

*The Grains & Legumes*  
HEALTH REPORT

A REVIEW OF THE SCIENCE



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# Executive Summary

The *Grains & Legumes Health Report* provides an overview of the latest scientific research for the important role of grain foods and legumes in the Australian diet.

The report finds that there is consistent scientific evidence for the role of wholegrains, and suggestive evidence for the role of legumes, in protecting against cardiovascular disease, type 2 diabetes, certain cancers and obesity.

## WHOLEGRAINS: KEY FINDINGS

- Consumption of 2-3 serves\* of wholegrain foods a day is consistently reported to reduce the risk of developing chronic disease – including cardiovascular disease,<sup>37</sup> type 2 diabetes<sup>61</sup> and certain cancers<sup>90</sup> – by 20-30%.
- Wholegrains may be more powerful than lipid lowering drugs. Eating 2-4 serves of wholegrain foods a day can reduce the risk of heart disease by as much as 40% - equal to the effect of statin drugs.<sup>38,42</sup>
- Wholegrain foods can help to lower blood pressure. Replacement of white rice with brown rice, white bread with wholegrain bread, and low-fibre cereals with barley or whole wheat cereals led to a significant reduction in systolic and diastolic blood pressure over a five week period in 25 overweight hypercholesterolaemic patients.<sup>47</sup>
- A diet high in wholegrains is associated with a lower BMI, waist circumference and risk of being overweight; it can also help to reduce weight gain and assist in weight loss as part of an energy-controlled diet.<sup>81</sup>
- Long-term dietary intervention studies confirm that diets incorporating frequent consumption of wholegrain foods can reduce the progression from impaired glucose tolerance to type 2 diabetes by up to 58%.<sup>71</sup>
- Cancer is a leading cause of death in Australia, and wholegrains may play a role in prevention. Regardless of how the evidence was analysed, there was compelling evidence in support of wholegrain consumption and reduced risk of some cancers.<sup>87,103</sup>
- There is emerging science about the benefits of wholegrain consumption for prevention of periodontal disease,<sup>108</sup> and asthma<sup>109</sup>, as well as suggestive evidence for improvements in mood and cognitive function.<sup>110-112</sup>
- The antioxidant capacity of many wholegrain foods is equal to, or greater than, that of fruits and vegetables.<sup>113</sup>

\*One serve is equivalent to one slice of bread.



- Australian dietary guidelines recommend Australians eat at least four serves of grain based foods each day<sup>3</sup> and health authorities around the world are recommending that at least half of all grain food consumption should be wholegrain.<sup>4,5</sup>

## LEGUMES: KEY FINDINGS

- Epidemiological studies consistently show that eating legumes can help reduce the risk of cardiovascular disease, diabetes and obesity as well as improve gut health.<sup>21</sup>
- Legume consumption four or more times a week (compared with less than once a week) was associated with a 22% lower risk of coronary heart disease and 11% lower risk of cardiovascular disease.<sup>131</sup>
- The World Cancer Research Fund and the American Institute for Cancer Research recommend people “eat relatively unprocessed cereals (grains) and/or pulses (legumes) with every meal.”<sup>145</sup>

## Foreword

*This important Australian report gives a comprehensive overview of the considerable potential for grains and legumes to prevent our most serious - and costly - diseases.*

*For the first time, it collates the extensive body of scientific findings that establish the ability of grains and legumes to lower the risk of a number of preventable health problems including cardiovascular disease, type 2 diabetes, certain cancers and obesity.*

*These conditions represent some of our leading causes of death and disability and their enormous scale means that the population as a whole is at risk. When we look to managing these serious issues prevention, not cure, is the preferred option.*

*The report is an evaluation of the literature relating to wholegrains, legumes and their constituents which have the potential to lower the risk of major lifestyle diseases by at least 20%. The evidence for risk reduction comes predominately from large prospective cohort studies which have been published in peer-reviewed international journals and have been the subject of meta-analyses by recognised authorities.*

*Importantly, this reduced risk is achievable through relatively modest dietary changes - incorporating as little as 2-3 serves of wholegrain foods into the daily diet - and can be attained with foods readily available at the supermarket.*

### **Dr David Topping**

*CSIRO Food Futures National Research Flagship  
Go Grains Health & Nutrition Internal Review Panel*

## Introduction

Food has an essential role to play in promoting good health and easing the burden of chronic disease being experienced in Australia and throughout the western world.

Grain-based foods and legumes are important dietary staples, and make a significant contribution to a healthy diet. The Grains & Legumes Health Report provides an overview of some of the latest scientific research (both

epidemiological and intervention trials) examining the relationships between grain consumption and health, and highlighting emerging areas of interest. It includes new Australian consumption data for both children and adults.

The Grains & Legumes Health Report has been co-authored by Go Grains Health & Nutrition (Go Grains) and Associate Professor Peter Williams, University of Wollongong. The report has been reviewed by Go Grains' internal review panel – Dr David Roberts and Dr David Topping.



# Grains

## WHAT IS A GRAIN?

Grains, commonly referred to as 'cereals', are the edible seeds of plants belonging to the cereal grass family (Gramineae)<sup>1</sup>. Wheat, oats and rice are the grains most commonly eaten in Australia with others such as rye, barley, corn, triticale and millet making a smaller contribution. Spelt, emmer, einkorn and kamut – which are often referred to as 'ancient' grains - are varieties of wheat.

'Pseudo-cereals' such as amaranth, buckwheat and quinoa, are generally considered as grains since their overall nutrient composition is similar and they are prepared and used in the same way as true cereal grains.

## GRAINS AND NUTRITION

Grains and grain-based foods are a staple in the diets of cultures around the world, and have made an important contribution to daily nutrient requirements since cultivation began around 10,000BC.<sup>2</sup> Their consumption is encouraged in dietary guidelines both in Australia and around the world for the significant contribution these foods make to nutrient intake.<sup>3-6</sup>

Cereal grains are high in carbohydrate, low in fat, good sources of protein and provide varying amounts of fibre, vitamins and minerals. The nutritional composition of grains may vary depending on the variety and environmental growing conditions. The protein content of wheat is higher, on average, than that of other cereals.

In the 1995 National Nutrition Survey,<sup>7</sup> 'breads and cereals' were the leading source of fibre, thiamin, magnesium and iron and the second most important source of folate, niacin, zinc and protein in the Australian diet.

## WHOLEGRAINS AND REFINED GRAINS

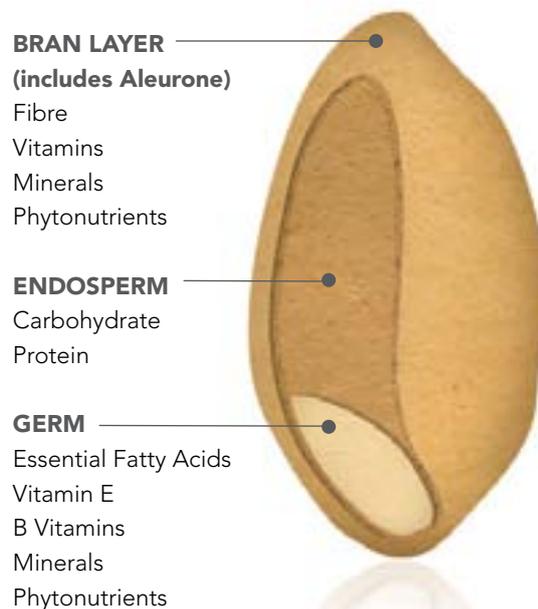
Grains need to be processed to make them suitable to eat. This may be as simple as de-hulling or could involve processes such as grinding, milling, or flaking. Milling grains helps to release valuable nutrient components concentrated within the outer layers of the grain and this can enhance nutrient availability.<sup>8-10</sup>

Grain-based foods are generally grouped as **wholegrain** or **refined**.

