

## Guidance on Overweight, Obesity and Cancer Risk

### Key Messages

Obesity is defined as having a body mass index (BMI) of over 30 and being overweight as over 25. Weight gain and obesity develop when the energy intake from food and drink exceeds energy expenditure from physical activity and other metabolic processes.

Obesity is a risk factor for cancer, as well as many other chronic diseases, such as cardiovascular disease and type 2 diabetes.

There is *convincing* evidence that overweight and obesity are a risk factor for cancers of the colon, kidney, pancreas, oesophagus, endometrium and breast (in post-menopausal women). In addition, excess body fat *probably* increases the risk of gallbladder cancer and there is *limited suggestive* evidence that overweight and obesity increases the risk of liver cancer. However, excess body fat *probably* decreases the risk of pre-menopausal breast cancer.

The Cancer Society recommends people maintain a healthy body weight within a BMI range of 18.5 to 25, and have a waist measurement less than 80cm for women and less than 90cm for men.

To achieve and maintain a healthy weight, the Cancer Society recommends regular physical activity and eating according to energy needs. Serving moderate portion sizes and making fruit, vegetables, cereals and other low fat foods the basis of the diet may assist with achieving and maintaining a healthy body weight.

In addition, mothers are encouraged to breastfeed infants exclusively until they are ready for extra food at around six months, continuing with complementary breastfeeding after the introduction of appropriate solids. Breastfeeding can help to prevent overweight and obesity in children and protect mothers from breast cancer.

### Background

Obesity is defined as having a body mass index (BMI) of over 30 and being overweight as over 25 (Table 1).<sup>1</sup> BMI is calculated by taking a person's weight in kilograms and dividing by their height in metres squared ( $\text{kg}/\text{m}^2$ ).

Table 1: Body mass index (BMI) definitions according to the World Health Organization <sup>1</sup>

| Category       | BMI ( $\text{kg}/\text{m}^2$ ) |
|----------------|--------------------------------|
| Underweight    | <18.5                          |
| Healthy weight | 18.5-25                        |
| Overweight     | 25-30                          |
| Obese          | >30                            |

Higher BMI's may be found in healthy athletes due to increased muscle mass. Higher BMI cut-off points are used to classify Māori and Pacific adults as overweight and obese (26 and 32 respectively), based on evidence that at an equivalent BMI, Māori and Pacific adults had a lower percentage of body fat than European adults.<sup>2</sup>

**Table 2: New Zealand ethnic-specific BMI cut-off points for adults**

| New Zealand classification | European/Other and Asian | Māori and Pacific |
|----------------------------|--------------------------|-------------------|
| Underweight                | < 18.50                  | < 18.50           |
| Normal range               | 18.50-24.99              | 18.50-25.99       |
| Overweight                 | 25.00-29.99              | 26.00-31.99       |
| Obese                      | ≥ 30.00                  | ≥ 32.00           |

Another indicative measure of overweight and obesity is waist circumference. A waist measurement (around the narrowest point for women or around the navel for men) over 80cm for women or over 90cm for men also indicates being overweight.<sup>2</sup> A waist circumference of more than 88cm for women and 102cm for men indicates that their risk of disease is substantially increased.<sup>2</sup>

**Table 3: Waist circumference cut-off points for adults aged 18 years and over <sup>2</sup>**

| Risk of metabolic complications | Men       | Women    |
|---------------------------------|-----------|----------|
| Average risk                    | < 94 cm   | < 80 cm  |
| Increased risk                  | 94-101 cm | 80-87 cm |
| Substantially increased risk    | ≥ 102 cm  | ≥ 88 cm  |

Weight gain and obesity develop when the energy intake from food and drink exceeds energy expenditure from physical activity and other metabolic processes.<sup>1</sup>

### **Burden of Disease Related to Obesity**

Obesity is regarded as a risk factor for cancer, as well as many other chronic diseases, such as cardiovascular disease (heart disease and stroke) and type 2 diabetes.

