MAKING EVERYDAY FOODS MORE NUTRITIOUS

HI-MAIZE™ resistant starch – fibre, carbohydrate and more

A balanced diet is vital to good health and wellbeing. Consumers understand this, but it's not always easy for them to choose healthier foods, even when they're constantly warned about rising rates of diabetes and chronic disease stemming from being overweight.

While they're actively looking for healthier foods that offer recognised health benefits, they still want great taste and convenience – a balance of nutrition and enjoyment. HI-MAIZE™ resistant starch makes it easier for food companies to provide this balance, adding fibre and nutrition with every mouthful...without changing the textures and flavours that consumers love.

Natural Hi-maize® The Vital Fibre

Ingredion™

Three types of fibre

Nutritionists know that one of the best ways to boost the nutritional value of a food is to increase its fibre levels. Fibre is not only beneficial for regularity, but according to the World Health Organisation (WHO), fibre is an important dietary component with convincing evidence to protect against weight gain, obesity and chronic diseases.

WHO recommends adults eat more than 25g of dietary fibre each day[1], including resistant starches and fibre from wholegrain cereals, beans, peas and legumes.

To reach these levels, most consumers need to boost their fibre intake and also need to try to include all three different types of fibre in their diets every day. Each type performs different functions within our bodies and fortunately, some foods and ingredients contain at least two different types of fibres:

- **Soluble fibre** – can help stabilise blood glucose levels in people with diabetes and may help lower LDL (bad) cholesterol levels. Found in fruits and vegetables, dried beans and lentils and oats.
- **Insoluble fibre** – best known for its laxative affect as it absorbs water to help soften the contents of the bowel, helping to promote regularity. It is now also recognised in helping to enhance insulin sensitivity and reducing the risk of diabetes. Found in high fibre breads and cereals, the skins of fruit and vegetables, nuts and seeds and HI-MAIZE™.
- **Resistant starch** - unlike other types of 'starch', resistant starch 'resists' digestion in the small intestine, making its way to the large intestine. Here it acts as a fuel supply for our 'good bugs' - beneficial digestive bacteria that help optimise inner health. Studies have also shown benefits in blood sugar management and weight management.

"One of the major developments in our understanding of the importance of carbohydrates for health in the past 20 years has been the discovery of resistant starch."

World Health Organisation[2]

What is resistant starch?

Resistant starch is defined as:
"Starches that resist small intestinal breakdown and are fermented by the resident bacteria in the large intestine; producing a variety of end-products including short chain fatty acids (SCFA) that in turn provide a range of physiological benefits[3]."

Sources of resistant starch and fibre

Resistant starch is found naturally in common foods such as legumes (beans, peas, lentils, etc), whole grains, under-ripe bananas and cooked then cooled potatoes, pasta and rice.

