Body Weight, Nutrition, Alcohol and Physical Activity:

Key Messages for The Cancer Council Australia

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1. Introduction

The Cancer Council recommends maintaining a healthy body weight, regular physical activity and eating a healthy diet to lower the risk of certain cancers.

There is accumulating evidence that body weight and physical activity influence the risk of some types of cancers. The effect of diet is less clear, but over-consumption of energy is likely to be a determinant of some types of cancer and there are some other aspects of diet that are associated with cancer risk.

These factors are also associated with other common chronic diseases of mid to late life, including type 2 diabetes and cardiovascular disease. Fortunately, there tends to be convergence on the public health recommendations that can be made on the basis of epidemiological evidence in relation to various chronic diseases. Thus, encouraging healthy body weight, increased consumption of fruits and vegetables, and increased physical activity should help in prevention and treatment of type 2 diabetes and heart disease, and prevention of some cancers.

This document summarises current national recommendations and population trends concerning body weight, nutrition, and physical activity. Where special recommendations apply in relation to cancer that differ from the general recommendations, these are also presented. Epidemiological evidence on the associations between body weight, physical activity, diet and cancer risk is also summarised. Much of the material presented is quoted directly from the publication sources cited.

2. Useful Summary Statements

2.1. Body Weight

- To achieve and maintain a healthy weight, The Cancer Council recommends regular physical activity and eating according to your energy needs. Making fruit, vegetables, cereals and other low fat foods the basis of your diet may assist with achieving and maintaining healthy body weight.
- Obesity increases the risk of cancer of the endometrium, kidney, breast (postmenopausal), colon and oesophagus.[1, 2]
- "High body mass" was responsible for 3.9% of the burden of disease from cancer in Australia in 2003.[3]
- The prevalence of obesity in Australia has more than doubled in the past 20 years.[4]
- In 2003/4, one in four children in NSW and WA were overweight or obese.[5, 6]
- The prevalence of overweight and obesity among Australian children has increased rapidly over recent years.[7]
- Waist circumference greater than 102 cm for men and 88 cm for women, which is a marker of central obesity, might be a better predictor of cancer risk than BMI.[8, 9]

2.2. Physical Activity

- Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.[10]
- 30 mins/day of moderate intensity activity is recommended for good general health, although some evidence suggests 60mins/day including some vigorous intensity exercise is more likely to reduce the risk of cancer.[11]
- The highest levels of activity may be associated with a 40% lower risk of colon cancer and 20-40% lower risk of breast cancer.[1]
- It is estimated that 14% of all cases of colon cancer are attributable to physical inactivity.[1]
- It is estimated that 11% of post-menopausal breast cancer is due to physical inactivity.[1]
- Physical inactivity was responsible for 5.6% of the burden of disease from cancer in Australia in 2003.[3]

2.3. Vegetables and Fruit

- Eat plenty of vegetables, legumes and fruits.[12]
- Adults should eat at least 2 serves of fruit and 5 serves of vegetables each day.[12]
- Vegetables and fruit are recommended for their important role as a low energy density source of nutrients (vitamins, minerals, phytochemicals and fibre) and their contribution to weight management as well as for the probable cancer protective effect.
- The evidence supporting a probable protective effect of fruit and vegetables is strongest in relation to cancers of the digestive tract, in particular of the oesophagus and colon-rectum.[13]
- There is also evidence for fruit probably being associated with reduced risk of cancer of the stomach and lung.[13]
- The International Agency for Research on Cancer (IARC) concluded that there is limited evidence in human studies that eating cruciferous vegetables reduces the risk for cancers of the stomach and lung and there is inadequate evidence for cancers at all other sites.[14] Human consumption of cruciferous vegetables has been shown to be associated with modest reductions

in the risks for cancers at some sites, although the reductions are no greater than those observed with total vegetable intake.[14]

- It is estimated that 5-12% of cancers are due to low vegetable and fruit intake.[13]
- Australian data suggests that 2% of cancers are attributable to low consumption of vegetables and fruit.[3]

2.4. Breads and Cereals

- As part of an overall healthy diet eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain.[12]
- There has been considerable research into the link between fibre consumption and a reduction in bowel cancer risk. While the evidence is not consistent, the current weight of evidence suggests a diet high in fibre could reduce bowel cancer risk.[15, 16]

2.5. Meat

- The Cancer Council supports the NHMRC Dietary Guidelines to include lean meat, fish, poultry or alternatives as part of an overall healthy diet.[12, 17]
- Red meat is an important contributor to dietary iron, zinc, vitamin B12 and protein in the Australian diet.[12, 17]
- However, research suggests that red meat consumption and in particular processed meat consumption is associated with a modest increase in bowel cancer risk.[18-22]
- There is limited but suggestive evidence for associations between increased fish consumption and a reduced risk of breast, rectal and prostate cancer.[23]
- The Cancer Council recommends only eating moderate amounts of red meat. A moderate serve of meat is 65-100g of cooked red meat, 3-4 times a week, as specified in the Australian Guide to Healthy Eating. Alternatives to red and processed meat include fish, poultry, eggs, legumes, nuts and some seeds.[24]
- The Cancer Council recommends people limit consumption of processed meats, which are high in fat and sodium (sodium chloride and sodium nitrate). Processed meats include salami, frankfurts, bacon and ham.
- Some research suggests that consumption of burnt or charred meat may increase cancer risk. However, the evidence is not conclusive.[21]

2.6. Dietary Fat

- As part of an overall healthy diet, limit saturated fat and moderate total fat intake.[12, 17]
- Current evidence does not indicate a direct link between fat intake and cancer at any site.[25, 26]
- However, high fat consumption probably contributes to obesity, and obesity is a risk factor for several cancers.[1, 12]

2.7. Salt

- Evidence for increased incidence of stomach cancer in association with high salt diets comes from countries where salting of foods is a common preserving method. In countries where refrigeration is commonly used for storage of perishable forms of food, stomach cancer has a relatively low incidence.[27, 28]
- The Cancer Council Australia supports the Dietary Guidelines suggesting adults and children choose foods low in salt.[12, 17]

2.8. Alcohol

- The Cancer Council recommends that, to reduce the risk of cancer, alcohol consumption should be limited or avoided.
- There is convincing evidence that alcohol is an important risk factor for some cancers, particularly mouth, pharynx, larynx, oesophagus, liver, breast and colorectal cancer.[2, 16, 29]
- The Cancer Council Australia acknowledges that small quantities of alcohol may protect against coronary heart disease.

2.9. Micronutrients

- Research cannot definitively identify which specific component of foods, in particular vegetables and fruit, provide a cancer protective effect – whole foods appear to be most beneficial.[16]
- Micronutrients ingested in supplement form are often pharmacologically active, and contain higher doses than the level of micronutrients someone would receive in a typical diet. The combination and interaction of nutrients and phytochemicals found together in whole foods may be the key in reducing the risk of chronic diseases.
- There have been varying results from studies looking at the association between Vitamin E intake and prostate cancer incidence, and beta-carotene and lung cancer.
- Trials of high dose beta carotene have shown a higher risk of lung cancer in smokers.
- There is insufficient evidence of an association between Vitamin C intake and increased or decreased cancer risk.[2, 16]
- Selenium is safe if taken in moderation. However selenium supplements are toxic if taken in high doses. Some studies suggest that selenium may be inversely associated with prostate cancer and colorectal cancer. The evidence of a protective role of selenium in other types of cancers is weak and inconsistent.[2, 16, 30]
- Some studies have suggested a protective association between lycopenes and prostate cancer, but this has not been confirmed in clinical trials.[31, 32] Experimental studies have suggested that there may be synergistic factors at play between lycopene and other phytonutrients in tomatoes, to explain the protective association.[33, 34]

