



The health benefits of Wholegrain Oats



Wholegrains are an important part of a healthy balanced diet and the evidence for benefits of diets high in wholegrain foods is well established. Wholegrains are defined as ‘the intact, ground, cracked or flaked or otherwise processed kernel after the removal of inedible parts such as the hull and husk; all anatomical components, including the endosperm, germ, and bran must be present in the same relative proportions as in the intact kernel’⁽¹⁾.

The Eat-Lancet Commission on healthy diets from sustainable food systems recommends 232g wholegrains per day for an intake of 2500 kcal/day⁽²⁾. Wholegrain foods are a source of dietary fibre. Fibre intakes in the UK are significantly lower than government recommendations: the current average intake for adults in the UK is around 16.4g per day⁽³⁾ compared to the recommended 30g per day⁽⁴⁾. Currently, there is no advice on what amount of wholegrains to eat in the UK, but The Eatwell Guide recommends that starchy foods should make up just over a third of the food we eat, and to choose higher fibre or wholegrain varieties, where possible⁽⁵⁾. Experts from other countries suggest aiming for 3 servings a day, with 1 tablespoon (tbsp) of uncooked oats counting as one serving. Despite this, surveys have highlighted that 95% of adults don’t eat enough wholegrains, and nearly a third get no wholegrains at all⁽⁶⁾.

Oats are one of the most commonly consumed cereals which can be eaten in wholegrain form⁽⁶⁾, and a large body of scientific research has investigated a range of health effects, resulting in four health claims authorised for use in the European Union (EU) and Great Britain related to oats. This guide is designed to provide an easy-to-read summary of the established evidence and provide a snapshot of current research on oats and their effects on health.

The terms “soluble” and “insoluble” fibre are widely used. However, the FAO (Food & Agricultural Organisation) state that these terms should be phased out as the differentiation is method-dependent, and solubility does not always predict physiological effects. The terms are, however, still widely used, and are referred to in this booklet. Soluble fibres include pectin and β-glucans and insoluble fibres include cellulose and hemicelluloses⁽⁴⁾

Key Points

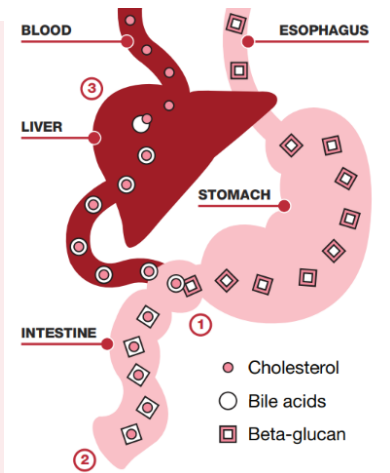
- There are four established health benefits for use in the EU and Great Britain; two health claims authorised for oat beta-glucans on blood cholesterol, one for oat beta-glucan on post prandial glycaemic control and a fourth for oat grain fibre on faecal bulk⁽⁷⁾.
- A significant body of evidence suggests that oats may have a beneficial effect on satiety^(8, 9), blood pressure^(10, 11) and gut microflora⁽¹²⁾.
- Recent research also suggests that polyphenolic compounds (called avenanthramides) that are found naturally in oats may have potential antioxidant⁽¹³⁾, anti-inflammatory⁽¹³⁾ and anti-itching properties^(14, 15).

Oats and cholesterol

As part of a healthy, balanced and varied diet, consumption of oats can help to lower blood cholesterol^(18, 19), a recognised risk factor for cardiovascular disease (CVD) which is a leading cause of premature mortality. High total and low-density lipoprotein (LDL) blood cholesterol levels are a risk factor for CVD⁽¹⁸⁻²¹⁾. Beta-glucan, a type of soluble fibre, is an active component found in oats. A significant body of research reviewed by the European Food Safety Authority in 2011, suggests that the daily consumption of at least 3g beta-glucan has shown a statistically significant decrease in LDL cholesterol concentrations⁽¹⁸⁾. The level of reduction is variable, but the majority of studies demonstrate a reduction of between 5 and 10%⁽²²⁾ with a meta-analysis study looking at 58 trials demonstrating an average of 4.2% when consuming 3.5g/d beta-glucan⁽²³⁾. Beta-glucan is a natural component of the oat grain, found predominantly in the bran outer layer but also in the endosperm, of which 100g of dry oats contain around 3.6g⁽²⁴⁾.

reducing blood LDL cholesterol levels. However, there have been numerous other proposed mechanisms that relate to beta-glucan including modulating the gut microbiota.

