.nzfsa.govt.nz>.

Key points on food safety for older people

- Foodborne illnesses can cause a range of health effects, most commonly acute gastrointestinal disease.
- The effects of foodborne illnesses can be mild or severe, including death.
- Ageing and poor nutritional status are associated with altered regulation of the immune system. Older people may also experience a decline in mobility and function, sensory and gastrointestinal function, and cognition. Older people are therefore at increased risk of foodborne illness.
- True rates of foodborne illness in the older population are unknown, but probably exceed the rates that are reported.
- Domestic food-handling practices are poor in areas such as hand washing and the cleaning of surfaces and knives.
- Older people should follow general food safety practices.
- Older people should maintain nutritional adequacy and immune function by continuing to eat a variety of food from all four food groups. They should not limit dietary intake because of unnecessary concerns over food safety.
- Older people who have difficulty with sight, smell or mobility, or who have inadequate kitchen facilities, may need extra assistance to identify whether a food is safe or not.

Appendix 1: Reducing Health Inequalities Tools

The Whānau Ora Tool

The Whānau Ora Tool is a practical guide to developing health programmes where whānau, hapū, iwi and Māori communities play a leading role in achieving whānau ora (Ministry of Health 2008e). It places Māori at the centre of programme planning, implementation and evaluation, and is designed to assist organisations to give effect to the policies and strategic pathways woven into *He Korowai Oranga: Māori Health Strategy* (Minister of Health and Associate Minister of Health 2002).

Principles underpinning the Whānau Ora Tool

- Whānau ora is a priority for reducing inequalities in health outcomes between Māori and other New Zealanders.
- Māori will be fully involved in the design, delivery and evaluation of services.
- Māori providers will be identified and resourced to work with services to design, deliver and evaluate programmes.
- Māori will be supported to implement Māori models of health.
- Building Māori staff capacity and capability to improve the uptake of services is a long-term commitment.
- There is a commitment to building the non-Māori staff capacity and capability to improve the uptake of services by Māori.
- Proposed programmes increase whānau ora by fostering Māori community development and utilising assets already present in the community.
- Proposed programmes improve access to general services for Māori.
- Proposed programmes utilise accurate ethnicity data to ensure effective service delivery for Māori.

The tool is intended to complement other resources aimed at promoting Māori health and reducing inequalities. These other resources include the *Health Equity Assessment Tool* (HEAT), the *Whānau Ora Health Impact Assessment tool*, and the *Intervention Framework*, all of which are available at the Ministry of Health website.

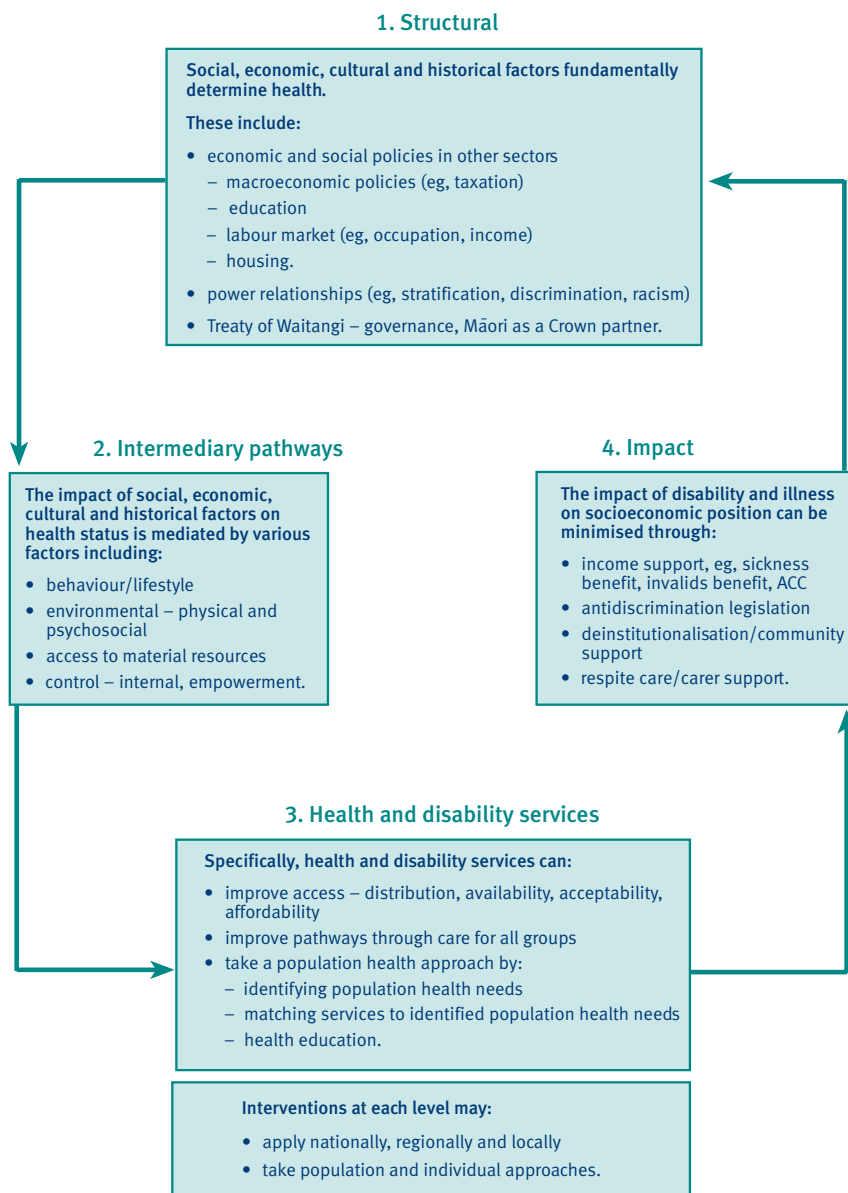
The Health Equity Assessment Tool

The following questions have been developed to help you consider how particular inequalities in health have come about and where the effective intervention points are to address them. The questions should be used in conjunction with the Ministry of Health's reducing inequalities intervention framework for reducing health inequalities (Ministry of Health et al 2004).

- What health issue is the policy or programme trying to address?
- What inequalities exist in this health area?
- Who is most advantaged and how?

- How did the inequality occur? (What are the mechanisms by which this inequality was created, is maintained or was increased?)
- What are the determinants of this inequality?
- How will you address the Treaty of Waitangi in the context of the New Zealand Public Health and Disability Act 2000?
- Where or how will you intervene to tackle this issue? Use the Ministry of Health’s Intervention Framework (Figure A1 below) for reducing health inequalities to guide your thinking (Ministry of Health 2002c).
- How could this intervention affect health inequalities?
- Who will benefit most from this intervention?
- What are the possible unintended consequences of this intervention?
- What will you do to make sure the intervention does reduce or eliminate inequalities?
- How will you know if the intervention has reduced or eliminated inequalities?