2.10. Shared Goals

- On the whole, Australians are falling short of recommendations for nutrition and physical activity.
- The public is likely to understand and respond to repeated, consistent advice, rather than conflicting, or inconsistent advice.
- Promoting healthy dietary and physical activity patterns may help prevent the burden of disease related to obesity, diabetes, cardiovascular disease, several forms of cancer, osteoporosis and dental disease.[2]

2.11. Summary of strength of evidence on lifestyle factors and the risk of developing cancer[1, 2, 13]

Evidence[35]	Decreased risk	Increased risk
Convincing Epidemiological studies show consistent links between cancer and the risk factor, with little or no evidence to the contrary and the association is biologically plausible.	• *Physical inactivity* (colon)	• *Overweight and obesity* (oesophagus, colon, rectum, breast in post-menopausal women, endometrium, kidney) • *Alcohol* (oral cavity, pharynx, larynx, oesophagus, liver, breast) • *Aflatoxin* (liver) • *Chinese-style salted fish* (nasopharynx)
Probable Epidemiological studies showing links are not so consistent, with a number and/or proportion of studies not supporting the association or only a limited number of studies available. Mechanistic evidence is usually supportive or strongly supportive.	• *Vegetables and fruit* (oesophagus) • *Fruit* (stomach, lung) • *Vegetables* (colon, rectum) • *Physical inactivity* (breast)	• *Processed meat* (colon, rectum) • *Salt-preserved foods and salt* (stomach)
Possible Epidemiological studies are generally supportive, but are limited in quantity, quality or consistency. There may or may not be supportive mechanistic or laboratory evidence.	• *Fibre* (colon, rectum) • *Vegetables and fruit* (mouth, pharynx, larynx, kidney) • *Fruit* (colon, rectum, bladder) • *Vegetables* (stomach, lung, ovary)	

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3. BODY WEIGHT

3.1. Useful Summary Statements

- To achieve and maintain a healthy weight, The Cancer Council recommends regular physical activity and eating according to your energy needs. Making fruit, vegetables, cereals and other low fat foods the basis of your diet may assist with achieving and maintaining healthy body weight.
- Obesity increases the risk of cancer of the endometrium, kidney, breast (postmenopausal), colon and oesophagus.[1, 2]
- "High body mass" was responsible for 3.9% of the burden of disease from cancer in Australia in 2003.[3]
- The prevalence of obesity in Australia has more than doubled in the past 20 years.[4]
- In 2003/4, one in four children in NSW and WA were overweight or obese.[5, 6]
- The prevalence of overweight and obesity among Australian children has increased rapidly over recent years.[7]
- Waist circumference greater than 102 cm for men and 88 cm for women, which is a marker of central obesity, might be a better predictor of cancer risk than BMI.[8, 9]

3.2. NHMRC Dietary Guidelines

Adults

- Prevent weight gain: be physically active and eat according to your energy needs.[10]

Children

- Children and adolescents need sufficient nutritious foods to grow and develop normally. Growth should be checked regularly for young children. Physical activity is important for all children and adolescents.[11]
  (Guideline does not refer specifically to body weight)

3.3. Definitions

- For adults, waist circumference and/or body mass index (BMI) are recommended for the measurement of overweight and obesity in individuals.[12]
- BMI can be used to estimate relative risk of disease in most people. It is not always an accurate predictor of body fat or fat distribution, particularly in muscular individuals, because of differences in body-fat proportions and distribution.[12]
  - The World Health Organization (WHO)[13] recommends the following cut-offs:
    - BMI less than 18.5 kg/m2 is classified as underweight.
    - BMI of 18.5 to 25.0 kg/m2 is classified as healthy weight.
    - BMI of 25.1 to 29.9 kg/m2 is classified as overweight.
    - BMI of 30.0 kg/m2 or higher is classified as obese.
- Waist circumference is a valid measure of abdominal fat mass and disease risk in individuals with a BMI less than 35. If BMI is 35 or more, waist circumference adds little to the absolute measure of risk provided by BMI.[12]
  - The World Health Organization (WHO)[13] recommends the following cut-offs:
    - For women:

        - Waist circumference less than 80 cm is normal risk.
        - Waist circumference between 80-88 cm is increased risk.
        - Waist circumference more than 88 cm is substantially increased risk.
    - For men:
        - Waist circumference less than 94 cm is normal risk.
        - Waist circumference between 94-102 cm is increased risk.
        - Waist circumference more than 102 cm is substantially increased risk.
- For children and adolescents BMI is a reasonable measure of adiposity.[14]
    - BMI-for-age percentile charts should be used to assess overweight and obesity. The Centers for Disease Control and Prevention (CDC)[15] BMI percentile charts are recommended for use in Australia.[14]
    - The National Health and Medical Research Council (NHMRC)[14] recommends the following cut-offs, based on Lazarus *et al* [16]:
        - BMI above the 85th percentile is indicative of overweight
        - BMI above the 95th percentile is indicative of obesity.
- The above definitions of overweight and obesity are recommended for clinical use with individual children and adolescents. For research, more detailed assessments for children of different age levels are recommended.[17]

3.4. Cancer Council Recommendations

- The Cancer Council Australia supports the NHMRC recommendations in relation to body weight.
- The Cancer Council recommends that children, adolescents and adults maintain a healthy weight.
- To achieve and maintain a healthy weight, The Cancer Council recommends regular physical activity and eating according to your energy needs. Making fruit, vegetables, cereals and other low fat foods the basis of your diet may assist with achieving and maintaining healthy body weight.

3.5. Epidemiology

- Obesity is linked to an increased risk of cancer of the endometrium, kidney, breast in postmenopausal women, colon and oesophagus. [1, 2]
- "High body mass" was responsible for 3.9% of the burden of disease from cancer in Australia in 2003.[3]
- Overweight and obesity may account for 14% of cancer deaths in men and 20% of cancer deaths in women.[18]
- It is estimated that 11% of all cases of colon cancer are attributable to obesity.[1]
- It is estimated that 10% of postmenopausal breast cancer is due to obesity.[1]
- Waist circumference greater than 102 cm for men and 88 cm for women , which is a marker of central obesity, might be a better predictor of cancer risk than BMI.[8, 9]

3.6. Population trends in Australia

Adults

- The 1995 National Nutrition Survey found that the proportion of overweight and/or obesity increases with age for both males and females. Among 19-24 year olds, 1 in 3 males and 1 in

4 females are overweight or obese. Among 45 to 64 year olds, this rises to 3 out of 4 males and almost 2 out of 3 females.[19]

- The AusDiab Survey in 1999-2000 found that the prevalence of overweight and obesity was almost 60% among Australian adults aged 25 and over.[4]
- The prevalence of obesity in Australia has more than doubled in the past 20 years.[4]
- Weight increased significantly for both men and women between 1983 and 1995. For men, mean weight increased by 5.2 kg. For women, mean weight increased by 6.9 kg.[20] During this period, there was no significant change in men's height. However, women's mean height increased slightly by an average of 0.8 cm.[20]
- As would be expected from the height and weight data, BMI increased significantly between 1983 and 1995 for both men and women.[20]

Children

- In 2003/4, one in four children in NSW and WA were overweight or obese.[5, 6]
- A recent study looking at weight changes among Australian children over three decades found that between 1985-1997, the prevalence of overweight and obesity combined doubled, and that of obesity trebled among young Australians, but the increase over the previous 16 years was far smaller.[7] These findings suggest that the prevalence of overweight and obesity among Australian children has increased rapidly over recent years.
- Overall there was a statistically significant increase in children's mean energy intake between 1983 and 1995. For boys, there was an increase of 1,400 kJ per day; for girls, there was an increase of 900 kJ per day. [20] These increases are much greater than those seen in adults.
- Children's mean weight increased significantly between 1985 and 1995. For boys the mean increase was 4.8 kg and for girls 6.5 kg. This increase is only partly due to the increase in height since 1985 and is much greater than has been observed previously in Australian children of this age over longer intervals of time.[21]

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4. Physical Activity

4.1. Useful Summary Statements

- Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.[1]
- 30 mins/day of moderate intensity activity is recommended for good general health, although some evidence suggests 60mins/day including some vigorous intensity exercise is more likely to reduce the risk of cancer.[2]
- The highest levels of activity may be associated with a 40% lower risk of colon cancer and 20-40% lower risk of breast cancer.[3]
- It is estimated that 14% of all cases of colon cancer are attributable to physical inactivity.[3]
- It is estimated that 11% of post-menopausal breast cancer is due to physical inactivity.[3]
- Physical inactivity was responsible for 5.6% of the burden of disease from cancer in Australia in 2003.[4]

4.2. National Physical Activity Guidelines for Australians

National Physical Activity Guidelines for Adults[1]

- Think of movement as an opportunity, not an inconvenience.
- Be active every day in as many ways as you can.
- Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.
- If you can, also enjoy some regular, vigorous exercise for extra health and fitness.

