Published in final edited form as:

Nat Rev Endocrinol. 2015 July ; 11(7): 389–390. doi:10.1038/nrendo.2015.76.

The whole cereal grain is more informative than cereal fibre

David R. Jacobs Jr

Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, 1300 S. 2nd Street, Suite 300, Minneapolis, MN 55454, USA

Abstract

A massive prospective study that assessed the association between consumption of cereals and mortality has concluded that cereal fibre is a component of whole grains that is potentially protective. This focus on cereal fibre is not fully consonant with plant and human biology and might distract from the aspect of most importance in prediction of chronic disease—the whole grain and its myriad bioactive phytochemical constituents.

Graphical abstract

Finding that intake of food containing whole-grain cereals and cereal fibre is associated with reduced total mortality¹ and chronic disease, in a broad sense,² is not new. Huang and colleagues add to this literature with a thorough epidemiologic analysis of mortality following baseline observations of whole-grain food and cereal fibre intake in the NIH-AARP Diet and Health Study.³ Over 360,000 participants aged 50–71 years, without cancer,

Competing interests

D.R.J.Jr is a consultant to the California Walnut Commission.

heart disease, stroke, diabetes mellitus or end-stage renal disease when enrolled in 1995, were followed up for cause-specific mortality until 2009. This article³ is subsequent to a study by Park and colleagues,⁴ which analysed the association of intake of dietary fibre from different sources with mortality in the same population; however, the follow-up of this initial study⁴ was 5 years less than that of Huang and colleagues. Both studies^{3,4} are in agreement with the approach taken by my colleagues and I⁵ in their fine separation of cause-specific deaths, such as cancer, cardiovascular disease, diabetes mellitus, respiratory disease and infections. All of these studies agree with the breadth of the possibly causal effect of the intake of whole-grain food on the incidence of chronic disease.

The novelty in the study from Huang and co-workers is their conclusion, which was developed on the basis of epidemiologic adjustment, that cereal fibre might, in part, account for the protective effects of whole grains on mortality.³ The distinction between the whole grain and cereal fibre has been much debated^{2,6,7} and is in need of improved understanding. The conclusion of the study by Huang *et al.* should be regarded cautiously, as it was inferred purely on statistical grounds.³ In the Iowa Women's Health Study (IWHS),⁸ for example, the correlation between the intake of whole-grain food and intake of cereal fibre is 0.7 (D. R. Jacobs Jr, unpublished work). Effects from variables that are so highly correlated are not easy to cleanly distinguish and the method of statistical adjustment might yield unpredictable findings. Importantly, a purely statistical adjustment solution ignores the biology of cereal fibre.

Cereal fibre is a nonstarch polysaccharide that is localized to the cell walls,⁷ whereas the cells of cereal grains, and, indeed, of seeds of any plant, also contain myriad important bioactive substances. Cereal fibre must work in the gut, as by definition fibre is not digestible. Plausible actions of fibre in the gut include improved laxation (which is a major issue for quality of life), as well as modulation of digestion and, probably, absorption of other compounds that are digestible. One could also conceive that fibre nourishes a healthy gut microbiome. These ideas are important, but the statements would seem to be true of all fibre; however, cereal fibre in many studies (including that of Park *et al.*⁴) was more predictive of reduced mortality than other fibre sources. There must be something about the cereal grain itself, not just the fact that the cereal grain contains a form of dietary fibre. That 'something' is probably the myriad of bioactive plant compounds contained in the cereal grain cells with non-starch polysaccharide. Jacobs and colleagues found that cereal fibre from refined grain, in the same amount as the cereal fibre from whole grain, did not predict reduced mortality.⁸ Thus, the fact that the whole cereal grain is a seed, rather than the amount of fibre it contains, seems to be the most important factor for long-term health.

