3 Risk factors for diabetes and its complications

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Introduction

A risk factor is the term given to a range of health-related behaviours and biomedical conditions that can impact on the health of an individual in a negative way. Risk factors include both modifiable and non-modifiable factors and for diabetes and its complications, they include genetic, behavioural and biomedical factors (Centers for Disease Control and Prevention 2005; WHO 1999). The determinants of health, however, go beyond these to the underlying social, economic, psychological and cultural factors that can contribute to disease (AIHW 2006a).

Assessing the prevalence of risk factors in the population is useful in understanding trends in disease prevalence, incidence and deaths, as well as predicting future trends, and can help explain why some groups have better or worse health than others. Monitoring prevalence can also provide insight into the success of health-related campaigns or the need to initiate health-promotion interventions.

What are the risk factors for diabetes and its complications?

Many factors contribute to the onset and development of diabetes. Type 1 diabetes is believed to be caused by particular biological interactions and exposure to environment agents among people genetically predisposed to diabetes (Atkinson & Eisenbarth 2001; Daneman 2006).

Several behavioural and modifiable risk factors play a role in the onset of Type 2 diabetes, including obesity, physical inactivity and unhealthy diet, as does genetic predisposition such as family history, ethnic background and age (Shaw & Chisholm 2003). In 2003, high body mass and physical inactivity together explained 60% of the disease burden (in terms of Disability Adjusted Life Years) from Type 2 diabetes (See Chapter 7 for more information). High body mass was the largest contributor (55%) to Type 2 diabetes while the contribution of physical inactivity was 24% (AIHW: Begg et al. 2007).

There is some evidence that depression can increase the risk of developing Type 2 diabetes and diabetes complications (Arroyo et al. 2004; Brown et al. 2005b; Carnethon et al. 2003; Golden et al. 2004). The increased risk for Type 2 diabetes may be due to elevated stress levels and weight gain (Diabetes Australia 2006b).

Poor foetal nutrition leading to low birth-weight for gestational age is another factor that may predispose some individuals to Type 2 diabetes. If these individuals are exposed to other risk factors (such as obesity and physical inactivity) the likelihood of developing Type 2 diabetes becomes greater (Forsen et al. 2000; WHO 1999; Barker 1999; Hales & Barker 2001).

The risk factors for gestational diabetes are similar to those for Type 2 diabetes: women are at higher risk if they are of relatively advanced age or obese when pregnant (Virjee et al. 2001).

There are also a number of additional risk factors for diabetes complications (see Chapter 4), including high blood pressure, high blood cholesterol and tobacco smoking (WHO 1999). Recent studies have suggested that tobacco smoking may also be a risk factor for developing insulin-resistant Type 2 diabetes (Meisinger et al. 2006), although the evidence for this is far more limited compared with other recognised risk factors.

The metabolic syndrome—the clustering of a number of risk factors including abdominal obesity, impaired fasting blood glucose, raised blood pressure, raised blood triglycerides and reduced blood HDL-cholesterol—substantially increases the risk of Type 2 diabetes. The prevalence of the metabolic syndrome among Australians aged 25 years and over was 29% in the AusDiab stucy, conducted in 1999–2000. The 2004–05 AusDiab follow-up study showed an annual incidence rate for the metabolic syndrome of 3% (3.8% in males and 2.4% in females) (Barr et al. 2006).

Risk factors such as physical inactivity, poor diet and tobacco smoking can influence biomedical risk factors, including impaired glucose regulation, overweight, high blood pressure and high cholesterol. Behavioural and biomedical risk factors have the potential to be modified.

The risk factors presented in this chapter are:

- impaired glucose regulation
- physical inactivity

- unhealthy diet
- overweight
- tobacco smoking
- high blood pressure
- high blood cholesterol and triglycerides.

Impaired glucose regulation

Impaired glucose regulation is the metabolic state between normal glucose regulation and diabetes (WHO 1999). There are two categories of impaired glucose regulation: impaired fasting glucose (IFG) and impaired glucose tolerance (IGT). IFG and IGT are not considered to be clinical entities in their own right but rather risk factors for the future development of diabetes and cardiovascular disease (Twigg et al. 2007; NHMRC 2001).

Early treatment and improved management of impaired glucose regulation could reduce the incidence of Type 2 diabetes (Bennett 1999; Shaw & Chisholm 2003). In a review of six studies exploring IFG and IGT as predictors of future diabetes, it was found that in the majority of the populations studied, 60% of people who developed diabetes had either IGT or IFG five years before they were diagnosed with diabetes (Unwin et al. 2002).

There is some evidence that lifestyle changes incorporating increased physical activity and healthy eating could reduce or stop the progression of IFG and IGT to diabetes. For example, results from a longitudinal study by Tuomilehto et al. (2001) showed that lifestyle intervention such as counselling aimed at reducing weight and total fat intake and increasing fibre intake and physical activity among obese adults with IGT reduced the rate of progression to diabetes by 40–60% over a 3 to 6 year period.

How is impaired glucose regulation defined?

IFG and IGT are measured using an Oral Glucose Tolerance Test (OGTT)—the same test used to measure diabetes. In the OGTT a blood glucose measurement is taken after a period of approximately 8 hours of fasting. Another measurement is taken 2 hours after consuming 75 g of glucose. IFG represents abnormalities of glucose regulation immediately after an overnight fast while IGT represents abnormalities of glucose regulation 2 hours after consuming 75 g of glucose, often in the form of a high sugar drink.

