

## Original Article

# Importance of preventing weight gain in adulthood

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In the last 20 years, there has been a dramatic upsurge in the average weight of Australian adults. In this period, on average, Australian women have gained 4.8 kg, whilst Australian men have gained 3.6 kg. Consequently, the prevalence of obesity in men has increased from 8% to 19% and in women from 7% to 21%. This threatens to wipe away many recent health gains, as obesity has been associated with a wide range of chronic and debilitating illnesses, such as diabetes, heart disease, some cancers, sleep apnoea and osteoarthritis. Any weight gain in adulthood is usually as a result of an increase in fat stores, and the risk of ill-health from increasing weight actually begins at quite low BMI. Unfortunately, weight gain can be difficult or slow to reverse in the middle years because of physiological and behavioural changes that occur at this time of life. Adults should focus on preventing or minimizing weight gain over time by retaining physical activity within their daily living and by sensible dietary changes. Even if weight gain does occur with age, a regimen of regular exercise and a diet rich in fruit and vegetables and low in fat will provide some protection against a rapid decline in health.

**Key words:** Body composition, obesity, prevention, risk factors, weight gain.

### Introduction

During the last 100 years there has been enormous advances in the health status of most Australians. Better nutrition, improved living conditions and advances in therapeutic options have led to gains in infant, child and adult health and today most Australians can expect to live an average of 80 years, most of them relatively healthy.<sup>1</sup> As the impact of infectious diseases diminishes in Australia, chronic diseases such as heart disease, stroke and cancer are emerging to replace them as the most important contributors to morbidity and premature mortality. Although there have been improvements in the management of these chronic diseases, their impact on the health of Australians remains significant and is likely to remain so for some time.

The first signs such chronic diseases usually manifest in the middle years of life, although frank illness may not result until later in life. The recently released AusDiab study revealed that risk factors for chronic diseases were extremely high among Australians aged 45–64 years, with approximately 20% displaying impaired glucose tolerance, 35% with hypertension and over 55% with an elevated low density lipoprotein (LDL) cholesterol level.<sup>2</sup> There are likely to be many reasons why the prevalence of these risk factors are so high in the middle years, but the extraordinarily high levels of overweight and obesity in this age group has been identified as being a major contributor. Among 45 to 64-year-olds a staggering 75% of men and 60% of women are either overweight or obese. What is even more alarming is that the rates of obesity within this age group has nearly doubled in the last 20 years, and today more than one-quarter of all Australians in their middle years are obese. This has not only a negative impact on their current health, but if

weight gains continue throughout life, it is likely to result in prolonged periods of poor health or premature death.

### Obesity and weight gain as a health problem

There is a very strong association between increasing body mass index (BMI) and the risk of developing a number of chronic non-communicable diseases, such as type II diabetes, cardiovascular disease, gallbladder disease and certain types of cancer. Information published in the National Health and Medical Research Council of Australia report *Acting on Australia's Weight* suggests that approximately 66% of type II diabetes, 22% of coronary heart disease and 29% of hypertension in Australia can be attributed to obesity.<sup>3</sup>

However, before life-threatening chronic disease develops, many overweight and obese patients develop at least one of a range of debilitating conditions in their middle years, which can drastically reduce quality of life (Table 1). These include musculo-skeletal disorders, respiratory difficulties, skin problems and infertility, which are often costly in terms of absence from work and use of health resources.<sup>4</sup> Sleep apnoea is a serious and potentially life-threatening condition, is highly prevalent in certain pacific communities, and is made much worse by obesity. Excessive bodyweight is also frequently associated with psycho-social problems, much of which appears to result from negative cultural biases and prejudice directed against obese people in Australia.