In Australia, obesity accounts for 3.9 percent of the total cancer burden and causes an estimated 7.5 percent of the total burden of disease and injury.<sup>3</sup> Figures from Europe attribute 5 percent of cancers to being overweight.<sup>4</sup> A large cohort study in the USA estimated that 14 percent of all deaths from cancer in men and 20 percent of those in women could be attributed to overweight and obesity.<sup>5</sup>

In New Zealand an estimate of the impact of higher than optimal BMI on cancer mortality put the figure at four percent of all cancer deaths. However, the authors note this is likely to be an underestimate since only colorectal and post menopausal breast cancers were included in the calculation and the risk coefficients used were conservative.<sup>2</sup>

Breast cancer is the leading cause of death in females, accounting for almost 20 percent of all cancer deaths in women. Over 80 percent of breast cancer deaths are post-menopausal. It is estimated that approximately 15-20 percent of post-menopausal breast cancer deaths in 1997 could be attributed to 'high' BMI.<sup>2</sup>

Approximately 15 percent of colorectal cancer was attributable to 'high' BMI in older age groups of New Zealanders (65 years and older), when the most colorectal cancer deaths occur.<sup>2</sup>

In 2004, colorectal and breast cancer, which are two of the three leading cancer registrations and causes of death in New Zealand, have convincing evidence of BMI being a risk factor.<sup>6</sup>

In the same year cancer was the leading cause of death in New Zealand accounting for 28.4 percent of deaths. Deaths from cancer increased by 1.5 percent from 2003 and 9.7 percent from 1995.<sup>6</sup>

### **Obesity and Cancer Prevention: Epidemiological Evidence**

The World Cancer Research Fund (WCRF) recently released a comprehensive report on food and the prevention of cancer.<sup>7</sup> The report found *convincing* evidence that excess body fat is a risk factor for cancers of the colon, kidney, pancreas, oesophagus, endometrium and post-menopausal breast cancer.<sup>7</sup> It also found that excess body fat *probably* increased the risk of gallbladder cancer and there was *limited suggestive* evidence that excess body fat increased the risk of liver cancer.<sup>7</sup> However, excess body fat was also found to *probably* decrease the risk of pre-menopausal breast cancer.<sup>7</sup>

The WCRF found that abdominal fatness was *convincingly* associated with an increased risk of colorectal cancer, and *probably* increased the risk of cancer of the pancreas, endometrium and breast (in post-menopausal women).<sup>7</sup> The WCRF also found that weight gain in adulthood *probably* increases the risk of post-menopausal breast cancer.<sup>7</sup>

Table 4 describes the proportion of cancer attributable to overweight and obesity factors.<sup>5,8,9</sup>

**Table 4: Proportion of cancers attributable to overweight and obesity.**<sup>5,8,9</sup>

| Cancer Type                   | Proportion of incidence attributable to overweight or obesity | Aspects of the association between overweight or obesity and cancer  |
|-------------------------------|---|--|
| Endometrial cancer            | 39%   | Women with a BMI of >25 have a two- to three-fold increase in risk<br><br>Limited evidence suggests risk is similar in pre- and post-menopausal women<br><br>Risk is greater with upper body obesity                                 |
| Oesophageal adenocarcinoma    | 37%   | Strong association between being overweight and adenocarcinomas of the lower oesophagus and the gastric cardia, with a two-fold increase in risk in individuals with a BMI of >25<br><br>Association seems greater in men than women |
| Renal (kidney) cancer         | 25%   | Individuals with a BMI of >30 have a two- to three-fold increase in risk compared to those below 25<br><br>The effect is similar in men and women  |
| Gallbladder cancer            | 24%   | Limited evidence available but there is a suggestion of almost a two-fold risk, especially in women  |
| Colon cancer                  | 11%   | Association seems greater in men than women<br><br>Risk not dependent on whether person has been overweight in early adulthood or later in life  |
| Post-menopausal breast cancer | 9%  | Increase in risk of 30% in women with a BMI >28 compared to those with a BMI of <21  |

### Potential Metabolic Mechanisms

Excess body weight may influence cancer risk because they:

- lead to elevated levels of insulin-like growth factor 1 (IGF-1), insulin and leptin, which can promote the growth of cancer cells.<sup>7</sup> Excess body weight (particularly abdominal fatness) exacerbates insulin resistance which leads to the pancreas producing more insulin. Hyperinsulinaemia increases the risk of colon and endometrial cancer, and possibly pancreatic and kidney cancer.<sup>9</sup> Increased circulating leptin levels are associated with an increased risk of colorectal and prostate cancer.<sup>10,11</sup>
- increase sex steroid hormones, including oestrogens, androgens and progesterone.<sup>7</sup> Adipose tissue is the main site of oestrogen synthesis in men and post-menopausal women.<sup>9</sup> Increased insulin and IGF-1 levels (from body fatness) result in higher oestradiol levels in men and women,<sup>9</sup> and testosterone levels in women.<sup>7</sup> Higher sex hormone levels are particularly associated with endometrial and post-menopausal breast cancer.<sup>12,13</sup> Body fatness may protect against pre-menopausal breast cancer, as obese women tend to have anovulatory menstrual cycles, which leads to lower levels of oestrogen.<sup>7</sup>