Cereal fibre versus the whole cereal grain as an adjunct to long-term health is not a purely academic argument. Goodlad and Englyst suggest that in terms of labelling foods, dietary fibre, in addition to being defined chemically, should also accurately reflect the recommended naturally fibre-rich diet.⁷ They remark on definitions proposed by the American National Academy of Sciences⁹ that dietary fibre comprises the nondigestible carbohydrates and lignin that are intrinsic to, and intact in, plants and that added fibre comprises isolated, non-digestible carbohydrates that have beneficial physiological effects in

humans. On the basis of these definitions, total fibre is the sum of dietary fibre and added fibre.⁹

I agree with Goodlad and Englyst⁷ that the available scientific evidence does not support broadening the scope of what is considered to be fibre to all nondigestible carbohydrates, including resistant starch and other compounds that are not currently regarded as fibre. Indeed, little evidence exists to support an association of health benefits with consumption of 'artificial fibre'. As a result, scientifically, much attention has been directed to fibre and its various forms, including artificial fibre; however, this might not be the richest vein of scientific ore. From the public and industrial perspectives, if any form of fibre (for example, vegetable, fruit, soluble, insoluble and artificial) is important, the grain would not be needed. This conclusion, however, is not consonant with the evidence; for example, with the finding in IWHS that cereal fibre from refined grain did not predict mortality⁸ or that consumption of cereal fibre was much more predictive of mortality, especially in men, than fruit or vegetable fibres.⁴

Goodlad and Englyst⁷ emphasize that nutritional recommendations should be for unrefined plant foods. I hypothesize that the fibre associated with seeds of other foods would be equally as predictive as cereal fibre. For example, the phytochemical-rich walnut pellicle¹⁰ bears an obvious analogy to the aleurone layer of the cereal grain. The argument is not that fibre itself has no effects, but that the most productive nutritional recommendations for long-term health encourage consumption of a wide variety of foods, many of which are naturally rich in fibre.⁷ Public health and the pursuit of new research would be best served if most attention were focused on the cereal grain, plant seeds in general and their phytochemical constituents.

Acknowledgments

D.R.J.Jr is funded, in part, by a grant from the NIH National Heart, Lung, and Blood Institute, HL R01 53560.

References

1. Wu H, et al. Association between dietary whole grain intake and risk of mortality: two large prospective studies in US men and women. *JAMA Intern Med.* 2015; 175:373–384. [PubMed: 25559238]
2. Jacobs DR Jr, Gallaher DD. Whole grain intake and cardiovascular disease: a review. *Curr Atheroscler Rep.* 2004; 6:415–423. [PubMed: 15485586]
3. Huang T, Xu M, Lee A, Cho S, Qi L. Consumption of whole grains and cereal fiber and total and cause-specific mortality: prospective analysis of 367,442 individuals. *BMC Med.* 2015; 13:59. [PubMed: 25858689]
4. Park Y, Subar AF, Hollenbeck A, Schatzkin A. Dietary fiber intake and mortality in the NIH-AARP diet and health study. *Arch Intern Med.* 2011; 171:1061–1068. [PubMed: 21321288]
5. Jacobs DR Jr, Andersen LF, Blomhoff R. Whole-grain consumption is associated with a reduced risk of noncardiovascular, noncancer death attributed to inflammatory diseases in the Iowa Women's Health Study. *Am J Clin Nutr.* 2007; 85:1606–1614. [PubMed: 17556700]
6. Pereira MA, et al. Dietary fiber and risk of coronary heart disease: a pooled analysis of cohort studies. *Arch Intern Med.* 2004; 164:370–376. [PubMed: 14980987]
7. Goodlad RA, Englyst HN. Redefining dietary fibre: potentially a recipe for disaster. *Lancet.* 2001; 358:1833–1834. [PubMed: 11741620]

8. Jacobs DR, Pereira MA, Meyer KA, Kushi LH. Fiber from whole grains, but not refined grains, is inversely associated with all-cause mortality in older women: the Iowa Women's Health Study. *J Am Coll Nutr.* 2000; 19(3 Suppl):326S–330S. [PubMed: 10875605]
9. Panel on the Definition of Dietary Fiber and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Dietary reference intakes: proposed definition of dietary fiber (2001). The National Academies Press [online]. 2001. www.nap.edu/catalog/10161.html
10. Colaric M, Veberic R, Solar A, Hudina M, Stampar F. Phenolic acids, syringaldehyde, and juglone in fruits of different cultivars of *Juglans regia* L. *J Agric Food Chem.* 2005; 53:6390–6396. [PubMed: 16076123]