

# NUTRITIONAL ASPECTS OF HIGH FIBRE CEREAL INGREDIENTS



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**Cereals and cereal products are a major part of Western diets, providing in the UK with more than one third of daily energy intakes, around a quarter of protein intakes, 40% of fibre intakes and significant amounts of vitamins and minerals.<sup>1</sup>**

According to the Eatwell plate, cereals form part of the starchy food category that should comprise 33% of the diet by volume. Commonly-consumed cereal foods include breakfast cereals, pasta, rice and bread, as well as the more discretionary options of biscuits, cakes and buns. Breakfast cereals contain an array of cereal ingredients, many of which offer nutritional benefits, or which could be classed as 'wholegrain'. This article will consider some of these ingredients, particularly in the light of EU authorised health claims.

## HEALTH CLAIMS

Since 2012, all health claims made on food and drink products must be authorised based on the available scientific evidence. Table 1 presents the health claims that can be made for cereal ingredients. While it is accepted that manufacturers will present health claims on pack in language more appropriate for consumers, it is nevertheless recommended that the wording remains as close as possible to the original statement in order to avoid misleading consumers. Examples of wording on pack include: 'to give digestion a helping hand', or 'to help actively reduce cholesterol'.

## WHEAT

Wheat is the second most important crop worldwide after rice and is a major staple in several regions.<sup>3</sup> The wheat grain consists of a germ, endosperm (which is the starchy element) and bran

fractions which are high in fibre and make up 14-16% of the grain.<sup>4</sup>

Wheat contains vitamins: thiamin, riboflavin, vitamin B6, folate and vitamin E, as well as sulphur-containing amino acids and phenolic compounds which express antioxidant characteristics. As reviewed by Stevenson et al<sup>4</sup>, several observational studies have associated wheat fibre with a reduced risk of cardiovascular disease and Type 2 diabetes. In addition, a recent meta-analysis<sup>5</sup> confirmed that higher intakes of wheat bran were linked with reduced risk of Type 2 diabetes. However, the few randomised controlled trials (RCT) are contradictory. The discrepancy may be because viscosity of fibre is the key factor in delivering metabolic effects.<sup>6</sup>

Observational evidence also exists for an inverse association between wheat fibre intake and cancer risk<sup>4</sup> This is backed by two large clinical trials (n=3209 combined) which found that men, but not women, with higher intakes of wheat bran had a 19% lower risk of colorectal adenoma recurrence.<sup>7</sup>

## OATS

Oats are consumed mainly in Europe and are a source of thiamin, niacin, folate, vitamin E, phosphorus, iron, magnesium and zinc. They are also rich in the soluble fibre, beta-glucan, which has been proven to lower LDL cholesterol. Beta-glucan works by boosting the transport of bile acids through the gastrointestinal tract which enhances their excretion via faeces. This, in turn, ►

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**Table 1: Authorised health claims for cereal ingredients<sup>2</sup>**

Ingredient	Claim	Amount needed
Wheat bran fibre	Contributes to an acceleration of intestinal transit	10g wheat bran fibre daily. Food must also qualify for a 'high in fibre' nutrition claim (6.0g per 100g)
	Contributes to an increase in faecal bulk	Food must qualify for a 'high in fibre' nutrition claim (6.0g per 100g)
Oat grain fibre	Contributes to an increase in faecal bulk	As above
Oat beta-glucan	Contributes to the maintenance of normal blood cholesterol levels	Food must contain at least 1.0g beta-glucan per portion and must state that beneficial effects occur at daily intakes of 3.0g
	Contributes to the reduction of the blood glucose rise after a meal	Food must contain at least 4.0g of beta-glucan for each 30g of available carbohydrates per portion and should be eaten as part of a meal
	Lowers blood cholesterol	Food must contain at least 1.0g beta-glucan per portion and must state that beneficial effects occur at daily intakes of 3.0g
Barley beta-glucan	Contributes to the maintenance of normal blood cholesterol levels	As above
	Contributes to the reduction of the blood glucose rise after a meal	Food must contain at least 4.0g of beta-glucan for each 30g of available carbohydrates per portion and should be eaten as part of a meal
Barley grain fibre	Contributes to an increase in faecal bulk	Food must qualify for a 'high in fibre' nutrition claim (6.0g per 100g)
Rye fibre	Contributes to normal bowel function	As above

stimulates the synthesis of new bile acids from endogenous and dietary cholesterol which lowers blood cholesterol levels.<sup>8</sup>