Australia's Physical Activity Recommendations for 5-12 Year Olds and Australia's Physical Activity Recommendations for 12-18 Year Olds[5, 6]

- Children and young people should participate in at least 60 minutes (and up to several hours) of moderate to vigorous intensity physical activity every day.
- Children and young people should not spend more than 2 hours a day using electronic media for entertainment (e.g. computer games, Internet, television), particularly during daylight hours.

4.3. Definitions

- Moderate-intensity activity[1]:
  - Causes a slight but noticeable increase in your breathing and heart rate.
  - Includes brisk walking, mowing the lawn, digging in the garden, medium-paced swimming or cycling.
- Vigorous activity[1]:
  - Makes you "huff and puff".
  - Is exercise at a heart rate of 70-85% of maximum heart rate (MHR), where MHR is calculated as 220 minus your age.
  - Includes active sports such as football, squash, netball and basketball, and activities such as aerobics, circuit training, jogging, fast cycling or brisk rowing.

4.4. Cancer Council Recommendations

- The Cancer Council endorses the National Physical Activity Guidelines.
- For cancer prevention, available evidence suggests a higher level of physical activity may be most beneficial.[3, 7]
    - 30 mins/day of moderate intensity activity is recommended for good general health
    - 60 mins/day of moderate-intensity or 30 mins/day of vigorous activity is more likely to reduce the risk of cancer.
- The Cancer Council recommends people increase both their incidental and recreational activity levels.
- The Cancer Council recognises the high levels of sedentary behaviour in the Australian population and supports messages that promote gradual increases in activity levels.

4.5. Epidemiology

- Lack of physical activity is a risk factor for colon cancer, breast cancer and possibly prostate cancer.[3]
- Studies have shown a 40% reduction in risk of colon cancer with increasing levels of activity. Studies for breast cancer have shown a 20-40% reduction in risk.[3]
- It is estimated that 14% of all cases of colon cancer are attributable to physical inactivity.[3]
- It is estimated that 11% of postmenopausal breast cancer is due to physical inactivity.[3]
- To achieve significant reductions in cancer risk, 3½ - 4 hours a week of vigorous activity or more than 7 hours a week of moderate-intensity activity is required.[7]
- Less than half (46.1%) of Australian adults meet the national physical active recommendations.[2] The proportion of Australian adults that meet the recommendations for cancer prevention is even lower:
    - 26.0% of adults reported 420 minutes/week of at least moderate intensity.[2]
    - 10.3% of adults reported 210 minutes/week of vigorous-intensity.[2]
- Physical inactivity was responsible for 5.6% of the burden of disease from cancer in Australia in 2003.[4]

4.6. Population trends in Australia

Adults

- National participation in 'sufficient physical activity' declined between 1997 and 1999, from 63% to 57%.[8]
- The proportion of physically inactive Australians increased between 1997 and 1999 (13% to 15%). This increase was greatest for people aged 30-44 years, and among people with tertiary education.[9]
- In 1999, 15% of Australian adults were classified as "completely sedentary" (no reported physical activity in the past week).[8]
- In 1999, the prevalence of sedentary behaviour in people with less than 12 years of education was double that of people with tertiary education.[9]

Children

- A 1985 national survey found that girls had significantly lower aerobic fitness than boys, and that 15 year old girls were the least fit of all children.[10]
- There is a lack of recent national data on physical activity levels among children.[11]
- The Western Australian Child and Adolescent Physical Activity and Nutrition Survey 2003 (CAPANS) found that:[12]
    - As children get older their levels of physical activity decline.
    - Less than 1 in 7 Primary school students reported no physical activity.
    - Around 1 in 4 males and 1 in 3 females in secondary school reported no physical activity.
    - Primary school males reported an average of 2.2 hours of television viewing per day and females 2.1 hours.
    - Secondary school males reported an average of 3.9 hours of television viewing per day and females 4.3 hours.

The 2004 NSW Schools Physical Activity and Nutrition Survey (SPANS) found that:[13]

- Three-quarters of boys and girls aged 11-16 years met the national recommendation of at least one hour of moderate to vigorous physical activity each day
- NSW school students are generally more active than their counterparts in 1985 and 1997, with the prevalence of physical activity participation increasing by between 15% and 25% from 1985 to 2004 among secondary school students.

4.7. References

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5. Vegetables and fruit

5.1. Useful Summary Statements

- Eat plenty of vegetables, legumes and fruits.[1]
- Adults should eat at least 2 serves of fruit and 5 serves of vegetables each day.[1]
- Vegetables and fruit are recommended for their important role as a low energy density source of nutrients (vitamins, minerals, phytochemicals and fibre) and their contribution to weight management as well as for the probable cancer protective effect.
- The evidence supporting a probable protective effect of fruit and vegetables is strongest in relation to cancers of the digestive tract, in particular of the oesophagus and colon-rectum.[2]
- There is also evidence for fruit probably being associated with reduced risk of cancer of the stomach and lung.[2]
- The International Agency for Research on Cancer (IARC) concluded that there is limited evidence in human studies that eating cruciferous vegetables reduces the risk for cancers of the stomach and lung and there is inadequate evidence for cancers at all other sites.[3] Human consumption of cruciferous vegetables has been shown to be associated with modest reductions in the risks for cancers at some sites, although the reductions are no greater than those observed with total vegetable intake.[3]
- It is estimated that 5-12% of cancers world-wide are due to low vegetable and fruit intake.[2]
- Australian data suggests that 2% of cancers are attributable to low consumption of vegetables and fruit.[4]

5.2. Dietary Guidelines for Australians

Adults

- Eat plenty of vegetables, legumes and fruits.[1]
- Adults should eat at least two serves of fruit and five serves of vegetables each day (the number of serves recommended for women who are pregnant or breastfeeding is higher).[5]
- Choose a variety of vegetables and legumes: starchy vegetables (e.g. potato), dark-green leafy and cruciferous vegetables (e.g. spinach, broccoli), orange-yellow vegetables (e.g. carrot, pumpkin), legumes (e.g. lentils, kidney beans and chickpeas), and other vegetables (e.g. beans, peas, tomatoes, sweet corn).[1]

Children

- Children and adolescents should be encouraged to eat plenty of vegetables, legumes and fruits.[6]
- It is recommended that children aged:[6]
    - 4-7 years should eat at least 1 serve of fruit and 2 serves of vegetables or legumes each day.
    - 8-11 years should eat at least 1 serve of fruit and 3 serves of vegetables or legumes each day.
    - 12-18 years should eat at least 3 serves of fruit and 4 serves of vegetables or legumes each day.