**Wholegrains** are defined in the Australia New Zealand Food Standards Code as "the intact grain or the dehulled, ground, milled, cracked or flaked grain where the constituents – endosperm, germ and bran – are present in such proportions that represent the typical ratio of those fractions occurring in the whole cereal, and includes wholemeal."<sup>11</sup>

Wholegrains are low in fat, and are important sources of protein, dietary fibre, vitamins (especially B-group and Vit E), minerals (magnesium, zinc) and many bioactive phytochemicals (such as lignans, flavonoids, ferulic acid, and anthocyanins).<sup>12</sup> These functional components work both alone and in synergy to promote health and offer significant protection against cardiovascular disease, diabetes and some gastrointestinal cancers.

Figure 1: Cross Section of a Grain



**Wholemeal** is produced by milling wholegrains to a finer texture. Wholemeal is defined in the Food Standards Code as "containing all the milled constituents of the grain in such proportions that it represents the typical ratio of those fractions occurring in the whole cereal."<sup>11</sup> Wholemeal flour and rye flour are examples of wholemeal products.

Examples of foods made with wholegrain or wholemeal ingredients include wholemeal and mixed-grain breads, rolls, wraps, flat breads and English muffins, wholegrain breakfast cereals, wheat or oat flake breakfast biscuits, wholegrain crispbreads, rolled oats, wholemeal pasta, brown rice, popcorn, bulgar (cracked wheat) and rice cakes.

WHOLEGRAINS MAY BE WHOLE, CRACKED OR MILLED. THEREFORE, WHOLEMEAL FOODS ARE ALSO WHOLEGRAIN.

**Refining** grains removes varying proportions of the bran and germ. Because micronutrients are generally present in higher concentrations in these outer layers of the grain, refined grain products are lower in vitamins and minerals than wholegrains.

The nutrient content of refined flour is determined by the 'extraction rate' (the proportion of the grain retained after milling). Refined flour produced in Australia is milled to an extraction rate of 78-80% resulting in a higher nutrient content (prior to fortification) than flour produced in countries using a lower extraction rate (eg 73-75% in the US).<sup>13</sup>

While wholegrain foods may be nutritionally preferable overall, refined grain-based foods generally have a lower phytate content, which can improve mineral bioavailability,<sup>14</sup> and they contribute valuable nutrients and fibre to a balanced diet.<sup>15</sup>

Refined grain-based foods such as white bread, white rice, corn tortillas, pasta and couscous, can be important elements in the traditional cuisines of many of the cultures represented in Australia.

## DIETARY RECOMMENDATIONS

The National Health and Medical Research Council (NHMRC) Dietary Guidelines for Australian Adults recommend that people "eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain."<sup>3</sup> All Australians over the age of four years old should eat at least four serves of grain-based foods each day,<sup>3,16</sup> with specific recommendations depending on age, gender and life stage (Table 1). Health authorities around the world recommend that at least half of all grain consumption be wholegrain.

*\*\*An 'ounce' equivalent of grains (wholegrain or refined grain) is equal to: 1 slice of bread, 1 cup of ready to eat cereal, 1/2 cup of cooked rice, 1/2 cup of cooked pasta, 1/2 cup or cooked cereal. These quantities are half the serve size referred to by Australian Dietary Guidelines.*

**Table 1: Recommended Serves of Grain-Based Foods<sup>3,16</sup>**

### Children and Adolescents

4-7 years .....	5-7 serves per day
8-11 years .....	6-9 serves per day
12-18 years .....	5-11 serves per day

### Women

19-60 years .....	4-9 serves per day
Pregnant .....	4-6 serves per day
Breastfeeding .....	5-7 serves per day
60+ years .....	4-7 serves per day

### Men

19-60 years .....	6-12 serves per day
60+ years .....	4-9 serves per day

### What is a 'serve' of grain-based food?<sup>3,16</sup>

The Australian Guide to Healthy Eating defines a serve as:

- 2 slices of bread
- 1 medium bread roll
- 1 cup of cooked pasta, noodles, rice
- 1 cup of porridge
- 1 cup of breakfast cereal flakes
- 2 wheat or oat breakfast biscuits
- 1/2 cup of muesli
- 1/3 cup of flour

## Wholegrain Recommendations

The significant health benefits associated with regular consumption of wholegrain foods are acknowledged, and consumption encouraged, by the NHMRC with the dietary guideline for 'breads and cereals' including the advice to choose 'preferably wholegrain' varieties.<sup>3</sup>

There is, however, no official Australian recommendation that quantifies the amount of wholegrain foods to include in a healthy diet each day.

In comparison, the 2005 US Dietary Guidelines include the advice to consume three or more ounce equivalents\*\* of wholegrain products each day, which means that at least half the recommended grain serves should come from wholegrains.<sup>4</sup> The 2007 revision of Canada's Food Guide also makes the recommendation that at least half the grain products consumed each day should be wholegrain.<sup>5</sup> There has been a recent recommendation for four servings of wholegrains each day in Denmark.<sup>6</sup>

Since the specific US public health nutrition guidelines for wholegrains were introduced in 2005 there has been a 20% increase in wholegrain consumption amongst Americans from 2005-2008.<sup>17</sup>

### Daily Target Intake

In 2008, in order to quantify 'preferably wholegrain', Go Grains, in collaboration with the International Life Sciences Institute (ILSI) convened an expert panel to establish **an Australian daily target for wholegrain intake**.<sup>18,19</sup>

After reviewing the scientific evidence, the expert panel agreed that **48g of wholegrains each day** is an achievable, evidence-based Daily Target Intake (DTI) for adults, teens and older children (aged 9 years+). This DTI is consistent with formal recommendations of the US dietary guidelines and with informal recommendations in Europe.

**Young children** need to increase the amount of wholegrains in their diets gradually as they grow. Go Grains endorses the following wholegrain daily targets for small children aged 2-8 years, based on US recommendations that are extrapolated from chronic disease prevention evidence in adults and adjusted for energy in young children:<sup>4</sup>

- **2-3 years:** 24g of wholegrains a day; and
- **4-8 years:** 32-40g of wholegrains a day.

The 48g DTI can be found on the label of many breads, cereals, crispbreads and snacks, helping food manufacturers to communicate a consistent wholegrain message to Australians.

### Defining Wholegrain Foods

Australian food regulations define the term 'wholegrain' but not 'wholegrain food'. Wholegrain products vary in the amount of wholegrains they contain and information about the wholegrain content can generally be found on the label. Products labelled as 'wholegrain' are required to state the proportion of wholegrains they contain (expressed as a percentage) in the ingredient list.

Table 2 includes examples of readily available wholegrain foods and their approximate wholegrain content.

Working with food manufacturers, Go Grains has produced a voluntary Wholegrains Communication Guide<sup>20</sup> to encourage consistency in wholegrain communications. The guide suggests that food products contain at least 10% wholegrains or  $\geq 4.8g$  of wholegrains per serve in order to make a wholegrain claim.



**Table 2: Wholegrain Content of Popular Foods**

Wholegrain Food	Serve Size	Wholegrain Content (approx.)
Wholemeal bread	2 slices	30-40g
Multi-grain bread	2 slices	5-30g
Wheat-flake breakfast biscuits	2 biscuits	30g
Wholegrain breakfast cereal	30-45g	15-30g
Natural muesli	1/2 cup	30-40g
Porridge	1/3 cup oats (raw)	30g
Brown rice	1 cup (cooked)	65g
Wholegrain pasta	1 cup (cooked)	55-65g
Rice cakes	4 (thin)	20g
Popcorn (plain)	20g	15g
Muesli bar	1 bar	10-15g

## WHOLEGRAINS AND HEALTH

Grain-based foods, both wholegrain and refined, make an important contribution to the nutrient intakes of Australians. Their role in a healthy diet goes beyond merely the provision of nutrients; there is strong and growing evidence that regular consumption of grain-based foods, specifically wholegrain, can play a role in disease protection.