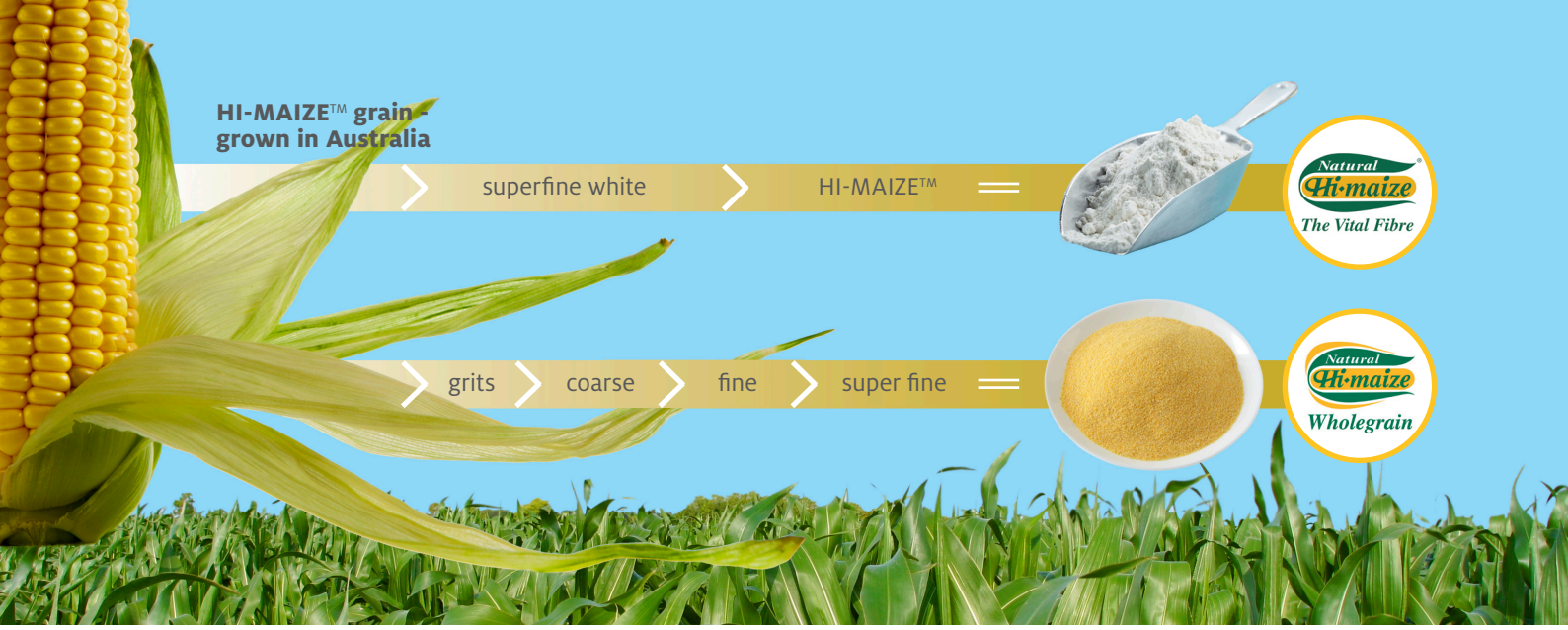
One of the richest natural sources of resistant starch is HI-MAIZE™ resistant starch from Ingredion, which is also available in wholegrain form.

Sources of types of resistant starch and fibre in everyday eating:

	Resistant starch[a]	Soluble fibre[b]	Insoluble fibre[b]
INCREASING FIBRE LEVELS ↑	Bananas Chickpeas Cooked & cooled pasta/noodles Baked beans Bread high fibre white*	Kidney beans Sweet potato Oranges/apricots Mangoes Porridge - oats/barley	Wheat bran cereal Kidney beans Lentils Wheat biscuit Bread high fibre white* or wholemeal [c]
	Peas Wheat bran cereal Potato salad	Wheat bran cereal Apple/pear with skin Bread wholemeal [c]	Green beans Porridge Bread white [c]
	Popcorn Muesli bar Rice cracker	Pasta Banana Popcorn	Popcorn Puffed wheat Pasta

a - Based on data from Landon S, Colyer CGB, Salman H, The Resistant Starch Report (2012) Food Australia
b - Adapted from Anderson J, Smith B. Gustafson N, Health benefits and practical aspects of high fiber diets (1990) AJCN
c - Based on further analysis from Landon S, Colyer CGB, Salman H, The Resistant Starch Report (2012) Food Australia

* containing HI-MAIZE™



Introducing HI-MAIZE™ resistant starch

Made from a traditionally bred hybrid of corn that is naturally high in amylose and naturally rich in resistant starch, HI-MAIZE™ resistant starch invisibly adds fibre and resistant starch to a wide variety of foods. It is found in a wide variety of foods on supermarket shelves around the world, including bread, pasta, noodles, snacks and breakfast cereals.

To make HI-MAIZE™, the corn kernel is ground so fine you cannot see or taste it, while HI-MAIZE™ Wholegrain corn flour is made by grinding the entire corn kernel to different particle sizes. The resulting flour has at least 50 percent fibre, as well as resistant starch.

HI-MAIZE™ resistant starches qualify as dietary fibre for labelling purposes by the official AOAC methods 985.29 and 991.43.

Reviewing the health effects

Many public health authorities including WHO, U.S. National Academy of Sciences, European Food Safety Authority and Australia's National Health and Medical Research Council (NHMRC) recognise resistant starch as a beneficial carbohydrate.

A large body of scientific evidence - more than 350 published studies – demonstrates compelling health advantages of natural HI-MAIZE™, made from high amylose corn.