5.3. Definitions

- The following are examples of one serve of vegetables:[5]
  - ½ cup (75g) cooked dark-green leafy and cruciferous vegetables (e.g. spinach, broccoli)
  - ½ cup (75g) cooked orange-yellow vegetable (e.g. carrot)
  - ½ cup (75g) cooked legumes or other vegetables (e.g. beans)
  - 1 medium sized starchy vegetable (e.g. potato)
  - 1 cup lettuce or salad vegetables
- The following are examples of 1 serve of fruit:[5]
  - 1 piece medium sized fruit (e.g. apple or orange)
  - 2 small pieces (eg apricots, kiwi fruit, plums)
  - 1 cup diced pieces or canned fruit
  - ½ cup (125mL) 100% fruit juice
  - 4 dried apricot halves
  - 1½ tablespoon sultanas

5.4. Cancer Council Recommendations

- The Cancer Council supports the NHMRC Dietary Guidelines for fruits, vegetables and legumes.
- Promoting increased vegetable consumption is of particular importance, as people are further from achieving recommended levels of consumption than they are for fruit.[7]
- Vegetables and fruit are recommended for their important role as a low energy density source of nutrients (vitamins, minerals, phytochemicals and fibre) and their contribution to weight management as well as for the probable cancer protective effect.
- An easy way to think about serve sizes is “handfuls”. A handful is a useful guide and whatever size the hand is, the amount will be proportionate. For example, adults should try to eat 2 handfuls of fruit and 5 handfuls of vegetables every day.
- The Cancer Council recommends people eat a variety of vegetables and fruit. Fruit and vegetables can be eaten raw or cooked and include fresh, frozen, tinned or dried varieties.
- Cruciferous vegetables, such as cabbage, broccoli and Brussels sprouts, should be included as part of the recommended 5 serves of vegetables.[3] There are no Australian or International recommendations for cruciferous vegetables, indoles nor isothiocyanates.
- Allium vegetables, such as onions, leeks and garlic, should be included as part of included as part of the recommended 5 serves of vegetables. There are no Australian or International recommended intakes for allium vegetables.

5.5. Epidemiology

- Table 1 summarises the findings from several major reviews on the state of the evidence for fruit and vegetable consumption decreasing the risk of cancer at a range of body sites. The most recent review is from the International Agency for Research on Cancer, published in 2003.[2]
- Fruit and vegetables are an important source of micronutrients, dietary fibre and essential non-nutrients.[8] A diet rich in fruit and vegetables reduces obesity risk as well as conferring a reduction in cardiovascular disease risk and a probable cancer protective effect.[2, 8, 9]

- The evidence supporting a probable protective effect of fruit and vegetables is strongest in relation to cancers of the digestive tract, in particular of the oesophagus and colon-rectum.[8] There is also evidence for fruit probably being associated with reduced risk of cancer of the stomach and lung.[2, 8]
- Whilst earlier reviews concluded fruit and vegetable consumption probably reduces the risk of cancers of the gastro-intestinal tract (see Table 1), the evidence from some recent prospective studies have not found results to support this.[9-11]
- The International Agency for Research on Cancer (IARC) concluded that the population attributable risk for low fruit and vegetable intake would fall into the range 5-12%.[2] Australian data suggested that 2% of cancers are attributable to low consumption of fruit and vegetables.[4]
- Despite many attempts, research cannot identify which specific component of vegetables or fruit provides a cancer protective effect – whole foods appear to be most beneficial.[12] For that reason, the Cancer Council recommends people eat a variety of vegetables and fruit.
- The International Agency for Research on Cancer (IARC) concluded that there is limited evidence in human studies that eating cruciferous vegetables reduces the risk for cancers of the stomach and lung and there is inadequate evidence for cancers at all other sites.[3] Human consumption of cruciferous vegetables has been shown to be associated with modest reductions in the risks for cancers at some sites, although the reductions are no greater than those observed with total vegetable intake.[3]
- Allium vegetables, such as garlic, onion and leeks, contain a variety of sulphur containing compounds. Allicin is a sulphur-containing compound that gives garlic its characteristic aroma and is thought to have an antibacterial effect in the stomach.[13] Observational studies have suggested that garlic may protect against stomach and colon cancers, however this needs to be confirmed in clinical trials.[13]

Table 1: Conclusions of various reviews of the cancer protective effect of vegetables and fruit.

Review	Highest evidence	Moderate evidence	Lower evidence
IARC 2003[2]		**Probable** Oesophagus (fruit and vegetables) Stomach (fruit) Lung (fruit) Colon-rectum (vegetables)	**Possible** Mouth (fruit and vegetables) Pharynx (fruit and vegetables) Colon-rectum (fruit) Larynx (fruit and vegetables) Kidney (fruit and vegetables) Bladder (fruit) Stomach (vegetables) Lung (vegetables) Ovary (vegetables)
WHO/FAO 2003[8]		**Probable** Oral cavity Oesophagus Stomach Colo-rectum	
COMA 1998[14]	**Strongly consistent** Oesophagus	**Moderate Association** Stomach Colon Rectum	**Weak** Breast cancer
WCRF/AICR 1997[12]	**Convincing** Mouth Pharynx Oesophagus Stomach Colon	**Probable** Larynx Pancreas Breast Bladder	**Possible** Ovaries Cervix Endometrium Thyroid Liver

	Rectum Lung		Prostate Kidney

5.6. Population trends in Australia

- On average, Australians do not consume enough vegetables and fruit for optimal health.[15]

Adults

- 1995 National Nutrition Survey results show that on the day of the survey less than 1 in 5 adults met the "5 or more serves of vegetables per day" recommendation and only half met the "2 serves per day" recommendation for fruit.[7] This means that most adults did not eat enough vegetables, and around half did not eat enough fruit.
- In 1995, 89% of adults reported eating a vegetable product on the day of the National Nutrition Survey.[16] This suggests that approximately 1 in 10 adults did not eat any vegetables that day, let alone achieve the recommended 5 serves of vegetables per day.
- In 1995, only 51% of men and 61% of women reported eating fruit on the day of the National Nutrition Survey.[16] This suggests that around 4 out of 10 Australian adults did not eat any fruit that day, let alone achieve the recommended 2 serves of fruit per day.
- National Nutrition Survey data show that the percentage of the adult population who ate a vegetable product or a fruit product on the day of the survey declined between 1983 and 1995.[17]

Children

- In 1995, 4 out of 5 children and teenagers reported eating vegetables on the day of the National Nutrition Survey.[16] This means, approximately 1 in 5 did not eat any vegetables on the day of the survey.
- In 1995, 6 out of 10 children and teenagers reported eating fruit on the day of the National Nutrition Survey.[16] This suggests that just under half the children surveyed did not eat any fruit on the day of the survey.
- National Nutrition Survey data show that the percentage of children consuming vegetable products or dishes on the day of the survey declined between 1985 and 1995 for boys, and remained unchanged for girls[17].
- The percentage of children consuming fruit products or dishes on the day of the survey declined between 1985 and 1995.[17] A similar decrease was seen for adults.
- The 2003 Western Australian Child and Adolescent Physical Activity and Nutrition Survey (CAPANS) found that:[18]
    - As children get older their fruit consumption declines, but vegetable consumption is steady.
    - On the day of the survey, 30% of children did not eat any vegetables and 45% did not eat any fruit.
- The 2004 NSW Schools Physical Activity and Nutrition Survey (SPANS) found that:[19]
    - Students ate reasonable amounts of fruits, but few ate the recommended amount of vegetables
    - About 65-70% of students reported eating at least two pieces of fruit each day
    - Only 15-25% of students reported eating at least four serves of vegetables per day.

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6. Breads and cereals

6.1. Useful Summary Statements

- As part of an overall healthy diet eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain.[1]
- There has been considerable research into the link between fibre consumption and a reduction in bowel cancer risk. While the evidence is not consistent, the current weight of evidence suggests a diet high in fibre could reduce bowel cancer risk.[2, 3]

6.2. Dietary Guidelines for Australians

Adults

- Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain.[1]
- The Australian Guide to Healthy Eating recommends adults aged 19-60 years eat the following number of serves of cereals per day: 4 to 9 serves for women; 5 to 12 serves for men.[1, 4]
- Cereal-based foods such as cakes, biscuits and pastries – which can have high levels of added fats and sugars – are not included in this recommendation and should be regarded as occasional treats only.[1]

Children

- Children and adolescents should be encouraged to eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain.[5]
- It is recommended that children:[4]
  - Aged 4-7 years eat 3 to 7 serves of cereals per day.
  - Aged 8-11 years eat 4 to 9 serves of cereals per day.
  - Aged 12-18 years eat 4 to 11 serves of cereals per day.
- The same definitions of a serve, and recommendations about treats (e.g. cakes) made for adults apply to children.