IFG is diagnosed when the OGTT results show that the fasting blood glucose level (that is the measurement taken immediately after fasting) is more than 6.1 mmol/L but less than 7.0 mmol/L, and the blood glucose level 2 hours after consuming the glucose is less than 7.8 mmol/L. This means that the fasting blood glucose level is higher than normal but does not rise abnormally after taking 75 g of glucose (Diabetes Australia 2003).

IGT is diagnosed when OGTT results show that the fasting blood glucose level is less than 7.0 mmol/L and the blood glucose level 2 hours after consuming the glucose is more than 7.8 mmol/L, but less than or equal to 11.0 mmol/L.

Diabetes is detected when the fasting blood glucose level is greater than or equal to 7.0 mmol/L and the 2 hour 75 g OGTT blood glucose level is greater than or equal to 11.1 mmol/L.

Who is affected by impaired glucose regulation?

As with Type 2 diabetes, impaired glucose regulation is most common in people who are overweight or obese, physically inactive, have high levels of triglycerides, low high density lipoprotein (HDL) cholesterol, high total cholesterol and high blood pressure. The prevention of risk factors for impaired glucose regulation can reduce the progression to Type 2 diabetes.

How many Australians have impaired glucose regulation?

Prevalence

Based on measured data from the 1999–2000 AusDiab study, it was estimated that approximately one in six Australians aged 25 years or over had impaired glucose regulation, with IGT more prevalent than IFG (10.6% and 5.8%, respectively) (Table 3.1).

Table 3.1: Prevalence of impaired glucose regulation among adults aged 25 years and over, 1999–2000

	Males	Females	Persons
		Per cent	
Impaired glucose regulation	17.4	15.4	16.4
Impaired glucose tolerance	9.2	11.9	10.6
Impaired fasting glucose	8.1	3.4	5.8

Source: AIHW analysis of the 1999–2000 AusDiab study.

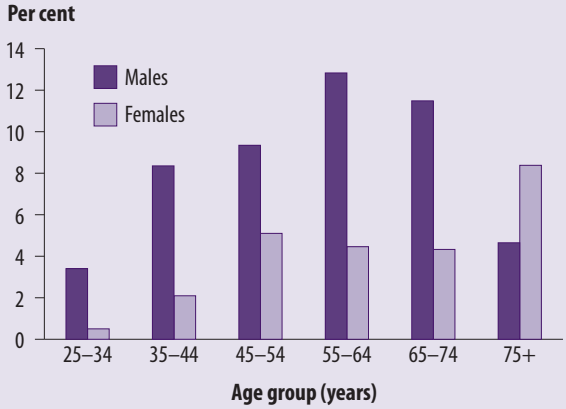
A comparison of results from the 1981 Busselton Study and 1999–2000 AusDiab study suggests a substantial increase for both males (3% to 10%) and females (3% to 12%) in the age-standardised prevalence of IGT (Dunstan et al. 2001).

Age and sex

The prevalence of impaired glucose regulation varies with sex and age as well as the category of glucose regulation. For example, the 1999–2000 AusDiab study found that the overall prevalence of IFG was significantly higher in males than females (8.1% compared with 3.4%) (Table 3.1). This pattern is consistent with results of other studies which report IFG in males being 1.5 to 3 times as high as in females (DECODE Study Group 2003; DECODA Study Group 2003).

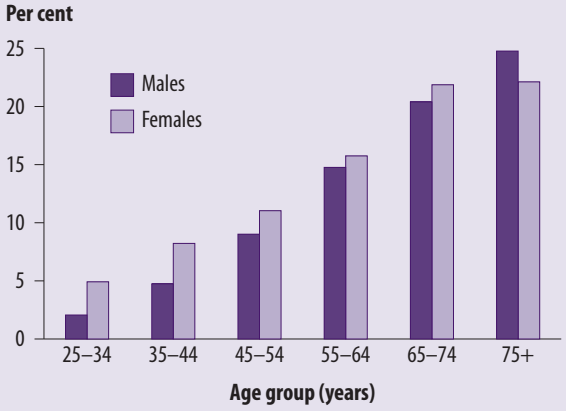
The age distribution of IFG indicates that the prevalence of IFG peaks in females aged 75 years and over and in males aged 55–64 years (Figure 3.1). The prevalence of IFG declines for males from age 65 years. There is a rapid increase in IFG in females aged 75 years and over, at which point the female prevalence of IFG exceeds that of males.

In contrast, the prevalence of IGT was higher in females than males for ages 25 to 74 years. However, from age 75 years the prevalence of IGT was higher for males than for females. Unlike the distribution of IFG by age, the prevalence of IGT increased steadily with age for both sexes (Figure 3.2).



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.1: Age-specific prevalence of impaired fasting glucose (IFG) in adults, 1999–2000



Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.2: Age-specific prevalence of impaired glucose tolerance (IGT) in adults, 1999–2000

Physical inactivity

Physical activity is important for maintaining good health. Regular participation in moderate- to vigorous-intensity physical activity is protective against a range of diseases and conditions, including diabetes, heart disease and some forms of cancer (AIHW 2006a).

Participation in regular physical activity is one of the major recommendations of the evidence-based guidelines for the primary prevention of Type 2 diabetes. Exercise was found to reduce the risk of developing Type 2 diabetes, slow the progression from impaired glucose regulation to Type 2 diabetes, and reduce diabetes-related mortality (NHMRC 2001).