- raise the inflammatory response which can promote cancer development.<sup>7</sup> Obesity has been described as a state of low-grade chronic inflammation. Adipose tissue produces pro-inflammatory factors, and obese people have higher levels of tumour necrosis factor alpha (TNF- $\alpha$ ), interleukin-6 and C-reactive protein than normal weight individuals.<sup>14</sup> Leptin is also higher with excess body weight, and it can function as an inflammatory cytokine.<sup>16</sup>

### Factors Influencing Body Weight

People take in energy from food and drinks, which is used for the body's natural processes and for physical activity. People gain weight if they take in more energy than they expend, and lose weight if they take in less energy than they use. Excess energy is stored mostly as body fat.

Environmental factors are extremely important in determining health behaviours, especially those that affect body weight. However, there are many different factors that may contribute to overweight and obesity. (Table 5)

Table 5: Factors that are linked to weight gain and obesity<sup>15</sup>

| Evidence     | Decreased Risk   | Increased Risk  |
|--------------|--|---|
| Convincing   | <ul style="list-style-type: none"> <li>• Regular physical activity</li> <li>• High intake of dietary fibre</li> </ul>                                    | <ul style="list-style-type: none"> <li>• Sedentary lifestyles</li> <li>• High intake of *energy-dense and micronutrient-poor foods</li> </ul>   |
| Probable     | <ul style="list-style-type: none"> <li>• Home and school environments that support healthy food choices for children</li> <li>• Breastfeeding</li> </ul> | <ul style="list-style-type: none"> <li>• Heavy marketing of *energy-dense foods and fastfood outlets</li> <li>• High intake of sugar-sweetened soft drinks and fruit juices</li> <li>• Adverse economic conditions</li> </ul> |
| Possible     | <ul style="list-style-type: none"> <li>• Low glycaemic index foods</li> </ul>  | <ul style="list-style-type: none"> <li>• Large portion sizes</li> <li>• High proportion of food prepared outside the home</li> <li>• “Rigid restraint” and “periodic disinhibition” eating patterns</li> </ul>                |
| Insufficient | <ul style="list-style-type: none"> <li>• Alcohol</li> </ul>  |   |

\*Energy-dense and micronutrient-poor foods tend to be processed foods that are high in fat and/or sugars. Low energy-dense foods, such as fruit, legumes, vegetables and whole grain cereals, are high in dietary fibre and water.

In children specifically, overweight and obesity are influenced by a lack of sufficient activity and excessive time spent in sedentary activities.<sup>16</sup> Poor food habits such as low fruit and vegetable intake, consumption of soft drinks, confectionery and fast food and skipping meals are also contributing factors.<sup>16</sup>

### Breastfeeding and Birth Weight

The WCRF reported that being breastfed *probably* decreases the risk of weight gain and becoming overweight or obese.<sup>7</sup> In addition, breastfeeding *convincingly* decreases a woman's chance of developing breast cancer and there is *limited suggestive* evidence that it can decrease the risk of ovarian cancer.<sup>7</sup> Furthermore, breastfeeding is known to help protect infants against infections and other childhood diseases.<sup>7</sup>

Higher birth weights have been linked to a *probable* increased risk of breast cancer in pre-menopausal women.<sup>7</sup>

## **Body Weight and Cancer Survival**

As well as a healthy body weight being associated with preventing cancer, it is also associated with preventing cancer recurrence and improving survival for people diagnosed with cancer.<sup>17</sup> There is a reasonable level of evidence that weight management and physical activity positively impacts on quality of life, cancer recurrence and overall survival for cancer survivors.<sup>18</sup> Randomised controlled trials, such as the Women's Intervention in Nutrition Study (WINS), have shown encouraging results of the effectiveness of nutrition and physical activity interventions in improving outcomes for cancer survivors.<sup>17</sup>

