

# The BARLEYmax Better Nutrition Report



BARLEYmax

8

Is a Nutritious Wholegrain

Contains Resistant Starch

Delivers Soluble Fibre

Has a Low Glycemic Load

WAYS TO BETTER NUTRITION

Is a Rich Source of Insoluble Fibre

Provides Powerful Antioxidants

Offers Prebiotic Properties

Includes Healthy Fats

For Health Professional Use

## AUSTRALIA'S CHRONIC DISEASE IMPERATIVE

The cold hard facts of chronic diseases in Australia highlight the need for practical, effective diet and lifestyle solutions that can help lift the burden of chronic disease impacting so heavily on our Nation. Consider the following\*:

- Type 2 diabetes prevalence has doubled in the last twenty years
- 2.5 million Australian adults are obese
- An additional 4.9 million Australians are overweight
- Obesity, heart disease, stroke, type 2 diabetes and cancer are the leading causes of preventable death
- Obesity alone cost Australian society and governments over \$58 billion in 2008

Facts such as these have prompted the Public Health Association of Australia to conclude:

*"...Australia is facing a chronic disease crisis"*

Despite the significance of the challenge, dietary change is a key

weapon in the fight against chronic disease. There is clear evidence that increasing the intake of particular foods can reduce chronic disease risk and improve health and well-being. In essence, Australians need to make 'simple yet effective' dietary changes to reduce chronic disease in this country.

Why simple changes? To enhance the prospects of the change being sustained in the long term. Of course any change needs to be 'effective' with good scientific evidence showing improved health outcomes.

Eating more wholegrains, like barley, is a good example.

*Increased wholegrain intake has been shown to reduce the risk of certain cancers, heart disease, diabetes, stroke and even help with weight control.*

While barley is perhaps less well known than other wholegrains, its health advantages are significant. In fact, foods containing a certain amount of barley soluble fibre can make a specific health claim in the USA.

## AN EVEN BETTER WHOLEGRAIN? THE CSIRO CHALLENGE

The benefits of wholegrains are well known but CSIRO scientists could see there was room for improvement and the potential existed to enhance the nutritional potency of wholegrains, like barley.

So began an intensive, multifaceted program of scientific investigation within CSIRO that culminated in the development of BARLEYmax, a high fibre wholegrain with the potential to amplify the nutritional benefits of wholegrains.

***"Our initial aim with BARLEYmax was to enhance the nutritional qualities of standard barley. Once this was achieved, it was important to make the improved grain available to the consumer via the food industry so all Australians could benefit from CSIRO's breakthrough."***

*Dr Bruce Lee,  
Director of the CSIRO Food Futures  
National Research Flagship*



\*Public Health Association Australia (2009) A Future for Food.

# The BARLEYmax Story

CSIRO has a long history of interest in barley as a grain with human health benefits. In the late 1990s, CSIRO researchers developed a collection of new non-GM barley grains and assessed them for their potential to improve health by delivering high levels of resistant starch and other dietary fibre components.

From this quest one particular gem emerged – a new type of barley grain that went on to become BARLEYmax.

CSIRO brought together scientists from its Plant Industry and Food and Nutritional Sciences divisions to work on understanding and substantiating the health attributes of BARLEYmax, under the CSIRO Food Futures National Research Flagship.

Through an extensive program of experimental studies, including a number of human trials, it was shown that a range of foods produced with BARLEYmax as their key ingredient had a low glycemic index and also produced positive changes in a range of biomarkers of bowel health.

Given these successful results, CSIRO formed a Joint Venture with Australian Capital Ventures Ltd to breed new BARLEYmax varieties and begin working with food manufacturers to create products containing BARLEYmax for consumers.

This Food Futures Flagship development program demonstrated that BARLEYmax not only enhances the positive nutritional attributes of a range of consumer foods, it improves texture and enhances flavour with a pleasant ‘nutty’ taste that sets it apart from other barley grains.

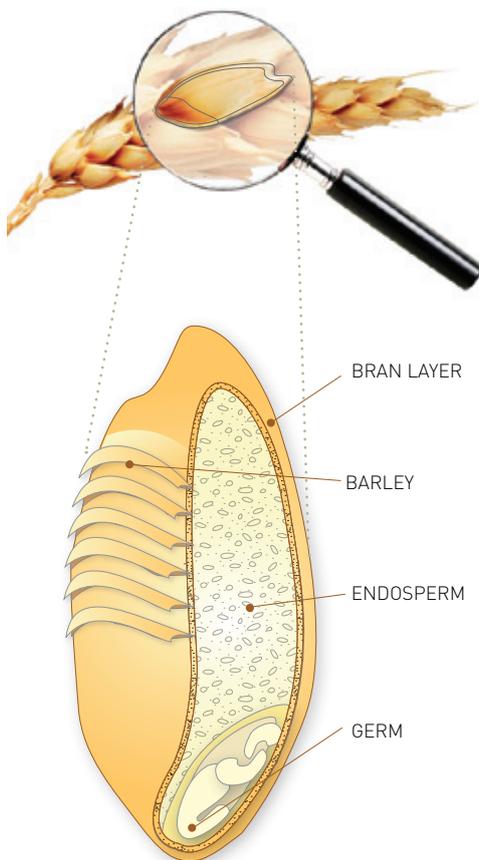


## BARLEYMAX IS A NUTRITIOUS WHOLEGRAIN

There is enormous interest in wholegrains because their regular consumption has been associated with better health and vitality and a reduction in chronic disease risk (see below). BARLEYmax is a wholegrain cereal of the type health authorities recommend we consume each day.

### What is a wholegrain?

Wholegrains retain all three components of the natural grain, including the bran, germ and endosperm<sup>1-4</sup>. When grains are refined, one or more of these parts are removed.



## The Health Power of Wholegrains

### Wholegrains have been shown to:

- Protect against heart disease and stroke
- Assist with weight control
- Reduce the risk of Type 2 diabetes
- Improve bowel health and regularity
- Lower cholesterol and blood pressure
- Protect against certain cancers
- Provide important nutrients like fibre, folate, vitamin E, magnesium, B vitamins, zinc and antioxidants

### HEALTH BENEFITS OF WHOLEGRAINS

Almost daily a new super food or ingredient is promoted as the answer to our chronic disease problems. All too often these claims are based upon inadequate research leaving the public confused as to which foods are likely to deliver meaningful health benefits.