Exercise has been shown to significantly improve blood sugar control in people with Type 2 diabetes (Thomas et al. 2006). Also, resistance exercise, such as lifting weights, has been shown to be beneficial for the health of older people with diabetes through improving control of blood sugar levels (Castaneda et al. 2002; Dunstan et al. 2002a).

Participation in sufficient physical activity can modify, or reduce the impact of, other risk factors for diabetes and its complications such as obesity and high blood cholesterol. Furthermore, insufficient physical activity is itself a risk factor for cardiovascular disease, one of the major complications of diabetes (AIHW 2006a). People with diabetes—particularly those taking insulin or oral blood glucose–lowering medicines—need to monitor their response to exercise and may need to adjust their diet or medication (Harris et al. 2006; Williams & Pickup 1999).

What is physical activity?

Physical activity includes moderate or vigorous exercise, resistance exercise and flexibility training. Recommended physical activity levels for both adults and children have been outlined in the National Physical Activity Guidelines for Australians (see Box 3.1).

The recommendations for children and adolescents also state that no more than 2 hours a day should be spent using electronic media for entertainment (such as computer games, the internet and television), particularly during daylight hours. Studies have found an association between increased time watching television and the risk of abnormal glucose metabolism or diabetes in adults (Dunstan et al. 2004; Hu et al. 2003).

For this report, sufficient physical activity is defined as 30 minutes of moderate physical activity on at least five days of the week, or 150 minutes spread out over five sessions in a week.

Box 3.1: What is sufficient physical activity for health?

The National Physical Activity Guidelines for Australians (AIHW 2003a; DHAC 1999; DoHA 2004a, 2004b) recommend at least 30 minutes of moderate-intensity activity on most, preferably all, days of the week to obtain health benefits. This is generally interpreted as 30 minutes on at least five days of the week — a total of 150 minutes of moderate activity per week. The guidelines for children and adolescents recommend at least 60 minutes of moderate to vigorous physical activity every day.

Examples of moderate-intensity activity are brisk walking, swimming, doubles tennis and medium-paced cycling. More vigorous physical activity includes jogging and active sports such as football and basketball.

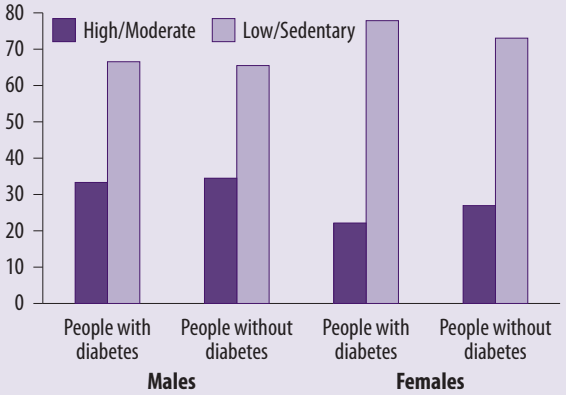
There are two ways of calculating 'sufficient' activity for health benefits in the Australian Guidelines. These are: 'sufficient time'—at least 150 minutes of moderate-intensity physical activity per week, and 'sufficient time and sessions'—at least 150 minutes of moderate-intensity physical activity accrued over at least five sessions per week, with vigorous activity counted double. For population-monitoring purposes, sufficient time and sessions is the preferred measure of activity for health as it takes into account the frequency, as well as duration of physical activity. Research suggests that even shorter sessions (down to 10 minutes) can be beneficial as well, provided they add up to the required total over the week.

How many Australians are physically inactive?

Prevalence

The most recent source of national data for physical activity levels is the 2004–05 NHS. According to this survey, the majority (about 70%) of Australians aged 15 years and over undertook insufficient (sedentary or low) levels of physical activity. Overall physical activity levels were slightly lower in people with diabetes: nearly three out of every four people with diabetes were classified as being sedentary (36%) or having low exercise levels (39%) compared with just over two-thirds (32% sedentary and 37% low) of people without diabetes.

In 2004–05, a similar proportion of males with diabetes had insufficient exercise levels as males without diabetes (67% and 66%, respectively). The main differences were found among females, where the prevalence of insufficient exercise was higher among those with diabetes (78%) than those without diabetes (73%) (Figure 3.3).



Notes
1. See appendix 1 for a definition of excercise level.
2. Based on self-reported data.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.3: Prevalence of physical activity among people aged 15 years and over, 2004–05

Trends

Published trend information indicates that the proportion of people in the low/sedentary group remained fairly constant, at about 70%, over the period 1995 to 2004–05 (ABS 2006c).

Unhealthy diet

Diet plays an important role in the prevention and development of chronic diseases such as diabetes (WHO 2003). The promotion of good health and prevention of chronic diseases through dietary behaviour may be achieved, in the first instance, by following dietary guidelines such as those developed by the National Health and Medical Research Council (NHMRC). According to these guidelines, Australian adults and children should consume a wide variety of nutritious foods including a high intake of plant foods and limit salt, saturated fat and alcohol intake (NHMRC 2003a) (see Box 3.2).

Nutrition plays an important part in the management of diabetes (ADA 2004). Poor nutrition is a risk factor for Type 2 and gestational diabetes largely through its influence on body weight, particularly obesity (NHMRC 2001; WHO 2003). Reducing total fat intake has been found to reduce the risk of developing diabetes independent of weight loss (Franz et al. 2002) however, evidence supporting claims that individual dietary factors can have an effect on diabetes, independent of obesity, is inconclusive (WHO 2003).