Epidemiological studies in the US, UK and Europe consistently report that consumption of wholegrain foods reduces overall disease risk and all-cause mortality.<sup>21-24</sup> For example, the ARIC study in the US, which followed more than 15,000 individuals for 11 years, found those consuming the most wholegrains (three serves a day) had a 23% reduction in mortality compared to those consuming an average of 0.1 serves a day.<sup>25</sup>

### Wholegrain Nutrients

Wholegrains contain a wide range of nutrients and phytochemicals that help to protect against lifestyle diseases such as heart disease, type 2 diabetes and some cancers.<sup>12, 27, 28</sup> These include:

**Vitamins** – B-group vitamins including folate and Vit E, a powerful antioxidant

**Minerals** – Selenium, iron, zinc and magnesium

**Fibre** –

- **Lignans** have antioxidant and weak oestrogenic activities
- **β-glucan** (a soluble fibre common in the cell wall of many grains that has cholesterol lowering properties)
- **Soluble pentosans** (eg arabinoxylans) have been shown to also lower cholesterol and to enhance the beneficial effects of fibre in promoting regularity

**Phytochemicals** –

- **Phytosterols** have cholesterol-lowering properties
- **Sphingolipids** are associated with tumour control and maintenance of normal epithelia
- **Polyphenols and phenolics** such as hydroxycinnamic, ferulic, vanillic and p-coumaric acids, which have antioxidant properties
- **Carotenoids** (such as α- and β-carotene, lutein and zeaxanthin), which have antioxidant functions
- **Phytate** may have a role in lowering glycaemic responses and reducing oxidation of cholesterol

According to a review of the scientific evidence in 2007 by the University of Wollongong's National Centre for Excellence in Functional Foods, eating 1-2 serves<sup>†</sup> of wholegrain foods a day provides comparable disease risk reduction – in the order of 20-30% of total mortality, cardiovascular disease, diabetes, stroke and some cancers – to that observed for 5-6 serves of fruit and vegetables.<sup>26</sup>

## Wholegrains and Cardiovascular Disease

### Cardiovascular Disease: Key Statistics

- Encompassing heart, stroke and blood vessel diseases – is a leading cause of death in Australia, accounting for 34% of all deaths in 2005.<sup>29</sup>
- It is estimated that the cost of treatment in Australia in 2000-01 was \$5,479million.<sup>30</sup>

In a meta-analysis, Mellen et al (2008) found "a consistent, inverse association between dietary wholegrains and incident cardiovascular disease in epidemiological cohort studies. In light of this evidence, policy makers, scientists and clinicians should re-double efforts to incorporate clear messages on the beneficial effects of wholegrains into public health and clinical practice endeavours."<sup>30</sup>

### Coronary Heart Disease (CHD)

In 2006 Food Standards Australia New Zealand (FSANZ) commissioned a review of a potential high-level health claim for wholegrains and CHD. That review concluded that the large body of prospective data provides convincing evidence for a protective effect of wholegrains against CHD. However, FSANZ did not accept that the relationship was convincing enough because of inconsistency in the definitions of wholegrain used in the studies, and because most studies focused on oats and barley, rather than wheat, which is the predominant cereal consumed in Australia.<sup>32</sup>

More recent reviews have been strongly consistent in supporting the protective effect of wholegrains. There have now been four meta-analyses and at least four systematic reviews published in international

*Quick Fact:* A 5% reduction in saturated fat intake has been shown to reduce the risk of ischaemic heart disease by 6-8%,<sup>33</sup> whereas eating 2-3 serves of wholegrain foods a day has been shown to lower the risk by 30%.<sup>26</sup>

† One serve is equivalent to two slices of bread.



“*[There is] a consistent, inverse association between dietary wholegrains and incident cardiovascular disease.*”

peer-reviewed journals which all report an association of reduced risk of CHD with wholegrain food consumption.<sup>31, 34-40</sup> The most recent systematic review published in 2008<sup>37</sup> concluded three serves of wholegrains a day is associated with a 30-48% risk reduction. Seven of the nine cohort studies summarised in that review found there was a significant reduction in relative risk with intakes as low as only one serve of wholegrains a day.

The definition of wholegrain foods in these studies varied from requiring 25% to 51% wholegrain ingredients. Using the few studies employing the stricter US Food and Drug Administration (FDA) definition of 51%, De Moura (2008) concluded the body of evidence was insufficient to draw conclusions.<sup>37</sup> However, most epidemiological studies, such as the Iowa Women’s Health Study, the Physicians Health Study and the Nurses Health Study used the lower 25% definition, and reported a positive association, suggesting the protective effect would also be present for foods with a higher percentage of wholegrains.

Another systematic review of prospective cohort studies and randomised controlled trials investigating the strength of causal evidence for a range of dietary factors in relation to CHD found moderate evidence of causal association for wholegrains – the same level of evidence as found for fish, fruit and folate.<sup>41</sup>

*Quick Fact:* Increasing wholegrains to 2-4-serves a day can reduce the risk of heart disease by as much as 40% - equal to the effect of statin drugs.<sup>38,42</sup>

### Hypertension

Three prospective cohort studies have reported an inverse association between wholegrain consumption and hypertension.

The US Health Professionals Follow-Up Study followed 31,864 male participants without hypertension for 18 years. It found that for those in the highest quintile of wholegrain intake (46g a day) the incidence of hypertension was reduced by 19% compared to those with the lowest intake (3g a day), independent of sodium intake.<sup>43</sup> Total bran intake was also inversely associated, with a 15% risk reduction in the highest versus lowest quintiles of intake.

In another prospective cohort of 28,926 female health professionals followed for 10 years, those who consumed 0.5-1, 1-2, 2-4 and four wholegrain servings a day had multivariate relative risks for hypertension of 0.93, 0.93, 0.92, and 0.77 respectively, compared with those who consumed <0.5 wholegrain servings a day.<sup>44</sup>

In the CARDIA study, the hazard ratio for incidence of hypertension during 15 years of follow-up in 4,304 young adults was 0.83, with a wholegrain intake of >1.9 serves a day.<sup>25</sup>

In addition, three randomised controlled trials have examined the effect of wholegrain cereal supplementation. These studies found:

- two serves of oats a day led to greater reduction in medication than two serves of wheat cereal in 43 patients on hypertensive medication;<sup>45</sup>
- three serves of foods supplemented with oat  $\beta$ -glucan significantly reduced blood pressure in hypertensive subjects who were obese, but not others;<sup>46</sup> and
- replacement of white rice with brown rice, white bread with wholegrain bread, and low-fibre cereals with barley or whole wheat cereals led to significant reduction in systolic and diastolic blood pressure during a five week period, in 25 overweight hypercholesterolaemic patients.<sup>47</sup>



The suggested mechanisms by which wholegrains can reduce blood pressure include increased insulin sensitivity, prevention of weight gain and improved endothelial function.<sup>25</sup>

#### Blood Lipids

A 2007 Cochrane Review of randomised trials assessed the evidence for the relationship between consumption of wholegrain foods and the effect on risk factors for CHD. Ten trials met the inclusion criteria and in eight of these studies, the wholegrain component was oats. Seven of these eight studies reported lower total cholesterol and LDL cholesterol with oatmeal foods compared to the control foods, with a significant weighted mean difference of -0.19mmol of total cholesterol/L.<sup>34</sup>

Significant reductions in blood lipids have been demonstrated not only with oats, but also barley<sup>48</sup> and psyllium,<sup>49</sup> and since 1997 the US FDA has permitted a health claim for cereal foods containing at least 0.75g of soluble fibre a serve.<sup>50</sup>

A cross-sectional study reported that intakes of wholegrains (but not refined grains) and cereal fibre were inversely associated with total and LDL cholesterol levels among participants from the Baltimore Longitudinal Study on Aging.<sup>51</sup>

#### Suggested Mechanisms

**Soluble Fibre:** A major mechanism by which wholegrain foods affect cardiovascular disease risk is through the action of viscous soluble fibres, which slow digestion and increase cholesterol excretion. This can inhibit cholesterol absorption by as much as 20% and promote the excretion of bile by up to 144%.<sup>52</sup>

**Nutrients and Phytochemicals:** While soluble fibre is an important mechanism it is not the only one. It has been clearly demonstrated that wheat fibre does not reduce serum cholesterol levels,<sup>40</sup> but in a randomised crossover study published in 2010, consumption of wholemeal wheat foods for three weeks significantly decreased fasting plasma cholesterol and LDL cholesterol levels in healthy individuals.<sup>53</sup> This suggests that components other than the fibre in wholegrain foods may also have an effect on cardiovascular risk.