There are two authorised health claims for use in the EU and Great Britain, one specific to oat beta-glucans and reducing blood cholesterol, and one relating to beta-glucans and the maintenance of normal blood cholesterol level. Daily consumption of 3g beta-glucan has been shown to significantly lower blood cholesterol concentrations⁽²⁷⁻²⁹⁾. A typical 40g serving of oats can provide almost half of this suggested 3g daily intake and therefore meets the claim requirements. In addition to porridge oats, oats are now a key ingredient in many foods such as muesli, oatcakes and bread. Oat fibre is also being used to increase the fibre content of foods such as white pasta, helping to contribute to daily intakes. Additionally, in recent years there has been an increase in plant-based dairy alternatives. These drinks are made using oats retaining their beneficial cholesterol lowering properties⁽³⁰⁾.



1. Beta-glucan prevents reabsorption of bile acids in the intestine;
2. Which increases excretion of bile acids in faeces;
3. Resulting in the liver extracting more cholesterol from the blood to synthesise more bile acids

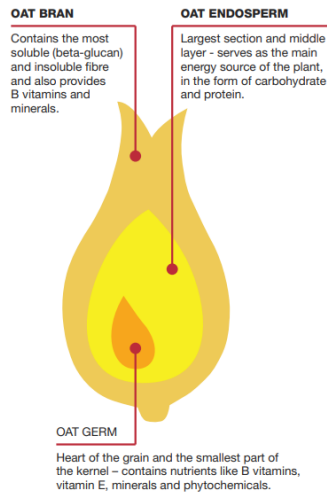
What are Oats?

Wholegrain oats are widely recognised to have a positive role in a healthy, balanced diet. They are frequently eaten as porridge but are also a versatile ingredient in cooking. Oats are milled upon harvesting and then rolled, cut or ground to produce the different types of oats that can be purchased, including rolled oats, flakes, oatmeal, oat flour and oat bran. The three key components of the oat grain provide different levels of key nutrients. By consuming the whole grain, the full nutritional value of the oat can be delivered.

What nutrients do oats provide?

Oats provide carbohydrate, protein, fat and are high in fibre. In addition, oats provide a useful source of a number of micronutrients including those listed below:

Nutrient	Examples of functions in the body with health claims authorised for use in the European Union* and Great Britain**	Amount per 100g of porridge oats (%NRV***)	Amount per 40g serving of oats (%NRV***)
Thiamin (B1)	Contributes to normal energy-yielding metabolism, function of the nervous system, psychological function and function of the heart.	1.05mg (95%)	0.42mg (38%)
Pyridoxine (B6)	Contributes to normal energy-yielding metabolism, function of the nervous system, psychological function, protein and glycogen metabolism and function of the immune system.	0.34mg (24%)	0.136mg (9.6%)
Folate (B9)	Contributes to normal blood formation, amino acid synthesis, psychological function and function of the immune system.	32µg (16%)	12.8 µg (6.4%)
Iron	Contributes to normal red blood cell formation, cognitive function, oxygen transport in the body and function of the immune system.	3.64mg (26%)	1.46mg (10.4%)
Magnesium	Contributes to normal muscle function, electrolyte balance and maintenance of normal bones and teeth.	114mg (30%)	45.6mg (12%)
Zinc	Contributes to normal fertility and reproduction, cognitive function, protection of cells from oxidative stress and the function of the immune system.	2.3mg (23%)	0.92mg (9.2%)
Manganese	Contributes to normal energy-yielding metabolism, the maintenance of normal bones, formation of connective tissue and protection of cells from oxidative stress.	3.7mg (185%)	1.48mg (74%)



The main mechanism for lowering blood cholesterol from oats is mediated by the binding of beta-glucan and bile acids in the gut which prevents the normal reabsorption of bile acids and leads to their excretion in faeces.

This disrupts the entero-hepatic recycling of bile acids and the liver extracts cholesterol from the blood to replenish the bile acid pool^(25, 26). This has the overall effect of



Health claims authorised for use in the EU and Great Britain on oats and cholesterol:

*Beta-glucans contribute to the maintenance of normal blood cholesterol levels.

**Oat beta-glucan has been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease

*Claim can be used for foods that provide at least 1 g of beta-glucan per portion from oats, oat bran, barley, barley bran or a mixture of these sources of beta-glucans. Information must be given to the consumer that the beneficial effect is obtained with a daily intake of 3g of beta-glucan.

**Claim can be used for foods that provide at least 1 g of oat beta-glucan per portion. Information must be given to the consumer that the beneficial effect is obtained with a daily intake of 3g of beta-glucan.