Dietary risk factors for diabetes and its complications

Both fat and fibre intake are associated with diabetes (WHO 2003). Dietary fat has received particular attention in relation to diabetes because of its strong association with overweight and obesity— a major risk factor for the development of diabetes (Howard 1999).

Dietary fat intake

It is recommended that people consume a diet with less than 30% energy as fat and less than 10% energy as saturated fat (NHMRC 2003a). This is especially important for those at risk of Type 2 and gestational diabetes. Reducing saturated fat intake can decrease the risk of developing diabetes by increasing the body's ability to use insulin properly, promoting weight loss (in people who are overweight or obese), and reducing low-density lipoprotein (LDL) cholesterol (the 'bad' cholesterol) (NHMRC 2001).

It can also help reduce the risk of cardiovascular disease — a major complication of both Type 1 and Type 2 diabetes (Howard 1999). Replacing saturated fats with monounsaturated fats can also lead to improved blood glucose control if total fat intake is less than 37% of total energy intake (WHO 2003).

Dairy products contribute significantly to saturated fat intake, therefore, the proportion of people consuming skim or reduced fat milk compared with whole cow's milk can be used as an indicator of lower total and saturated fat intake (AIHW 2006b).

Box 3.2: Dietary guidelines for Australian adults

Enjoy a wide variety of nutritious foods

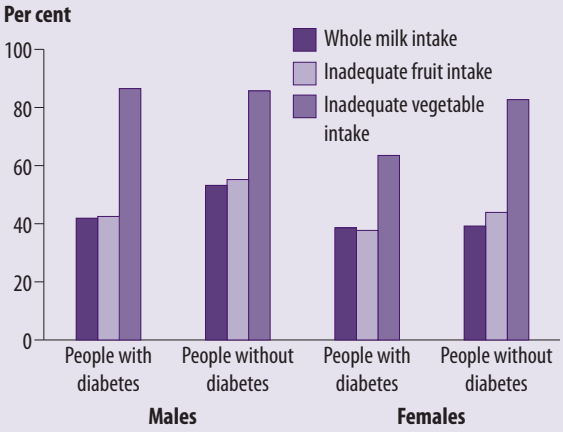
- eat plenty of vegetables, legumes and fruit
- eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
- include lean meat, fish, poultry and/or alternatives
- include milks, yoghurts, cheeses and/or alternatives: reduced fat varieties should be chosen where possible
- drink plenty of water

and take care to:

- limit saturated fat and moderate total fat intake
- choose foods low in salt
- limit your alcohol intake if you choose to drink
- consume only moderate amounts of sugars and foods containing added sugars
- prevent weight gain: be physically active and eat according to your energy needs
- care for your food: prepare and store it safely
- encourage and support breastfeeding.

Source: NHMRC 2003a.

In 2004–05, 45% of the Australian population drank whole milk, 49% drank other types of milk (including soy) and 5.1% did not drink milk. A smaller proportion of people with diabetes (40%) drank whole milk compared with people without diabetes (46%). A higher proportion of males consumed whole milk than females, although these sex differences were greater among people without diabetes (Figure 3.4).



Notes

1. Inadequate fruit intake is defined as less than two serves of fruit per day for adults and less than three serves a day for children and adolescents aged 12–18 years.
2. Inadequate vegetable intake is defined as less than five serves of vegetables per day for adults and less than four serves a day for children and adolescents aged 12–18 years.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.4: Prevalence of whole milk consumption, and inadequate fruit and vegetable intake among people aged 12 years and over, 2004–05

Dietary fibre intake

A high fibre diet is recommended to reduce the risk of developing Type 2 diabetes and complications commonly associated with both Type 1 and Type 2 diabetes (ADA 2002; Mann et al. 2004; NHMRC 2001; WHO 2003). The increased consumption of foods rich in dietary fibre (such as cereals, fruits, vegetables and legumes) has been found to reduce the incidence of cardiovascular disease in people with and without diabetes (Mann et al. 2004). It is also associated with lower body mass index in people with Type 1 diabetes and higher insulin-sensitivity in people without diabetes (Mann et al. 2004). The protective effect of dietary

fibre against diabetes has been shown to be independent of age, body mass index, smoking and physical activity (WHO 2003). Fruit and vegetable intake can be used as an indicator of dietary fibre intake.

In 2004–05, 49% of Australians did not eat the recommended serves of fruit and 84% of Australians did not eat the recommended serves of vegetables each day.

More males and females with diabetes met the daily requirement for fruit intake compared with males and females without diabetes. In 2004–05, 41% of people with diabetes and 50% of people without diabetes were consuming less than the recommended daily serves of fruit. Overall, a greater proportion of males with diabetes (43%) and males without diabetes (55%) had inadequate fruit intake compared with their female counterparts (38% and 44% respectively) (Figure 3.4).

In 2004–05, the majority of people with diabetes (73%) and without diabetes (84%) were not meeting the recommended daily intake of vegetables (Figure 3.4). Overall, only about 1 out of 10 males with and without diabetes consumed the recommended daily serves of vegetables. A higher proportion of females with diabetes met the recommenced daily serves of vegetables (36%) than females without diabetes (17%).

