Oats and Oat Products in Cholesterol Lowering Diets

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Dyslipidaemia (raised and unhealthy patterns of cholesterol and triglycerides and the lipoproteins that carry them in the blood) is one of four main modifiable risk factors for cardiovascular disease. The others are diabetes, high blood pressure and smoking. High total cholesterol is ranked number seven of the 20 leading risk factors which contribute to the overall burden of disease in the UK.1

The prevalence of high cholesterol
Average UK cholesterol levels are decreasing but this is reflective of a population heavily medicated with statins. Over half of all UK adults still have a total cholesterol level above 5 mmol/L.

Recent changes in the Quality Outcomes Framework (QOF) mean that in future data on cholesterol levels may be lacking. GPs are no longer rewarded for measuring and recording the cholesterol levels of their patients, with the exception of diabetics. HEART UK has raised concerns that the loss of this incentive to measure and record cholesterol levels in patients where cholesterol poses a significant risk factor is misguided.1

Dyslipidaemia itself has many causes, both primary (inherited) and secondary to other problems. Familial Hypercholesterolaemia (FH) is an under-recognised inherited form of high cholesterol. FH is the most common condition to be caused by a single gene alteration; it affects between 120,000 and 240,000 people in the UK of which 28,000 are children or teenagers. Less than 15% are currently diagnosed. Lifelong exposure to high cholesterol puts the alteration; it affects between 120,000 and 240,000 people in the UK currently diagnosed. Lifelong exposure to high cholesterol puts the inheritance of many genes that negatively influence cholesterol levels. Familial Combined Hyperlipidaemia (FCH), in which both cholesterol and triglycerides are raised, is also influenced by many genes. Both these conditions are relatively more common than FH, however GPs, dietitians and practice nurses should be aware that patients with all these conditions will be seen in their clinical practice at some time.

Recommended cholesterol levels
For healthy individuals a total cholesterol level of ≤5 mmol/L and an LDL cholesterol of ≤3 mmol/L is associated with low risk.

Until recently those with existing, or higher risk of, cardiovascular disease (CVD) were advised to aim for a total cholesterol ≤4 mmol/L and an LDL cholesterol ≤2 mmol/L. However, a recent revision of the NICE guidelines1 set no targets for cholesterol levels – preferring to advise a 40% LDL cholesterol reduction from baseline for those with a 10% or more CVD risk. The Joint British Society (JBS3) guidelines, also updated in 2014, recommend an LDL target of 1.8 mmol/L for those at high risk; equivalent to a non-HDL target of 2.5 mmol/L.4 Two other changes to the guidelines mean that for most people a non-fasting cholesterol test is now recommended and that non-HDL cholesterol (rather than LDL cholesterol) is now the target of treatment. This is because non-HDL cholesterol represents the sum of all atherogenic lipoproteins, including VLDL and IDL. NICE guidelines also recommend a 50% LDL cholesterol reduction from baseline for those individuals with FH. Whilst it is useful to have targets, most lipidologists in the UK would agree that the lower the cholesterol the lower the risk of coronary heart disease (CHD).

The role of non starch polysaccharides (NSP) in heart health
Dietary fibres, both soluble and insoluble, are defined as non starch polysaccharides (NSP) and are neither digested nor absorbed in the small intestine in humans.

NSP is currently measured and reported in the UK by the Englyst method of analysis. However, recently, the Scientific Advisory Committee for Nutrition (SACN) recommended a move toward the AOAC method.1 This means that the UK population average dietary reference value (DRV) for NSP for adults, currently set at 18 g using the Englyst method, would become 23-24 g using AOAC. In addition, SACN, having recognised the health benefits of increasing NSP intake, called for an increase in the average DRV for NSP to 30 g per day (AOAC) – an increase of around a third.
Hot Topic | Oats in Cholesterol Lowering Diets

Many cohort studies have demonstrated a beneficial relationship between increasing NSP and whole grains in the diet and reducing the risk of cardiovascular disease. The mechanism for the reduction of risk is not entirely known, but credible explanations include an increase in fibre, vitamin or mineral intake, reduction in plasma lipid and glucose levels, as well as the displacement of other foods from the diet. Despite this good evidence, dietary intakes in the UK remain well below the current average DRV of 18 g/day, with lowest intakes in low income populations. Cereals and cereal products are the biggest contributor to NSP intakes.