This includes benefits to:

- Digestive health – beyond laxation to prebiotic effects and helping to protect colon cells;
- Energy management and satiety – playing a role in both short-term and long-term satiety by reducing glycemic response and helping to control appetites;
- Blood glucose management and cognitive effects – by better managing insulin (blood sugar levels) to help maintain energy and concentration.

Not all resistant starches are equal

It is important to remember that most scientific research pointing to health advantages of resistant starch relates to high amylose maize starch (eg. HI-MAIZE™). Other types of resistant starch have been less well researched, with few published studies.

Helping consumers boost their resistant starch intake

HI-MAIZE™ makes it easier for consumers to boost their fibre and resistant starch intake – without having to change what they eat. It offers manufacturers a simple, natural way to add value to products, even beyond the benefits traditionally associated with dietary fibre.

Proven commercial success over many years indicates that including the HI-MAIZE™ logo on pack provides better differentiation, clearer communication of health messages and helps consumers easily spot the valuable health benefits.

Appealing in application

HI-MAIZE™ resistant starch is versatile and easy to use for food companies. Naturally white in appearance, neutral in taste and with a small particle size, HI-MAIZE™ doesn't change the taste or texture of foods consumers love.

In many recipes, it simply replaces some or all of the flour in foods, delivering good texture and clean flavour.

For foods with the added appeal of wholegrains, using HI-MAIZE™ Wholegrain provides a mild corn flavour and golden colour. Both HI-MAIZE™ resistant starch and HI-MAIZE™ Wholegrain provide other benefits too. The descriptor "the vital fibre" is well deserved.

Ideal applications for HI-MAIZE™ resistant starch include:

Ingredion ingredient	Application	Key functionality	Usage level	Additional features
HI-MAIZE™ resistant starch	• Breads and bakery products • Nutrition bars • Biscuits and cookies • Breakfast cereals • Pasta and noodles • Sheeted baked snacks and crackers • Extruded snacks • Soups and ready meal components • Thickened beverages	Offers clinically substantiated health benefits including: • Low calorie • Increases satiety/weight management • Low glycemic and insulin response • Promotes digestive/bowel health • Increases insulin sensitivity and assists with glycemic management	5-50%	• Clean label • Source of natural Type 2 resistant starch • Low water holding capacity • Bland flavour • Structure/ function labelling claims • Approximately 60% fibre
HI-MAIZE™ Wholegrain corn flour		• Offers the highest fibre content of all commercial wholegrain flours • 100% wholegrain	5-50%	• Clean label wholegrain • Range of particle sizes available • Suitable for multi-grain formulations

Get started today

Ingredion is a leading global provider of ingredient solutions with a broad portfolio of speciality ingredients designed to improve the nutritional content of foods. We can help you solve the nutritional benefit/eating quality/processing equation by creating innovative, more nutritious and equally appealing foods for consumers.

The Ingredion team can help with labelling and regulatory challenges too, as well as share consumer insights to help optimise the success of new or reformulated products.

REFERENCES:

1. Carbohydrates in Human Nutrition Joint FAO/ WHO Expert Consultation in Human Nutrition, April 1997.
2. World Health Organisation (2003) "Diet, Nutrition and the Prevention of Chronic Diseases" WHO Technical Report Series 916.
3. Topping D & Clifton P. (2001) Short Chain Fatty Acids and Human Colonic Function: Roles of Resistant Starch and Non-starch Polysaccharides, Physiological Reviews Vol 81, 1031-1064.

For more detailed references and information, see: apac.ingredion.com/HiMaize

Local offices of the Ingredion group of companies:

ASIA PACIFIC (Regional Office)
SINGAPORE
+65 6872 5335

AUSTRALIA
+61 2 9911 1200

CHINA
+86 21 3774 0066 (Shanghai)
+86 10 8586 7171 (Beijing)
+86 20 3860 6018 (Guangzhou)

INDIA
+91 22 6609 7672
+91 22 6609 7673

INDONESIA
+62 21 7592 4377

JAPAN
+81 3 3504 9690

MALAYSIA
+60 3 5569 2633

NEW ZEALAND
+64 9 582 0284

PHILIPPINES
+63 2 650 3081

SOUTH KOREA
+82 2 3485 1300

THAILAND
+66 2 725 0200

VIETNAM
+84 8 5413 3368

ingredion.com/apac
apac@ingredion.com

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