The components of wholegrains which have been suggested to be important include magnesium, folate, alpha-tocotrienol<sup>6</sup> and the variety of phytochemicals which may directly or indirectly inhibit oxidative stress and inflammation.<sup>24, 54-57</sup>

**Gluten:** Grain proteins such as gluten, with a low lysine to arginine ratio, may help to reduce the risk of developing atherosclerosis through its effect on nitric oxide production.<sup>58</sup>

#### Wholegrains and Type 2 Diabetes

##### Diabetes: Key Statistics

- Diabetes is Australia's fastest growing chronic health problem and is the sixth leading cause of death.<sup>59</sup>
- In 2008, total number of Australians with diagnosed diabetes was 1.015 million people.<sup>60</sup>
- The total cost of type 2 diabetes in 2008 was estimated to be \$8.28 billion.<sup>60</sup>

There is strong epidemiological evidence from around the world to suggest that eating a variety of wholegrain foods is beneficial in the prevention and management of type 2 diabetes – this relationship is a consistent conclusion in systematic reviews.<sup>37, 61-66</sup>

#### Diabetes Prevention

A Cochrane review published in 2008 concluded that high intakes of wholegrain foods reduce the risk of developing type 2 diabetes by 21-33%, a finding

consistently demonstrated in the 11 cohort studies and one randomised controlled trial included in the review. The prospective studies also consistently showed an association between high intakes of wholegrain foods and cereal fibre, and reduced risk of type 2 diabetes, ranging from 27-30% and 28-37% respectively.<sup>61</sup>

A study which followed 43,000 men for around 12 years found that those who ate the most wholegrain foods, including brown rice, oats, and barley, were less likely to be diagnosed with type 2 diabetes than those who ate the least. Those who ate the least wholegrain foods (around 0.2 serves per day) were nearly 30% more likely to develop type 2 diabetes compared with men who consumed the most - about 3.4 servings of wholegrains daily.<sup>67</sup>

*The American Diabetes Association recommends that individuals at high risk of diabetes consume half of their grain intake as wholegrain.<sup>68</sup>*

Since the Cochrane review, several other studies provide further supporting evidence. The MESA study of more than 5,000 US adults followed for seven years found a dietary pattern characterised by a high intake of wholegrains and fruit was associated with a 15% lower diabetes risk.<sup>69</sup>

### Diabetes Management

Wholegrain and high-fibre cereal foods can also help in the management of people who already have diabetes. A review of 24 studies that incorporated wholegrain foods into dietary interventions in subjects with type 2 diabetes found that, in all but two, there were improvements in glucose metabolism, including reduction in insulin or oral hypoglycaemic agents, lowering fasting blood glucose, lowering glycosylated protein concentrations and reduced urinary glucose and C-peptide.<sup>70</sup> Long-term dietary intervention studies confirm that diets incorporating frequent consumption of wholegrain foods can reduce the progression from impaired glucose tolerance to type 2 diabetes by up to 58%.<sup>71</sup>

### Improving Glycaemic Control and Insulin Sensitivity

Epidemiological studies as well as dietary intervention and metabolic studies strongly support the suggestion that wholegrain foods improve glycaemic control and insulin sensitivity.<sup>56, 63, 66, 72</sup> In the MESA study, there were significant inverse associations between wholegrain

intake (0.02 to 1.4 serves a day in the highest quintile) and fasting glucose (2.5%), fasting insulin (9%) and insulin resistance (9%).<sup>73</sup>

In a weight loss intervention trial with overweight subjects at high risk of diabetes, those fed two serves of a wholegrain-based liquid diet product had significantly better improvement in insulin resistance than controls fed an inulin-based product with equivalent levels of dietary fibre.<sup>74</sup>

*“For those who are at risk but have not yet developed diabetes, the progression of impaired glucose tolerance to type 2 diabetes can be delayed, and insulin resistance improved, by lifestyle changes that include exercise and a diet that includes wholegrain foods.”*

Professor Jim Mann <sup>65</sup>

### Suggested Mechanisms

While there are several plausible mechanisms by which wholegrain foods might reduce diabetes risk and improve glycaemic control, some uncertainties remain.<sup>75</sup>

**Insoluble Fibre:** The evidence that wholegrain foods and insoluble dietary fibre derived from cereals protect against type 2 diabetes is strong and consistent among prospective studies. It is possible that this protection is afforded by the intact structure of the cereal grains slowing digestion and partially restricting absorption of the glycaemic carbohydrate.

**Nutrients:** Long-term diabetes prevention benefits might also relate to the nutrient content of wholegrains. The strongest evidence of this is linked to the higher magnesium content of wholegrains, with prospective studies suggesting that low magnesium intake and status predates the diabetic condition.<sup>70</sup>

*“There is strong epidemiological evidence from around the world to suggest that eating a variety of wholegrain foods is beneficial in the prevention and management of type 2 diabetes.”*

## Wholegrains and Weight Management

### Obesity: Key Statistics

- Of the developed nations, Australia is one of the most overweight, with more than 60% of adults and one in four children overweight or obese.<sup>76</sup>
- The prevalence of overweight and obesity in Australia has been steadily increasing during the past 30 years and if the current trends continue unabated, it is estimated that nearly three-quarters of the Australian population will be overweight or obese by 2025.<sup>77</sup>
- While evidence suggests that rates of overweight and obesity may be reaching a plateau in children, the prevalence in Australia is still higher than is desirable.<sup>78</sup>
- The direct treatment costs are estimated to be at least \$700 million per annum.<sup>76,79</sup>

Two reviews of epidemiological and intervention studies have both concluded that there is an association between cereal intake (particularly wholegrain) and reduced risk of weight gain or being overweight.

A meta-analysis of 11 prospective cohort studies on the relationship between wholegrain consumption and body weight reported a mean reduction of 0.63 Body Mass Index (BMI) units between the highest ( $\geq 3$  serves a day) and lowest intakes of wholegrain foods.<sup>80</sup>

The second review of 41 cross-sectional, cohort and intervention studies concluded that there is good evidence that a diet high in wholegrains:

- is associated with a lower BMI, waist circumference and risk of being overweight;
- can help reduce weight gain; and
- can assist in weight loss as part of an energy-controlled diet.<sup>81</sup>

There is no evidence that changing from refined to wholegrain foods without energy restriction will lead to weight loss, but a study of cereal foods (at least five serves a day) in a hypocaloric diet led to significantly greater reduction of abdominal body fat with wholegrain compared to refined grain cereals.<sup>82</sup>

In a prospective cohort of over 27,000 men (from the Health Professionals Follow-up Study), a high wholegrain intake was found to be inversely associated with long term weight gain. It was estimated that for every 40g a

day increment in wholegrain intake from all foods, weight gain was reduced by an average of 0.49kg during the eight year follow-up, with the associations persisting after accounting for changes in added bran or fibre intakes.<sup>83</sup>

The protective role of wholegrains in weight management is further supported by three recent studies:

