Viscous fiber from oats and barley: keep them in your cholesterol-lowering portfolio

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Cardiovascular diseases (CVDs), mainly those resulting from atherosclerotic CVD (ASCVD), remain the leading cause of death globally (1). An elevated level of low-density-lipoprotein cholesterol (LDL-C) is a major risk factor for ASCVD. However, LDL-C is a surrogate for the level of circulating atherogenic lipoprotein particles that contain apolipoprotein B (2,3). Results from randomized controlled trials (RCTs) of statin therapy demonstrated that a 1 mmol/L reduction in LDL-C reduces the risk of a major vascular event, such as myocardial infarction, stroke, or cardiovascular death, by 22% over roughly 5 years (4). Evidence from studies of genetic variants that affect lipoprotein lipid levels shows that a 1 mmol/L genetically driven LDL-C reduction maintained for decades is associated with a 50–55% lower risk for a major vascular event (3). These results support the view that both the LDL-C level and time of exposure are important determinants of ASCVD risk, i.e., "lower for longer is better" for minimizing risk for ASCVD events.

Lifestyle therapies remain a foundational component of ASCVD risk reduction strategies (5-9). RCTs have shown reductions in levels of cardiometabolic risk markers, including LDL-C, glucose, insulin, blood pressure, and markers of chronic inflammation in response to various dietary interventions, which can mitigate ASCVD risk (10). One type of dietary intervention that has been found to lower the LDL-C concentration is consumption of foods or supplements containing viscous dietary fibers. The primary proposed mechanism for the cholesterol-lowering effects of viscous fibers is trapping of bile acids and cholesterol, which reduces absorption and reabsorption of these substances (11-13). Reduced absorption results in lower levels of cholesterol and bile acids in hepatocytes, triggering up-regulation of hepatic LDL receptors that remove apolipoprotein B-containing lipoproteins, including LDL particles, from the blood, thus lowering the circulating level of LDL-C (10,14). The fermentability of dietary fibers may play a smaller, secondary role in the cholesterol-lowering effect of fiber, although the evidence for this is mixed (13,15).

Reiners *et al.* conducted an RCT with a crossover design to investigate the effects of traditional and roasted barley and oat flakes on fasting and post-prandial levels of lipoprotein lipids and glucose, as well as several other biomarkers of cardiometabolic risk (16). Thirty-two adults with mild hypercholesterolemia (median LDL-C =3.90 mmol/L) not taking lipid-lowering drug therapy completed five 3-week intervention periods with 3-week

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washout periods between interventions. The five conditions were: roasted oat flakes, roasted barley flakes, traditional oat flakes, traditional barley flakes, and 100 g of white toast bread (control). The 80 g of oat flakes (roasted or traditional) provided 8.8 g total fiber and 3.2 g of β-glucan, a viscous fiber. The 80 g of barley flakes (roasted or traditional) provided 10.0 g total fiber and 4.1 g β-glucan. The 100 g of white bread provided 2.8 g total fiber and no β-glucan.

Control-adjusted percent changes from baseline for LDL-C were –11.7%, –7.0%, –8.2%, and –9.5% for the roasted oat, roasted barley, traditional oat, and traditional barley flake conditions, respectively (all $P<0.05$ *vs.* control). It was not surprising that both the oat and barley treatments resulted in improved blood lipids since both the United States Food and Drug Administration and the European Food Safety Administration have approved health claims for the blood cholesterol-lowering effects of β-glucans in oats and barley (17-19). Similar control-adjusted percent changes were observed for total (–7.5% to –10.5%) and high-density-lipoprotein cholesterol (HDL-C; –5.5% to –9.0%). No statistically significant differences from control were observed for fasting levels of triglycerides, glucose, insulin, or homeostasis model assessment of insulin resistance, nor for levels of glycated hemoglobin or systolic and diastolic blood pressures.

Compared to the control condition, mean differences in LDL-C with the oat and barley interventions were –0.27 to –0.43 mmol/L. Reductions of this magnitude would be expected to lower ASCVD event risk by roughly 19–28%, if maintained for an extended period (3). Higher levels of HDL-C are associated with lower ASCVD risk (7). However, interventions that alter the HDL-C concentration have not been shown to impact ASCVD event risk, thus the clinical importance of the observed changes are unknown (7).

The results of the study by Reiner *et al.* suggest that both roasted and traditional oat and barley products are reasonable options to incorporate into a healthy dietary pattern to lower LDL-C. It should be noted that other dietary interventions can be added to viscous fibers to produce larger reductions in LDL-C. The portfolio approach combines a diet low in saturated fatty acids with plant sterols, viscous fiber, soy protein, and almonds. In RCTs, the portfolio approach reduced LDL-C levels by ~30% with controlled feeding, and 12–15% when participants were free-living during follow-up periods of one year or longer (10,20-22). Thus, dietary strategies for lowering LDL-C levels can have a significant impact on expected ASCVD risk when maintained over time. Also, lipid-lowering pharmacotherapies and dietary interventions work additively (23,24). Therefore, dietary strategies, including consumption of viscous dietary fibers, may assist in achieving therapeutic objectives for LDL-C with a lower medication dosage for those in whom risk is sufficient to justify lipid-altering pharmacotherapy. A majority of the LDL-C-lowering effect of statin therapy, the most commonly employed class of lipid-altering medication, is achieved at the starting dosage. Each subsequent doubling of the daily dosage produces an additional LDL-C reduction of ~6% (25). Therefore, inclusion of 80 g/d of oat or barley flakes produces an effect equivalent to one to two doublings of statin dosage.

Strengths of the study by Reiners *et al.* include the randomized crossover design with a washout period after each intervention, and that the oat and barley flake conditions were double-blinded (the white bread control could not be blinded). Additionally, the traditional oat and barley products used in the study are commercially available and accessible. The main limitation is that each treatment phase was only three weeks, so the study cannot provide information about the persistence of the effect over longer periods, as well as adherence to daily consumption of the quantities consumed. However, prior studies with viscous dietary fibers have shown that the cholesterol-lowering effect persists over longer periods (11,13).

The atherosclerotic process begins early in life and typically progresses for decades before a cardiovascular event occurs (5,7,8). Encouraging the consumption of cholesterol-lowering foods, including oats and barley, as part of a healthy dietary pattern, can be helpful for maintaining lower levels of LDL-C. In addition to β-glucan from oats and barley, other dietary sources of viscous dietary fiber include pulses/legumes, some fruits (e.g., plums, pears apples), and psyllium fiber used as a bulking laxative. As stated above, "lower for longer is better" for LDL-C, which is a key determinant of ASCVD risk.

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