Other dietary factors

The glycaemic index

Foods with a particular glycaemic index (GI)—a ranking of carbohydrate foods based on their overall effect on blood glucose levels—may also be associated with Type 2 diabetes. Some studies indicate that high GI diets may contribute to the risk of Type 2 diabetes, while low GI diets may play a protective role. Other studies have found no relationship at all (Sheard et al. 2004). Low GI foods are considered good carbohydrate-rich sources as long as other attributes of the food (such as saturated fat, salt and sugar content) are appropriate (Mann et al. 2004; Sheard et al. 2004).

Alcohol consumption

High alcohol consumption is associated with an increased risk of diabetes complications such as heart, stroke and vascular disease (Mann et al. 2004). Moderate alcohol consumption has been found to reduce the risk of hypoglycaemia (low blood glucose levels); however, there is currently insufficient evidence to confirm or refute suggestions that alcohol might protect against the development of Type 2 diabetes (Mann et al. 2004; WHO 2003). Furthermore, drinking too much alcohol can cause hypoglycaemia in people who are taking insulin or certain diabetes tablets (Diabetes Australia 2006a).

Overweight

Overweight, and in particular obesity, are key risk factors for the development of diabetes, with the escalating prevalence of obesity believed to be a significant contributing factor to the rapid rise of Type 2 diabetes (Dunstan et al. 2001; Eckel et al. 2006). There is evidence that the risk of Type 2 diabetes increases with increasing excess weight (Chan et al. 1994; Colditz et al. 1995; Golay & Ybarra 2005).

Overweight also increases the risk of developing cardiovascular diseases in people with and without diabetes. Because diabetes is a risk factor for cardiovascular diseases, people who are both overweight and have diabetes are at an even greater risk than those who are just overweight or just have diabetes (Eckel et al. 2006).

Increased body weight can lead to increased insulin resistance and defects in insulin secretion. Type 2 diabetes occurs when insulin resistance declines to a level at which it cannot compensate for insulin secretion (Golay & Ybarra 2005; Sharma 2006). Weight loss reduces the risk of diabetes in people who are overweight by improving insulin sensitivity and glycaemic control. People at risk of or who already have Type 2 diabetes can achieve weight reduction through diet and physical activity (Sharma 2006) (for further information see sections on physical activity and dietary behaviour).

What is overweight?

Overweight is a condition of excess weight that normally results from a sustained energy imbalance. Energy imbalance occurs when dietary energy intake exceeds energy expenditure over a period of time. Obesity is a severe form of overweight.

A combination of body mass index (BMI) and waist circumference is recommended for the clinical measurement of overweight and obesity (see Box 3.3) (NHMRC 2003b; 2003c). BMI is an acceptable approximation of total body fat at the population level and can be used to estimate the risk of disease in most people; however, because BMI does not distinguish between weight attributable to fat and weight attributable to muscle, it should be interpreted with caution when assessing an individual's body weight (NHMRC 2003b).

People tend to overestimate their height and underestimate their weight, leading to an underestimate of BMI. As a result, self-reported data is likely to underestimate the true prevalence of overweight and obesity based on BMI and therefore should not be directly compared with prevalence estimates based on measured data.

Although measured data provide more accurate estimates of the prevalence of excess body weight among people with diabetes, the self-reported information on BMI from the 2004–05 NHS is also reported here as it is the most recent source of national prevalence information.

Waist circumference is an indicator of excess abdominal weight, which is a risk factor for Type 2 diabetes and cardiovascular disease. Waist circumference is a valid measure of abdominal fat and disease risk in people with a BMI of less than 35 (NHMRC 2003b).

Box 3.3: Monitoring body weight

There are two main methods used for monitoring body weight in settings such as population health surveys: body mass index (BMI) and waist circumference. Both provide an acceptable alternative to more accurate measurement of total body fat, which is only feasible for specialised clinical or other settings.

Body mass index

The most common measure of body weight is the BMI, which is calculated by dividing weight in kilograms by the square of height in metres (kg/m2). The standard recommended by the WHO (WHO 2000) and included in the *National Health Data Dictionary* for adults aged 18 years and over is:

- underweight (BMI <18.5)
- healthy weight (BMI ≥18.5 and BMI <25)
- overweight (BMI ≥25; includes obese)
- overweight but not obese (BMI ≥25 and BMI <30)
- obese (BMI ≥30).

For children and adolescents aged 2–17 years, Cole et al. (2000) have developed a separate classification of overweight and obesity based on age and sex.

Waist circumference

For monitoring overweight, waist circumference is a useful addition to BMI because abdominal fat mass can vary greatly within a narrow range of total body fat or BMI. The *National Health Data Dictionary* defines waist circumference cut-offs for increased and substantially increased risk of ill-health. Waist circumferences of 94 cm or more in men and 80 cm or more in women indicate increased risk (referred to here as abdominal overweight). Waist circumferences of 102 cm or more in men and 88 cm or more in women indicate substantially increased risk (referred to here as abdominal obesity) (NHDC 2003). This classification is not suitable for use in people aged less than 18 years and the cut-off points may not be suitable for all ethnic groups.

Self-reported versus measured data

Height and weight data may be collected in surveys as measured or self-reported data. People tend to overestimate their height and underestimate their weight, leading to an underestimate of BMI. Thus, rates of overweight and obesity based on self-reported data are likely to be underestimates of the true rates, and should not be directly compared with rates based on measured data (Flood et al. 2000; Niedhammer et al. 2000).

How many Australians are overweight?

Body mass index

Prevalence

Estimates from the 1999–2000 AusDiab study suggest that about 60% of Australians aged 25 years and over were overweight, as measured by the BMI. Approximately one third of them were obese. Being overweight or obese increases the risk of developing diabetes in individuals without diabetes and it increases the risk of developing diabetes-related complications in persons with diabetes.