In contrast, the population studies linking regular wholegrain consumption to better health and well-being are impressive and consistent. Good quality research published in credible journals by reputable scientists reflect the value of wholegrains in addressing some of the most pressing chronic disease issues.

Wholegrains are associated with a lower risk of the following conditions:

#### Heart disease and stroke<sup>1-9</sup>

Research shows a 20-40% reduction in heart disease risk for people eating the most wholegrains.

#### Weight control<sup>3,9,10</sup>

Wholegrain foods not only provide volume, but are also high in fibre and complex carbohydrates, making you feel full longer and less likely to snack.

#### Type 2 diabetes<sup>1,3-5,7-9</sup>

People consuming the most

wholegrains have been found to have a 20 - 30% reduction in risk of diabetes.

#### Bowel health and regularity<sup>1-3,5,7,8,11</sup>

The fibre found in wholegrains helps improve digestive health.

#### Cholesterol and blood pressure<sup>3,4,7-9</sup>

Wholegrains containing soluble fibre, such as barley, have the capacity to help reduce LDL cholesterol levels. The increased intake of wholegrains has also been linked to lower blood pressure.

#### Cancer<sup>1-5,7,11</sup>

Regularly consuming wholegrains may reduce the risk of developing colon cancer by 30-40%.

#### The Potency of Wholegrains

Wholegrain foods offer even greater protection than other foods commonly promoted for heart health. Increasing fruit and vegetable intake can reduce the risk of heart disease by 10-15% while increasing wholegrains to four serves a day can reduce heart disease risk by up to 40%.<sup>12</sup>

In relation to heart disease, 4 serves a day of wholegrains...

*"...is comparable to the effect we get from the powerful 'statin' drugs doctors now prescribe to lower cholesterol levels."<sup>12</sup>*

## DID YOU KNOW?

Increasing wholegrains to four serves a day may reduce the risk of heart disease by as much as 40% – more than double that of cholesterol lowering margarines.<sup>12</sup>

## BARLEYmax Fact

BARLEYmax is the highest fibre wholegrain with resistant starch.

### WHAT MAKES WHOLEGRAINS SO HEALTHY?

Wholegrains are naturally rich in a number of important nutrients that work together to improve health outcomes. Nutrients like:

- ✓ **Protein**  
For cell growth and repair
- ✓ **Fibre**  
For good digestive health
- ✓ **Vitamins**  
Both B group as well as vitamin E
- ✓ **Minerals**  
Calcium, zinc, magnesium and iron
- ✓ **Antioxidants**  
May reduce the impact of damaging compounds such as free radicals.<sup>12</sup>

### NOT ALL WHOLEGRAINS ARE EQUAL

BARLEYmax has superior quantities of fibre compared to other wholegrains and delivers much more of all three important fibre types – soluble fibre, insoluble fibre and resistant starch.

In fact, BARLEYmax is the highest fibre wholegrain with resistant starch.

### HOW MANY WHOLEGRAINS DO YOU NEED?

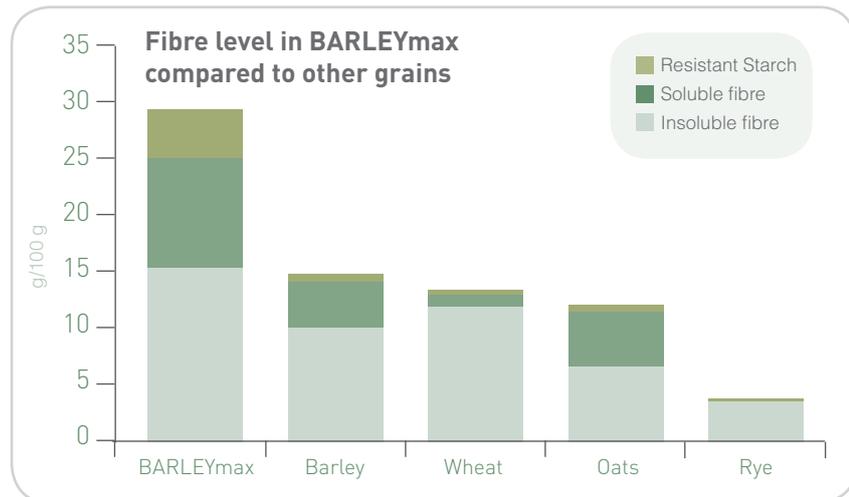
The current dietary guidelines recommend we should eat at least four serves of grain-based foods everyday.<sup>13</sup> At least half of these serves should be wholegrains.<sup>1</sup>

This works out to be 48grams of wholegrain per day.<sup>14</sup>

Research has shown that only 34% of Australian men and 21% of women meet the recommended number of wholegrain servings each day.<sup>15</sup>

## DID YOU KNOW?

Australian men need to triple their intake of wholegrains while women need to increase their intake five fold in order to meet recommended levels.<sup>15</sup>



### WHOLEGRAINS – A NUTRITIONAL POWERHOUSE!

Wholegrains naturally contain literally hundreds of antioxidants, phytonutrients plus vitamins, fibre, protein and minerals all working together to deliver real benefits to those who include them regularly in their diet.

Once a grain is refined, there can be considerable loss of nutrients, so it is advisable to ensure at least half of your grain servings each day are wholegrain.

### WHOLEGRAINS FOR BREAKFAST?

Wholegrain foods can be consumed at any time throughout the day. However, breakfast provides a great opportunity to make a wholegrain start to the day and research shows that this can have a significant impact on health.

In a large study<sup>17</sup> to examine the effect of wholegrain breakfast cereals on the risk of cardiovascular disease, researchers examined the intakes of breakfast cereals reported by over 92,000 male physicians in the US.

They found that over the five years of the study, men who consumed one or more servings of wholegrain breakfast cereals per day had a 20% lower risk of cardiovascular disease compared to men who rarely consumed wholegrain breakfast cereals.