6.3. Definitions

- The following are examples of one serve of breads and cereals:[4]
  - 2 slices of bread
  - 1 medium bread roll
  - 1 cup cooked rice, pasta or noodles
  - 1 cup porridge
  - 1⅓ cup breakfast cereal flakes
  - ½ cup muesli

6.4. Cancer Council Recommendations

- The Cancer Council supports the NHMRC Dietary Guidelines for breads and cereals.[1]

6.5. Epidemiology

- There has been considerable research into the link between fibre consumption and a reduction in colorectal cancer risk. While the evidence is not consistent, the current weight of evidence suggests a diet high in fibre could reduce colorectal cancer risk.[2, 3]
- It is important to note that fruit and vegetables are also an important source of dietary fibre.

6.6. Population trends in Australia

Adults

- In 1995, most adults (94% of men and 95% women) reported eating a cereal product (such as breakfast cereal, rice, bread or pasta) on the day of the National Nutrition Survey.[6]
- However, even among those adults with the highest cereal product intakes (18-34 year olds), only 1 in 3 men and 1 in 5 women met the recommended core food group target of 7 servings per day in 1995.[6]
- There was a slight decline in the number of people eating cereals each day between the 1983 and 1995 National Nutrition Surveys. Yet, among those people who did eat cereal, the average amount of cereal eaten per day increased.[7]

Children

- In 1995, over 95% of boys and girls reported eating a cereal product on the day of the National Nutrition Survey.[6] That is, most children ate a food such as breakfast cereal, rice, breads or pasta on the day of the survey.
- Between 1983 and 1995, there were no significant changes in the proportion of children who ate foods in this food group, or in the mean intake of these foods.[7]
- However, for other less healthy cereal-based products (e.g. cakes, biscuits, pies), there was a significant increase in mean intake between 1985 and 1995.[7]

6.7. References

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7. Meat

7.1. Useful Summary Statements

- The Cancer Council supports the NHMRC Dietary Guidelines to include lean meat, fish, poultry or alternatives as part of an overall healthy diet.[1, 2]
- Red meat is an important contributor to dietary iron, zinc, vitamin B12 and protein in the Australian diet.[1, 2]
- However, research suggests that red meat consumption and in particular processed meat consumption is associated with a modest increase in bowel cancer risk.[3-7]
- There is limited but suggestive evidence for associations between increased fish consumption and a reduced risk of breast, rectal and prostate cancer.[8]
- The Cancer Council recommends only eating moderate amounts of red meat. A moderate serve of meat is 65-100g of cooked red meat, 3-4 times a week, as specified in the Australian Guide to Healthy Eating. Alternatives to red and processed meat include fish, poultry, eggs, legumes, nuts and some seeds.[9]
- The Cancer Council recommends people limit consumption of processed meats, which are high in fat and sodium (sodium chloride and sodium nitrate). Processed meats include salami, frankfurts, bacon and ham.
- Some research suggests that consumption of burnt or charred meat may increase cancer risk. However, the evidence is not conclusive.[6]

7.2. Dietary Guidelines for Australians

Adults and children

- Include lean meat, fish, poultry and/or alternatives.[1, 2]
- Include red meat three to four times a week.[9]

7.3. Definitions

- The following are examples of one serve of meat:[9]
  - 65-100g cooked meat or chicken (e.g. ½ cup mince, 2 small chops or 2 slices roast meat). This should roughly fit into the palm of your hand.
  - 80-120g cooked fish fillet
  - 2 small eggs
  - ½ cup cooked (dried) beans, lentils, chick peas, split peas or canned beans
  - ⅓ cup peanuts or almonds
  - ¼ cup sunflower seeds or sesame seeds

7.4. Cancer Council Recommendations

- The Cancer Council recognises that red meat is an important contributor to dietary iron, zinc, vitamin B12 and protein in the Australian diet.
- The Cancer Council recommends eating only moderate amounts of red meat: a moderate serve of meat is 65-100g of cooked red meat, 3-4 times a week (as specified in the Australian

Guide to Healthy Eating).[9] Alternatives to red and processed meat include fish, poultry, eggs, legumes, nuts and some seeds.

- The Cancer Council recommends people limit consumption of processed meats, which are high in fat and sodium (sodium chloride and sodium nitrate). Processed meats include salami, frankfurts, bacon and ham.

7.5. Epidemiology

- Research suggests that red meat consumption and in particular processed meat consumption is associated with a modest increase in colorectal cancer risk.[3-7, 10]
- The salts used to cure meat, nitrate and nitrite, are probably carcinogenic to humans under conditions where antioxidant intake is low.[11]
- Some research suggests that consumption of burnt or charred meat may increase cancer risk. However, the evidence is not conclusive.[6]
- There is limited but suggestive evidence for associations between increased fish consumption and a reduced risk of breast, rectal and prostate cancer.[8]

7.6. Population trends in Australia

Adults

- National Nutrition Survey data show that most adults (85% of men and 77% of women) ate some meat, poultry or game on the day of the 1995 survey.[12]
- National Nutrition Survey data show that approximately 20% of adults ate a fish or seafood product on the day of the survey in both 1983 and 1995.[12]
- On the day of the 1995 National Nutrition survey, adults' mean intake of red meat was consistent with the recommendations of the Australian Guide to Healthy Eating.[9, 12] Also, around two-thirds of red meat cuts eaten were reported to be either trimmed of fat or lean when eaten.[13]
- Between 1983 and 1995, mean daily intake of red meat and pork declined for both men and women; whereas mean daily intake of poultry and seafood increased.[13]

Children

- National Nutrition Survey data show that 8 out of 10 children ate some meat, poultry or game on the day of the 1995 survey.[12]
- National Nutrition Survey data show that approximately 1 out of 10 children ate a fish or seafood product on the day of the survey in both 1983 and 1995.[12]
- Children's mean intake of meat rose slightly between 1985 and 1995.[14]
- Between 1983 and 1995, mean intake of seafood increased by about 8 grams per day for boys and 7 grams per day for girls.[14]

7.7. References

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8. Dietary fat

8.1. Useful Summary Statements

- As part of an overall healthy diet, limit saturated fat and moderate total fat intake.[1, 2]
- Current evidence does not indicate a direct link between fat intake and cancer at any site.[3, 4]
- However, high fat consumption probably contributes to obesity, and obesity is a risk factor for several cancers.[1, 5]

8.2. Dietary Guidelines for Australians

Adults

- Limit saturated fat and moderate total fat intake.[1]
- The dietary guidelines also recommend that lean meat and reduced fat varieties of dairy foods should be chosen where possible.[1]
- A common recommendation has been that total fat should comprise about 30% of total energy intake, with a maximum of 10% of total energy intake coming from saturated fat.[1]

Children

- Care should be taken to limit saturated fat and moderate total fat intake.[2]
- Low-fat diets are not suitable for infants.[2] Excessive restriction of dietary fat intake for infants and young children can lead to growth failure.
- It is recommended that in children aged:[2]
  - 0-12 months: fat intake makes up roughly 50% of energy intake.
  - 2-14 years: fat intake makes up roughly 30% of energy intake– with no more than 10% energy coming from saturated fat for this age group.

8.3. Definitions

Nutrient Reference Values

- An estimated average requirement (EAR), recommended dietary intake (RDI) or adequate intake (AI) for total fat was not set for children, adolescents and adults. The type of fats consumed relate to essentiality and to many of the physiological and health outcomes.[6]

8.4. Cancer Council Recommendations

- The Cancer Council Australia supports the Dietary Guidelines concerning dietary fat.