Figure A1: Intervention Framework to improve health and reduce inequalities



Source: Ministry of Health 2004b

Appendix 2:

Priority Population Health Objectives in the New Zealand Health Strategy

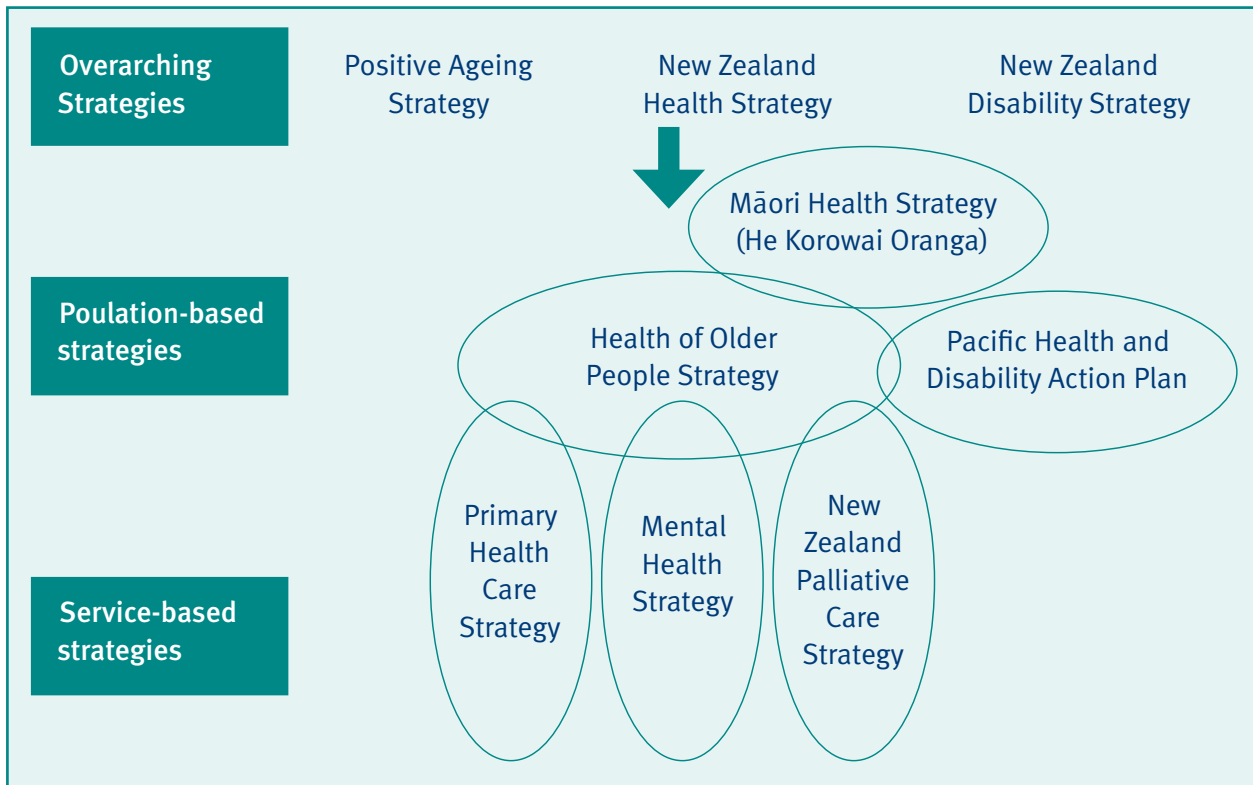
The 13 priority population health objectives listed in the New Zealand Health Strategy (Minister of Health 2000) are to:

- reduce smoking
- improve nutrition
- reduce obesity
- increase the level of physical activity
- reduce the rate of suicide attempts
- minimise harm caused by alcohol and illicit and other drug use to both individuals and the community
- reduce the incidence and impact of cancer
- reduce the incidence and impact of cardiovascular disease
- reduce the incidence and impact of diabetes
- improve oral health
- reduce violence in interpersonal relationships, families, schools and communities
- improve the health status of people with severe mental illness
- ensure access to appropriate child health care services, including Well Child and family health care and immunisation.

Appendix 3: The Health of Older People Strategy in Context

The Health of Older People Strategy (Ministry of Health 2002b) operates within a broader policy context as illustrated in Figure A2.

Figure A2: The context of the Health of Older People Strategy



Source: Ministry of Health 2004b

Appendix 4:

Sample Meal Plans for Healthy Older People

The meal plans in Tables A1 and A3 have been designed and checked to ensure they meet the recommended dietary intakes (RDIs) or adequate intakes (AIs) for healthy older people aged 51–70 years and over 70 years. Tables A2 and A4 provide a nutritional analysis of each of these plans, which was produced using FoodWorks Professional edition 2005.

The purpose of the meal plans is to show how the RDIs and/or AIs can be met, but they are not intended to be used as a dietary regimen for individuals. For more information on food groups and the nutrients they provide, see the Part 1: The New Zealand Food and Nutrition Guidelines.

Sample three-day meal plans: 70-year-old female

Table A1: Estimated energy level 8.3–9.3 MJ (mid range on NRV tables), 70-year-old female

Day 1	Day 2	Day 3
Breakfast Tomato juice: 100 ml Whole wheat biscuits: 2 Calcium-enriched milk: ½ cup Wholemeal toast: 2 med. slices Polyunsaturated margarine: 2 t Marmalade: 1 t Cup of tea with calcium-enriched milk	Breakfast Pineapple juice: 100 ml Porridge, prepared with milk and water, small pkt raisins + salt: 1 cup Brown sugar: 2 t Yoghurt: 2 T Wholemeal toast: 1 med. slice Polyunsaturated margarine: 1 t Marmite: 1 t Cup of tea with calcium-enriched milk	Breakfast Fresh orange juice: 100 ml Natural muesli: 30 g Apricots in light syrup: ½ cup Yoghurt: 100 g Wholemeal toast: 2 med. slices Polyunsaturated margarine: 2 t Berry jam: 2 t Cup of tea with calcium-enriched milk
Mid-morning Digestive biscuits: 2 Polyunsaturated margarine: 1 t Cup of coffee with calcium-enriched milk	Mid-morning Crispbread crackers: 4 Cottage cheese: 2 T Cup of coffee with calcium-enriched milk	Mid-morning Blueberry muffin: 1 standard Cup of coffee with calcium-enriched milk
Lunch Homemade pumpkin soup: 200 ml Small bread roll: 1 Polyunsaturated margarine: 2 t Yoghurt: 100 g Apple: 1 Mixed nuts: 30 g Olives: 4 Cup of tea with calcium-enriched milk Glass of water with meal: 200 ml	Lunch Canned salmon: 75 g Lettuce salad, no cheese: 1 cup Tomato: 1 Vinaigrette: 2 T Wholemeal bread: 2 med. slices Polyunsaturated margarine: 2 t Orange: 1 Cup of tea with calcium-enriched milk Glass of water with meal: 200 ml	Dinner Stir-fry beef and vegetables: 200 g Egg noodles: 1 cup Dessert Ice-cream: 2 small scoops Strawberries: about 8 Glass of water with meal: 200 ml

Day 1	Day 2	Day 3
Mid-afternoon Ham sandwich, made with light-grain bread: 1 slice Polyunsaturated margarine: 1 t Sandwich ham: ½ slice Cup of tea with calcium-enriched milk	Mid-afternoon Chocolate chippie biscuit: 1 Cup of tea with calcium-enriched milk	Mid-afternoon Fresh pear: 1 Cup of tea with calcium-enriched milk
Dinner Roast lean lamb shoulder: 75 g Gravy: 2 T Mint sauce: 1 T Boiled/steamed potato: 1 med. Green beans: 1 serving Pumpkin, boiled/steamed: 1 serving Dessert Apple crumble: small serving (4 T) Custard: 2 T Water with meal: 200 ml	Dinner Chicken drums, grilled/baked: 2 Barbecue sauce: 2 T Brown rice: ¾ cup Broccoli: 1 serving Carrots: 1 serving Dessert Assorted berries: 1 cup Yoghurt: 3 T Glass of water: 200 ml	Tea Eggs florentine: Poached eggs: 2 med. Spinach: ½ cup Tomato: 1 Wholemeal toast: 1 thick slice Polyunsaturated margarine: 1 t Parmesan cheese garnish: 1 t Fresh fruit salad: ½ cup Yoghurt: 100 ml Cup of tea with calcium-enriched milk
Supper Milo made with calcium-enriched milk: 200 ml Plain biscuits: 2 Grapes: about 6	Supper Milo made with calcium-enriched milk: 200 ml Gingernut biscuits: 2 Kiwifruit: 1	Supper Milo made with calcium-enriched milk: 200 ml Gingerbread: small serving Mandarin: 1