Source: McCance & Widdowson (2014)⁽¹⁶⁾

*EU register of Health Claims⁽⁷⁾
 **Great Britain Nutrition and Health Claims⁽¹⁷⁾
 ***EU Nutrient Reference Value for labelling⁽¹⁸⁾

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Oats and the glycaemic response to meals

Over the past few decades, **studies have shown the beneficial effects of oat consumption on blood glucose levels after a meal⁽¹⁸⁾.**

Blood glucose levels rise following the consumption of carbohydrate-containing foods, and insulin is released to stimulate the uptake of glucose into cells. If the cells become resistant to the effects of insulin, then blood glucose levels can increase and cause more insulin to be released from the pancreas. This can lead to impaired glucose tolerance and insulin resistance, both of which have significant long-term implications for health and increase the risk of type 2 diabetes.

There are several mechanisms by which oats can reduce the rate at which blood glucose levels rise through beta-glucan activity. The most convincing evidence is that the viscosity of beta-glucans slows gastric emptying (the rate at which food leaves the stomach) by forming a gel-like consistency in the stomach. This gel increases the viscosity of the stomach content, making it harder for food to pass into the small intestine, delaying gastric emptying. This then impacts on glucose absorption in the small intestine as food is released more gradually, reducing postprandial (after-meal) blood sugar spikes, which may help to control blood glucose levels and improve insulin response⁽³¹⁾.

Intervention studies in healthy and diabetic subjects have shown a reduction in post-prandial glycaemic and insulin responses following consumption of oat beta-glucans⁽³²⁾, with a meta-analysis demonstrating a reduced relative risk for oat consumers compared to non-consumers for type 2 diabetes incidence⁽³³⁾.

There is one health claim authorised for the use in the EU and Great Britain for the effect of oat and barley beta-glucan as part of a meal contributing to the reduction of the blood glucose rise after that meal⁽¹⁸⁾.

EU and Great Britain approved health claim on oats and glycaemic response:

**Consumption of beta-glucans from oats or barley as part of a meal contributes to the reduction of the blood glucose rise after that meal.*

*This claim can be used on foods that contain at least 4 g of beta-glucans from oats or barley for each 30 g of available carbohydrates in a quantified portion as part of the meal. In order to bear the claim information shall be given to the consumer that the beneficial effect is obtained by consuming the beta-glucans from oats or barley as part of the meal.

“Oats can help to reduce the rise in blood glucose...”



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Oats and gut health

Oat grain fibre can contribute to an increase in faecal (stool) bulk, which helps to improve and maintain normal bowel function⁽³⁴⁾. Dietary fibre is the part of plants we eat, but can't be digested by enzymes within the human digestive tracts. Instead, it can be completely broken down by bacteria in our large intestine. Cereal grains like oats provide soluble and insoluble fibre. The soluble fibre in oats consists primarily of beta-glucans, which dissolve in water to form a viscous gel, whereas the insoluble fibre consists mainly of cellulose, hemicelluloses and lignin.

The insoluble fibre in oats adds bulk to faeces, whilst soluble beta-glucan fibre absorbs water, forms a viscous gel in the gut, which helps to move food through the gut more efficiently. The soluble fibre in oats can act as a prebiotic^(12, 35), through fermentation by host microorganisms in the large intestine⁽³⁶⁾.

Why is it important to include fibre in the diet?

A diet high in fibre is important for overall health and can help support healthy digestion and regular bowel movements, which help reduce the risk of constipation and bowel cancer. In addition, diets high in fibre can reduce the risk of some diseases such as heart disease, stroke, and type 2 diabetes⁽³⁸⁾. The dietary reference intake recommendation for fibre for adults in the EU is 25g per day⁽³⁹⁾, while the UK is 30g per day, with children requiring a slightly lower amount depending on their age⁽⁴⁾. However, dietary surveys show people do not consume enough fibre⁽³⁾. Intakes fall below the recommendation in all age groups, and for adults the average daily intake is around 16.4g per day, with only 4% of adults meeting the 30g/d recommendation⁽³⁾. Increasing fibre intake by including fibre-rich, wholegrain foods like oats in a healthy, balanced and varied diet can help to improve digestive health and may help to reduce the risk of heart disease, type 2 diabetes and bowel cancer⁽³⁸⁾.

*This claim may be used only for food which is high in fibre as referred to in the claim HIGH FIBRE i.e. they contain at least 6g fibre per 100g. Oats would therefore qualify for this claim.