- A cross-sectional study of participants aged 60-80 years in a US clinical trial found that fat mass, percent body fat and trunk fat mass were inversely associated with wholegrain intake using DEXA (Dual energy x-ray absorptiometry).<sup>84</sup>
- A sub-analysis of a Netherlands cohort study examining 4,237 adults aged 55-60 years for a five year period, using logistic regression, demonstrated that the risk of being obese as compared to normal weight was 10% lower for each additional gram of wholegrain consumption. In women, this risk was 4% lower.<sup>85</sup>
- A hypocaloric clinical trial in overweight adults, found that including three serves of oat-based wholegrain foods per day reduced their waist circumference significantly more than control subjects consuming the same levels of energy a day.<sup>86</sup>

*“There is an association between cereal intake (particularly wholegrain) and reduced risk of weight gain or being overweight.”*



### Suggested Mechanisms

**Fibre:** It is believed that the higher fibre content of diets rich in wholegrains is one of the main mechanisms through which they help control body weight. Dietary fibre can assist weight control in the following ways:

- higher fibre wholegrain foods are typically less energy dense than refined foods;
- the bulking properties of dietary fibre promote satiety; and
- high fibre wholegrain foods typically (but not always) have a lower glycaemic index (GI), which slows the rate of starch digestion leading to lower blood glucose and insulin levels after a meal.<sup>81</sup>

**Metabolic Effects:** In the Health Professionals Follow-up Study, associations between wholegrain intake and reduced weight gain were attenuated after adjustments were made for micronutrients like magnesium, and they persisted even after bran and fibre intakes were accounted for, implying additional metabolic effects beyond the effect of the fibre content.<sup>83</sup> This suggests there are additional components in wholegrains that may contribute to metabolic alterations which favour long-term weight management.<sup>81</sup>

### Wholegrains and Cancer

#### Cancer: Key Statistics

- Cancer is a leading cause of death in Australia costing \$3.8 billion in direct health system costs.<sup>87</sup>
- The most common diet related cancers (prostate, colorectal and breast) account for 41.5% of the burden of cancer.<sup>88</sup>

There have been a number of reviews of the relationship between wholegrain cereal consumption and cancer risk which all conclude that wholegrain foods are associated with lower cancer risk.<sup>89-92</sup> In one review of 40 case-control studies of 20 cancers, the pooled odds ratio for high versus low wholegrain intake was 0.66 (95%CI: 0.60-0.72).<sup>88</sup> The evidence suggests wholegrain cereal foods and cereal fibre rich foods may protect against colorectal cancers, gastric cancers and possibly also breast, endometrial and prostate cancers.<sup>3</sup>

The consistency of evidence was recognised by the US FDA in July 1999 when a wholegrain health claim was approved.<sup>50</sup> It permitted any low-fat product that contained 51% wholegrains by weight to claim "diets rich in wholegrain foods and other plant foods and low in total

fat, saturated fat, and cholesterol may reduce the risk of heart disease and some cancers."

Regular consumption of wholegrain foods has been linked to a variety of positive health outcomes with respect to specific cancers:

- In case-control and cohort studies wholegrains have been shown to reduce the risk of developing cancer of the colon by as much as 30%<sup>93-95</sup> and a meta-analysis of 11 cohort studies estimated a risk reduction of 6% for the development of colorectal cancer comparing the highest with lowest quintiles of wholegrain consumption.<sup>96</sup> A meta-analysis of the largest two intervention studies with wheat bran concluded that there was a significant 19% reduction in risk of recurrence of adenomas in men, but not in women.<sup>97</sup>
- In a prospective cohort study of more than 400,000 people, intake of wholegrain foods and fibre from grains was inversely associated with risk of cancer of the small intestine, with an odds ratio of 0.59 in those with the highest quintile of wholegrain intake.<sup>98</sup>
- The risk of cancers of the upper respiratory tract was reduced by 47% in the highest tertile of wholegrain consumption in the Iowa Women's Health cohort study<sup>99</sup> and similar protective effects have been reported in European populations as well.<sup>100</sup>
- People consuming more than two serves of wholegrains a day had a 40% lower pancreatic cancer risk in a large case-control study in California.<sup>101</sup>
- One prospective cohort study in 10 European countries with 312 incident gastric cancers found that intake of cereal fibre was protective (with a hazard ratio of 0.69 in the highest quartile).<sup>102</sup> This is consistent with Italian case-control studies which estimate an odds ratio of 0.5 for risk of stomach cancer with the highest wholegrain intake.<sup>89</sup>

*"Regardless of how the evidence was analysed, either by cancer type or by type of wholegrain product, there was compelling evidence in support of wholegrain consumption and reducing the risk of some cancers." Marquart et al 2002<sup>103</sup>*

### Suggested Mechanisms

The mechanisms by which wholegrain foods may be cancer protective are not yet clear. A large prospective European study<sup>104</sup> found that total dietary fibre was protective against colo-rectal cancer. Another cohort study concluded that it was not, but that wholegrain consumption lowered risk, suggesting that wholegrain components other than fibre may have a role to play.<sup>98</sup>

The protective components could include fermentable carbohydrates, oligosaccharides, flavonoids, phenolics, phytoestrogens, lignans, protease inhibitors, saponins and selenium.<sup>105,106</sup> Protease inhibitors in grains (such as phytic acid, phenolics, and saponins) have been shown to reduce the risk of colon and breast cancer in animals, and in grains they make up 5-10% of the water-soluble protein, so they may be one possible mechanism.<sup>28</sup>

*Quick Fact: The Cancer Council New South Wales recommends at least half our daily bread, cereals and pasta choices should be wholegrain.*<sup>107</sup>

Chan et al (2007) suggested that another plausible biological mechanisms for the reduction in cancer risk could be the decreased levels of insulin and/or inflammation observed with consumption of wholegrain foods.<sup>101</sup>

### Wholegrains: Emerging Research

In addition to the more established benefits of wholegrains in the prevention of chronic diseases, there is also emerging science about the benefits of wholegrain consumption for prevention of periodontal disease<sup>108</sup> and asthma,<sup>109</sup> as well as suggestive evidence for improvements in mood and cognitive function.<sup>110-112</sup> Further research will be needed to confirm these findings.

## Antioxidants

A study by the Agricultural Research Service of the United States Department of Agriculture in 2007 ranked foods for their antioxidant capacity. Cereal-based foods including ready-to-eat cereals, oats, wholegrain breads and legumes were found to be amongst the highest antioxidant containing foods by ORAC score.<sup>113</sup>

A study presented at the 2009 American Chemical Society conference examined total phenol antioxidants in breakfast cereals and snacks, and found that

wholegrain cereals with the highest antioxidant content are those made with wheat, corn, oats and rice, in descending order. Of snacks, popcorn has the highest level of antioxidants.<sup>114</sup>

Phenolic compounds found in wholegrains that contribute to potent antioxidant activity include:

- Avenanthramides in oats.<sup>115</sup>
- Long chain esters of ferulic and caffeic acids.<sup>27</sup>

*Quick Fact: A cup of popcorn contains as many beneficial polyphenols as an apple.*<sup>114</sup>

**Table 3: ORAC Antioxidant Capacity of Selected Fruits, Vegetables, Grains and Legumes ( $\mu\text{molTE}/100\text{g}$ )<sup>115</sup>**

Grains	Total ORAC	Fruit and Vegetables	Total ORAC
Rice bran	24287	Blueberries	6552
Cornflakes	2359	Blackberries	5347
Granola	2294	Strawberries	3577
Oat bran	2183	Apples	2828
Rolled oats	2169	Avocados	1933
Pumpernickel	1963	Oranges	1819
Popcorn	1743	Spinach	1515
Mixed grain bread	1421	Broccoli	1362
Shredded wheat cereal	1303	Green tea, brewed	1253
<b>Legumes</b>		Mangoes	1002
Pinto beans	904	Carrots	666
Chickpeas	847	Green peas	600
Lima beans	243		

# Legumes

## WHAT IS A LEGUME?

Legumes (also known as pulses) include all forms of beans and peas — dried, canned and cooked. Among the well known legumes are butter beans, haricot (navy) beans, cannellini beans, red kidney beans, adzuki beans, black-eyed beans, soybeans, mung beans, lentils, split peas, peanuts and chick peas.