Note: T = Tablespoon; t = teaspoon

Table A2: Summary of the nutritional analysis of the three-day menu plan

Nutrient	Average per day
Fluid (ml)	2545
Energy (KJ)	8452
Carbohydrate (g)	250 (50% TE)
Protein (g)	101 (20% TE)
Total fat (g)	70 (30% TE)
Saturated fat (g)	21 (9.5% TE)
Polyunsaturated fat (g)	18 (8.1% TE)
Monounsaturated fat (g)	22 (10% TE)
Fibre (englyst) (g)	27
Vitamin D (µg)	5.4
Folate (µg)	411
Calcium (mg)	1432
Iodine	Not assessed

Note: % TE = % of total energy.

Sample three-day meal plans: 70-year-old male

Table A3: Estimated energy level 9.5–10.7 MJ (mid range on NRV tables), 70-year-old male

Day 1	Day 2	Day 3
<p>Breakfast</p> <p>Pineapple juice: 100 ml</p> <p>Porridge, prepared with milk and water, small pkt raisins + salt: 1 cup</p> <p>Brown sugar: 2 t</p> <p>Milk or yoghurt: 3 T</p> <p>Wholemeal toast: 2 med. slices</p> <p>Polyunsaturated margarine: 2 t</p> <p>Marmite: 1 t</p> <p>Cup of tea with calcium-enriched milk</p>	<p>Breakfast</p> <p>Tomato juice: 100 ml</p> <p>Whole wheat biscuits: 3</p> <p>Yoghurt: 100 g</p> <p>Wholemeal toast: 3 med. slices</p> <p>Polyunsaturated margarine: 3 t</p> <p>Marmalade: 3 t</p> <p>Cup of tea with calcium-enriched milk</p>	<p>Breakfast</p> <p>Fresh orange juice: 100 ml</p> <p>Natural muesli: 50 g</p> <p>Apricots in light syrup: ½ cup</p> <p>Calcium-enriched milk: ½ cup</p> <p>Wholemeal toast: 3 med. slices</p> <p>Polyunsaturated margarine: 3 t</p> <p>Berry jam: 2 t</p> <p>Cup of tea with calcium-enriched milk</p>
<p>Mid-morning</p> <p>Digestive biscuits: 3</p> <p>Polyunsaturated margarine: 1 t</p> <p>Cup of coffee with calcium-enriched milk</p>	<p>Mid-morning</p> <p>Crispbread crackers: 6</p> <p>Cottage cheese: 2 T</p> <p>Cup of coffee with calcium-enriched milk</p>	<p>Mid-morning</p> <p>Bran muffin: 1 standard</p> <p>Cup of coffee with calcium-enriched milk</p>
<p>Lunch</p> <p>Homemade pumpkin soup: 200 ml</p> <p>Small bread rolls: 2</p> <p>Polyunsaturated margarine: 2 t</p> <p>Yoghurt: 100 g</p> <p>Apple: 1</p> <p>Cup of tea with calcium-enriched milk</p> <p>Glass of water with meal: 200 ml</p>	<p>Lunch</p> <p>Canned salmon: 100 g</p> <p>Lettuce salad, no cheese: 1 cup</p> <p>Tomato: 1</p> <p>Vinaigrette: 2 T</p> <p>Wholemeal bread: 3 med. slices</p> <p>Polyunsaturated margarine: 3 t</p> <p>Orange: 1</p> <p>Cup of tea with calcium-enriched milk</p> <p>Glass of water with meal: 200 ml</p>	<p>Dinner</p> <p>Stir-fry beef and vegetables: 1 cup</p> <p>Egg noodles: 1 cup</p> <p>Dessert</p> <p>Ice-cream: 2 small scoops</p> <p>Strawberries: about 8</p> <p>Glass of water with meal: 200 ml</p>
<p>Mid-afternoon</p> <p>Fresh pear: 1</p> <p>Mixed nuts: 30 g</p> <p>Olives: 4</p> <p>Cup of tea with calcium-enriched milk</p>	<p>Mid-afternoon</p> <p>Chocolate chippie biscuits: 3</p> <p>Cup of tea with calcium-enriched milk</p>	<p>Mid-afternoon</p> <p>Ham sandwich, made with light-grain bread: 2 slices</p> <p>Polyunsaturated margarine: 2 t</p> <p>Sandwich ham: 1 slice</p> <p>Cup of tea with calcium-enriched milk</p>

Day 1	Day 2	Day 3
Dinner Chicken drums, grilled/baked: 3 Barbecue sauce: 2 T Brown rice: ¾ cup Broccoli: 1 serving Carrots: 1 serving Dessert Fresh fruit salad: 1 cup Yoghurt: 2 T Glass of water: 200 ml	Dinner Roast lean lamb shoulder: 100 g Gravy: 2 T Mint sauce: 1 T Boiled/steamed potatoes: 2 med. Green beans: 1 serving Pumpkin, boiled/steamed: 1 serving Dessert Apple crumble: small serving (4 T) Custard: 2 T Water with meal: 200 ml	Tea Eggs florentine Poached eggs: 2 med. Spinach: ½ cup Tomato: 1 Wholemeal toast: 2 thick slices Polyunsaturated margarine: 2 t Parmesan cheese garnish: 1 t Assorted fresh fruits: 125 g (2 small fruits or 12–15 berries) Fruit yoghurt: 100 ml Cup of tea with calcium-enriched milk
Supper Milo made with calcium-enriched milk: 200 ml Plain biscuits: 3 Grapes: about 6	Supper Milo made with calcium-enriched milk: 200 ml Gingernut biscuits: 2 Kiwifruit: 1	Supper Milo made with calcium-enriched milk: 200 ml Gingerbread: small slice Mandarin: 1

Note: T = Tablespoon; t = teaspoon

Table A4: Summary of the nutritional analysis of the three-day menu plan

Nutrient	Average per day
Fluid (ml)	2692
Energy (KJ)	10726
Carbohydrate (g)	328 (51.3% TE)
Protein (g)	123 (19.3% TE)
Total fat (g)	86 (29.4% TE)
Saturated fat (g)	26 (9% TE)
Polyunsaturated fat (g)	23 (8% TE)
Monounsaturated fat (g)	28 (9.9% TE)
Fibre (englyst) (g)	37
Vitamin D (µg)	6.9
Folate (µg)	508.8
Calcium (mg)	1561.3
Iodine	Not assessed

Note: % TE = % of total energy.