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Recent analyses have shown that weight gain per se is one of the principal factors associated with increased health risk and this risk is independent of BMI. In 1989, a 40 year retrospective study of Danish draftees showed that hypertension was highest in those men who entered the army with a high BMI, but at any BMI level (in both normal and overweight subjects) the level of hypertension was higher in people who had gained weight in adulthood.<sup>5</sup> Similar interactions between absolute BMI and weight gain in adulthood have been found in the relationship between weight and the development of diabetes in cohort studies in both men,<sup>6</sup> and women.<sup>7</sup> In both these studies, larger weight gains led to an increased risk of diabetes at each level of BMI. The relationship was extremely strong and an assessment of women found that those who entered adulthood very overweight and put on more than 20 kg over the 18 year follow-up period were 70-fold more likely to develop diabetes than those who entered adulthood lean and maintained their weight over time.<sup>7</sup> Similar relationships have been found between weight gain and coronary heart disease, hypertension and gall bladder disease,<sup>8</sup> with the risk of each of these conditions being greater with larger increases in weight (Fig. 1).

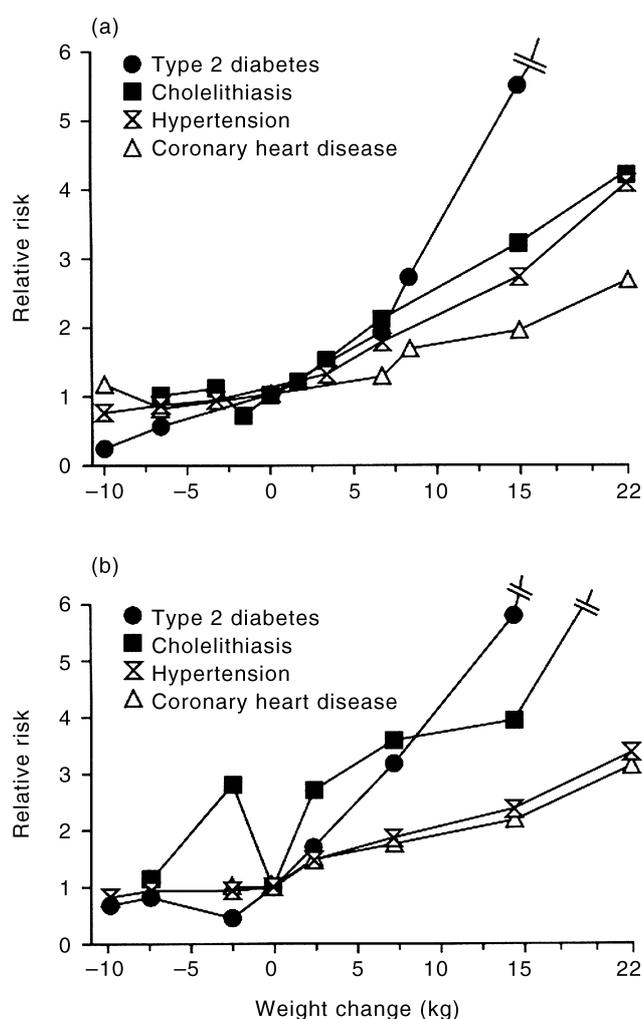
#### Age-related changes in bodyweight, body composition and fat distribution

Cross-sectional data from studies of the Australian population show that the level of overweight and obesity begins to climb rapidly in early adulthood and reaches its peak level in the middle years of life (Table 2).<sup>2,3</sup> This is true for both men and women. These surveys also indicate that rates of overweight and obesity begin to decline from the sixth decade. This has sometimes been falsely interpreted as a decline in the weights of individuals as they get older. However, longitudinal studies indicate that this is a bias created by the disproportionately higher death rate in obese people in middle age and that survivors tend to continue to increase in weight over time until late in life.<sup>9,10</sup>

Even more alarming for those entering their middle years is that increases in bodyweight are also accompanied by changes in body composition, which results in middle-aged and older adults having a higher level of body fatness for any level of BMI when compared to younger adults. Ageing results in a loss of lean muscle tissue in both men and women, and can decline by as much as 40% between the ages of 30 and 70 years.<sup>11</sup> This decline in lean tissue is certainly influenced by a reduction in resistance exercise with age and a decline in the level of circulating anabolic

hormones, such as growth hormone and androgens. It may also be related to dietary changes.