***“The intake of wholegrain foods clearly protects against heart disease and stroke.”***

***“Carbohydrate-rich foods should be wholegrain.”***

Ingrid Flight and Peter Clifton, CSIRO<sup>18</sup>

## DID YOU KNOW?

Compared to its refined counterpart, wholegrain wheat contains:

- 75% more fibre
- 60% more iron and thiamine
- 80% more folate<sup>16</sup>

## DID YOU KNOW? Resistant starch produces more than twice the amount of butyrate than wheat fibre.<sup>29</sup>

### BARLEYMAX CONTAINS RESISTANT STARCH

BARLEYmax is a rich source of resistant starch – the third and most recently discovered type of fibre. Importantly, in addition to its resistant starch content, BARLEYmax also contains the more traditional forms – soluble and insoluble fibre. Studies indicate that resistant starch provides a range of important benefits and has recently been included in Australia's dietary fibre recommendations by the nation's peak health authority, the National Health and Medical Research Council.<sup>19</sup>

#### WHAT IS RESISTANT STARCH?

Most starches are digested and absorbed into the body through the small intestine, but some starches resist digestive attack by the enzymes present and pass through to the large intestine where they act like dietary fibre and improve digestive health. This type of starch is called 'resistant starch'.<sup>20</sup>

#### WHY IS RESISTANT STARCH SO IMPORTANT?

When resistant starch reaches the bowel it is broken down (fermented) by the healthy bacteria present and generates a range of beneficial changes. These can impact our digestive and metabolic health in a number of ways, including:

- ✓ Beneficially increasing stool bulk giving a mild laxative effect which promotes 'regularity'.<sup>21</sup>

### Cool Carb's Rich in Resistant Starch

Cooked then cooled potatoes, pasta and rice contain resistant starch

*"When pasta, rice or potatoes are cooked and still hot the starch contained in these foods is more readily digested. But when it cools, some of the starch molecules aggregate and become resistant to digestion. So, more resistant starch is formed."*

*Shane Landon, Accredited Practising Dietitian*

- ✓ Encouraging the growth of healthy bacteria in the bowel – the 'prebiotic effect'<sup>22</sup>
- ✓ Producing compounds called short chain fatty acids (in particular butyrate) which promote intestinal health<sup>23</sup>
- ✓ Maintaining healthy blood sugar by increasing the body's sensitivity to insulin<sup>24</sup>

#### SHORT CHAIN FATTY ACIDS

Resistant starch has its most important effects via bacterial fermentation in the large bowel, which leads to the production of a number of compounds collectively called Short Chain Fatty Acids.<sup>25</sup>

Considerable interest has focused on the benefits of one acid in particular, butyrate, as it is considered especially important for bowel health. In addition to it being a favoured fuel source for cells lining the colon<sup>25</sup>, butyrate has also been shown to facilitate other important physiological changes including the capacity to:

- Reverse neoplastic changes in vitro<sup>26</sup>
- Inhibit the growth and proliferation of tumour cells in vitro<sup>27</sup>
- Induce apoptosis (programmed cell death) of damaged cells before they can become malignant<sup>28</sup>

#### HOW MUCH RESISTANT STARCH DO WE CONSUME?

An estimate of resistant starch intake for Australian adults derived from the most recent National Nutrition Survey, suggested the range of intake to be from 3-9 grams/person/day with adult men consuming more resistant starch than women.<sup>30</sup>

#### HOW MUCH RESISTANT STARCH DO YOU NEED?

CSIRO has recommended that intakes of resistant starch should be more than 20 grams per day, which is almost four times greater than a typical western diet currently provides.<sup>31</sup>

As the suggested intakes for resistant starch are significantly higher

than current consumption, there is considerable scope to increase resistant starch consumption across the population.

#### RESISTANT STARCH, FERMENTATION AND COLON CANCER

There is growing recognition of the important connection between diet and bacterial metabolism in the colon and specifically how the interaction can impact on important diseases like colon cancer.<sup>33</sup>

In fact, the human colon is one of the most densely populated natural habitats known to science with the human body containing an order of magnitude more prokaryotic cells than it does mammalian ones.<sup>33</sup>

*The bacterial flora in the gastrointestinal tract should be considered 'an organ within an organ' exerting considerable metabolic capability.*

Research with dietary components like resistant starch supports a direct link between diet, colonic bacteria and colon cancer, with recent animal studies indicating high resistant starch diets may prevent colon carcinogenesis.<sup>33</sup>

#### RESISTANT STARCH REDUCES DAMAGE OF HIGH PROTEIN 'FAD' DIETS

CSIRO research<sup>34-37</sup> has shown the popular trend of high protein, low fibre diets may damage the bowel. It also found increasing fibre and specifically resistant starch can prevent such damage in animal studies.

The research also found resistant starch reduced DNA damage and reversed mucus thinning in the bowel caused by diets high in fat and protein and low in fibre.

#### DID YOU KNOW?

**Bowel cancer is the second most common cancer in both Australian men and women.<sup>38</sup>**

## New Fibre Recommendations Include Resistant Starch

In a global first for any government health authority, the recommendations of Australia's National Health and Medical Research Council specify a resistant starch component in their fibre intake advice<sup>32</sup> – reflecting its considerable contribution to human health.

*“We considered the scientific evidence showing a positive impact of resistant starch on digestive health convincing and warranted inclusion in the new fibre intake recommendations.”*

*Dr Katrine Baghurst, Chair, Nutrient Reference Values Working Party.*

**“High protein, low fibre diets may help you lose weight in the short term, but unless you include enough fibre, particularly resistant starch, you risk damaging your bowel.”**

*Dr David Topping, Chief Research Scientist, CSIRO Food Futures Flagship.*

### FIBRE AND BOWEL CANCER – THE AFRICAN PARADOX

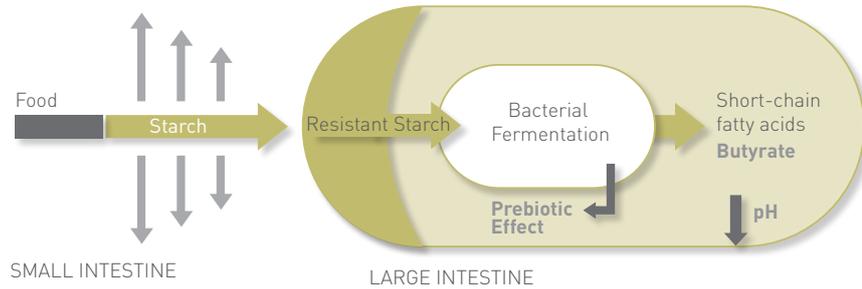
Despite the adoption of ‘Westernised diets’ by indigenous South Africans leading to much lower dietary fibre intakes than most Western populations, colon cancer rates remain low in the urban black South African population.<sup>39,40</sup>

In fact, indigenous South Africans continue to have colon cancer rates 10 times lower than their white counterparts in the same region.<sup>33</sup>

This surprising result may be due to the regular consumption of cold maize porridge. Maize porridge is a dietary staple among black Africans and when consumed cold, as it often is, the porridge is rich in resistant starch (a form of ‘cool carb’ discussed earlier).