The role of beta glucan

Diet high in soluble fibres (pectin, glucan, gums, psyllium) have been shown to decrease both total and LDL cholesterol levels. In clinical studies the effect varies from 0% to 18% dependent upon the type of soluble fibre, dosage, background diet and dietary control.

Beta glucan is a water soluble fibre found in cereals grains, particularly oats and barley and is well known for its cholesterol-lowering ability. It is thought that there may be a number of mechanisms but the main one that is usually cited is the disruption of the enterohepatic circulation, see Figure 1.

The enterohepatic circulation describes the recycling of cholesterol rich bile acids. Bile acids are produced in the liver as breakdown products of cholesterol. Cholesterol rich bile then passes, via the bile duct, into the duodenum in response to a meal. Bile acts as an emulsifier, breaking down dietary fat into microscopic droplets with a very large surface area, allowing dietary fat to mix intimately with digestive enzymes.

Bile is not altered by the process of digestion and under normal circumstances most bile acids are reabsorbed in the small intestine returning to the liver where they can be recycled. Beta glucan acts within the gut to reduce the absorption of bile and dietary cholesterol. As a result less bile is available for recycling and LDL receptors are up-regulated to collect more cholesterol out of the circulation to produce more bile for digestion. As a result blood cholesterol levels are lowered.

How beta glucan reduces bile and cholesterol absorption

Within the gut beta glucan fibres swell and become viscous. The viscosity of beta glucan is dependent upon the molecular weight (which in turn is dependent upon the presence of mixed-linkage polysaccharides) and the concentration. Ultimately, it is this viscosity that helps bind bile acids and cholesterol and prevent their absorption.

Other mechanisms, not dependent upon molecular weight and viscosity, include the possible fermentation of beta glucan by bacteria within the lower gut to short chain fatty acids which then inhibit a key enzyme involved in cholesterol synthesis and the down regulation of genes involved in the intestinal uptake of lipids.

Randomised control trials (RCTs) have shown that beta glucan lowers total cholesterol and LDL cholesterol but has no effect on either HDL cholesterol or triglycerides. The magnitude of the reduction appears to be greater in those with higher baseline cholesterol. Whilst a dose response effect appears logical, a recent meta-analysis of 28 oat beta glucan RCTs found no evidence of this within a dose range of 3-12 g per day. A similar meta-analysis of 11 barley RCTs also found no dose related effect.

The Portfolio Diet

Soluble fibre, and specifically beta glucan, is a key element of the Portfolio Diet, an experimental diet shown to lower cholesterol in hypercholesterolaemic individuals by 28% in metabolic studies, and by 20% in free living populations. Jenkins theorised that a portfolio of four foods (almonds, soy, sterol fortified spread and soluble fibre) when eaten together, on top of a diet low in saturated fat, would have additive cholesterol-lowering equal to the sum of the individual effects of each food. This dietary approach to cholesterol-lowering is becoming better established in the UK under the guise of HEART UK’s Ultimate Cholesterol Lowering Plan (UCLP).

The role of oats and oat products

Oats contain around 10% total fibre and have a greater proportion of soluble fibre (4%) than any other grain. The oat grain also provides a valuable source of protein (13%) and unsaturated fats (5.3%) and is naturally low in saturated fats (1.2%). Oats also supply significant amounts of minerals (magnesium, calcium, iron, zinc) vitamins (vitamin E, thiamine, folate and B6) and phytochemicals (phytosterols, phenolics and carotenoids). The consumption of oats has been associated with many cardiovascular benefits, including the reduction in total and LDL cholesterol.

Figure 1: Enterohepatic Circulation – this is disrupted by beta glucan reducing bile reabsorption and increasing faecal losses. More cholesterol is then taken from the circulation to replace the lost bile.
Although a small reduction, this can make a valuable contribution to a portfolio of cholesterol-lowering strategies such as those in the portfolio diet or UCLP. The inclusion of oats and beta glucan in the diet is also recommended in several international and UK recommendations for the management of dyslipidaemia. 1, 12, 13 Oats have also been shown to have small beneficial effects on blood pressure control, 13, 14, 15 incidence of Type 2 diabetes, 12, 13 post prandial blood sugars 16, 17 and satiety. 16