People with diabetes are on average more likely than those without diabetes to be overweight. In 1999–2000, based on measured data, 80% of people with diabetes were overweight (BMI of 25 or more) compared with 59% of people without diabetes. The prevalence of obesity among people with diabetes was 3 times that of those without diabetes (Table 3.2).

In 1999–2000, the prevalence of obesity was similar among males (58%) and females (59%) with diabetes. A slightly higher proportion of females (20%) without diabetes were obese compared with males without diabetes (17%). A greater proportion of males than females were overweight regardless of diabetes status (Table 3.2).

Based on self-reported information, 51% of Australians aged 15 years and over were overweight or obese (BMI of 25 or more) in 2004–05. A higher proportion of males than females were overweight; 61% and 42% respectively, with a higher prevalence of obesity in males and females with diabetes compared with people who do not have the disease (Figure 3.5).

Trends

Published data, based on self-reported information, indicate that the prevalence of overweight and obesity in adults increased from 41% in 1995 to 49% in 2004–05. The age-standardised prevalence of overweight (but not obese) among Australian adults aged 18 years and over in 1995, 2001 and 2004–05 was 30%, 31% and 33%, respectively and obesity was 11%, 15% and 16% respectively (ABS 2006c).

Waist circumference

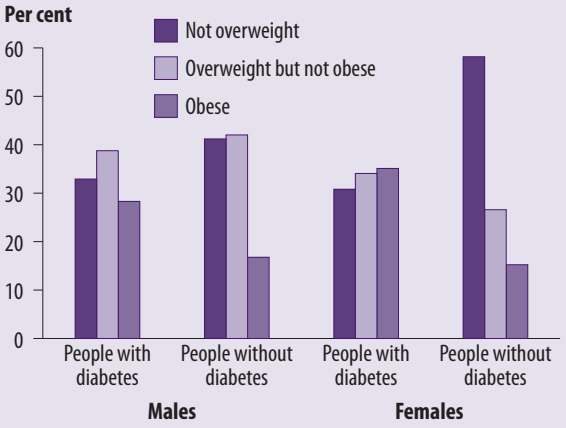
The only source of national data for overweight based on waist circumference is the 1999–2000 AusDiab study. In this study, 23% of Australians aged 25 years and over had an increased risk of health problems and 30% had a substantially increased risk of health problems, based on their waist circumference. A higher proportion of males (81%) and females (83%) aged 25 years and over with measured diabetes were abdominally overweight compared with males and females without diabetes (53%) (Figure 3.6).

Table 3.2: Prevalence of overweight (measured) based on body mass index[(a)], people aged 25 years and over, 1999–2000 (per cent)

	People with diabetes			People without diabetes		
	Males	Females	Persons	Males	Females	Persons
Not overweight	15.7	21.0	19.9	33.0	49.6	41.4
Overweight but not obese	26.4	19.6	23.4	49.7	30.5	39.9
Obese	58.0	59.4	56.7	17.3	20.0	18.7
Overweight[(b)]	**84.4**	**79.0**	**80.1**	**66.9**	**50.4**	**58.6**

(a) See Box 3.3 for classification of body mass index.
(b) Includes both overweight and obese, classified as BMI >25.0.
Notes
1. Based on measured data.
2. Directly age-standardised to the 2001 Australian population.
3. Column totals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.
Source: AIHW analysis of the 1999–2000 AusDiab study.

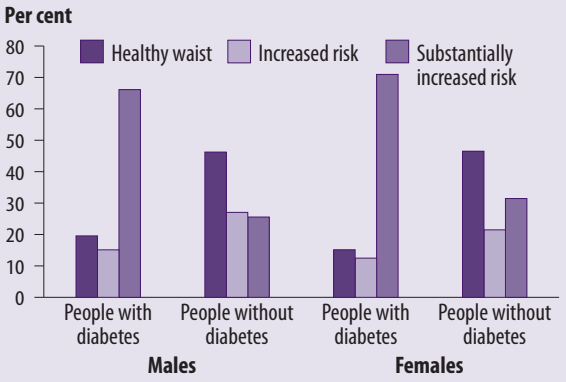
Results from the 1999–2000 AusDiab study indicated that more people with diabetes were on the upper spectrum of the abdominal overweight scale (substantially increased risk of health problems) compared with those without diabetes (Figure 3.6).



Notes
1. See Box 3.3 for classification of body mass index.
2. Directly age-standardised to the 2001 Australian population.
3. Missing values were excluded from the numerator and the denominator

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.5: Prevalence of overweight (self-reported) based on body mass index, people aged 15 years and over, 2004–05



Notes
1. See Box 3.3 for classification of body mass index.
2. Directly age-standardised to the 2001 Australian population.
3. Subtotals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab Study.

Figure 3.6: Prevalence of overweight (measured) based on waist circumference among people aged 25 years and over, 1999–2000

Tobacco smoking

Tobacco smoking increases the risk of developing diabetes-related complications such as coronary heart disease, stroke, peripheral vascular disease and kidney disease (AIHW 2005a; ACDS 2004; Eliasson 2003). Exposure to environmental smoke, or passive smoking, has also been found to increase the risk of coronary heart disease in non-smokers (National Drug Strategy 2002; USDHHS 2006).