The higher levels of resistant starch are considered to play a role in the low rates of colorectal cancer observed in indigenous Africans.<sup>41</sup>

## Resistant Starch - Metabolic Mechanisms



## BARLEYMAX CONTAINS SOLUBLE FIBRE

### WHAT IS SOLUBLE FIBRE?

As the name suggests, soluble fibres are those forms of dietary fibre that are soluble in water. This includes pectins, gums and mucilage, which are found mainly in plant foods. Good sources of soluble fibre include fruits, vegetables, barley, seed husks, flaxseed, dried beans, lentils and peas.<sup>42</sup>

### WHY DO YOU NEED SOLUBLE FIBRE?

According to the National Heart Foundation, there is good evidence to show that soluble fibre can lower LDL cholesterol levels and can therefore reduce heart disease risk.<sup>43</sup> Plus, soluble fibre can help with keeping you regular.<sup>42</sup>

### HOW DOES SOLUBLE FIBRE LOWER CHOLESTEROL?

During the digestive process the soluble beta glucans fibre blocks the re-absorption of cholesterol back into the body so that more of this cholesterol is lost naturally from the body.<sup>45</sup>

Of course, to help manage or prevent increases in LDL cholesterol in

your blood, you should also try to limit foods such as the amount of saturated fat (found in fatty meats, full cream dairy products, deep fried foods, pastries, crisps) in the diet.<sup>46</sup>

### HOW MUCH DO YOU NEED?

A large analysis of 67 published studies investigating the cholesterol lowering effects of fibre showed a small but significant effect at three grams of soluble fibre per day. At this level of intake there were worthwhile reductions in both total as well as LDL cholesterol.<sup>45</sup>

The Food and Drug Administration in the USA permits a health claim for barley products as a source of soluble beta glucans fibre that can, as part of a low saturated fat diet, reduce the risk of coronary heart disease.<sup>47</sup>

A recent review of the ability for barley to lower blood cholesterol stated:

“Health practitioners should feel comfortable recommending barley beta glucan to their patients to help reduce total cholesterol and LDL cholesterol concentrations...”<sup>48</sup>

## BARLEYmax Fact

BARLEYmax contains high levels of beta glucan – a type of soluble fibre.<sup>44</sup>

**BARLEYMAX HAS A LOW GLYCEMIC LOAD**

While many of us are familiar with the Glycemic Index or the GI, the concept of Glycemic Load (GL) is not so well known even though they are closely related.

The GI relates to the release of glucose into the bloodstream of a 50 gram portion of carbohydrate food compared to an equal portion of glucose. On the other hand the Glycemic Load (GL) considers the impact on the blood glucose levels of the entire food – as eaten in a normal serving. As such, some health professionals prefer GL as it is reflective of normal eating patterns as opposed to the 50 gram portions used in the laboratory to determine GI.<sup>49</sup>

It should be noted that the Glycemic Load is determined by multiplying the GI value of the food in question by the amount of available carbohydrate in a standard serving of that food and dividing by 100.<sup>50</sup>

*For both GI and GL the lower the figure the better as this reflects a slow release of glucose into the bloodstream.*

**WHY IS CONTROLLING GLYCEMIC RESPONSE IMPORTANT?**

Type 2 diabetes has emerged as a significant chronic condition in Australia, and like many other industrialised nations, the prevalence of the condition is increasing<sup>51</sup>. Improving the diet is recognised as central to both the management as well as the prevention of Type 2 diabetes. Moderating the glucose response to foods is acknowledged as a viable dietary strategy in this regard.<sup>50</sup>

In a recent study, breakfast cereal made with BARLEYmax gave a lower glucose and insulin response compared to a breakfast cereal made with standard barley<sup>50</sup>.

Lower levels of insulin in the bloodstream are considered

**Two Cereals Compared – A Human Trial at CSIRO<sup>50</sup>**

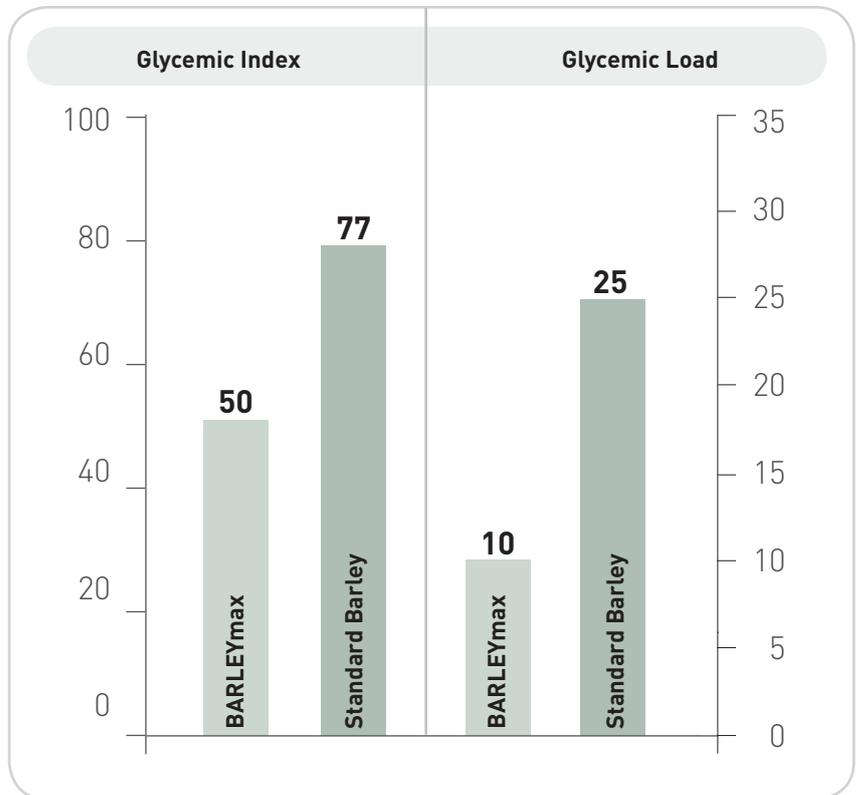
To determine the effect of BARLEYmax on blood glucose, a breakfast cereal was made using either standard barley or BARLEYmax. The GI and the GL were then measured and compared. The results are revealing:

