

# Whole Grain Definition: New Perspectives for Inclusion of Grains and Processing but not for Analysis

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## Introduction

The growing market for whole grain products worldwide is accompanied with lively discussions about the definition of whole grain. Which grains can be included and which processing treatments are allowed? Furthermore there is a wish for having analytical methods for determination of the level of whole grain in products. This paper is aiming at providing some new views and insights for these debates.

## Grains Included—Relationships with Purpose of Definition: Public Health, Dietary Recommendation or Health Claims

In 2010 the HEALTHGRAIN Consortium issued its definition of whole grain (7), with inclusion of all cereal and pseudo-cereal grains included in the AACCI definition (1). At the same time Frølich and Åman (2010) stated that the whole grain definition should include only wheat, rye, oats, and barley, since with the current insights regarding health benefits only these grain may qualify for a health claim; with new knowledge of health benefits of other grains the number of grains in the definition may be increased.

Starting not with health claims but from the public health perspective, many generic guidelines for healthy eating are recommending consumption of fruits, vegetables, and whole grain products. In these guidelines whole grain products of every grain are recommended as the preferred choice over their refined counterparts due to their higher levels of vitamins, minerals, dietary fiber, and other bioactive compounds. Recommendations like “let at least half of your grains be whole” without specifying the type of grain are comparable to the “five a day” or “six a day” recommendations for the number of servings of fruits and vegetables without further specifications.

A number of authoritative bodies, e.g., WHO (9) and the Health Council of the Netherlands (5), recommend whole grain products, fruits, and vegetables—and not isolated added fibers—as the preferred products for realizing the intake of

sufficient dietary fiber, since in these products fibers are closely associated with beneficial co-passengers; many health benefits associated with fiber may partially be mediated by these co-passengers (3,5). These specific, fiber-oriented recommendations implicitly include whole grains high in fiber and not those—e.g., maize—low in fiber.

An overview of grains included for labeling and dietary guidelines on the one hand and for health claims on the other hand in the United States, Scandinavia, and the United Kingdom is presented in Table I.

The United States was the first country to adopt a whole grain health claim (4). In this claim the complete set of grains included in the AACCI/FDA whole grain definition is included.

In the United Kingdom, the range of grains included in the JHCI whole grain health claim (2) is smaller than the range included in the Guidance Note developed by the retail organizations (6) intended for labeling and—as stated explicitly—not for health claims. The same holds for Scandinavia: a fairly broad range of cereal grains is included in nutrition rec-

**Table I. Grains included in whole grain definitions—Related to purpose**

Issuing body	Whole grain definitions Grains included	Purpose of definition	
		Labelling/ dietary guidelines	Health claims
AACC(1999)/ FDA	“All” cereals and pseudocereals	X	X (> 50% WG)
HEALTHGRAIN, 2010	“All” cereals and pseudocereals	X	–
U.K. IGD Whole grain guidance note, 2007	Cereals and generally accepted pseudocereals	X	–
U.K. Joint Health Claim Initiative, 2002	Major cereal grains, such as wheat, rice, maize, and oats	–	X
Scandinavian Keyhole for healthy eating, 2010	Wheat, rye, oats, barley, maize, rice, millet, sorghum	X	–
Sweden, Health claim code of practice, 2003	Wheat, rye, oats, barley	–	X (> 50% WG)

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ommendations—the keyhole system—whereas the whole grain health claim adopted in Sweden only applies to wheat, rye, barley, and oats.

Finally, the HEALTHGRAIN definition of whole grain, including all cereal and pseudocereal grains covered in the AACCI/FDA definition, states: “This whole grain definition is expected to be useful in the context of nutrition recommendations and guidelines and nutrition claims. Health claims, on the other hand, must be based on documentation of specific effects of grains or grain components in the diet.”

As a conclusion it is recommended:

- To include a wide range of cereal and pseudocereal grains in the definition of whole grain, as is done in the definitions of AACCI and HEALTHGRAIN.
- To include a more limited number of grains, especially for health claims, but also for specific dietary guidelines, for instance where whole grain intake is primarily recommended as a source of dietary fiber.

### Whole Grain Definition and Processing

The great majority of whole meal flour is produced by modern milling technologies where white flour, bran, and germ are separated for recombination at a later stage. In this process with milling streams, where also germ may be heat treated before recombination, germ, bran, and white flour of various batches of wheat may be recombined. In many—but not all—stone grinding processes—one bag of wheat is used for one bag of flour. Sometimes it is argued that only this type of processing delivers “real” whole meal. The recombination processes are delivering flours at significantly lower costs than stone grinding and also enable millers to deliver flour with a more constant technological performance.

Most whole grain definitions require the presence of all the endosperm, germ, and bran present in the grain kernel. The HEALTHGRAIN definition allows small losses of components—i.e., less than 2% of the grain or 10% of the bran—that occur through processing methods consistent with safety and quality. Removal of this outer part of the bran may help in reducing the levels of mycotoxin and other contaminants, whereas the losses of bioactive components include mainly cellulosic fiber with little co-passengers. Removal of the outer layer was allowed earlier in the definitions in Germany (DIN Standard 10355 (1992)) and Switzerland (Ordinance by the Swiss Federal Department of the Interior (EDI) concerning Cereals, Legumes/Pulses, Vegetable Proteins and their Products of 23.11.2005).

Sometimes detrimental effects are attributed to processing; for example, heat treatment of the germ, in order to prevent rancidity upon storage of flour, may result in reduced levels of some phytochemicals. However in debates about processing one should keep in mind the following:

- Whole grains cannot be consumed without any processing; all processing steps will induce changes in composition.
- The impact of dry processing as applied in flour mills is, generally speaking, limited compared to processing operations in systems with water—e.g., boiling, fermentation, baking, extrusion, etc. Just an example: acrylamide formation may be induced by baking or extrusion, but is never due to milling.
- Processing has also beneficial effects: baking of bread results in formation of additional dietary fiber (resistant

starch) and fermentation can result in additional B vitamins.

### Measurement of the Level of Whole Grain—A Mission Impossible

As has been shown in several studies, and recently in the major HEALTHGRAIN study on impact of genetic and environmental factors on the composition of wheat and—less detailed—of rye, oats, and barley, considerable variations are observed in the composition of whole grains, both for fiber and other macronutrients and for micronutrients and other bioactive compounds (8). For instance, fiber levels vary from below 9% to over 15% and the level of alkylresorcinols varies with a factor of over 2.5. Alkylresorcinols are being used as a marker of whole grain intake in human nutrition studies. However, for an analytical method for determining the level of whole grain in a product the variation in level is too high and, moreover, alkylresorcinols are not present in the germ, so products with bran and no germ would still qualify as whole grain. Millers and their clients may consider a different approach: aiming at supplying recombined flours not only with a constant technological performance but also with a more or less constant composition, in any case regarding the level of fiber, which is seen as a key component related to health benefits.

### Acknowledgments

For my presentation at the Whole Grain Summit and this short publication I am indebted to helpful discussions with members of the Healthgrain Forum ([www.healthgrain.org](http://www.healthgrain.org)) and to earlier discussions in the HEALTHGRAIN project, especially with the late Nils-Georg Asp, who passed away June 1, 2012.

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