Research from a range of prospective studies has shown that quitting tobacco smoking can reduce the risk of developing Type 2 diabetes (Foy et al. 2005; Patja et al. 2005; Carlsson et al. 2004; Eliasson 2003; Wannamethee et al. 2001).

People who stop smoking may reduce their risk of developing Type 2 diabetes to that of people who have never smoked (Foy et al. 2005). In their analysis of the British Regional Health Study, Wannamethee et al. (2001) found that the risk of developing diabetes decreased with time since quitting smoking tobacco, and the benefits were apparent within about 5 years.

What is tobacco smoking?

Tobacco smoking includes the smoking of tobacco products such as packet cigarettes, roll-your-own cigarettes, pipes and cigars.

People who smoke inhale a range of chemicals. The addictive substance in cigarettes is nicotine, but a range of other noxious substances, such as carbon monoxide and cadmium are also inhaled (Foy et al. 2005).

How many Australians smoke?

Prevalence

According to the 2004 National Drug Strategy Household Survey (NDSHS), just over one in six Australians aged 14 years and over (17.4%, 2.9 million) smoked on a daily basis (AIHW 2005e). More than half had never smoked (52.9%).

Trends

Smoking rates have been declining since the 1950s (AIHW 2006a). Between 1995 and 2004,

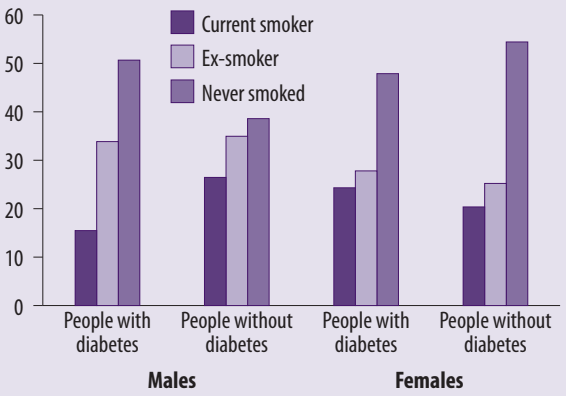
the prevalence of smoking for males and females declined by 7.3 and 5.5 percentage points, respectively (AIHW 2005e).

Smoking and people with diabetes

The 2004–05 NHS also provides information on the prevalence of smoking among people aged 18 years and over and, unlike the NDSHS, the 2004–05 NHS can be used to compare the prevalence of smoking among people with and without diabetes.

In 2004–05, among people with diagnosed diabetes more females currently smoked (24%) than males (16%). This is in contrast to people without diabetes where more males (27%) currently smoked than females (20%) (Figure 3.7).

In 2004–05, 34% of males and 28% of females with diabetes were ex-smokers compared with 35% of males and 25% of females without diabetes. A further 51% of males and 48% of females with diabetes had never smoked, compared with 39% and 54% of males and females without diabetes (Figure 3.7).



Notes
1. Current smoker includes people who reported smoking daily, at least once a week or less than weekly.
2. Based on self-reported data.
3. Directly age-standardised to the 2001 Australian population.

Source: AIHW analysis of ABS 2004–05 National Health Survey data.

Figure 3.7: Prevalence of smoking among people aged 18 years and over, 2004–05

High blood pressure

High blood pressure (also known as hypertension) is a major risk factor known to contribute to, or lead to, the development of diabetes complications including cardiovascular disease, kidney disease and diabetic eye disease. The risk of cardiovascular disease increases as the level of blood pressure increases. When high blood pressure is controlled, the risk of cardiovascular disease and overall mortality is reduced, but not necessarily to the levels of unaffected people (WHO–ISH 1999).

High blood pressure is more likely to occur in people who are obese, physically inactive and consume high levels of dietary salt and/or alcohol (NHMRC 2004). Psychological stress is likely to have an indirect effect by influencing harmful health behaviours associated with high blood pressure (WHO 2002). Lifestyle modification plays an important role in preventing and managing high blood pressure.

What is blood pressure?

Blood pressure is the force of blood on the artery walls as the heart pumps it around the body. It is expressed as a ratio, for example 120/80 mmHg, stated as '120 over 80'. The first number is the systolic blood pressure, which represents the maximum pressure in the arteries when the heart contracts to pump blood. The second number is the diastolic blood pressure, which represents the minimum pressure in the arteries when the heart relaxes.

The WHO (1999) defines high blood pressure as:

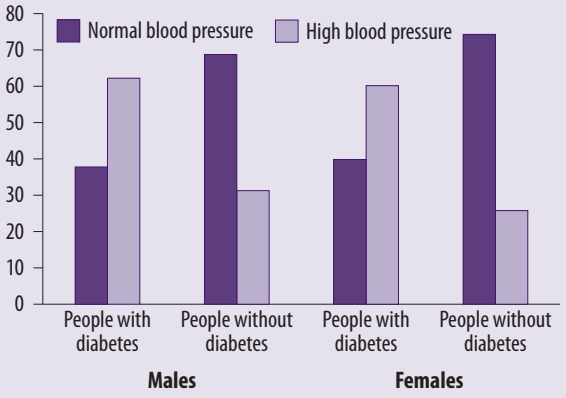
- systolic blood pressure of 140 mm Hg or more or
- diastolic blood pressure of 90 mm Hg or more or
- receiving medication for high blood pressure.

There is evidence that people with diabetes are at greater risk of cardiovascular disease at equivalent blood pressure levels than people without diabetes; as such, the NHMRC recommends that high blood pressure in people with Type 2 diabetes be defined as more than 130/80 mmHg (NHMRC 2004).