## **Weight Loss and Cancer Risk**

Up to now we have known that excess body weight increases cancer risk, but there has been a dearth of evidence to suggest whether losing weight would lower cancer risk. Recent evidence indicates that weight loss in those who are overweight lowers breast cancer risk.<sup>19</sup> This is probably linked to the fall in circulating oestrogen levels seen with weight reduction.<sup>19</sup>

## **Prevalence of Obesity in New Zealand Adults**

Mean BMI and the prevalence of overweight and obesity have been increasing in developed countries for the last two decades. The speed and extent of the increase in obesity has led the World Health Organization (WHO) to describe it as an epidemic.<sup>22</sup>

In New Zealand adults aged 15 years and over, the prevalence of obesity increased from 9.5 to 14.7 percent in males and from 12.6 to 19.2 percent in females between 1989 and 1997, an increase of more than 50 percent for both males and females.<sup>21</sup> During the same eight-year period, mean BMI increased from 25.3 to 26.2 kg/m<sup>2</sup> in males and from 24.7 to 26.1 kg/m<sup>2</sup> in females.<sup>2</sup>

The 2002/03 New Zealand Health Survey<sup>22</sup> reported that:

- one in five (20.8 percent) New Zealand adults were obese
- one in three adults (32.5 percent) was overweight (excludes obese)
- obesity in New Zealand adults over 15 years old has increased to 21 percent, the prevalence in 1989 was 11 percent, and in 1997 it was 17 percent.
- 27 percent of Māori men were obese
- 27 percent of Māori women were obese
- 36 percent of Pacific men were obese
- 47 percent of Pacific women were obese.
- over half of all adults had gained 10kg more since age 18
- males (40.5 percent; 38.3-42.8 percent) were significantly more likely than females (27.5 percent; 25.8-29.2 percent) to be overweight
- in both males and females, the prevalence of obesity was significantly higher in NZDep2001 quintile 5 (most deprived) than quintile 1 (least deprived).

The 2006/07 New Zealand Health Survey showed no significant change from these figures.<sup>23</sup>

## **Prevalence of Obesity in New Zealand Children**

The 2006/07 New Zealand Health Survey identified that;

- 29 percent of children were either overweight or obese.
- the mean BMI for Pacific children was 21.1.
- the mean BMI for Māori children was 19.4
- the mean BMI for European/other children was 18.3
- the mean BMI for Asian children was 18.1

- there were no significant differences between boys and girls within ethnic groups and there has been no change in children aged 5-14 years since 2002
- there has been a decrease in the mean BMI for Māori children, from 22.1 in 2002 to 19.9 in 2006/7
- almost half the overweight 7 year-olds in a Dunedin study were still overweight at 21; leaner children became overweight too.<sup>24</sup>

Obese children have a 25-50 percent chance of progression to adult obesity and it may be as high as 78 percent in older obese adolescents.<sup>25</sup> The significant risk for childhood obesity to continue into adulthood makes it a priority for targeted preventive action.

### **Recommendations**

The Cancer Society supports the recommendations people:

- maintain a healthy body weight within a BMI range of 18.5 to 25; and
- have a waist measurement less than 80cm for women and less than 90cm for men.

It is also preferable that people be as lean as possible within the healthy body weight range and avoid weight gain and increases in waist circumference throughout adulthood.

To achieve and maintain a healthy body weight, the Cancer Society recommends regular physical activity and eating according to energy needs. Serving moderate portion sizes and making fruit, vegetables, cereals and other low fat foods the basis of the diet may assist with achieving and maintaining a healthy body weight.

Preventing excess weight gain in children is also a priority, as obese children have a greater risk of becoming obese adults.<sup>26</sup> The Cancer Society recommends that growth should be checked regularly in young children and physical activity encouraged.

In addition, the Cancer Society supports the Food and Nutrition Guidelines for Healthy Infants and Toddlers (Aged 0-2), which recommend breastfeeding be encouraged and supported.<sup>25</sup> The Cancer Society encourages mothers to breastfeed infants exclusively until they are ready for extra food at around six months and to continue with complementary breastfeeding after the introduction of appropriate foods.

### **Future Research**

More studies are needed on the association between body weight and cancer risk. In the future, there is a need for more studies that:

- investigate further the effect of childhood obesity on long term cancer risk
- Explore and evaluate successful strategies to help people maintain a healthy body weight long term
- Determine how weight loss and weight loss methods can influence cancer risk.

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Page 8 of 9

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