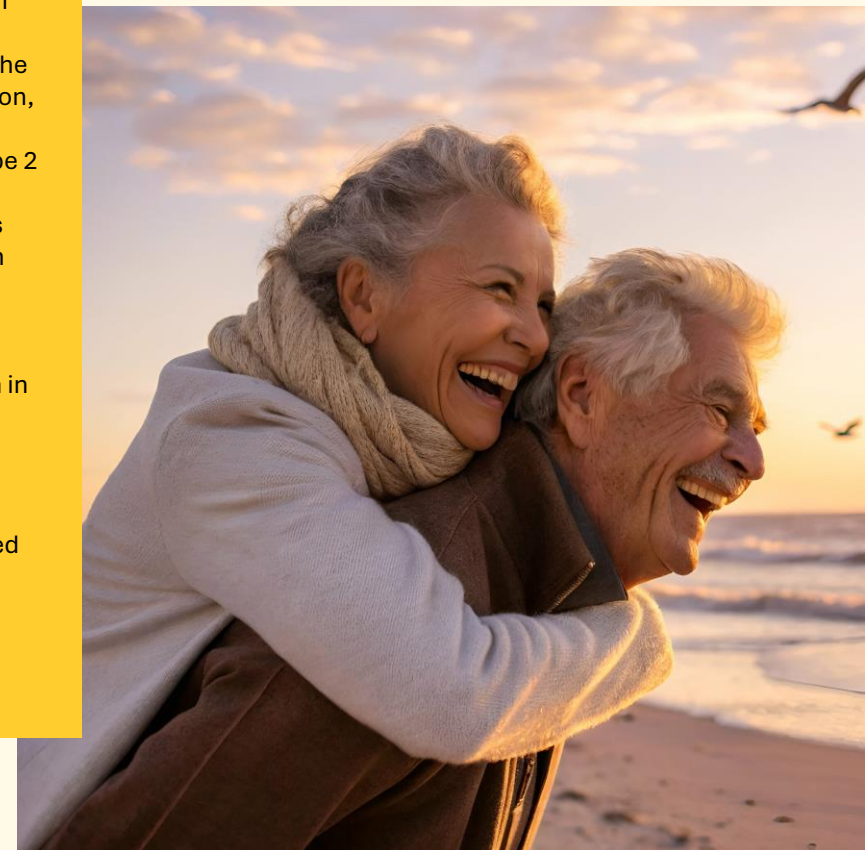
A prebiotic is “a substrate that is selectively utilized by host microorganisms conferring a health benefit on the host”⁽³⁶⁾. This process of bacterial fermentation can help to support a healthy gut microflora and also produce short-chain fatty acids (SCFAs) which can stimulate intestinal mobility by interacting with gut receptors and improving muscle contractions, as well as having beneficial effects throughout the body (e.g. SCFAs can help lower plasma lipid profiles⁽¹²⁾ and reduce post-prandial glucose metabolism^(12, 31, 37))

As the role of insoluble fibres, such as those found in oats, has a well-established effect on faecal bulk, there is one health claim authorised for use in the EU and Great Britain on oat grain fibre and faecal bulk⁽³⁴⁾.

Health claim authorised for use in the EU and Great Britain on oats and gut health:

**Oat grain fibre contributes to an increase in faecal bulk.*

“Fibre is important for gut health and can help support healthy digestion.”



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Emerging evidence on the health effects of oats

Satiety

Epidemiological studies have found associations between fibre intake and lower body weight, Body Mass Index (BMI), waist circumference and waist-to-hip ratio, and it is possible that this could be due to increased satiety and reduced energy intake on higher fibre diets^(40, 41). Some studies have found a relationship between consumption of oat beta-glucans and increased satiety^(8, 9) and a systematic review of fibre and satiety concluded that beta-glucans were one of the fibre types that warranted further study in relation to satiety and obesity prevention⁽³³⁾.

The viscous gel formed by soluble fibres like beta-glucans is hypothesised to interfere with the peristaltic mixing process in the small intestine. This slows down digestion and absorption of nutrients, which alters satiety signals⁽⁸⁾. However, more research is needed to fully understand oat bioactives that influence satiety and reduce energy intake, and to establish whether this is a sustainable effect that could help support weight management in the longer term.