**Glycemic Index**

The cereal made with BARLEYmax had a low GI = 50  
The cereal made with standard barley had a high GI = 77

**Glycemic Load**

The cereal made with BARLEYmax had a GL of just 10  
The cereal made with standard barley had a GL 2.5 times higher = 25



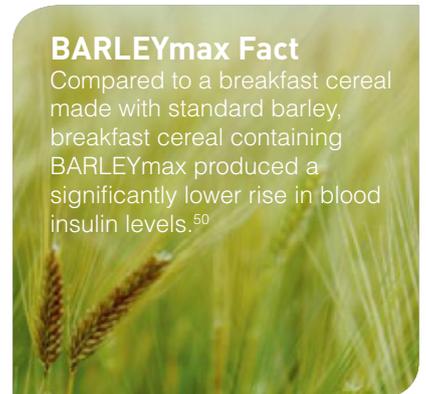
beneficial to reduce the risk of insulin resistance and diabetes.<sup>52</sup>

The CSIRO research team investigating the impact of BARLEYmax on blood glucose and insulin considered this new ingredient...

***“...may be of value in foods designed to assist in the prevention and management of diabetes”<sup>50</sup>***

**BARLEYmax Fact**

Compared to a breakfast cereal made with standard barley, breakfast cereal containing BARLEYmax produced a significantly lower rise in blood insulin levels.<sup>50</sup>



## BARLEYMAX IS A RICH SOURCE OF INSOLUBLE FIBRE

BARLEYmax contains a higher total fibre level than any other grain. That's because BARLEYmax contains much more of all three types of dietary fibre we need each day – that is, soluble fibre, insoluble fibre and resistant starch.

### WHY DO YOU NEED INSOLUBLE FIBRE?

Insoluble fibre is largely responsible for keeping things moving, adding bulk and helping to maintain normal functioning of the bowel. In many high fibre foods, the insoluble fibre component is the predominant form and large population studies have shown that high fibre diets can protect against conditions such as colon cancer.<sup>15</sup>

### Bigger Is Better!

When it comes to the size of stools, the idea that 'bigger is better' really does apply.

Compared to a diet containing refined cereal products, those subjects consuming foods made with BARLEYmax had a 33% increase in stool size.<sup>15</sup> Bigger really is better!

### HOW MUCH FIBRE DO YOU NEED EACH DAY?

Australia's peak health authority, the National Health and Medical Research Council (NHMRC) in its

Nutrient Reference Values report<sup>32</sup> developed a set of Adequate Intake figures for dietary fibre that are designed for general good health (see table below).

### REDUCING CHRONIC DISEASE RISK

Importantly, the NHMRC's Nutrient Reference Values report also highlighted the important role fibre plays in reducing the risk of a range of lifestyle conditions.

**“Increasing dietary fibre intakes have been linked to lower rates of obesity, cardiovascular disease, diabetes and certain cancers.”<sup>32</sup>**

The NHMRC aims to provide recommendations to actually reduce disease risk – termed Suggested Dietary Targets (SDT).

#### SDT's for dietary fibre<sup>32</sup>

Men – 38 grams/day

Women – 28 grams/day

### DIETARY FIBRE AND BODY WEIGHT – IS THERE A CONNECTION?

The global burden of obesity continues to increase both in terms of ill-health as well as direct economic cost to the community.

Diet and lifestyle have long been recognised as modifiable risk factors for excess weight gain. However, in the search for answers, the role of a high fibre diet in the prevention of weight gain is often overlooked.

In its global report, *Diet, Nutrition and the Prevention of Chronic Diseases*, the World Health Organisation

identified a high intake of fibre as the only dietary component with the 'convincing evidence' required to protect against weight gain and obesity.<sup>53</sup>

### What Does the Heart Foundation Say About Fibre?

The Heart Foundation recommends that, as part of your total fibre intake, you should consume **at least six grams of wholegrain fibre per day.**<sup>56</sup>

Dietary fibre's ability to increase satiety and therefore decrease subsequent hunger, along with altering the secretion of hormones related to food digestion, are likely mechanisms.<sup>54,55</sup>

This is exactly the type of fibre found in BARLEYmax.

### MIX IT UP

When it comes to fibre the best advice is to mix up the types of fibre – to obtain the benefits of all of the three main types of fibre – soluble, insoluble and resistant starch.

**“The evidence suggests that the three main types of fibre, soluble, insoluble and resistant starch, offer a range of important health benefits and so we should aim to consume a combination of different types of fibre daily”.**

Dr Tony Bird, CSIRO.

### BARLEYmax Fact

Adding BARLEYmax to a diet based on refined cereal foods more than doubled the total fibre content of the diet<sup>15</sup>.

### NHRMC Adequate Intakes for Dietary Fibre

Males	Adequate Intake(g/day)	Females	Adequate Intake(g/day)
1-3 years	14	1-3 years	14
4-8 years	18	4-8 years	18
9-13 years	24	9-13 years	20
14-18 years	28	14-18 years	22
19+ years	30	19+ years	25
-	-	Pregnancy	25-28
-	-	Breastfeeding	27-30

**Disease prevention- Women 28g per day Men 38g per day**

Source: NHRMC

**BARLEYMAX CONTAINS POWERFUL ANTIOXIDANTS**

It is important to eat foods that are rich in antioxidants to help neutralise free radicals. These are highly reactive, unstable compounds produced naturally within the body as well as being derived from external sources such as cigarette smoke, environmental pollutants and ultraviolet light.<sup>57</sup>

If free radicals are not inactivated, they can damage all types of cells in the body, including our DNA, the genetic material that sits at the heart of every cell in the body. It has been estimated that there are 10,000 oxidative 'hits' to our DNA per cell per day.<sup>58</sup>

Wholegrains are an important source of antioxidants<sup>59</sup> and have been found to have a higher antioxidant content than many fruits and vegetables.<sup>60</sup>

Dietary antioxidants along with nutritional attributes like fibre may be part of the reason wholegrains have been linked to disease risk reduction. Indeed, there may be synergistic actions between various wholegrain components that combine to improve health outcomes.<sup>60</sup>