Another detrimental consequence of ageing on the development of obesity-related illness is the increase in the central distribution of body fat that occurs in both men and women with age. This is evident in the increasing level of abdominal overweight found for both sexes in the AusDiab study



**Figure 1.** Relation between change in weight and the relative risk of type 2 diabetes, hypertension, coronary heart disease and cholelithiasis. (a) Women; (b) men. Change of weight from 18 years of age among women in the Nurses' Health Study, initially 30 to 55 years of age, who were followed for up to 18 years. Change of weight from 20 years of age among men in the Health Professionals Follow-up Study, initially 40 to 65 years of age, who were followed for up to 10 years.<sup>8</sup> Copyright 1999 Massachusetts Medical Society. All rights reserved.

**Table 1.** Relative risk of health problems associated with obesity<sup>4</sup>

Greatly increased (relative risk >3)	Type 2 diabetes, hypertension, sleep apnoea, insulin resistance, breathlessness
Moderately increased (relative risk 2–3)	Coronary heart disease, gallbladder disease, osteoarthritis (knees), hyperuricaemia and gout, dyslipidaemia, endometrial cancer
Slightly increased (relative risk 1–2)	Certain cancers (postmenopausal breast cancer, colon cancer), reproductive hormone abnormalities, polycystic ovary syndrome, impaired fertility, low back pain due to obesity, increased anaesthetic risk, fetal defects associated with maternal obesity

(Table 2).<sup>2</sup> Evidence clearly indicates that abdominal fat stores are associated with an increased risk of metabolic disease, such as diabetes and cardiovascular disease, and that this change has the potential to profoundly influence health.<sup>12</sup> In general, men have a higher proportion of body fat stored centrally than women and the level of abdominal fat increases gradually with age. Women generally enter the middle years with a lower level abdominal fat, but it begins to accumulate rapidly within this period so that by the seventh decade of life men and women have a distribution of body fat that is more equal. Some studies have suggested that abdominal obesity does not really increase in women until after the menopause,<sup>13</sup> but other studies indicate that the increase among women is more related to age.<sup>14</sup> The reasons for this increase in abdominal fat accumulation are similar to those that precipitate the decrease in lean muscle tissue, and include a decline in physical activity, changes in the level of sex hormones and lifestyle factors, such as decreased physical activity, and increased smoking, alcohol and positive energy balance.<sup>15</sup>

Certain ethnic groups, such as Asians, Mexican Indians and Australian Aborigines tend to have a higher level of abdominal fat for every level of bodyweight when compared to Caucasians and may preferentially deposit fat centrally.<sup>16</sup> As a consequence, age-related increases in central adiposity may be exaggerated and may occur at younger ages in these groups.

#### Factors contributing to weight gain and associated chronic disease in the middle years

Weight gain and obesity develops when the energy intake from food and drink exceeds the energy expenditure from physical activity and other metabolic processes. Unfortu-

nately, during the middle years of life, changes in dietary and physical activity behaviours, together with physiological changes associated with ageing, tend to make maintenance of the energy balance more difficult. The extent and level of weight gain with age has led some observers to question whether it is possible to prevent weight gain that occurs with age.<sup>17,18</sup>

Energy intake actually declines with age after a reaching a peak in adolescence and early adulthood. This is obvious in cross-sectional studies of dietary intake, such as the 1995 *National Nutrition Survey* in Australia (Table 3), which showed that total energy intake remains relatively stable through the middle years, after an initial decline, until later in life when it drops dramatically.<sup>19</sup> There are no large longitudinal studies of diet in Australia, but studies from the USA support this pattern of energy intake throughout life.<sup>20</sup> Similarly, the intake of fat, and the proportion of energy derived from fat, declines slightly with age, although the absolute level of fat intake is well above what is considered appropriate for maintenance of energy balance.<sup>4</sup> It is interesting to note that in an analysis of changes in nutrient intake between two national dietary surveys in 1983 and 1995, energy intake increased significantly between the two surveys for each age group and fat intake remained stable or dropped very slightly (Table 3).<sup>21</sup> The largest increases in energy intake occurred in the 45–54 year age group and this was not accompanied by any change in fat intake.<sup>21</sup> So, whilst it is clear that changes in energy intake with age do not explain the increase in overweight that accompanies ageing, the extent of the increase in energy intake in the middle years in recent times helps explain the rapid increase in mean bodyweight in this group.