Appendix 5: Nutrient Reference Values for Australia and New Zealand for Older People

Table A5: Recommended dietary intakes per day

Nutrient	Women aged 51–70 years RDI	Women aged > 70 years RDI	Men aged 51–70 years RDI	Men aged > 70 years RDI
Energy, macronutrients and dietary fibre				
Energy (kJ)	See Appendix 8 for estimated energy requirements.			
Protein (g)	46	57	64	81
Carbohydrate (g)	–	–	–	–
Dietary fibre (g)	25 (AI)	25 (AI)	30 (AI)	30 (AI)
Total fat (g)	–	–	–	–
Linoleic acid (g)	8 (AI)	8 (AI)	13 (AI)	13 (AI)
A-linolenic acid (g)	0.8 (AI)	0.8 (AI)	1.3 (AI)	1.3 (AI)
LCPUFA n-3 fatty acids (mg) (DHA, EPA, DPA)	90 (AI)	90 (AI)	160 (AI)	160 (AI)
Minerals				
Calcium (mg)	1300	1300	1000	1300
Phosphorous (mg)	1000	1000	1000	1000
Zinc (mg)	8	8	14	14
Iron (mg)	8	8	8	8
Magnesium (mg)	320	320	420	420
Iodine (µg)	150	150	150	150
Selenium (µg)	60	60	70	70
Copper (mg)	1.2 (AI)	1.2 (AI)	1.7 (AI)	1.7 (AI)
Fluoride (mg)	3.0 (AI)	3.0 (AI)	4.0 (AI)	4.0 (AI)
Sodium (mg)	460–920 (AI)	460–920 (AI)	460–920 (AI)	460–920 (AI)
Potassium (mg)	2800 (AI)	2800 (AI)	3800 (AI)	3800 (AI)
Fat soluble vitamins				
Vitamin A (µg RE)	700	700	900	900
Vitamin D (µg)*	10 (AI)	15 (AI)	10 (AI)	15 (AI)
Vitamin E (mg α-TE)	7 (AI)	7 (AI)	10 (AI)	10 (AI)
Vitamin K (µg)	60 (AI)	60 (AI)	70 (AI)	70 (AI)

Nutrient	Women aged 51–70 years RDI	Women aged > 70 years RDI	Men aged 51–70 years RDI	Men aged > 70 years RDI
Water soluble vitamins				
Thiamin (mg)	1.1	1.1	1.2	1.2
Riboflavin (mg)	1.1	1.3	1.3	1.6
Niacin (mg NE)	14	14	16	16
Vitamin B ₆ (mg)	1.5	1.5	1.7	1.7
Vitamin B ₁₂ (µg)	2.4	2.4	2.4	2.4
Folate (µg DFEs)	400	400	400	400
Pantothenic acid (mg)	4.0 (AI)	4.0 (AI)	6.0 (AI)	6.0 (AI)
Biotin (µg)	25 (AI)	25 (AI)	30 (AI)	30 (AI)
Vitamin C (mg)	45	45	45	45
Choline (mg)	425 (AI)	425 (AI)	550 (AI)	550 (AI)
Total water (L) (including food and fluids)	2.8	2.8	3.4	3.4
From fluids only (L)	2.1	2.1	2.6	2.6

Notes:

– = not established; α-TE = alpha-tocopherol equivalents; AI = adequate intake; DHA = docosahexaenoic acid; DFE = dietary folate equivalents; DPA = docosapentaenoic acid; EPA = eicosapentaenoic acid; LCPUFA = long chain polyunsaturated fatty acid; NE = niacin equivalent; NP = not possible to set – there may be insufficient evidence or no clear level for adverse effects; RDI = recommended dietary intake; RE = retinol equivalent.

* Assumes minimal sun exposure.

Table A6: Upper levels of intake per day

Nutrient	Women aged 51–70 years UL	Women aged > 70 years UL	Men aged 51–70 years UL	Men aged > 70 years UL
Energy, macronutrients and dietary fibre				
Energy (kJ)	See Appendix 8 for estimated energy requirements.			
Protein (g)	NP	NP	NP	NP
Carbohydrate (g)	–	–	–	–
Dietary fibre (g)	NP	NP	NP	NP
Total fat (g)	–	–	–	–
Linoleic acid (g)	NP	NP	NP	NP
α-linolenic acid (g)	NP	NP	NP	NP
LCPUFA n-3 fatty acids (mg) (DHA, EPA, DPA)	3000	3000	3000	3000
Minerals				
Calcium (mg)	2500	2500	2500	2500
Phosphorous (mg)	4000	3000	4000	3000
Zinc (mg)	40	40	40	40
Iron (mg)	45	45	45	45
Magnesium (mg) ¹	350	350	350	350
Iodine (µg)	1100	1100	1100	1100
Selenium (µg)	400	400	400	400
Copper (mg)	10	10	10	10
Fluoride (mg)	10	10	10	10
Sodium (mg)	2300	2300	2300	2300
Potassium (mg) ²	NP	NP	NP	NP
Fat-soluble vitamins				
Vitamin A (µg retinol) ³	3000	3000	3000	3000
Vitamin D (µg) ⁴	80	80	80	80
Vitamin E (mg α-TE)	300	300	300	300
Vitamin K (µg)	NP	NP	NP	NP
Water-soluble vitamins				
Thiamin (mg)	NP	NP	NP	NP
Riboflavin (mg)	NP	NP	NP	NP
Niacin (mg NE) ⁵	35	35	35	35
Vitamin B ₆ (mg) ⁶	50	50	50	50
Vitamin B ₁₂ (µg)	NP	NP	NP	NP
Folate (µg) ⁷	1000	1000	1000	1000
Pantothenic acid (mg)	NP	NP	NP	NP
Biotin (µg)	NP	NP	NP	NP

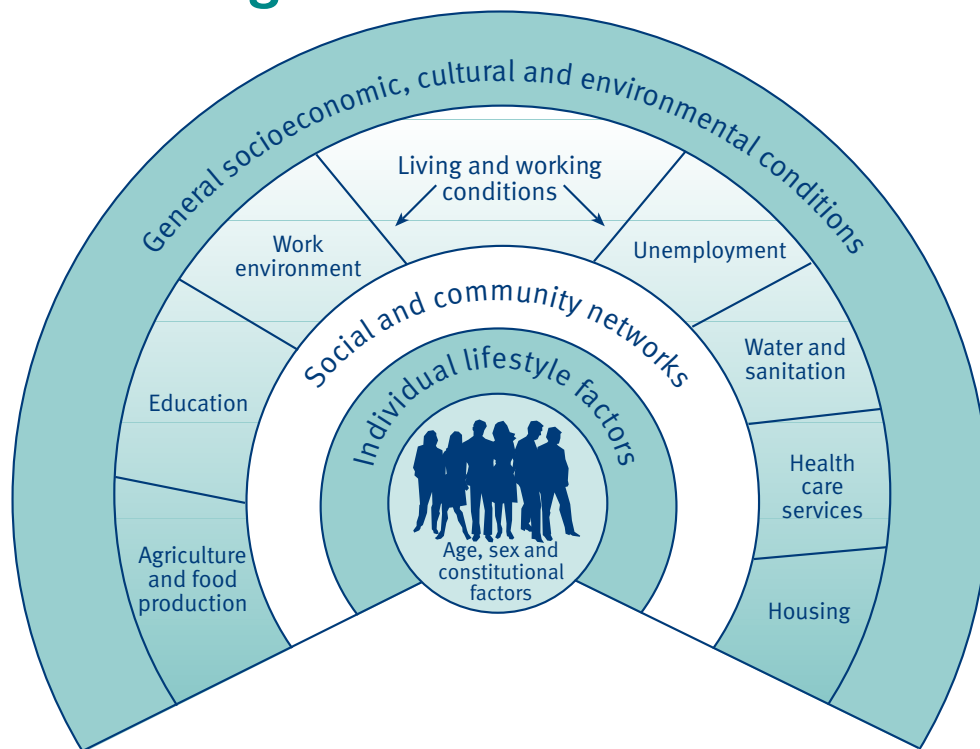
Nutrient	Women aged 51–70 years UL	Women aged > 70 years UL	Men aged 51–70 years UL	Men aged > 70 years UL
Vitamin C (mg) ⁸	NP	NP	NP	NP
Choline (mg)	3500	3500	3500	3500
Total water (L) (including food and fluids)	NP	NP	NP	NP
From fluids only (L)	NP	NP	NP	NP

Notes:

– = not established; α -TE = alpha-tocopherol equivalents; DHA = docosahexaenoic acid; DFE = dietary folate equivalents; DPA = docosapentaenoic acid; EPA = eicosapentaenoic acid; LCPUFA = long chain polyunsaturated fatty acid; NE = niacin equivalent; NP = not possible to set – there may be insufficient evidence or no clear level for adverse effects.