***“Antioxidant activity is one of several factors...responsible for the observed efficacy of wholegrains in the daily diet to reduce chronic disease”.***<sup>60</sup>

**VITAMIN E**

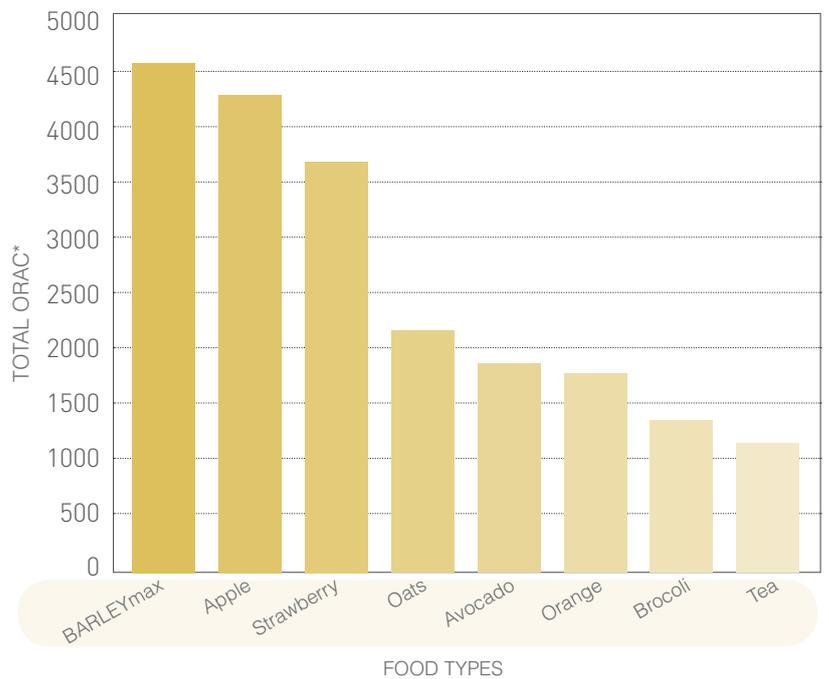
Vitamin E is the collective name for a group of fat-soluble compounds with distinctive antioxidant activities. Naturally occurring vitamin E exists in eight chemical forms (alpha-, beta-, gamma-, and delta-tocopherol and alpha-, beta-, gamma-, and



**BARLEYmax Fact**

BARLEYmax is a richer source of antioxidants than apples and strawberries, has twice the antioxidants of oats, three times the level of broccoli and four times that of tea.

**Total Antioxidant Capacity**



\* Total ORAC Values = sum of hydrophilic-ORAC (H-ORAC) and lipophilic-ORAC (L-ORAC) reported in μmol of Trolox Equivalents per 100 grams. Source for other foods: US Department of Agriculture, Oxygen Radical Absorbance Capacity of Selected Foods, November 2007; BARLEYmax measured by CSIRO.

delta-tocotrienol).<sup>61</sup> Higher intakes of Vitamin E have been promoted as a means of helping reduce chronic disease risk in Australia with Suggested Dietary Intakes of 19 mg for men and 14 mg for women<sup>62</sup>. Recent animal

research has also suggested a possible role for the gamma- and delta – tocotrienol forms of Vitamin E in cancer prevention.<sup>62</sup>

Relative to standard barley, BARLEYmax provides a higher total for all forms of Vitamin E.



**BARLEYmax Fact**

BARLEYmax has more than twice the level of total Vitamin E (all forms) than standard barley\*

\*CSIRO laboratory measures 2009

**The data shows that BARLEYmax is a potent source of natural antioxidants.**

## BARLEYMAX HAS PREBIOTIC PROPERTIES

Prebiotics act as a fuel to enhance the growth or activity of the friendly bacteria in our digestive system to improve health.<sup>63</sup> Probiotics are live, healthy bacteria consumed via food, drinks or supplements.

Not surprisingly, pre- and probiotics are related with recent investigations examining the ability for prebiotics to assist in promoting bacterial colonisation in the bowel. It is possible that prebiotics act as enhancers of probiotic bacteria.<sup>22</sup>

Resistant starches (such as those contained in BARLEYmax) can have prebiotic properties and some resistant starches may provide protection to beneficial Bifidobacteria as they travel through the upper gastrointestinal tract.<sup>64</sup> Although there is still much investigation required to develop our understanding in this field, the potential to capture the benefits of prebiotics and probiotics in relation to measurable health outcomes is promising.<sup>22</sup>

**Preliminary evidence for BARLEYmax is positive in regard to its prebiotic potential.<sup>65</sup>**



## BARLEYMAX CONTAINS HEALTHY FATS

We all need some fat in our diet. Fat is important for many body processes. Fat protects your organs, keeps you warm and helps your body absorb and move nutrients around. It also helps hormone production. However, some fats are better for you than others.

Categories of fats:

- Saturated
- Monounsaturated
- Polyunsaturated
- Trans fats

Saturated fats (found mostly in animal products) increase blood cholesterol, which is a risk factor in coronary heart disease. Monounsaturated and polyunsaturated fats tend to lower blood cholesterol.

Trans fatty acids are found in small amounts in milk, cheese, beef and lamb. Trans fatty acids are also created during the manufacture of some table margarines and in solid spreads used in the food industry.

Trans fatty acids behave like saturated fats in the body; they raise 'bad' LDL levels and increase the risk of heart disease. Unlike saturated fats, they also lower 'good' HDL cholesterol, so may be more damaging.<sup>66</sup>

There is considerable interest in the role monounsaturated fats may play in reducing the risk of heart disease with researchers examining the Mediterranean diet where a high consumption of monounsaturated fats from olive oil (for example, in Greece and Italy) may result in low rates of coronary heart disease, regardless of body weight.<sup>66</sup>

### Fat Profile of BARLEYmax

Product	Total Fat Content	Saturated	Mono-unsaturated	Omega 6	Omega 3
	g/100g	(% of total)			
<b>BARLEYmax</b>	5.9	18.7	27.6	47.0	2.4

## BARLEYmax Fact

BARLEYmax contains a mix of healthy fats including monounsaturated fat as well as omega 6 and omega 3 polyunsaturated fats.