8.5. Epidemiology

- Fat is the most energy dense of all the nutrients and there is evidence to suggest that high fat intakes and the resulting high-energy intakes are important in the causation of obesity.[1]
- Obesity is a risk factor for cancer of endometrium, kidney, breast (postmenopausal), colon and oesophagus.[5]

- The WCRF report concluded that total fat possibly increased risk of cancer of the lung, colon, rectum, breast and prostate, although the UK review did not find sufficient evidence to make any recommendations about fat and cancer.[7, 8]
- Current evidence does not indicate a direct link between fat intake and cancer at any site.[3, 4] However, high fat consumption probably contributes to obesity and obesity is a risk factor for several cancers.[1, 5]
- Some epidemiological studies suggest that higher intakes of omega 3 fatty acids may slightly reduce the risk of colorectal, breast and prostate cancer.[9]

8.6. Population trends in Australia

Adults

- The 1995 Nutrition Survey indicated that for adults the mean contribution of total fats to energy intake (33%) slightly exceeded the recommended 30% of total energy intake.[1, 10]
- In the 1995 National Nutrition Survey, saturated fat accounted for 13% of the total energy intake, which is slightly higher than the target of 10%.[1, 10]
- The 1995 National Nutrition Survey showed that those who consumed whole milk had a higher contribution of both total fat and saturated fat to energy intake than those who used reduced fat/skim milk.[11] Choosing low or reduced fat milk would decrease the intake of both total and saturated fats assuming the rest of the diet remained unchanged.[12]
- Among adults, mean intake of total fats fell significantly between 1983 and 1995.[13] The decrease was 6g per day for men and 3g per day for women (equivalent to 100 to 200kJ per day).

Children

- National Nutrition Survey data show that in 1995, fat contributed to 33% of energy intake in 2 to 18 year olds.[10] This figure does not grossly exceed the recommendation for total fat intake.
- However, at all ages, saturated fats accounted for the highest proportion of children's fat intake in 1995.[10]
- The proportion of total energy from saturated fat exceeded 10%, contrary to the current recommendation for children aged 5-14 years.[2, 10]
- Total fat intake did not change significantly for boys and girls between 1985 and 1995.[13]
- Between 1985 and 1995 there appeared to be reduced fat intake from fats added to prepared foods (eg. butter). However this was balanced out by an increased intake of fat from other sources such as cereal-based food and confectionery and 'health' bars.[13]

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9. Salt

9.1. Useful Summary Statements

- Evidence for increased incidence of stomach cancer in association with high salt diets comes from countries where salting of foods is a common preserving method. In countries where refrigeration is commonly used for storage of perishable forms of food, stomach cancer has a relatively low incidence.[1, 2]
- The Cancer Council Australia supports the Dietary Guidelines suggesting adults and children choose foods low in salt.[3, 4]

9.2. Dietary Guidelines for Australians

Adults and Children

- Choose foods low in salt.[3, 4]

9.3. Definitions

Nutrient Reference Values

- The Nutrient Reference Values recommend the following upper level of intake (UL) for sodium:[5]
  - 1-3 years: No more than 1000 mg/day
  - 4-8 years: No more than 1400 mg/day
  - 9-13 years: No more than 2,000 mg/day
  - 14+ years: No more than 2,300 mg/day

9.4. Cancer Council Recommendations

- The Cancer Council Australia supports the Dietary Guidelines and Nutrient Reference Values concerning salt and sodium.[3-5]

9.5. Epidemiology

- Diets high in salted foods have been linked to an increased risk of stomach cancer.[2, 6]
- Evidence for increased incidence of stomach cancer in association with high salt diets comes from countries where salting of foods (meats) is a common preserving method. In countries where refrigeration is commonly used for storage of perishable forms of food, stomach cancer has a relatively low incidence.[1]

9.6. Population trends in Australia

Adults

- 1995 National Nutrition Survey data showed that about 1in 4 adults usually added salt to their food during cooking, with a similar proportion adding salt after cooking.[7]

- National data from 1993 indicate that mean intakes of sodium were 3144mg/day for men and 2430mg/day for women[8] , which is higher than the recommended maximum level of 2,300 mg/day[5]. This includes sodium contained in foods as well as that added at the table.
- A Tasmanian study found only 6% of men and 36% of women had intakes below the recommended maximum level of 100 mmol/day (2,300 mg/day).[9]

Children

- Little is known about current intakes of salt in Australian children and adolescents.[4]

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10. Alcohol

10.1. Useful Summary Statements

- The Cancer Council recommends that, to reduce the risk of cancer, alcohol consumption should be limited or avoided.
- There is convincing evidence that alcohol is an important risk factor for some cancers, particularly mouth, pharynx, larynx, oesophagus, liver, breast and colorectal cancer.[1-3]
- The Cancer Council Australia acknowledges that small quantities of alcohol may protect against coronary heart disease.

10.2. Guidelines for Australians

Adults

- There are two sets of NHMRC guidelines concerning alcohol:
  - Australian Alcohol Guidelines: health risks and benefits (2001).[4]
  - Dietary Guidelines for Australian Adults (2003).[5]
- Limit your alcohol intake if you choose to drink.[5]
- Because of alcohol's effect on both short- and long-term health, and the additional kilojoules it provides in the diets of a society with increasing rates of obesity, adults – if they drink at all – should limit their average daily intake of alcohol to no more than 2 standard drinks a day for men and 1 standard drink a day for women.[5]

10.3. Definitions

- A standard drink is 10 grams of ethanol (alcohol):[4, 6]
  - 285 ml full-strength beer
  - 450 ml light beer
  - 100 ml wine
  - 30 ml spirits.

10.4. Cancer Council Recommendations

- The Cancer Council recommends that, to reduce the risk of cancer, alcohol consumption should be limited or avoided.
- For people who do drink alcohol, the recommended amounts are: for men – an average of no more than 2 standard drinks a day; for women – an average of no more than 1 standard drink a day.

10.5. Epidemiology

- There is no evidence from studies in human populations that any alcoholic beverage consumption provides any protection against cancer.
- There is convincing evidence that alcohol is an important risk factor for some cancers, particularly mouth, pharynx, larynx, oesophagus, liver, breast and colorectal cancer.[1-3]

- Smoking and alcohol together have a synergistic effect on upper gastrointestinal and aerodigestive cancer risk. This means the combined effects of smoking and alcohol greatly exceed the risk from either one of these factors alone.[7]
- Alcohol is one dietary factor where there is "conflict" between risks and benefits for different chronic diseases. Whilst alcohol is a risk factor for cancer, the evidence in relation to cardiovascular disease is mixed. High intake of alcohol is associated with higher blood pressure and death from stroke; however, a small amount of alcohol taken regularly may be protective against coronary heart disease.[4] Thus, from a cancer point of view, alcohol consumption is undesirable; whereas from a heart disease point of view, low alcohol consumption may be beneficial.