There is consistent evidence to link consumption of oats with cardiovascular health via a direct impact on total and LDL cholesterol and, possibly, via changes to post-prandial glycaemia and blood pressure.<sup>9</sup> A systematic review evaluated the published literature on oats and lipid management finding that oats significantly lowered total or LDL cholesterol in most of the 21 RCT included.<sup>10</sup> A more up-to-date systematic review confirmed these findings for cholesterol, but disputed whether oats had any impact on blood pressure or glycaemia due to under-powered RCT.<sup>11</sup>

Oats have been identified as having a role in weight management, but the evidence can be inconsistent. A 12-week RCT in 144 participants found a reduced waist circumference in those given an oat cereal versus a low fibre control cereal.<sup>12</sup> However, in two other trials, there was no spe-

cific weight loss attributed to the high oats diet, although metabolic benefits were apparent.<sup>13, 14</sup>

**RYE**

The rye grain is related to wheat and barley and is commonly used in Europe for bread flour and muesli. Health aspects of rye include blood lipid reduction, glycaemic control and weight management.

An acute trial in 12 healthy subjects found that rye products produced a significantly lower insulin response compared with a control wheat bread, which was not related to the glycaemic index (GI) of the products, suggesting that other bioactive properties were at work.<sup>15</sup> In addition, rye had a greater impact on satiety compared with the control food. A four-week trial in 21 participants confirmed these findings and reported that wholegrain rye was associated with a significant reduction in post-prandial glucose and insulin, as well as an increase in short-chain fatty

*Barley is a fibre-rich grain that contains significant levels of beta-glucan and insoluble fibre, and has been classified as low GI.*

acids, suggesting colonic fermentation of rye constituents.<sup>16</sup> However, a crossover trial in women with impaired glucose tolerance found no effect of rye on insulin sensitivity, although acute post-prandial insulin excretion was higher.<sup>17</sup>

Turning to lipid reduction, a crossover trial in 40 adults with hypercholesterolaemia found significant reductions in total and LDL cholesterol when rye was consumed, but only in men.<sup>18</sup> A dose response was also noted. These effects were confirmed by a later trial in 63 healthy adults which noted that LDL cholesterol became more resistant to oxidation with each rise in the consumption of rye.<sup>19</sup> The addition of plant sterols had no observed impact on LDL cholesterol oxidation.

#### BARLEY

Barley is a fibre-rich grain that contains significant levels of beta-glucan and insoluble fibre, and has been classified as low GI.<sup>20</sup> Originally used by animal feed and brewing sectors, barley is now being incorporated into a greater variety of food products due to its health benefits.

In a five-week RCT, involving 18 men with hypercholesterolaemia, partially replacing usual carbohydrates with barley-rich products, total cholesterol, LDL cholesterol and triglycerides were significantly lowered without reducing HDL cholesterol.<sup>21</sup> The positive impact was most likely mediated via changes in soluble fibre. Similar findings were reported when an experimental diet containing barley and legumes was compared with a healthy control diet matched for fibre content.<sup>22</sup> In the 46 female participants, significant reductions were seen over four weeks in total cholesterol, LDL cholesterol and diastolic blood pressure. Unlike the previous study, HDL cholesterol levels did reduce. Further research<sup>20</sup> suggests that the beta-glucan content of barley can lower blood glucose and insulin responses, while the overall soluble fibre content appears to stimulate production of GLP-1, a satiety hormone.

#### DISCUSSION AND CONCLUSIONS

This brief review highlights the benefits associated with increased consumption of fibres from wheat, oats, barley and rye. Studies consistently report associations with lipid management and, in some cases, glycaemic control. Studies on weight loss and blood pressure control are less consistent. The benefits appear to be mediated via fibre, often soluble fibre such as beta-glucan and other bioactive compounds.

Given the habitual low fibre intakes in the UK at 14g in adults and 12g in children compared with the Dietary Reference Value of 18g, it is well accepted that choosing wholegrain options is a positive step. No specific wholegrain targets exist in the UK, but in the US and Canada, it is recommended that adults and older children consume three to five 16g wholegrain portions daily. An analysis of the National Diet and Nutrition Survey found that median wholegrain intakes were 20g in adults and 16g in children, i.e. just over one portion daily.<sup>23</sup> Only 17% of adults and 6.0% of children met the US/Canadian recommendation. A systematic review<sup>24</sup> confirmed associations between wholegrain foods and reduced risk of chronic conditions.

In conclusion, the promotion of wholegrain or high fibre cereals, such as oats, barley, wheat and rye, could significantly benefit health as supported by European health claims. Manufacturers should be encouraged to include more of these ingredients in products.

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