## LEGUMES AND NUTRITION

Legumes provide a range of essential nutrients including protein, low glycaemic carbohydrates, dietary fibre, minerals and vitamins.<sup>116,117</sup> They are:

- A good source of B vitamins, iron, zinc, calcium, magnesium, omega-3 fats and are rich in phytonutrients (e.g. isoflavones, lignans, protease inhibitors) that can potentially reduce the risk of cancer and other chronic diseases.<sup>118</sup>
- An economical dietary source of good quality protein and are higher in protein than most other plant foods. Legumes have about twice the protein content of cereal grains.
- Generally low in fat and have no cholesterol. Soybeans and peanuts are the exception, with significant levels of mostly mono and polyunsaturated fatty acids, including alpha-linolenic acid.

Legumes contain relatively low quantities of the essential amino acid methionine (which is found in higher amounts in grains). Grains, on the other hand, contain relatively low quantities of the essential amino acid lysine, which legumes contain. This is why some vegetarian cultures - in order to get a balanced diet - combine their diet of legumes with cereal grains. Common examples of such combinations are dhal with rice in India, beans with corn tortillas in Mexico, tofu with rice in Asia and peanut butter with bread in the US and Australia.

Soy beans are particularly high in compounds called phytoestrogens. Research over the last 20 years has linked soy foods and/or phytoestrogens to a reduced risk of certain cancers including breast and prostate cancer, heart disease, osteoporosis and problems associated with menopause.<sup>119-121</sup>

## DIETARY RECOMMENDATIONS

Consumption of legumes is recommended in the Australian dietary guidelines - recognising their favourable nutrient profile.<sup>3</sup> In these guidelines and in the Australian Guide to Healthy Eating,<sup>16</sup> legumes are considered both as vegetables and as alternatives to lean meat, fish and poultry.

Other countries specifically recommend greater legume consumption for good health:

- The South African Food Based Dietary Guidelines include a guideline to "eat dry beans, peas, lentils and soy regularly."<sup>116</sup> The recommended amount of cooked legumes is 100-200g a day.<sup>122</sup>
- The 2007 Canadian Food Guide prioritises legumes and states "have meat alternatives such as beans, lentils and tofu often."<sup>5</sup>

Evidence is strengthening for the role legume consumption can play in disease protection, as are calls to emphasise plant proteins in order to reduce the environmental impacts of diets high in animal protein.<sup>123</sup> However, overall legume intake is very low in Australia, with a mean intake of less than 10g a day by adults in the 1995 National Nutrition Survey.<sup>7</sup> According to the 2007 National Children's Nutrition and Physical Activity Survey, Australian children aged 2-16 are eating only 4-12g legumes a day.<sup>124</sup>

*Quick Fact:* Every 20g increase in legume intake was associated with a 7-8% lower risk of death in older people in a study of five cohorts in Japan, Sweden, Greece and Australia.<sup>125</sup>



Peanuts and soybeans account for most of the legume products eaten around the world. Legumes are eaten in a variety of ways, including tofu (Japan, China), bean sprouts (China, Korea), chilli and refried beans (Mexico), dhal and pappadums (India), falafel and hummus (Middle East), tempeh (Indonesia), Boston baked beans, Swedish pea soup and peanut butter (US, Australia).

*“Today, a balanced meal includes smaller amounts of meat, more meat alternatives and a greater emphasis on vegetables, fruit and whole grain foods....”*

*Canada’ Food Guide Resource for Educators and Communicators<sup>126</sup>*

## LEGUMES AND HEALTH

The scientific literature on legumes and health is not as extensive as that for cereal grains, and it has been limited by the generally low intake of legumes in most free-living populations. However, there is consistent evidence from epidemiological studies showing that eating legumes can play a role in preventing chronic disease, including cardiovascular disease, diabetes and overweight, as well as improving gut health.<sup>21</sup>

According to research published as part of the ATTICA Study in Greece, a dietary pattern that includes legumes, along with cereals, fish, vegetables and fruits was independently associated with reduced levels of clinical and biological markers linked to the metabolic syndrome.<sup>127</sup>

Supporting this relationship are results from the Greek EPIC prospective cohort study, which found that the Mediterranean diet was associated with a 14% lower mortality among the 23,349 participants during 8.5 years, and that high legume consumption was calculated to contribute to almost 10% of the protective effect of the diet.<sup>128</sup>

In a seven year longitudinal study of older people from different dietary cultures (including Japan, Sweden, Greece and Australia), higher legume intake was reported to be the most protective dietary predictor of longevity, regardless of ethnicity, with a 7-8% reduction in risk of death for every 20g increase in daily legume intake.<sup>125</sup>

There are a range of nutritional characteristics associated with legumes that are considered to be protective against chronic diseases. These include:

- **Low saturated fat content** – replacing some animal protein in the diet with legumes reduces saturated fat intake without compromising overall protein intake.
- **Low glycaemic index** – contributes to the satiating effect of a meal and may reduce insulin responses.
- **Phytochemical content** – non-nutritive bioactive compounds including antioxidants may play a role in the disease protection benefits of legumes. Legumes are also sources of phytosterols, isoflavones, saponins, and alkaloids, as well as some bioactive sugars, oligosaccharides and phytates.<sup>129</sup>

## Legumes and Cardiovascular Disease

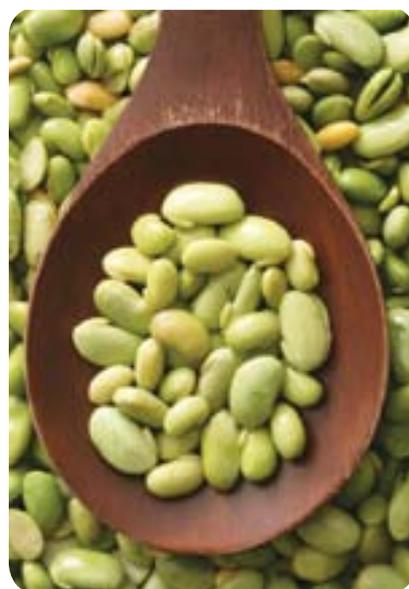
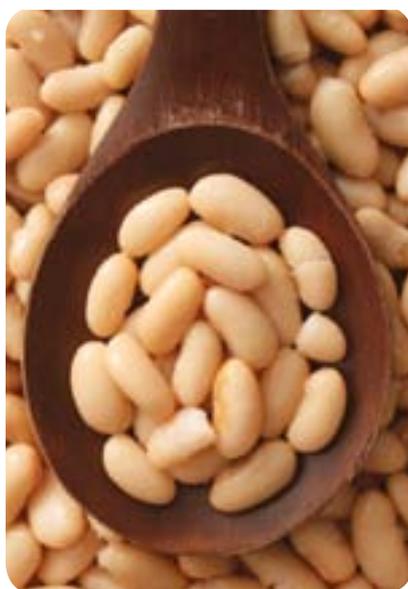
A review of studies on cereals, legumes and prevention of coronary heart disease published in 2006 has summarised most of the relevant research.<sup>38</sup> Four epidemiological studies reported legume consumption was significantly and inversely associated with cardiovascular disease (CVD) risk. Three of those studies were conducted in Asia, where the main legume is soy, but at least one American study, where other legumes are more commonly consumed, also reported a protective association.