A number of health claims related to cholesterol-lowering have been approved for oat beta glucan worldwide, including the United States, 18 Canada, 19 Europe, 20 Malaysia, Australia and New Zealand – see Table One for UK/EU Claims. With the exception of Malaysia, these approvals are based on an intake of 3 g beta glucan per day, although the conditions of use may vary. In the USA, a claim may be made where an individual serving contains ≥0.75 g of beta glucan; however across Europe 1 g beta glucan per portion is needed to make a similar claim. Approved health claims enable informative food labelling and help spark new innovative products, such as oat milks, breakfast cereals and oat-containing breads. Although not a condition of the health claim, companies should be encouraged to conduct their own research to demonstrate the efficacy of these products and alleviate any concerns that processing may have had on the products ability to lower cholesterol.

One such study, using a well known oat milk, demonstrated a 6% cholesterol reduction in hypercholesterolaemic men when consumed over five weeks and compared to rice milk in a randomised controlled crossover trial. 18

### Conclusion

There is strong support for the hypothesis that generous intakes of wholegrains, including oats, can be cardio-protective.

Beta glucan has been extensively studied and found to have significant total and LDL cholesterol lowering effects. The magnitude of this effect is around 5% and appears to plateau out at intakes above 3 g per day. 19

### Table One: Health Claims Approved for Use in the UK

<table>
<thead>
<tr>
<th>Joint Health Claims Approved for Use in the UK</th>
<th>Oats in Cholesterol Lowering Diets</th>
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<tbody>
<tr>
<td>Joint initiative</td>
<td>Oats in Cholesterol Lowering Diets</td>
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<tr>
<td>UK 2004 19</td>
<td>Oats in Cholesterol Lowering Diets</td>
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<td>EU 2019 - Article 13 claim 20</td>
<td>Oats in Cholesterol Lowering Diets</td>
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<td>EU 2010 - Article 14 claim 21</td>
<td>Oats in Cholesterol Lowering Diets</td>
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### Table Two: Oat Beta Glucans – Food servings providing 1 or 3 grams

<table>
<thead>
<tr>
<th>1 g oat beta glucan is provided by:</th>
<th>Oats in Cholesterol Lowering Diets</th>
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</thead>
<tbody>
<tr>
<td>• A bowl of porridge (using 30 g of porridge oats)</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>• 2 tablespoons of oat bran • 1 oat breakfast biscuit</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>• 1 serving of Mornflake oat bran cereals • 3 oatcakes</td>
<td>Oats in Cholesterol Lowering Diets</td>
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<tr>
<td>• 30 g of oats in recipes that are also in saturated fat</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>• 2 slices or 1 roll of LIV or Hovis Hearty Oats bread</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>• 250 ml glass of oat drink/milk</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>3 g oat beta glucan is provided by a single portion of:</td>
<td>Oats in Cholesterol Lowering Diets</td>
</tr>
<tr>
<td>• OatWell products: bran powder, instant drink mix, crispy hearts breakfast cereal • BetaVivo</td>
<td>Oats in Cholesterol Lowering Diets</td>
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THIS HEADLINE WOULD LIKE YOU TO READ THE BULLET POINTS

That wasn’t a very exciting headline but since it got you here we would like to mention that what is really great about our oat drink products (beside the taste of course) is what you find in the details which we have organised as well structured and informative bullet points below. So before we are tempted to fill this ad with sales oriented power slogans about how easy it is to cook with or enjoyable it is to pour on your morning cereal, perhaps we should take a look at those bullet points we wanted you to read.

- Totally dairy and soya free
- Low in saturated fats (1.5g/100ml total fat of which 1.3g is unsaturated)
- Lowers your cholesterol thanks to those wondrous fibres called beta-glucans*
- Rich in vitamin D and a source of riboflavin, vitamin B12 and calcium
- No added sugar
- Sustainable for the environment (one third of the carbon footprint of milk)

So now you know, but before we let you go we should probably tell you that this handsome looking package is not always easy to find because the supermarkets usually place it in the specialist milk aisle and not at all because we thought it would be fun to hide it from you. Promise.

* As a part of a varied and balanced diet and a healthy lifestyle, beta-glucans may help lower cholesterol levels in your blood. High cholesterol is a risk factor for heart disease. One 250ml glass of Oatly provides a third (1g) of the 3g suggested daily intake of beta-glucan.