10.6. Population trends in Australia

Adults

- Population trends in alcohol consumption have remained unchanged between 1991-2001.[8]
- In 1995, 42% of men and 24% of women reported drinking an alcoholic beverage on the day of the National Nutrition Survey.[9]
- In 2001, 57% of males and 39% of females aged 14 years and over drank alcohol at least once a week.[8]
- Those aged 60 years or more recorded the highest prevalence of daily drinking (23% males and 11% females).[8]
- One in three persons (39% of males, 30% of females) consumed alcohol in a manner that put themselves at risk of alcohol-related harm in the short term with the highest proportion amongst those aged 20-29 years.[8]
- Around 10% of males and 9% of females consumed alcohol in a way that put themselves at risk of alcohol-related harm in the long term.[8]
- National Nutrition Survey data show that the percentage of the adult population who drank an alcoholic beverage on the day of the survey decreased between 1983 and 1995.[10]
- Between 1983 and 1995, mean intake of pure alcohol declined for men (from 6.4g/day to 4.5g/day) and women (from 3.5g/day to 2.6g/day).[11]
- In 2001, Australia ranked 23rd in the world in terms of per capita consumption of pure alcohol with 7.4 L per person. In 2001 Australians consumed 93 L of beer (9th in the world), 20 L of wine (17th in the world) and 1.2 L of spirits (35th in the world).[12]

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11. Micronutrients

11.1. Useful Summary Statements

- Research cannot definitively identify which specific component of foods, in particular vegetables and fruit, provide a cancer protective effect – whole foods appear to be most beneficial.[1]
- Micronutrients ingested in supplement form are often pharmacologically active, and contain higher doses than the level of micronutrients someone would receive in a typical diet. The combination and interaction of nutrients and phytochemicals found together in whole foods may be the key in reducing the risk of chronic diseases.
- There have been varying results from studies looking at the association between Vitamin E intake and prostate cancer incidence, and beta-carotene and lung cancer.
- Trials of high dose beta carotene have shown a higher risk of lung cancer in smokers.
- There is insufficient evidence of an association between Vitamin C intake and increased or decreased cancer risk.[1, 2]
- Selenium is safe if taken in moderation. However selenium supplements are toxic if taken in high doses. Some studies suggest that selenium may be inversely associated with prostate cancer and colorectal cancer. The evidence of a protective role of selenium in other types of cancers is weak and inconsistent.[1-3]
- Some studies have suggested a protective association between lycopenes and prostate cancer, but this has not been confirmed in clinical trials.[4, 5] Experimental studies have suggested that there may be synergistic factors at play between lycopene and other phytonutrients in tomatoes, to explain the protective association.[6, 7]

11.2. Guidelines for Australians

Nutrient Reference Values

- The Nutrient Reference Values for Australia and New Zealand contains age-, gender- and lifecourse-specific recommendations for many micro- and macronutrients.[8]

11.3. Background

- Research cannot definitively identify which specific component of foods, in particular vegetables and fruit, provide a cancer protective effect – whole foods appear to be most beneficial.[1] For that reason, the Cancer Council supports the National Health and Medical Research Council (NHMRC) Dietary Guidelines for Australians which state that adults and children should "enjoy a wide variety of nutritious foods", especially vegetables and fruit.[9, 10]
- The Cancer Council supports the NHMRC Nutrient Reference Values.[8]
- Micronutrients include vitamins (e.g. folate, beta-carotene, Vitamin C and E) and minerals (e.g. selenium, calcium). Some biologically active substances or phytochemicals (e.g. lycopenes, indoles and allicin) have been investigated for cancer protective properties.
- Much of the evidence for dietary supplements is mostly derived from experimental studies and not properly conducted clinical trials. However the results from the large-scale randomised controlled trials on the efficacy of dietary supplements to reduce the risk of cancer have been disappointing. For example, the Alpha-Tocopherol, Beta-Carotene Cancer (ATBC) Prevention Trial and Beta-Carotene and Retinol Efficacy Trial (CARET) both showed increased risk of certain cancers and mortality.[11-14]
- Any diet-cancer association is far more complex than simply supplementing the diet with micronutrients. Micronutrients ingested in supplement form are often pharmacologically active,

and contain much higher doses than the level of micronutrients someone would receive in a typical diet. It seems to be the combination and interaction of nutrients and phytochemicals found together in whole foods that help reduce the risk of chronic diseases.

11.4. Vitamin E

NHMRC Nutrient Reference Values

- The NHMRC Nutrient Reference Values for vitamin E (expressed as α-tocopherol equivalents) are:[8]

Age group and gender		Adequate intake (AI)	Upper level of intake (UL)
Infants	0-6 months	4 mg/day	Not possible to establish. Source of intake should be breast milk, formula and food only
	7-12 months	5 mg/day	
Children	1-3 years	5 mg/day	70 mg/day
	4-8 years	6 mg/day	100 mg/day
Boys	9-13 years	9 mg/day	180 mg/day
	14-18 years	10 mg/day	250 mg/day
Girls	9-1 years	8 mg/day	180 mg/day
	14-18 years	8 mg/day	250 mg/day
Men	19+ years	10 mg/day	300 mg/day
Women	19+ years	7 mg/day	
Pregnancy	14-18 years	8 mg/day	
	19-50 years	7 mg/day	
Lactation	14-18 years	12 mg/day	
	19-50 years	11 mg/day	

Cancer Council Recommendations

- The Cancer Council supports the NHMRC Nutrient Reference Values concerning Vitamin E.[8]

Epidemiology

- Vitamin E is an antioxidant found in foods, such as whole grains, seeds, nuts and vegetable oils.
- The ATBC Study found an association between Vitamin E intake (at a dose of 50mg/day) and a reduced incidence of prostate cancer.[15]
- However the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial found that dietary or supplemental Vitamin E was not associated with prostate cancer incidence, except in the subgroup of men who were current or recent smokers.[16]
- The Selenium and Vitamin E Cancer Prevention Trial (SELECT), which began in 2001, will determine if vitamin E supplements can protect against prostate cancer. The 32,400 participants have been randomised to receive daily supplements of either: selenium and vitamin E (alpha-tocopherol); selenium and placebo; vitamin E and placebo; or two placebos. The results of the SELECT trial will not be available until 2012.

11.5. Vitamin A

Definitions

- The term vitamin A includes provitamin A carotenoids that are dietary precursors of retinol.[8]

NHMRC Nutrient Reference Values

- The NHMRC Nutrient Reference Values for Vitamin A (expressed as retinol equivalents) are:[8]

Age group and gender		Estimated Average Requirement (EAR)	Recommended Dietary Intake (RDI)	Upper level of intake (UL)
Infants	0-6 months	*Adequate Intake*: 250 µg/day of retinol (as retinyl esters)		600 µg/day
	7-12 months	*Adequate Intake*: 430 µg/day (as retinyl esters)		
Children	1-3 years	210 µg/day	300 µg/day	600 µg/day
	4-8 years	275 µg/day	400 µg/day	900 µg/day
Boys	9-13 years	445 µg/day	600 µg/day	1,700 µg/day
	14-18 years	630 µg/day	900 µg/day	2,800 µg/day
Girls	9-13 years	420 µg/day	600 µg/day	1,700 µg/day
	14-18 years	485 µg/day	700 µg/day	2,800 µg/day
Men	19+ years	650 µg/day	900 µg/day	3,000 µg/day
Women	19+ years	500 µg/day	700 µg/day	3,000 µg/day
Pregnancy	14-18 years	530 µg/day	700 µg/day	2,800 µg/day
	19-50 years	550 µg/day	800 µg/day	3,000 µg/day
Lactation	14-18 years	780 µg/day	1,100 µg/day	2,800 µg/day
	19-50 years	800 µg/day	1,100 µg/day	3,000 µg/day

Cancer Council Recommendations

- The Cancer Council supports the NHMRC nutrient reference values concerning Vitamin A.[8]

Epidemiology

- Beta-carotene is an antioxidant, which can help to protect the body against the damaging effects of oxygen free radicals. Beta-carotene is found in orange coloured vegetables and fruits, such as carrots, sweet potato, apricots, peaches and rockmelon.
- Observational studies have shown a protective association between beta-carotene intake and lung cancer risk.[1] However both the Alpha-Tocopherol, Beta-Carotene Cancer (ATBC) Prevention Trial and Beta-Carotene and Retinol Efficacy Trial (CARET) showed that beta-carotene supplements, given to participants who were mostly smokers, put them at increased risk of lung cancer and increased their overall mortality.[11-14]

11.6. Vitamin C

NHMRC Nutrient Reference Values

- The NHMRC Nutrient Reference Values for vitamin C are:[8]