**Table 2.** Age-specific prevalence (%) of overweight as defined by body mass index and excess waist circumference<sup>2</sup>

	25–34 years	35–44 years	45–54 years	55–64 years	65–74 years	75+ years	Total
Body mass index							
Men	60.5	64.2	72.4	74.0	73.1	63.8	67.4
Women	35.1	44.5	58.1	67.6	68.9	52.2	52.0
Total	48.1	54.4	65.3	70.8	70.8	57.1	59.6
Excess waist circumference <sup>†</sup>							
Men	40.1	51.3	58.3	66.6	71.2	64.8	55.2
Women	36.6	46.9	59.1	72.7	79.7	67.5	56.5
Total	38.4	49.1	58.7	69.6	75.9	66.3	55.9

<sup>†</sup>Waist circumference men greater than 94 cm, women greater than 80 cm.

**Table 3.** Comparison of estimated 24-h intake of energy and total fat for adults aged 25–64 years, 1983 and 1995<sup>21</sup>

Age group	Energy (kJ)				Fat (g)			
	25–34	35–44	45–54	55–64	25–34	35–44	45–54	55–64
Men								
1983	11 739	11 019	10 260	9539	117	107	99	92
1995	12 283	11 339	10 922	9377	110	103	98	80
Women								
1983	7928	7162	7060	6650	79	72	69	65
1995	8326	7511	7597	6577	77	67	68	57

Although energy intake decreases with age, there is also a significant decrease in energy expenditure with age. Part of this decrease in energy expenditure can be explained by a reduction in resting metabolic rate that accompanies ageing. Approximately three-quarters of this decline can be explained by changes in lean muscle tissue, which occurs with age,<sup>22</sup> and there may also be changes in the thermic effect of feeding. However, there is also a very clear reduction in physical activity that occurs with age. Repeated surveys of self-reported levels of physical activity in Australian adults show that the proportion of adults who are achieving the minimal level of activity (150 min of moderate-intensity activity per week) declines with age (Fig. 2).<sup>23</sup> This has also been declining with time, so that only 41% of adults aged 45–59 years were reaching this modest level of activity each week.

Another factor that has been implicated in increasing levels of overweight in women the middle years is excessive weight gain during pregnancy and its retention after childbirth. A recent USA study has shown that a pregnancy weight gain of 40 lb (18 kg) leads to a 40% increased risk of breast cancer later in life.<sup>24</sup>

#### When does weight gain become a problem?

When initial BMI cut-off points were defined for overweight and obesity, a great deal of attention was directed at identifying the relationship between weight and mortality. Most studies at that time showed a U- or J-shaped association, with higher mortality rates at both upper and lower body-weights, and where substantial increases in relative risk for mortality do not occur until BMI reaches approximately 27–28 kg/m<sup>2</sup>.<sup>25</sup> As a result, it was assumed that a weight below this level could be considered healthy. However, more recent studies that have controlled for confounding factors, such as age, cigarette smoking and weight loss associated with illness, have found an almost linear, continuous association between BMI and mortality with no specific threshold.<sup>9</sup> The relationship between weight and risk of many common, chronic conditions is also continuous and graded,