The two forms of polyunsaturated fats found in BARLEYmax also offer the potential to improve health with both playing a vital role in growth and development as well as improving the health of our arteries.<sup>32</sup>

### THE MOST RECENT ADVICE FROM THE HEART FOUNDATION

The Heart Foundation's most recent review<sup>67</sup> of the role of fats in cardiovascular health advises all Australians to:

**“Replace Saturated Fats with Monounsaturated and Polyunsaturated fats to help reduce the intake of Saturated fat.”**

The Heart Foundation also states:

**“Polyunsaturated and monounsaturated fats are healthier fats that reduce the ‘bad’ cholesterol (LDL cholesterol) in your blood and increase the ‘good’ cholesterol (HDL cholesterol). This helps to lower your risk of getting heart disease.”<sup>67</sup>**

**BARLEYmax contains a mixture of healthy fats.**

- References
1. Cancer Council [www.cancercouncil.com.au](http://www.cancercouncil.com.au) & [http://www.nswcc.org.au/html/healthprofessionals/nutrition\\_physical/downloads/positionstatement\\_fibre\\_wholegraincereal.pdf](http://www.nswcc.org.au/html/healthprofessionals/nutrition_physical/downloads/positionstatement_fibre_wholegraincereal.pdf)
  2. Slavin J et al (1997) Whole-grain consumption and chronic disease: protective mechanisms. *Nutr Cancer*;27(1):14-21.
  3. Slavin J.(2004) Wholegrains and human health. *Nutr Research Reviews* :17(1);99-110.
  4. Slavin J et al (2001) The role of whole grains in disease prevention. *JADA*;101(7):780-785.
  5. McIntosh G. (2001) Cereal foods, fibres and the prevention of cancers. *Aust J Nutr & Diet*;58(S2):S34-S48.
  6. Liu S et al. (1999) Whole-grain consumption and risk of coronary heart disease: results from the Nurses' Health Study. *AJCN*;70(3):412-419.
  7. Anderson J, Hanna T.(1999) Whole grains and protection against coronary heart disease: what are the active components and mechanisms? *AJCN*;70(3):307-308.
  8. Truswell A, (2000). Cereal grains and coronary heart disease- A review of the literature. Grains Research & Development Corporation and BRI Australia Ltd.
  9. Anderson J.(2003) Wholegrains protect against atherosclerotic cardiovascular disease. *Proc Nutr Soc*;62(1):135-142.
  10. Liu S et al (2003) Relation between changes in intakes of dietary fiber and grain products and changes in weight and development of obesity among middle-aged women. *AJCN*;78:920-927.
  11. Jacobs D et al (1998) Whole-grain intake and cancer: an expanded review and meta-analysis. *Nutr Cancer*;30(2):85-96.
  12. Flight I., Clifton P Cereal Grains and Legumes in the Prevention of Coronary Heart Disease and Stroke – A review of the literature – Summary Findings, Go Grains Health and Nutrition
  13. NHMRC, (2003) Food for health- Dietary Guidelines for Australians. Australian Government Publishing Service, Canberra.
  14. Go Grains Health and Nutrition [www.gograins.com.au/pdfs/Wholegrain%20Communication%20Guide%20Nov%2008.pdf](http://www.gograins.com.au/pdfs/Wholegrain%20Communication%20Guide%20Nov%2008.pdf)
  15. Bird, AR, et al (2007) Wholegrain foods made from a novel high-amylose barley variety (Himalaya 292) improve indices of bowel health in human subjects *BJN* 1-9 doi: 10.1017/S000711450783902X
  16. Thompson LU (1992), Potential health benefits of whole grains and their components, *Contemporary Nutrition*;17(6).
  17. Liu S et al (2003) Is intake of breakfast cereals related to total and cause-specific mortality in men? *Am J Clin Nutr*;77:594-599.
  18. Flight I, Clifton P, (2006), Cereal grains and legumes in the prevention of coronary heart disease and stroke: a review of the literature *European Journal of Clinical Nutrition* 60, 1145–1159.
  19. Landon S (2007), Resistant Starch Review, Position Paper for Health Professionals, National Starch Food Innovation.
  20. Asp NG (1992) Resistant starch – proceedings from the second plenary meeting of EURESTA: European FLAIR Concerted Action, 11 on physiological implications of the consumption of resistant starch in man. Preface. *European J Clin Nutr*. 46: S1.
  21. Phillips, J. et al (1995). Effect of resistant starch on fecal bulk and fermentation-dependent events in humans. *Am J Clin Nutr* 62(1):121-130.
  22. Topping D, et al (2003) Resistant starch as a prebiotic and symbiotic: state of the art. *Proceedings of the Nutrition Society* 62,171-176.
  23. Weaver GA et al (1992) Cornstarch fermentation by the colonic microbial community yields more butyrate than does cabbage fibre fermentation; cornstarch fermentation rates correlate negatively with methanogenesis. *Am J Clin Nutr* 55, 70–77.
  24. Robertson, D. et al (2005). Insulin-sensitising effects of dietary resistant starch and effects on skeletal muscle and adipose tissue metabolism, *American Journal of Clinical Nutrition*; 82:559-67
  25. Topping D, Clifton P. (2001) Short chain fatty acids and human colonic function – roles of resistant starch and non starch polysaccharides *Physiol. Reviews* 81:1031-64.
  26. Toscani A, et al (1988) Molecular analysis of sodium butyrate-induced growth arrest *Oncogene Research* 3, 223-38
  27. Whitehead RH, et al (1986) Effects of short chain fatty acids on a new human carcinoma cell line (LIM1215) *Gut* 27, 1457-63
  28. Young GP, Le Leu R (2004) Resistant starch and colorectal neoplasia *Journal of the Association of Official Analytical Chemists International* 87(3):775-86.
  29. Champ MJ (2004) Adapted from *Physiological effects of resistant starch and in vivo measurements Journal of the Association of Official Analytical Chemists International* 87(3):749-55.
  30. Roberts J et al (2004) Resistant starch in the Australian Diet *Nutr Diet* 61:98-104.