The NHANES I Epidemiologic Follow-up Study found that legume consumption was significantly and inversely associated with the risk of CHD and CVD. Legume consumption four times or more a week (compared with less than once a week) was associated with a 22% lower risk of CHD and an 11% lower risk of CVD.<sup>130</sup>

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*“There is consistent evidence from epidemiological studies showing that eating legumes can play a role in preventing chronic disease, including cardiovascular disease, diabetes and overweight, as well as improving gut health.”*

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The Japanese are one population who have a traditionally high intake of legume based foods. The Japan Collaborative Cohort Study followed over 60,000 adults for 13 years and found the highest bean intake (4.5 serves a week) was associated with a 16% reduction in total CVD risk and a 10% reduction in total mortality.<sup>131</sup> It is possible that the high soy intake in Japan is responsible for this effect.

A meta-analysis of 23 trials using intact soy isoflavones found an LDL cholesterol lowering effect of 5%, independent of initial cholesterol levels.<sup>132</sup>

Since 1999 the US FDA has permitted food manufacturers to claim that foods high in soy protein may help lower heart disease risk and recent meta-analyses continue to support this relationship.<sup>133,134</sup>

#### Suggested Mechanisms

The fatty acid profile, dietary fibre, isoflavones and antioxidants in legumes may contribute to reducing the risk of cardiovascular disease through their hypocholesterolaemic effect. Legumes are also good sources of saponins and phytosterols which may assist with decreasing absorption of cholesterol from the gut.<sup>129</sup>

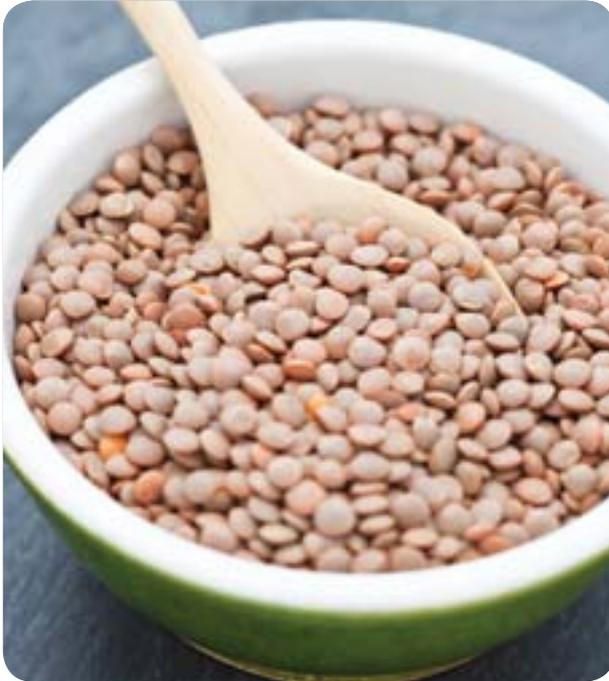
#### Legumes and Type 2 Diabetes

Two reviews have considered the role of legumes in diabetes. Most epidemiological studies do not separate the effect of wholegrain cereals and legumes sufficiently, although it has been concluded that "wholegrain foods and legumes improve indicators of glucose, lipid and lipoprotein metabolism in people with diabetes and healthy people."<sup>70</sup>

A systematic review and meta-analysis of randomised controlled trials in people with and without diabetes considered a total of 41 studies involving legumes.<sup>135</sup> That review concluded that legumes alone lowered fasting blood glucose and insulin, and in low-GI diets legumes lowered HbA1c or fructosamine, but that further large well designed trials are still needed.

A large Chinese study, following more than 64,000 women for more than four years, found significant inverse associations between legume intake and the incidence of type 2 diabetes. The highest quintile of intake was 65g a day and soyfoods made up 40% of the total legume content of the diets. While soybeans alone had a clear protective effect (with a relative risk of 0.53), other non-soy legumes were also associated with significantly lower risk (relative risk = 0.76).<sup>136</sup>

*Quick Fact:* Legume consumption, including soybeans, is inversely associated with the risk of type 2 diabetes.<sup>136</sup>



### Suggested Mechanisms

It is proposed legumes may reduce the risk of type 2 diabetes through the action of several components which could potentially reduce postprandial blood glucose and insulin excursions, effectively lowering the GI of the diet through slowed absorption.<sup>135</sup>

### Legumes and Weight Management

A review in 2008 concluded that there was insufficient evidence to make any clear conclusions about the effect of legumes on weight control,<sup>137</sup> but other studies suggest there is a possibility of a protective effect.

A cross-sectional study of adults in Iran reported that the risk of being centrally obese was significantly lower in the highest quartile of legume intake in men (30g a day).<sup>138</sup>

A small trial with overweight diabetic subjects in Mexico compared a low-GI and a high-GI diet, with more carbohydrates being provided from legumes in the low-GI diet.<sup>139</sup> Those consuming more legumes had improved glycaemic control and greater weight loss.

### Suggested Mechanisms

The main postulated mechanism by which legumes may benefit weight management is through their higher fibre content.<sup>81</sup> Higher fibre diets can exhibit positive effects on energy balance, post-prandial glycaemia and insulinaemia, and colonic health.<sup>140,141</sup>

The low GI value of legumes, known to enhance satiety, may be another important mechanism.<sup>142</sup> An Australian study found consuming four 300g cans of chickpeas a week resulted in significantly higher levels of satiety and improved bowel function.<sup>143</sup> A second Australian study, using lupin flour enriched bread at two meals a day, also found higher self-reported satiety and lower energy intakes with the higher legume diet.<sup>144</sup>

### Legumes and Cancer

The 2007 World Cancer Research Report into diet and cancer risk concluded there was suggestive but limited evidence that legumes reduced the risk of stomach and prostate cancer.<sup>145</sup> Other reviews since then have suggested the evidence for prostate cancer protection is stronger<sup>146</sup> and that legumes are also protective against breast and colorectal cancers, although much of the evidence is limited to the effect of soy intake.

Two meta-analyses concluded that there is a 14-25% reduced risk of breast cancer with high soy intakes.<sup>147,148</sup> An analysis of the Nurses Health Study, involving 34,467 US women, found that those who consumed four or more servings of legumes a week had a lower incidence of colorectal adenomas than women who reported consuming one serving or less.<sup>149</sup> This is supported by results from the Shanghai Women's Health Study, which found women in the highest tertile of soy consumption had a 33% lower colorectal cancer risk.<sup>150</sup>

### Suggested Mechanisms

The mechanisms of cancer protection are not clearly understood.<sup>12</sup> Legumes contain several phenolic compounds, in addition to glutathione, soluble proteins and tocopherols which are considered to be natural antioxidants and may provide some cancer protective effects.<sup>151</sup> Legumes are also significant sources of resistant starches, which are fermented by colonic bacteria to short chain fatty acids, thus improving colonic health.<sup>152</sup>

*Quick Fact:* The World Cancer Research Fund and the American Institute for Cancer Research recommend people "eat relatively unprocessed cereals (grains) and/or pulses (legumes) with every meal."<sup>153</sup>

# Consumption Data

## ALL AUSTRALIANS

In 2009, Colmar Brunton undertook a comprehensive national study on behalf of Go Grains to determine consumption of grain-based foods (data was collected for 63 foods) among Australians, aged 5 to 80 years. A two day consumption diary was kept by more than 1,700 participants, followed by an online survey to establish consumption behaviour as well as usage and attitudes to grain-based foods.