Age group and gender		Estimated Average Requirement (EAR)	Recommended Dietary Intake (RDI)	Upper level of intake (UL)
Infants	0-6 months	*Adequate Intake*: 25 mg/day		It is not possible to establish a UL for Vitamin C, but 1,000 mg/day is a prudent limit.
	7-12 months	*Adequate Intake*: 30 mg/day		
Children	1-3 years	25 mg/day	35 mg/day	
	4-8 years	25 mg/day	35 mg/day	
	9-18 years	28 mg/day	40 mg/day	
Men & women	19+ years	30 mg/day	45 mg/day	
Pregnancy	14-18 years	38 mg/day	55 mg/day	
	19-50 years	40 mg/day	60 mg/day	
Lactation	14-18 years	58 mg/day	80 mg/day	
	19-50 years	60 mg/day	85 mg/day	

Cancer Council Recommendations

- The Cancer Council supports the NHMRC nutrient reference values concerning Vitamin C.[8]

Epidemiology

- Vitamin C is found in fruits and vegetables, particularly citrus fruits.
- There is insufficient evidence of an association between Vitamin C intake and increased or decreased cancer risk.[1, 2] Some earlier studies suggested that Vitamin C may protect against stomach cancer risk, but this is now thought to be not the case. Earlier studies may not have properly controlled for confounding by helicobacter pylori, the established risk factor for stomach cancer.[2]

11.7. Selenium

NHMRC Nutrient Reference Values

- The NHMRC Nutrient Reference Values for selenium are:[8]

Age group and gender		Estimated Average Requirement (EAR)	Recommended Dietary Intake (RDI)	Upper level of intake (UL)
Infants	0-6 months	*Adequate Intake*: 12 µg/day		45 µg/day
	7-12 months	*Adequate Intake*: 15 µg/day		60 µg/day
Children	1-3 years	20 µg/day	25 µg/day	90 µg/day
	4-8 years	25 µg/day	30 µg/day	150 µg/day
Boys	9-13 years	40 µg/day	50 µg/day	280 µg/day
	14-18 years	60 µg/day	70 µg/day	400 µg/day
Girls	9-13 years	40 µg/day	50 µg/day	280 µg/day
	14-18 years	50 µg/day	60 µg/day	400 µg/day
Men	19+ years	60 µg/day	70 µg/day	400 µg/day
Women	19+ years	50 µg/day	60 µg/day	400 µg/day
Pregnancy	14-50 years	55 µg/day	65 µg/day	400 µg/day
Lactation	14-50 years	65 µg/day	75 µg/day	400 µg/day

Cancer Council Recommendations

- The Cancer Council supports the NHMRC nutrient reference values concerning selenium.[8]
- Selenium is safe if taken in moderation. However selenium supplements are toxic if taken in high doses.

Epidemiology

- Selenium is a mineral found in cereals, meat and fish.[8] Cereals provide about 50% of dietary selenium. The selenium content of plant foods varies with the selenium content of the soil.[8]
- Selenium helps to prevent tissue damage caused by free radicals.[8]
- Some studies suggest that selenium may be inversely associated with prostate cancer and colorectal cancer, but most of this evidence comes from trials designed to answer questions about other types of cancer.[17-19] The evidence of a protective role of selenium in other types of cancers is weak and inconsistent.[1-3] The true effects of selenium require confirmation in an independent trial(s) before new public health recommendations regarding selenium (either from dietary sources or as supplements) can be made.[20]
- The Selenium and Vitamin E Cancer Prevention Trial (SELECT), which began in 2001, will determine if selenium supplements can protect against prostate cancer. The 32,400 participants have been randomised to receive daily supplements of either: selenium and vitamin E (alpha-tocopherol); selenium and placebo; vitamin E and placebo; or two placebos. The results of the SELECT trial will not be available until 2012.

11.8. Lycopenes

Recommended intake

- Lycopenes are a type of antioxidant found in tomatoes.
- There are no Australian or International recommended intakes for lycopene.

Cancer Council Recommendations

- The Cancer Council recommends that people eat a variety of different vegetables, and not only consume vegetables high in lycopenes.

Epidemiology

- Some studies, such as the Harvard Health Study and some smaller case-control studies, have suggested a protective association between lycopenes and prostate cancer, but this has not been confirmed in clinical trials.[4, 5]
- Experimental studies have suggested that there may be synergistic factors at play between lycopene and other phytonutrients in tomatoes, to explain the protective association.[6, 7]

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12. Shared Goals: Prevention of Chronic Diseases

12.1. Useful Summary Statements

- On the whole, Australians are falling short of recommendations for nutrition and physical activity.
- The public is likely to understand and respond to repeated, consistent advice, rather than conflicting, or inconsistent advice.
- Promoting healthy dietary and physical activity patterns may help prevent the burden of disease related to obesity, diabetes, cardiovascular disease, several forms of cancer, osteoporosis and dental disease.[1]

12.2. Background

- Whilst our primary focus is on cancer prevention, we recognise that diet and physical activity patterns relate to other chronic diseases.
- Promoting healthy dietary and physical activity patterns may help prevent the burden of disease related to obesity, diabetes, cardiovascular disease, several forms of cancer, osteoporosis and dental disease.[1, 2]

12.3. Diabetes

- Excess weight gain, overweight and obesity and physical inactivity contribute to the escalating rates of type 2 diabetes, worldwide.
- Diabetes leads to increased risk of heart disease, kidney disease, stroke, infections and blindness.
- Increased physical activity and maintaining a healthy weight play critical roles in the prevention and treatment of diabetes.[1]

12.4. Cardiovascular diseases

- Cardiovascular diseases are to a great extent due to unbalanced diets and physical inactivity.
- Risk of their main forms, heart disease and stroke, is reduced by eating less saturated and trans fats, and sufficient amounts of (n-3 and n-6) polyunsaturated fats, fruits and vegetables, eating less salt, as well as by physical activity and controlling weight.
- Reduction of salt intake helps reduce blood pressure, a major cause of cardiovascular diseases.[1]

12.5. Alcohol

- Alcohol is one dietary factor where there is “conflict” between risks and benefits for different chronic diseases. Whilst alcohol is a risk factor for cancer, the evidence in relation to cardiovascular disease is mixed. High intake of alcohol is associated with higher blood pressure and death from stroke; however, a small amount of alcohol taken regularly may be protective against coronary heart disease.[3] Thus, from a cancer point of view, alcohol consumption is undesirable; whereas from a heart disease point of view, low alcohol consumption may be beneficial.
- Alcohol, even at low doses, is a risk factor for many mental health conditions and contributes to energy intake, which can lead to weight gain.[3, 4]

12.6. Conclusion

- In Australia, collaborating with other public health agencies in promoting healthy body weight, healthy dietary practices, and physical activity makes sense because:
    - These lifestyle factors are protective in relation to cancer and other chronic diseases affecting many Australians, so we have many shared objectives in this area.
    - Surveys indicate that Australians are falling short of recommendations for diet and physical activity, and the prevalence of overweight and obesity is increasing.
    - Most of the recommendations of the Dietary Guidelines for Australians are consistent with what The Cancer Council Australia recommends on the basis of evidence on associations between cancer and body weight, physical activity and diet.[4, 5] (The exceptions are that to reduce the risk of cancer, more intense levels of physical activity and avoidance of alcohol are likely to be beneficial.)
    - The public is likely to understand and respond to repeated, consistent advice, rather than conflicting, or inconsistent advice. Collaboration between public health groups, in promoting the Dietary Guidelines for Australians and the Physical Activity Guidelines for Australians, should help present the public with consistent and coherent advice.[4-8]
    - There are already a number of established players in the field of public health nutrition (eg. Heart Foundation, Diabetes Australia, Dietitians Association of Australia, Nutrition Australia) and physical activity (eg. Active Australia). We share a lot of common territory with these groups, and can build on existing strengths.
    - With limited resources, collaboration on shared objectives may facilitate greater progress in addressing these lifestyle factors among the Australian population, than would isolated initiatives conducted by disparate groups.

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