  31. Baghurst PA et al (1996) Dietary fibre, non-starch polysaccharides and resistant starch – a review. *Food Aust*;48(Suppl):S3–S35.
  32. National Health and Medical Research Council (2006) *Nutrient Reference Values for Australia and New Zealand including Recommended Dietary Intakes*.
  33. Ridlon JM & Hylemon PB (2006) A Potential Role for Resistant Starch Fermentation in Modulating Colonic Bacterial Metabolism and Colon Cancer Risk. *Cancer Biology & Therapy* vol 5:issue 3, 273-4.
  34. Toden S et al (2005) Resistant Starch Attenuates Colonic DNA Damage Induced by Higher Dietary Protein in Rats *Nutrition and Cancer*, 51(1), 45–51
  35. Toden S et al (2006) Resistant Starch Prevents Colonic DNA Damage Induced by High Dietary Cooked Red Meat or Casein in Rats *Cancer Biology & Therapy* 5:3, 267-272
  36. Toden S et al (2007) Differential effects of dietary whey, casein and soya on colonic DNA damage and large bowel SCFA in rats fed diets low and high in resistant starch *British Journal of Nutrition* 97, 535–543
  37. Toden S et al (2007) Dose-Dependent Reduction of Dietary Protein-Induced Colonocyte DNA Damage by Resistant Starch in Rats Correlates More Highly with Caecal Butyrate than with Other Short Chain Fatty Acids *Cancer Biology & Therapy* 6:2, 253-258
  38. Australian Institute of Health and Welfare (2008) *Cancer in Australia: an overview*
  39. O'Keefe SJD et al. (1985) Relationship between nutritional status, dietary intake patterns and plasma lipoprotein concentrations in rural black South Africans. *Hum Nutr Clin Nutr*; 39:335-41.
  40. Segal I. (2002) Physiological small bowel malabsorption of carbohydrates protects against largebowel diseases in Africans. *J Gastroenterol Hepatol*; 17:249-52.
  41. Ahmed R et al (2000) Fermentation of dietary starch in humans. *Am J Gastro*, vol95 (4) 1017-1020.
  42. Better Health Channel, Victoria, Reviewed April 2008 [www.betterhealth.vic.gov.au/BHCv2/BHCARTICLES.NSF/pages/Fibre\\_in\\_food?OpenDocument](http://www.betterhealth.vic.gov.au/BHCv2/BHCARTICLES.NSF/pages/Fibre_in_food?OpenDocument)
  43. National Heart Foundation of Australia (2006) Position statement on the relationships between carbohydrates, dietary fibre, glycaemic index/glycaemic load and cardiovascular disease
  44. Bird, AR et al (2004) A novel high-amylose barley cultivar lowers plasma cholesterol and alters indices of large bowel fermentation in pigs. *British Journal of Nutrition* 92, 607-615
  45. Brown L et al (1999) Cholesterol-lowering effects of dietary fiber: a meta-analysis. *Am J Clin Nutr* ;69:30-42.
  46. National Heart Foundation (2004) *Dietary Fats and Heart Disease*
  47. Food and Drug Administration Final Rule (2006) [www.fda.gov/ohrms/dockets/98FR/04p-0512-nfr0001.pdf](http://www.fda.gov/ohrms/dockets/98FR/04p-0512-nfr0001.pdf)
  48. Talati, R et al (2009) The Effects of Barley-Derived Soluble Fiber on Serum Lipids *Ann Fam Med*;7:157-163.
  49. Landon S (2005) Modern diets converging: move to low GI/GR diets. *Nutrition and Food Science* 35 (5): 320-3.
  50. King R et al (2008) An extruded breakfast cereal made from a high amylose barley cultivar has low glycemic index and lower plasma insulin response than one made from standard barley. *Journal of Cereal Science* 48 526-530
  51. Mascie-Taylor, C.G., Karim, E. (2003) The burden of chronic disease. *Science* 302, 1921-1922.
  52. Behall, K.M.et al (2005) Comparison of hormone and glucose responses of overweight women to barley and oats. *Journal of the American College of Nutrition* 24, 182-188.
  53. World Health Organisation, Joint WHO/FAO Expert Consultation (2003) *Diet, Nutrition and the Prevention of Chronic Diseases WHO Technical Report Series 916*, pp 63,64.
  54. Slavin, JL (2005) Dietary fiber and body weight. *Nutrition* (3):411-8.
  55. Slavin J., Green H. (2007) Dietary fibre and satiety, *British Nutrition Foundation Nutrition Bulletin* 32 (suppl 1), 32–42
  56. Heart Foundation Position statement (2006) Carbohydrates, dietary fibre, glycaemic index/glycaemic load and cardiovascular disease, Questions and Answers – General
  57. Langseth L (1995) Oxidants, antioxidants and disease prevention, *International Life Sciences Institute, Europe*.
  58. Ames B, Shigenaga M, Hagen T (1993) : Oxidants, antioxidants, and the degenerative diseases of ageing. *Proc Natl Acad Sci* 90:7915-7922.
  59. Adom KK, Liu RH, (2002) Antioxidant activity of grains, *J Agric Food Chem*;50(21):6182-6187.
  60. Miller HE et al (2000) Antioxidant content of wholegrain breakfast cereals, fruits and vegetables, *J Am Coll Nutr*;19(3):312S-319S.
  61. National Institutes of Health USA, Office of Dietary Supplements, Vitamin E Fact Sheet <http://ods.od.nih.gov/FACTSHEETS/VITAMINE.ASP>
  62. Hiura Y et al (2008) Specific accumulation of gamma and delta tocotrienol in tumor and their antitumor effect in vivo *Nutr. Biochem* doi: 10.1016/j.jnutbio.2008.06.004
  63. Gibson GR & Roberfroid MB, (1995) "Dietary modulation of the human microbiota: introducing the subject of prebiotics" *Journal of Nutrition* 125:1401-12.
  64. Wang X et al, (1999) "In vitro utilization of amylopectin and high-amylose maize (Amylomaize) starch granules by human colonic bacteria" *Journal of Applied Microbiology* 87:631-9.
  65. Bird, AR et al (2004) A Novel Barley Cultivar (Himalaya 292) with a Specific Gene Mutation in Starch Synthase IIa Raises Large Bowel Starch and Short-Chain Fatty Acids in Rats *J. Nutr.* 134: 831–835, 2004.
  66. Better Health Channel [www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Fats\\_and\\_oils](http://www.betterhealth.vic.gov.au/bhcv2/bhcarticles.nsf/pages/Fats_and_oils)
  67. Heart Foundation Position statement (2009) *Dietary fats and dietary sterols for cardiovascular health*