- 1 For magnesium the UL is for supplements.
- 2 Potassium supplements should be taken only under medical supervision.
- 3 The UL for beta-carotene cannot be established for supplement use and does not need to be established for food use.
- 4 Assumes minimal sun exposure.
- 5 The UL refers to niacin as nicotinic acid. For supplemental nicotinamide, the UL is 900 mg/day.
- 6 For vitamin B6 the UL is for pyridoxine.
- 7 For folate the UL is for intake from fortified foods and supplements as folic acid.
- 8 It is not possible to set a UL for vitamin C from available data, but 1000 mg/day would be a prudent limit.

Appendix 6: Determinants of Population Health and Wellbeing



Source: Dahlgren and Whitehead 1992

Appendix 7:

Sources of Nutrient Intake and Dietary Pattern Data

The following sources are listed in reverse chronological order.

2006/07: New Zealand Health Survey

The New Zealand Health Survey measures self-reported physical and mental health status (including health conditions diagnosed by a doctor), risk and protective health behaviours for health outcomes, and the use of health care services, among the usually resident New Zealand population living in private dwellings. The Ministry of Health repeats the New Zealand Health Survey at regular intervals: the 2006/07 New Zealand Health Survey is the fourth such survey, with previous surveys conducted in 1992/93, 1996/97 and 2002/03.

For the 2006/07 survey, comprehensive health information was collected from more than 17,000 New Zealanders: 12,488 adults and 4922 children. Participants included more than 5000 Māori, 1800 Pacific peoples and more than 2000 Asian people of all ages, making it the largest survey of New Zealanders' health to date.

2002/03: Auckland Diabetes, Heart and Health Study

This survey collected data on 4007 adults aged 35–74 years in the Auckland region, and included 44 percent Europeans, 25 percent Māori, 25 percent Pacific peoples and 7 percent Asian people. Data are not specific to older people. Food intake was estimated using the food frequency questionnaire, and included foods favoured by Māori and Pacific peoples. Data are presented for the whole study population (ie, there are no separate analyses for older people). This study has been included because these are New Zealand data reporting on differences in dietary patterns among Māori, Pacific, Asian and European people.

1997: The National Nutrition Survey

The 1997 National Nutrition Survey (NNS97) was a voluntary cross-sectional population survey of adults aged 15 years and over. The survey method used in the NNS97 was the 24-hour diet recall, with a percentage of repeats, to provide a quantitative record of food consumption during the previous day only, thus reflecting what participants 'usually' ate. A self-administered qualitative food frequency questionnaire also estimated the frequency of intake of foods over the preceding 12 months.

Although NNS97 data are presented for the total Māori population, these data are limited for older Māori people: the upper age category is 45 years and over due to a limited number of participants aged 65 years and over. Due to the small number of Pacific peoples participating in the survey, data for this population are 'indicative' only. For older Pacific peoples, even the data for the age category of 45 years and over are limited by sample size, with large confidence intervals, and caution should be used when interpreting them.

The NNS97 provides data on:

- nutrient intakes
- dietary sources of major macronutrients and micronutrients
- eating patterns, including self-reported dietary changes
- frequently eaten foods from each of the four major food groups.

The 2008/09 New Zealand Adult Nutrition Survey is being analysed. Data will be reported in categories that match the age categories in the 2006 nutrient reference values (NRVs). New data will be incorporated into the final background paper once available as resourcing permits. This will provide valuable information on current dietary patterns and serve as a basis for comparing data with the NNS97 findings.

1995/96: Mosgiel Community Study of Health and Nutrition in Old Age (Part 2)

Participants in the original 1988/89 survey (see below) were followed up. The major method of data collection was the semi-quantitative food-frequency questionnaire. Patterns of food consumption were investigated through the use of food scores, which were reported as servings per month.

1988/89: Mosgiel Community Study of Health and Nutrition in Old Age (Part 1)

This study collected dietary intake data from 712 people aged 70 years and older living in Mosgiel, a small rural town just south of Dunedin. Data were collected using a semi-quantitative food-frequency questionnaire. All subjects in this study were Caucasian, and were described as a predominantly middle-class retired community. Nearly all (678 out of 712) were living independently in the community.

Appendix 8:

Australia and New Zealand Estimated Energy Requirements for Older People

Table A7: Estimated energy requirements for older people

Age	BMI = 22.0 ¹		BMR MJ/d	Physical activity level: ²						BMR MJ/d	Physical activity level: ²					
				Males MJ/day							Females MJ/day					
	Ht (m)	Wt (kg)	Male	1.2	1.4	1.6	1.8	2.0	2.2	Female	1.2	1.4	1.6	1.8	2.0	2.2
51–70 years	1.5	49.5	–	–	–	–	–	–	–	4.9	6.0	6.9	7.9	8.9	9.8	10.9
	1.6	56.3	5.8	7.0	8.2	9.3	10.4	11.5	12.7	5.2	6.2	7.3	8.3	9.3	10.4	11.4
	1.7	63.6	6.1	7.3	8.6	9.8	11.1	12.3	13.6	5.4	6.5	7.6	8.7	9.8	10.7	12.0
	1.8	71.3	6.5	7.8	9.1	10.4	11.7	13.1	14.4	5.7	6.9	8.0	9.1	10.3	11.4	12.6
	1.9	79.4	6.9	8.3	9.6	11.1	12.4	13.8	15.2	6.0	7.2	8.4	9.6	10.8	12.0	13.2
	2.0	88.0	7.3	8.8	10.2	11.7	13.2	14.7	16.1	–	–	–	–	–	–	–
> 70 years	1.5	49.5	–	–	–	–	–	–	–	4.6	5.6	6.5	7.4	8.3	9.3	10.2
	1.6	56.3	5.2	6.3	7.3	8.3	9.4	10.4	11.5	4.9	5.9	6.9	7.8	8.8	9.8	10.8
	1.7	63.6	5.6	6.7	7.8	8.9	10.0	11.2	12.3	5.2	6.2	7.2	8.3	9.3	10.3	11.4
	1.8	71.3	6.0	7.1	8.3	9.5	10.7	11.9	13.1	5.5	6.6	7.7	8.7	9.8	10.9	12.0
	1.9	79.4	6.4	7.6	8.9	10.2	11.4	12.7	14.0	5.8	6.9	8.1	9.2	10.4	11.5	12.7
	2.0	88.0	6.8	8.1	9.5	10.8	12.2	13.5	14.9	–	–	–	–	–	–	–

Note: The original Schofield equations (Schofield 1985) from which these tables were derived used 60+ years as the upper age category. For people aged 51–70 years, the estimates were derived by averaging those for the adults (31–50 years) and older (> 70 years) adults.