Blood pressure

Studies have suggested that the consumption of wholegrains (including oats) and soluble fibres (including oat beta-glucan) can improve risk factors for coronary heart disease (CHD) including blood pressure. Evidence from a recent systematic review and meta-analysis has suggested a systolic blood-pressure lowering effect (2.82 mm Hg) of oats against a control group, which is thought to be due to their fibre content. The same review also noted that diastolic blood-pressure levels were significantly decreased when participants consumed oat beta-glucan at 5g or more per day, or if participants consumed oats for more than 8 weeks⁽¹¹⁾. A separate recent systematic review and meta-analysis looking at soluble fibres, including oat beta-glucans, in healthy and hypertensive participants showed a positive effect on systolic and diastolic blood pressure with each 5g/d increment⁽¹⁰⁾.

Prebiotic effects

A prebiotic is “a compound or ingredient that is utilised by the microbiota producing a health or performance benefit to the host”. The Global Prebiotic Association also defines a ‘prebiotic effect’ as “a health or performance benefit that arises from alteration of the composition and/or activity of the microbiota, as a direct or indirect result of the utilization of a specific and well-defined compound or ingredient by microorganisms”⁽⁴²⁾, while the International Scientific Association for Probiotics and Prebiotics (ISAPP) consensus definition is “a substrate that is selectively utilized by host microorganisms conferring a health benefit”⁽³⁶⁾. Research on prebiotics is still evolving, but there is significant evidence that consumption of prebiotics can directly modulate the gut microbiota composition⁽⁴³⁾, especially an increase in bifidobacteria and beyond⁽⁴²⁾.

Beta-glucans are fermented in the colon by the gut bacteria. Some studies have shown that oat-based cereals can increase the number of probiotic bacteria in the gut, including *Lactobacillus-Enterococcus* and *Bifidobacterium*, potentially supporting the protection of the gut mucosa to promote gut health⁽⁴⁴⁾ although other studies have not found these effects⁽⁴⁵⁾. In a systematic review, the effects of oat consumption and gut modulation demonstrated increases in *Lactobacillus*, *Bifidobacterium* and *Akkermansia*, increasing production of SCFAs. The combination of these microbes and metabolites are thought to be responsible for the lipid regulation and glucose metabolism health benefits⁽³⁷⁾.



Polyphenols in oats – avenanthramides

Much research on polyphenols has focussed on fruits and vegetables but there is also a class of polyphenolic compounds called avenanthramides (AVAs), which are found exclusively in oats. More than 35 forms of AVAs have been identified and they are found mainly in the bran and outer layers of the oat grain⁽⁴⁶⁾. Research on potential beneficial effects of AVAs from oats is still an area of interest requiring further human clinical trials.

Antioxidant and anti-inflammatory effects: *In vitro* and animal studies suggest that AVAs may exhibit antioxidant activity, exert anti-inflammatory effects⁽¹³⁾ and reduce diet-induced atheroma lesion formation⁽⁴⁷⁾. In addition, a small human study suggested they may also help to increase antioxidant protection and reduce inflammation after exercise in young men and women⁽⁴⁸⁾, and older women⁽⁴⁹⁾ where intervention groups received 20.6mg or 9.2mg AVAs per day respectively. One systematic review and meta-analysis concluded that there was poor overall supporting evidence for the alleviation of inflammatory responses from oat consumption. Oat consumption ranged from whole oats, oat bran, fibre-rich fractions, oat proteins or AVAs. The authors called for more human studies with larger sample sizes with low risk of bias to further explore the link⁽⁵⁰⁾.

Anti-itch effects: Oats have been used topically for centuries as a remedy for skin irritation and itching related to conditions like eczema, allergic reactions and psoriasis⁽⁵¹⁾. Studies in animal models have suggested that the mechanism behind their “anti-itch effect” might be due to anti-histamine and anti-inflammatory effects of AVAs^(14, 15), with *in vitro* study showing an anti-inflammatory effect through inhibition of nuclear factors (NF)-κB activation⁽⁵²⁾. However, human studies on the beneficial effects of AVAs is still being explored⁽¹⁴⁾.



“Oat-based cereals can increase the number of probiotic bacteria”

Summary

A diet rich in fibre is beneficial for health and has been associated with a lower risk of heart disease, stroke, type 2 diabetes and bowel cancer. Government recommendations are for 30g of fibre per day for adults as part of a healthy, balanced diet. Most adults need to increase their fibre intakes. It is important to get fibre from a variety of different sources, as eating too much of one type of food is unlikely to provide a balanced healthy diet. Including oats as part in the diet, alongside other wholegrains, fruit, vegetables, legumes, nuts, and seeds can help increase fibre intakes to meet government guidelines alongside providing cardiometabolic protection through the beta-glucan activities.

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