### Key Findings

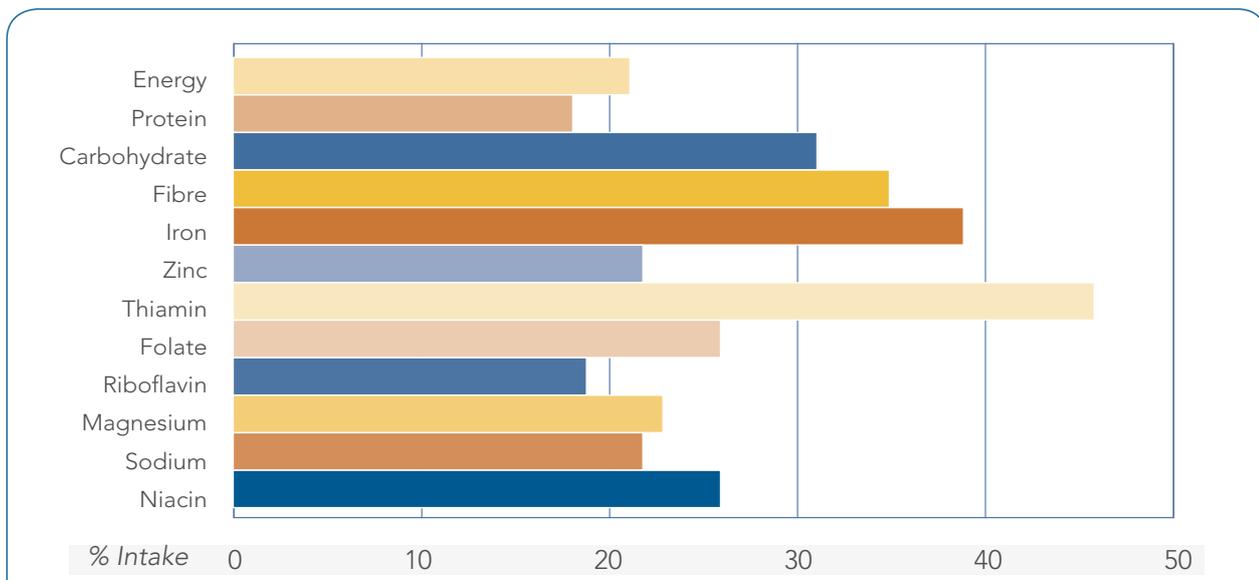
- Australians, on average, consumed just over five servings of grain-based foods a day. Almost 25% of this was made up of non-core grain-based foods such as cakes, biscuits, pastries, hamburgers, pizza, hot dogs, pies, sausage rolls and other takeaway foods.
- Australian females, on average, consumed just over three serves a day, never reaching the recommended '4+ serves a day' at any point during the week.
- Australians on average, consumed less than one and a half of their grain food serves from wholegrains each day, this represents barely one third of their daily grain food intake coming from wholegrains.

- Legumes were consumed by only 23% of all Australians with those people eating on average one cup (two servings) of legumes a day. Baked beans were the main contributor to legume intake (58%).

## AUSTRALIAN CHILDREN

A secondary analysis<sup>154</sup> of data from the 2007 Australian National Children's Nutrition and Physical Activity Survey conducted by CSIRO<sup>124</sup> has revealed:

- 93-99% of children ate grain-based foods (bread, breakfast cereals, rice and pasta) on the day of the survey.
- Core cereal foods are important contributors to nutrient intake in the diets of Australian children, contributing from 18-46% of macro- and micro-nutrient intakes (Graph 1).
- Breads and bread rolls were the primary contributors to energy, protein, carbohydrate, fibre, magnesium, sodium and niacin intakes, with breakfast cereals the main sources of iron, zinc, thiamin, folate and riboflavin.
- Around 50% of children commonly consumed white varieties of bread and bread rolls, with 20% consuming wholemeal and 12.5% consuming mixed grain, suggesting further opportunity to promote wholegrain and wholemeal varieties.
- Core cereal foods contributed approximately 3.5% of total saturated fat intake and 6% of total sugar intake.



**Graph 1: Contribution of core cereal foods to macro- and micro- nutrient intakes of children aged 2-16 in the 2007 Australian National Children's Nutrition and Physical Activity Survey.**

- Core cereal foods contributed around 22% of the total sodium intake for children. The report concluded that core cereal foods are important contributors of macro- and micro-nutrients in the diets of Australian children, highlighting the importance of strategies to reduce sodium contribution from non-core foods.
- Only 5-7% of Australian children consumed legumes, with an average daily intake of 88-139g.

According to the CSIRO, "legumes play an important role in a healthy diet and thus increasing familiarity and popularity [of legumes and pulses] may be beneficial."<sup>154</sup>

### THE CHALLENGE: INCREASING CONSUMPTION

There are substantial challenges that need to be addressed in order to increase the consumption of wholegrain foods.<sup>154,155</sup> These include traditional preferences for refined products, limited availability of wholegrain foods in supermarkets and foodservice settings, unfamiliarity with cooking techniques and confusion in product labelling.

Understanding the benefits of wholegrain foods will enable health professionals to effectively communicate

with, and encourage, consumers to incorporate more wholegrains into their diets. Along with food manufacturers, health professionals are well positioned to help consumers identify wholegrain foods and products, and offer recipes and convenient ways to add them to the diet. Continued education and consistent wholegrain labelling and messaging on pack have been identified as important factors in increasing consumption of wholegrains.<sup>155</sup>

In Australian focus groups discussing consumption of chickpeas, factors that were perceived to discourage legume consumption were health issues such as gastrointestinal upset, sensory aspects, the perceived inconvenience of dried legume preparation, and lack of legume recipes in common cookbooks.<sup>143</sup>

The low cost of legumes, along with their health benefits and dietary variety are important factors encouraging legume consumption. The convenience of canned legumes and recipes or advice on how to cook with legumes, have been recognised as important factors in increasing acceptability among Australians.<sup>143</sup>

As current and emerging research demonstrates the positive influence of wholegrains and legumes on health, it is clear that it is an effort worth making.



## Healthcare Savings

From the literature summarised here, it is likely that consumption of three serves<sup>#</sup> of wholegrain foods a day could reduce the risk of cardiovascular disease, type 2 diabetes and cancer by 20-30%.

Table 4 estimates the savings that could theoretically result from a conservative 20% reduction in each of these major diseases, based on recurrent costs in 2000 - 2001 estimated by the Australian Institute of Health and Welfare in 2005.<sup>30</sup>

# One serve is equivalent to one slice of bread.

Based on a conservative 20% reduction [in cardiovascular disease, type 2 diabetes and cancer], health expenditure cost savings could potentially be over \$1.2 billion annually.

**Table 4: Potential Health Expenditure Cost Savings with Three Serves<sup>#</sup> of Wholegrains Each Day**

Disease Group	2001 Annual Healthcare Expenditure (\$million) <sup>29</sup>	Percent Related to Diet	20% Annual Saving (\$million)
Cancers	2,918	40% (prostate, colorectal, breast only) <sup>88</sup>	233.3
Cardiovascular	5,479	40% (CHD and stroke) <sup>156</sup>	438.3
Diabetes	812	84% (type 2) <sup>157</sup>	136.4
Endocrine, nutritional and metabolic	1,587	45% (obesity) <sup>30</sup>	142.8
<b>Total in 2001</b>			<b>950.8</b>
<b>Adjusted for 3.1% annual inflation in health care expenditure to 2009<sup>59</sup></b>			<b>1,213.8</b>

## Summary

There is consistent scientific evidence for the role of wholegrains, and suggestive evidence for the role legumes, in protecting against cardiovascular disease, type 2 diabetes, certain cancers and obesity.

The disease risk reduction from just three serves of wholegrain foods a day is in the order of 20-30%, which could translate to health expenditure savings of over \$1.2 billion a year. While the scientific literature for legumes is not as extensive as that for cereal

grains, there is nevertheless consistent evidence from epidemiological studies that legumes can play a role in preventing chronic disease.

Based on the strength of the scientific evidence and its public health implications, it is imperative Australians are encouraged to include grain-based foods – particularly wholegrain – and legumes in their diets.

Working with Government, health authorities, health professionals and industry, Go Grains is committed to promoting the benefits of grain foods and legumes in health and nutrition.

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