- 1 BMI (body mass index) is a measure of weight/height² (kg/m²). A BMI of 22.0 is approximately the mid-point of the WHO (2000) healthy weight range (BMI 18.5–24.9).
- 2 Physical activity level (PAL) ranges from 1.2 (bed rest) to 2.2 (very active or heavy occupational work). PALs of 1.75 and above are consistent with good health. PALs below 1.4 are incompatible with moving around freely or earning a living. Physical activity levels above 2.5 are difficult to maintain for long periods.

Appendix 9:

Sources of Data on Chronic Disease

Prevalence of chronic disease

Data on the prevalence of obesity, cardiovascular disease, diabetes and osteoporosis, and on the prevalence of risk factors for cardiovascular disease, have come from the most recent national health survey, the 2006/07 New Zealand Health Survey (Ministry of Health 2008a). The target population for this survey was the New Zealand adult population living in permanent private dwellings.

For coronary heart disease, stroke and diabetes, participants in this survey self-reported the presence of these conditions as diagnosed by a doctor. For high blood pressure and high cholesterol, participants in this survey self-reported medications for these conditions as prescribed by a doctor. These definitions will underestimate the true prevalence of high blood pressure and high cholesterol because not all people with these risk factors will be diagnosed, or will remember being diagnosed, and not all people with these risk factors will be taking medication for it.

The prevalence of cancer was determined from the New Zealand Cancer Registry data 2005 (Ministry of Health 2009).

Age-specific prevalence of chronic disease

The age-specific prevalence of disease in each ethnic group from the 2006/07 New Zealand Health Survey has not been calculated. Therefore, where comparisons have been made between the prevalence in Māori, Pacific, Asian and European/other populations, these are age-standardised rates. Data describing the differences in the age groups 65–74 years, 75–84 years and 85 years and over have come from the *Older People's Health Chart Book* (Ministry of Health 2006c), which analysed data from the 2002/03 New Zealand Health Survey.

Type of data

It is important to note that data on risk factors and the prevalence of diseases are presented at one point in time (ie, cross-sectional), which means it is not possible to determine whether differences in rates between younger and older age groups relate to the difference in their age (ie, an age effect) or to their different experiences (ie, a cohort effect). A cohort effect can be defined as a variation in health status (or health risk and protective factors, or health service utilisation) arising from different causal factors to which each birth cohort is exposed as the environment and society change. Thus differences in health status between groups of different ages may not be attributable to their age *per se*, but to the different characteristics of the historical periods during which they lived. It is most likely that the differences presented here will represent a mix of both effects.

Appendix 10: Sample Meal Plan for Frail Older People

The meal plan in Table A8 has been designed and checked to ensure it meets the recommended dietary intakes (RDIs) or adequate intakes (AIs) for frail older people aged 51–70 years and over 70 years. Table A9 provides a nutritional analysis of the plans, which was produced using FoodWorks Professional edition 2005.

The purpose of the meal plan is to demonstrate how the RDIs and/or AIs can be met, but it is not intended to be used as a dietary regimen for individuals. For more information on food groups and the nutrients they provide, see Part 1: The New Zealand Food and Nutrition Guidelines.

Table A8: Meal plan based on a frail female aged 85 years, 50 kg, 160 cm, sedentary activity*

Day 1	Day 2	Day 3
Breakfast Fresh orange juice: 150 ml Whole wheat biscuit: 1 Wheat bran: 1 T Standard milk: 100 ml Stewed apples: ¼ cup Cup of tea with standard milk	Breakfast Pineapple juice: 150 ml Poached egg: 1 Tomato, canned or fresh: ½ Wholemeal toast: ½ med. slice Polyunsaturated margarine: 1 t Cup of coffee with standard milk	Breakfast Tomato juice: 150 ml Porridge made with milk: 100 g Brown sugar: 2 t Wheat bran: 1 T Stewed apples, with sugar: ¼ cup Cup of tea with standard milk
Mid-morning Egg sandwich (1 slice bread) Cup of tea with standard milk	Mid-morning Fruit yoghurt: 100 g Peaches, light syrup: 100 g Cup of tea with standard milk	Mid-morning Latté made with standard milk: 200 ml Cheese and tomato toasted sandwich: ¼ sandwich
Dinner Shepherd's pie: 1 cup Mashed carrot and parsnip: 4 T Broccoli and cheese sauce ¼ cup Water to drink: 200 ml	Lunch Macaroni cheese: ½ cup Beetroot: 4 slices Lean grilled bacon: 1 rasher Chicken sandwich: 1 slice bread Water to drink: 200 ml	Dinner Baked hoki: 80 g Parsley sauce: 2 T Oven-baked potato chips: 10 Stir-fried vegetables: ⅔ cup Silverbeet: ¼ cup Water to drink: 200 ml
Mid-afternoon Milkshake, made with standard milk Orange: 1	Mid-afternoon Banana custard: 1 banana Cup of tea with standard milk	Mid-afternoon Ice-cream: 2 small scoops Chocolate sauce: 2 T Dark plums: 2 Cup of tea with standard milk

Day 1	Day 2	Day 3
Tea Homemade pumpkin soup: 180 ml (¾ cup) Bread roll, small round: 1 Polyunsaturated margarine: 1 t Greek salad small serving: ¼ cup Canned fruit salad, sweetened: 100 g Fruit yoghurt, 1 pottle: 150 g Cup of tea with standard milk	Dinner Roast lamb, lean: 75 g Mint sauce: 30 ml Gravy: 4 T Mashed potato: 1 scoop Steamed pumpkin: 60 g (small piece) Spinach: ¼ cup Water to drink: 200 ml	Tea Chicken and corn soup: 180 ml Scrambled egg: 1 egg Wholemeal toast/bread: 1½ medium slices Polyunsaturated margarine: 1 t Fruit salad, canned: 3 T Cup of tea with standard milk
Supper Baked custard: 100 g Pear in juice: ½ Milo made with standard milk: 200 ml	Supper Homemade rice pudding: 100 g Wheat bran: 1 T Peaches, canned: ¼ cup Milo made with standard milk: 200 ml	Supper Banana cake: small slice Milo made with standard milk: 200 ml

Notes:

T = Tablespoon; t = teaspoon

* Estimated energy level to gain weight based on ideal weight for height and age = 6.9–7.8 MJ (PAL 1.4–1.6).

Table A9: Summary of the nutritional analysis of the three-day menu plan for a frail female aged 85 years

Nutrient	Average per day
Fluid (ml)	2275
Energy (KJ)	7393
Carbohydrate (g)	206 (46.5% TE)
Protein (g)	78 (17.6% TE)
Total fat (g)	71 (36% TE) ¹
Saturated fat (g)	33 (16.8% TE) ²
Polyunsaturated fat (g)	8 (4% TE)
Monounsaturated fat (g)	22 (11.2% TE)
Fibre (englyst) (g)	19
Vitamin D (µg)	4.43
Folate (µg)	273 ³
Calcium (mg)	1246 ⁴
Iodine	Not assessed

Notes:

% TE = % of total energy.

