Dietary prevention of atherosclerosis: go with whole grains¹,²

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Since the appearance of stone processing tools in the fossil record in the Upper Paleolithic (40 000–12 000 y ago), cereal grains have emerged as an important cornerstone of the human diet (1). Before the Industrial Revolution, all cereals were stone-milled and contained the entire constituents of the grain kernel (1). With the advent of industrialized roller milling at the end of the 19th century, mass refining of grains occurred, which significantly changed the nutritional quality of milled grain (1).

In the 1970s, Burkitt and Trowell (2) pioneered the link between chronic disease and refined grain consumption by observing that African natives who consumed large quantities of whole-plant foods had a lower prevalence of coronary heart disease, diabetes, and cancer than did refined-grain consumers of the West. To date, a number of epidemiologic studies have found a protective effect of whole-grain consumption against chronic disease, including various cancers (3), cardiovascular disease (4), and type 2 diabetes (5). In contrast, positive associations have been reported between the consumption of refined grains and risk of chronic diseases (6).

Whole grains are composed of germ, bran, and endosperm. In contrast, refined grains lack both the germ and bran, which are removed during processing and result in the loss of fiber, vitamins, minerals, lignans, phenolic compounds, and phytochemicals (7). It is this unique constellation of constituents that are thought to confer the beneficial effects of whole grain on chronic disease risk. These constituents were subsequently shown to be associated with various processes related to improvements in cardiovascular disease risk, including reduced insulin resistance and adiposity, a cardioprotective lipid profile, improved endothelial function and oxidative stress (8), and reduced inflammation (9). It has been speculated that whole-grain intake may have favorable effects on the progression of atherosclerosis, although limited data are available. Previously, a prospective cohort study reported a significant reduction in atherosclerotic progression in postmenopausal women with preexisting heart disease who consumed ≥6 servings/wk of whole grains compared with those with lower intakes over 3 y (10). In this issue of the Journal, Mellen et al (11) report the results of their investigation of the association between whole-grain intake and carotid intimal medial thickness (IMT) and IMT progression in the Insulin Resistance Atherosclerosis Study (IRAS).

IRAS is a multicenter observational study designed to evaluate insulin resistance, cardiovascular disease risk factors, and atherosclerosis in an ethnic cohort (62% nonwhite). The current analysis included 1178 (55.8% women) participants with a mean age of 55.2 y who, at baseline, had undergone carotid ultrasonography and had dietary data collected and had follow-up carotid sonograms at year 5. IMT and IMT progression were assessed for the common carotid artery (CCA) and internal carotid artery (ICA).

The authors report a strong inverse and independent association between whole-grain intake and CCA IMT and IMT progression. For ICA IMT and IMT progression, the associations were inverse, although not as strong, particularly for IMT progression, and did not persist in exploratory models or dietary pattern analyses. A potential explanation for this difference, as posited by the authors, stems from previous observations in this cohort that CCA and ICA IMT progression are not strongly correlated and that progression at one arterial site may induce remodeling at distal sites. Confirmation of these findings and further evaluation of how whole grain may differentially affect IMT progression are warranted.

The association between whole-grain consumption and CCA IMT persisted in exploratory models that evaluated dietary characteristics such as glycemic load and potential intermediate pathways that could explain the observed effects. This implies that the benefits of whole grains are complex and multifactorial. Whether the benefits of whole-grain consumption are mediated by individual components or are a result of the synergistic effect of multiple components has been a long-standing question. In the past, much emphasis has been placed on fiber—a constituent of bran. However, separating the effects of different components of whole grains in epidemiologic studies is exceedingly challenging, and emerging evidence suggests that the consumption of fiber per se may not be as beneficial as the consumption of fiber when it is consumed as a whole grain (4), which is supported in part by the results of the study by Mellen et al.

A major strength of this study was its use of empirically derived dietary patterns to adjust for potential residual confounding. When whole-grain intake was adjusted for the “healthy dietary pattern” score, the association with CCA IMT and IMT progression persisted, which indicates an independent association between whole-grain intake and atherosclerotic progression.

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However, because the study is observational, residual and unmeasured confounding may still exist. Other strengths of the study include its inclusion of an ethnically diverse cohort, although the study was not powered to assess interethnic differences in the associations. Additionally, outcome assessment was prospective and included the use of a validated noninvasive marker of systemic atherosclerosis.

The accurate assessment of whole-grain consumption has been a challenge in epidemiologic studies. The IRAS food-frequency questionnaire (FFQ) was not designed to assess whole-grain intake; therefore, misclassification and attenuation of results was likely. Daily whole-grain intake was estimated on the basis of 3 items from the FFQ: dark bread or high-fiber bran or granola cereals, shredded wheat, and cooked cereal, including oatmeal, cream of wheat, and grits. In most studies, foods are considered whole grain if >25% of the product is whole grain or bran by weight. Jensen et al (12) recently calculated whole-grain intake by multiplying a person’s intake of foods by the amount of whole grains in each food and then summing the intake of whole grain from all foods. This definition avoids the use of an arbitrary cutoff for defining whole-grain foods and allows the calculation of bran and germ separately. At this time, no specific biomarker exists for whole-grain intake, although intake of whole grains has been shown to be inversely associated with homocysteine and markers of glycemic control (12) and inflammation (9).

On average, Americans eat less than one serving per day of whole grains. Some reasons for this low intake include an inability to identify whole grains, a lack of awareness of its health benefits, its cost, and taste, and an unfamiliarity with preparation methods (13). The findings of Mellen et al provide further evidence of a beneficial role of whole grain in disease prevention. Dietary recommendations should encourage the substitution of whole grains for refined grains and added sugar. Meanwhile, efforts should be made to increase the public’s awareness about health benefits of whole grains. Indeed, an increased consumption of whole grains represents a wholesome and palatable opportunity to reduce the risk of atherosclerosis and cardiovascular disease.

The authors had no conflicts of interest to declare.

REFERENCES