How many Australians have high blood pressure?

Prevalence

Based on measured data from the 1999–2000 AusDiab study, 30% of Australians had high blood pressure. People with diabetes (60%) had much higher rates of high blood pressure compared with people without diabetes (28%). Overall, males with and without diabetes (62% and 31%, respectively) had slightly higher rates of high blood pressure than their female counterparts (60% and 26%, respectively) (Figure 3.8).



Notes
1. Based on measured data.
2. Directly age-standardised to the 2001 Australian population.
3. Subtotals may not add to 100.0 due to rounding.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.8: Prevalence of high blood pressure among people aged 25 years and over, 1999–2000

Another source of information for the prevalence of measured high blood pressure is the North West Adelaide Health Study. In this study, 27% of study participants had high blood pressure and the prevalence of high blood pressure was significantly higher among people with diabetes than people without diabetes (Grant et al. 2005).

Trends

Between 1995 and 1999–2000, the prevalence of high blood pressure among people aged 25 years or over remained about the same—31% in 1995 and 30% in 1999–2000 (AIHW 2006a).

Longer-term trends are available only for the urban population. They indicate that the prevalence of high blood pressure more than halved for males aged 25 to 64 years (from 47% in 1980 to 21% in 1999–2000) and halved for females of the same ages (from 32% in 1980 to 16% in 1999–2000) (AIHW 2006a).

High cholesterol and high triglycerides

People with diabetes, particularly those with Type 2 diabetes, often have high levels of LDL cholesterol ('bad' cholesterol) and triglycerides. Both of these conditions are risk factors for diabetes-related complications, coronary heart disease and stroke (Rewers and Hamman 1995). For most people, saturated animal fat in the diet is the main cause of raised cholesterol levels, although genetic factors may also play a role (NHFA 1999). Maintaining a healthy lifestyle through moderate physical activity and balanced nutrition plays an important role in reducing the risks associated with high LDL-cholesterol and triglycerides (NHFA & CSANZ 2001).

What are cholesterol and triglycerides?

Cholesterol is a fatty substance produced by the liver and carried by the blood to the rest of the body. Its natural function is to provide material for cell walls and for steroid hormones. If levels in the blood are too high, this can lead to the artery-clogging process known as atherosclerosis that can trigger heart attacks, angina or stroke. This process may be intensified by diabetes. The risk of heart disease increases steadily from a low base with increasing blood cholesterol levels. A total cholesterol level of 5.5 mmol/L or more is considered 'high'.

Total cholesterol has several parts:

- LDL cholesterol, often known as 'bad' cholesterol. Excess levels of LDL cholesterol are the main way that cholesterol contributes to atherosclerosis.
- High-density lipoprotein (HDL) cholesterol, often known as 'good' cholesterol. High levels

of HDL have a protective effect against heart disease by helping reduce atherosclerosis.

Triglyceride is another form of fat that is made by the body. Its levels can fluctuate according to dietary fat intake and under some conditions excess levels may contribute to atherosclerosis.

How many Australians have high cholesterol and triglycerides?

Prevalence

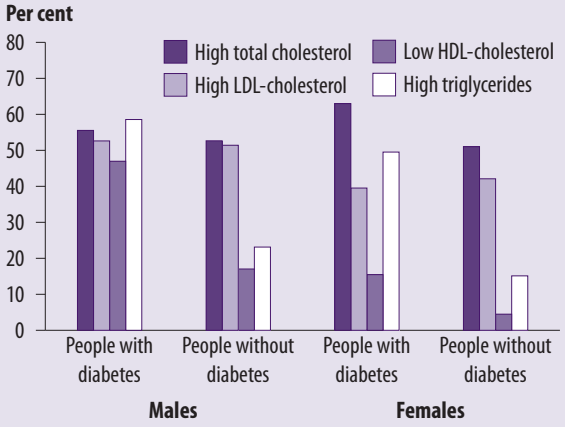
According the the AusDiab study, among Australians aged 25 years and over, 51% had high total cholesterol, 11.5% had low levels of HDL-cholesterol, 46% had high levels of LDL-cholesterol and 21% had high triglyceride levels in 1999–2000.

Using the same data source, total cholesterol levels were higher in people with diabetes: 56% of males and 63% of females with diabetes had high total cholesterol compared with 53% of males and 51% of females without diabetes. Even larger differences were found for HDL-cholesterol and triglycerides. The prevalence of low levels of HDL-cholesterol was 47% in males and 15% in females with diabetes compared with 17% and 4% respectively in people without diabetes. High triglyceride levels were observed among 59% of males and 50% of females with diabetes compared with 23% of males and 15% of females without diabetes (Figure 3.9).

The North West Adelaide Health Study also found that the prevalence of high blood cholesterol was significantly higher among people with diabetes than people without diabetes (Grant et al. 2005).

Trends

Trends in the prevalence of high blood cholesterol are only available to the year 2000 for people aged 25–64 years living in capital cities and show that there has been no apparent change in the prevalence of high blood cholesterol since 1980 (AIHW 2006a).



Notes

1. See Appendix 1 for definitions of blood lipid risk factors.
2. Based on measured data.
3. Directly age-standardised to the 2001 Australian population.
4. Missing values were excluded from the numerator and the denominator.

Source: AIHW analysis of the 1999–2000 AusDiab study.

Figure 3.9: Prevalence of blood lipid risk factors among adults, 1999–2000