1 Exceeds recommendations, but is necessary to add energy.

2 A high saturated fatty acid intake is due to a high (full-fat) milk intake.

3 Folate does not meet the recommendations, but could be improved with the addition of tomato juice every morning.

4 Calcium does not meet the RDI, but does meet the estimated average requirement (EAR).

Glossary

Acceptable macronutrient distribution range (AMDR)	An estimate of the range of intake for each macronutrient for individuals (expressed as percentage contribution to energy) that would allow for an adequate intake of all the other nutrients while maximising general health outcomes.
Adequate intake (AI)	Where an estimated average requirement (and therefore a recommended dietary intake) for the nutrient cannot be determined because of limited or inconsistent data, an AI is determined. The AI can be used as a goal for individual intake. It is based on experimentally derived intake levels or approximations of observed mean nutrient intakes by a group of apparently healthy people maintaining a defined nutritional state.
Alcohol Use Disorders Identification Test (AUDIT)	A 10-item screening questionnaire developed by the World Health Organization, which is designed to identify people with potentially hazardous or harmful alcohol consumption.
Alpha-linolenic (α-linolenic) acid	An omega-3 fatty acid with 18 carbon atoms, found in soybean, canola, flaxseed, walnut oils, nuts and seeds.
Anaemia	A reduction of the haemoglobin concentration below normal for age and sex. A diagnosis of iron deficiency anaemia is made when anaemia is accompanied by laboratory evidence of iron deficiency, such as low serum ferritin.
Anorexia of ageing	A physiological decline in food intake.
Arachadonic acid	An omega-6 fatty acid with 20 carbon atoms, found in egg yolk and meats (particularly organ meats).
Atrophic gastritis	Degeneration of the stomach mucosa resulting in reduced secretions of gastric acid, intrinsic factor and pepsin from the stomach.
Basal metabolic rate (BMR)	The amount of energy required to sustain basic essential processes for keeping the body alive, healthy and growing, such as heart, lungs, nervous system and kidneys. It is measured when an individual is at rest in a warm environment, is in the post-absorptive state (ie, they have not eaten for at least 12 hours), and is disease-free.
Bioavailability	The degree to which a drug, medication or another substance (eg, iron) becomes available for use by the body after administration or consumption.

Body mass index (BMI)	An indicator of body fatness, calculated from the formula: weight divided by height squared, where weight is in kilograms and height is in metres.
Cachexia	A catabolic disease-state resulting in weight loss and muscle wasting.
Calcitonin	A hormone secreted by the parathyroid gland to decrease the concentration of calcium in the blood.
Calcitriol	(1,25(OH) ₂ D) the biologically active form of vitamin D.
Cardiovascular disease (CVD)	Diseases that affect the heart and circulatory system.
Carotenoid	Phytochemicals (plant metabolites) that are found in vegetables and fruit and that provide the red and yellow pigments essential for photosynthesis.
Coronary heart disease (CHD)	Also called coronary artery disease and atherosclerotic heart disease, CHD results from the growth of atheromatous plaques (associated with the progressive accumulation of macrophages) within the blood vessel wall. After decades of progression, some of these atheromatous plaques rupture and (along with the activation of the blood-clotting system) start limiting blood flow to the heart muscle.
Dental caries	Tooth decay.
Determinants of health	Factors that promote (or inhibit) good health. These factors can change over time, often interact, and may compound or mitigate the effects of the others. The determinants of health are not static.
Diabetes	Diagnosed when levels of glucose are abnormally elevated in blood. It is usually caused either by a lack of insulin or by the body's inability to use insulin efficiently. The two most common types of diabetes mellitus are type 1 (T1DM) and type 2 (T2DM).
Dietary folate equivalents (DFEs)	Recommended folate intake is expressed as dietary folate equivalents to account for differences in the bioavailability of food folate and synthetic folic acid. 1 µg of DFEs equals: <ul style="list-style-type: none"> • 1 µg of folate from food • 0.5 µg of a folic acid tablet taken on an empty stomach • 0.6 µg of folic acid from fortified food or as a tablet taken with meals (NHMRC 2006).

Discretionary fat intake	Fat (in various forms; eg, oil, margarine, butter) added to food after the food or meal has been prepared, but prior to it being consumed (eg, adding butter to bread or cooked potatoes at the table).
Docosahexaenoic acid (DHA)	An omega-3 fatty acid with 22 carbon atoms and 6 double bonds, found in oily fish.
Docosapentaenoic acid (DPA)	An omega-3 fatty acid with 22 carbon atoms and 5 double bonds, found in oily fish.
Eicosapentaenoic acid (EPA)	An omega-3 fatty acid with 20 carbon atoms and 5 double bonds, found in oily fish.
Energy-dense	The amount of energy stored in a given food per unit volume or mass. Foods that are composed mostly of fat and sugars are very energy-dense, and often are limited in the other nutrients they provide.
Essential amino acids	See Indispensable amino acids .
Essential nutrient	A nutrient required for normal body functioning that can not be synthesised by the body. Categories of essential nutrients include vitamins, dietary minerals, essential fatty acids and essential amino acids.
Estimated average requirement (EAR)	The median usual intake estimated to meet the requirement of half the healthy individuals in a life stage or gender group. This value is usually used for assessing the adequacy of intakes of certain populations.
Estimated energy requirement (EER)	The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of defined age, gender, weight, height and level of physical activity, consistent with good health. In children and pregnant and lactating women, the EER is taken to include the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.
Fatty acid	A component of fat that is an even-numbered chain of carbon atoms with hydrogens attached, with a methyl group at one end and a carboxylic acid group at the other. Fatty acids are classified as short (fewer than 8 carbons), medium (8–12 carbons) or long (14 or more carbons) chain. Some fatty acids are essential.
Folate	A generic term for the various forms of folate found in food. Folate is involved in the metabolism of nucleic and amino acids, and hence in the synthesis of DNA, RNA and proteins.

Folic acid	A synthetic form of folate found in supplements and fortified foods and beverages.
Food security	An internationally recognised term that encompasses the ready availability of nutritionally adequate and safe foods, and the assured ability to acquire personally acceptable foods in a socially acceptable way.
Fortification	The addition of nutrients to food. Nutrients may be added to correct a demonstrated deficiency in the population, to replace nutrients lost during processing, storage or handling, or for other reasons.
Fruit	Generally includes the sweet, fleshy edible portion of a plant that arises from the base and flower and surrounds the seed.
Functional capacity	The capability to perform tasks and activities that people find necessary or desirable to do in their lives.
Gamma linolenic acid (GLA)	An omega-6 fatty acid with 18 carbon atoms, found in evening primrose and blackcurrant oils.
Glycaemic index (GI)	The rise in blood glucose after a portion of carbohydrate-containing food is eaten compared with the rise in blood glucose after a standard food (usually white bread or glucose) is eaten. The GI is normally expressed as a percentage.
Hapū	Sub-tribe.
Hauora	An encompassing concept which includes the spiritual, mental, physical, familial and environmental aspects of life and wellbeing.
Homoeostasis	A metabolic equilibrium actively maintained by physiological processes.
Hypertension	High blood pressure.
Indispensable amino acids	Nine amino acids required for protein synthesis that cannot be synthesised by the body and must be obtained through the diet. These amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine.
Insulin	A polypeptide hormone that regulates carbohydrate metabolism. Apart from being the primary effector in carbohydrate homoeostasis, it takes part in the metabolism of fat, triglycerides and proteins. It has anabolic properties.