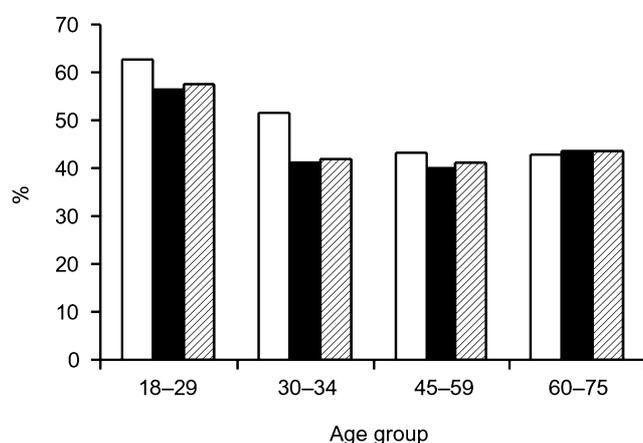
with risk beginning to increase from a BMI below 21 kg/m<sup>2</sup>. This means that the risk of coronary heart disease in women at a BMI of 26 is already twice that of a women with a BMI of 21, while for men the risk is 1.5-fold greater than for those with a BMI of 26 compared to 21.<sup>8</sup> The same comparison for diabetes shows an eightfold increase in risk in women and a fourfold increase in men. Therefore, assessments of the health risks associated with different grades of overweight can be misleading, as even modest increases in weight in adults who are within the acceptable BMI range can result in quite significant increases in health risk. Similarly, in those who already have a high BMI, the risk of ill-health continues to increase if they continue to put on weight.

Weight gain in the middle years needs to be tackled early, rather than waiting for BMI and waist measurements to reach designated cut-off points. In addition, the longer the weight-gain process goes on, the more difficult it becomes to make significant enough changes to dietary and physical activity behaviours to reduce weight back to its original level as the body strives to form a new energy equilibrium. In contrast, the small changes necessary to prevent weight gain early in the dynamic phase, when weight first begins to increase, are likely to be easier to initiate and sustain.

#### What is required to prevent weight gain

Very few trials have been established to evaluate the most effective strategies for the prevention of weight gain in adulthood amongst the general community. Two recent systematic reviews of interventions to prevent obesity in adults could only identify four appropriate trials.<sup>26,27</sup> None of the trials, which were based on a range of educational strategies, was able to show any significant reduction in weight gain over the controls, although some gains were achieved. However, prevention of weight gain or minor weight loss in high-risk groups has been shown to be extremely effective in the prevention of development of weight-related illness, such as hypertension, type II diabetes and cardiovascular disease. Two recent trials using people with impaired glucose tolerance have shown substantial benefits in terms of reduced diabetes incidence from programmes of modest dietary change, based on low-fat eating, combined with improved physical activity.<sup>28,29</sup> In the larger study from the USA the intervention group reduced their diabetes incidence rate by 57%, with those over 60 years of age showing nearly a 75% reduction.<sup>29</sup> However, a recent analysis by the International Obesity Task Force has shown that the level of physical activity required to prevent weight gain in our modern sedentary lifestyle is much greater than the 30 min each day recommended to reduce the risk of other chronic diseases.<sup>30</sup>

These results also agree with an analysis of the features of successful participants in the *Pound of Prevention* community weight gain prevention trial in the USA.<sup>31</sup> This study showed that those who ate the greatest amount of fat were the most likely to gain weight, and the individuals least likely to gain weight were those who exercised hard and frequently. The authors concluded that attention to exercise,



**Figure 2.** Percentage of people achieving sufficient activity time and sessions, by age group.<sup>23</sup> □, 1997; ■, 1999; ▨, 2000.

fat and total calorie intake are all important in preventing weight gain as we age.

### Conclusions

Weight gain during the middle years has been shown to be associated with greatly increased risk of a range of chronic and debilitating illness. Recent studies have clearly shown that prevention of middle-age weight gain has major positive effects on adult health. Prevention of weight gain prevents most adult-onset diabetes, reduces the development of hypertension and reduces lipid disorders. All of these factors in turn reduce the risk of heart disease. There are many reasons why programmes to tackle the problem of overweight and obesity should focus on the prevention (or minimization) of weight gain in adulthood. Such an approach presents a clear and simple message, which is equally relevant to all members of the community, regardless of their age, gender, ethnicity or current level of BMI. Obese individuals will also benefit from additional advice and support at an individual level, to assist them to achieve and sustain a modest weight loss. Such an approach should also prevent further stigmatization of obese persons and ameliorate concern that the effective management of obesity by necessity increases the risk of eating disorders.

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