Insulin resistance	The decreased sensitivity of target cells (muscle and fat cells) to insulin.
Ischaemic	An insufficient supply of blood to an organ, usually due to a blocked artery.
Iwi	Tribe.
Kai	Food.
Kaumātua	Elder. Often used to refer specifically to older people, both men and women, and especially to those with the mana to have an influence in community decision-making.
Kuia	A female elder.
Koroua	A male elder.
Linoleic acid	An omega-6 fatty acid with 18 carbon atoms, found in soybean, safflower, sunflower, corn oils, green leafy vegetables, nuts and seeds. It is used to make the long-chain polyunsaturated fatty acids (LCPUFAs) arachidonic acid (AA) and gamma-linolenic acid (GLA).
Long-chain polyunsaturated fatty acids (LCPUFAs)	longer chain fatty acids that are derived from the essential fatty acids and are precursors to hormone-like eicosanoid compounds, prostaglandins and leukotrienes. These fatty acids occur in foods and can be made from the essential fatty acids.
Low-density lipoprotein (LDL)	A class and range of lipoprotein particles, varying somewhat in their size and contents, which carry cholesterol in the blood and around the body for use by various cells. LDL is commonly referred to as ‘bad’ cholesterol because of the link between high LDL levels and cardiovascular disease.
Mana	Authority, control, identity, prestige.
Marae	The courtyard or area in front of a meeting house; also the whole ‘marae complex’ – meeting house, dining hall, marae ātea and the grounds in which they are located.
Metabolism	The uptake and digestion of food and the disposal of waste products in living organisms.
Moderate activity	As defined by the <i>New Zealand Guidelines for Promoting Physical Activity (Movement = Health)</i> , activity that will cause a slight but noticeable increase in breathing and heart rate. This level of activity is equivalent to brisk walking.

Monounsaturated fatty acids	Unsaturated fatty acids whose carbon chain has one double bond per molecule, mainly found in nuts and nut oils, and in red meat when animals are grass-fed.
New Zealand National Nutrition Survey 1997 (NNS97)	A cross-sectional survey of adult New Zealanders aged 15 years and older.
New Zealand Total Diet Survey/Study	A periodic survey/study examining contaminants and selected nutrients in a number of commonly eaten New Zealand foods.
Niacin equivalents (NEs)	Nicotinic acid, nicotinamide and the contribution to niacin obtained by conversion from dietary L-tryptophan. The relative contribution of tryptophan is estimated as follows: 60 mg of L-tryptophan = 1 mg of niacin = 1 mg of niacin equivalents.
Non-communicable diseases	Diseases that cannot be transmitted from one person to another, such as obesity, hypertension, diabetes, cardiovascular disease and gout.
Non-starch polysaccharide (NSP)	Non-starch polysaccharides are included in the definition of dietary fibre. There are two kinds of NSP – insoluble and soluble. Most plant foods contain both types, although the proportions vary. Good sources of insoluble NSP include wheat, corn, rice, vegetables and pulses. Good sources of soluble NSP include peas, oats, dried beans, lentils, barley, pasta and fruit.
Nutrient-dense	The amount of nutrients that a food contains per unit volume or mass. Nutrient dense foods include vegetables, fruit, legumes, whole grains, lean meats and low-fat milk and milk products.
Nutrient reference values (NRVs)	A set of recommendations, including recommended dietary intakes, for intakes of nutrients.
Obese	having a BMI of ≥ 30 kg/m ² . These levels of body fat are associated with an increased risk of chronic disease.
Omega-3	Polyunsaturated fatty acids found in oily fish, and in vegetable oils, nuts and seeds. Some omega-3 fatty acids are classed as essential fatty acids. Common omega-3 fatty acids in the body are alpha-linolenic, eicosapentaenoic acid and docosahexaenoic acid.
Omega-6	Polyunsaturated fatty acids found in vegetable oils, green leafy vegetables, and nuts and seeds. Some omega-6 fatty acids are classed as essential fatty acids. Common omega-6 fatty acids in the body are linoleic acid (the shortest-chain omega-6 fatty acid) and arachidonic acid.

Osteoporosis	The thinning of the bones (or ‘porous’ bones) resulting from a loss of bone density.
Overweight	Having a BMI ≥ 25 and < 30 kg/m ² .
Parathyroid hormone	A hormone secreted by the parathyroid gland to increase the concentration of calcium in the blood.
Physical activity	The entire spectrum of ‘bodily movements’ that a person can undertake in daily life, ranging from normal active living conditions to ‘intentional’ moderate physical activities, to structured and repetitive physical exercises, to physical fitness and training sessions, to collective sport activities, especially leisure and recreational sports.
Polypharmacy	The use of a number of prescribed medications (usually describes more than five medications) by one person at one time.
Polyunsaturated fatty acids (PUFAs)	Unsaturated fatty acids whose carbon chain has more than one double or triple bond per molecule, found mainly in fish, vegetable oils, green leafy vegetables, nuts and seeds.
Recommended dietary intake (RDI)	The average daily dietary intake level sufficient to meet the nutrient requirements of nearly all healthy individuals (97–98%) in a life stage or gender group.
Retinol equivalents (RE)	The recommendation for vitamin A intake is expressed as micrograms (μg) of retinol equivalents (RE). Retinol activity equivalents account for the fact that the body converts only a portion of beta-carotene to retinol. 1 μg RE equals 1 μg of retinol or 6 μg of beta-carotene.
Rēwena	Māori bread.
Sarcopenia	The inevitable loss of (skeletal) muscle mass that occurs with age. This loss of muscle mass leads to a fall in metabolic rate, and may influence an older person’s physical function.
Satiety	A state of feeling full.
Saturated fat	A fatty acid in which there are no double bonds between the carbon atoms of the fatty acid chain. Saturated fats tend to be solid at room temperature. Diets high in saturated fat correlate in some studies with an increased incidence of atherosclerosis and coronary heart disease. Hydrogenation converts unsaturated fats to saturated fats, while dehydrogenation accomplishes the reverse.

Socioeconomic status	Social position, measured by an ordinal scale, indicating an individual's (or a family's or household's) relative position in the social hierarchy, based on criteria such as income level, occupational class or educational attainment.
Subcutaneous fat	Fat found just beneath the skin.
Tapu	Sacred, requiring reverence; restriction and prohibition.
Thermic effect of food	The stimulation of metabolism that occurs for three to six hours after a meal as a result of the processing of food in the stomach and intestine, and of nutrients in the blood and body cells. It is about 10% of the total daily energy expenditure.
Tikanga	Custom, correct process in a given situation.
Total energy expenditure (TEE)	Amount of energy used through basal metabolic rate, thermoregulation and physical activity.
Triglycerides	Also called triglycerols, they are fat molecules composed of one glycerol and three fatty acids.
Type 1 diabetes mellitus (T1DM)	Previously known as insulin-dependent diabetes mellitus (IDDM), it is caused by the destruction of insulin-producing cells, resulting in insulin deficiency.
Type 2 diabetes mellitus (T2DM)	Previously known as non-insulin-dependent diabetes mellitus (NIDDM), it is of unknown cause but is associated with a combination of insulin resistance and a relative insulin deficit. The major risk factors for type 2 diabetes are obesity, increasing age, physical inactivity, and nutritional factors such as a high intake of saturated fatty acids. It can usually be controlled by diet and physical activity, along with oral hypoglycaemic agents and (increasingly) insulin to control blood glucose levels.
Unsaturated fat	A fat or fatty acid in which there is one or more double bonds between carbon atoms of the fatty acid chain. Such fat molecules are monounsaturated if each contains one double bond and polyunsaturated if each contains more than one.
Upper level of intake (UL)	The highest level of continuing daily nutrient intake likely to pose no adverse health effects in almost all individuals.
Vegetables	All leafy greens, members of the crucifer family, all root (including potatoes) and tuber vegetables, edible plant stems, gourd vegetables, allium vegetables and corn.

Vigorous activity	As defined by the <i>New Zealand Guidelines for Physical Activity (Movement = Health)</i> , activity that makes people ‘huff and puff’.
Waist circumference	<i>An indicator of abdominal obesity and chronic disease risk</i>
Whānau	Family; extended family. Recognised as the foundation of Māori society. As a principal source of strength, support, security and identity, whānau plays a central role in Māori individually and collectively.
Whānau ora	Māori families supported to achieve their maximum health and wellbeing.

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