
Perspective: A definition for whole-grain food products - Recommendations from the Healthgrain Forum.

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Perspective: A Definition for Whole-Grain Food Products—Recommendations from the Healthgrain Forum

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ABSTRACT

Whole grains are a key component of a healthy diet, and enabling consumers to easily choose foods with a high whole-grain content is an important step for better prevention of chronic disease. Several definitions exist for whole-grain foods, yet these do not account for the diversity of food products that contain cereals. With the goal of creating a relatively simple whole-grain food definition that aligns with whole-grain intake recommendations and can be applied across all product categories, the Healthgrain Forum, a not-for-profit consortium of academics and industry working with cereal foods, established a working group to gather input from academics and industry to develop guidance on labeling the whole-grain content of foods. The Healthgrain Forum recommends that a food may be labeled as “whole grain” if it contains ≥30% whole-grain ingredients in the overall product and contains more whole grain than refined grain ingredients, both on a dry-weight basis. For the purposes of calculation, added bran and germ are not considered refined-grain ingredients. Additional recommendations are also made on labeling whole-grain content in mixed-cereal foods, such as pizza and ready meals, and a need to meet healthy nutrition criteria. This definition allows easy comparison across product categories because it is based on dry weight and strongly encourages a move from generic whole-grain labels to reporting the actual percentage of whole grain in a product. Although this definition is for guidance only, we hope that it will encourage more countries to adopt regulation around the labeling of whole grains and stimulate greater awareness and consumption of whole grains in the general population. Adv Nutr 2017;8:525–31.

Keywords: whole grains, cereal, food regulation, food guidelines, food labelling, dietary guidelines, dietary intake, public policy

Introduction

The purpose of this perspective is to define what constitutes a whole-grain food in a manner that is scientifically meaningful, is readily usable by the food industry, and results in labeling that is easily understood and credible to consumers in the context of helping them choose healthier foods. This guidance document does not aim to define what a whole-grain food is for the purposes of health claims based on whole grains. People who eat more whole-grain food have a lower risk of disease and mortality than people who eat the least (1–5), which has led to many countries including recommendations for whole-grain intake in their dietary guidelines (6). These recommendations range from “consume at least half of all grains as whole grains,” equating to ≥48–85 g/d depending on age and sex (United States) (7), to 75 g/10 MJ (Denmark and Sweden) (8) and less-specific recommendations including “eat a variety of grain (cereal) foods, mostly whole-grain and/or high cereal fiber varieties” (6, 9). Current research indicates that in European countries where whole-grain intake has been measured, the average daily intake is <15 g in the United Kingdom, France, and Spain...
Whole grains shall consist of the intact, ground, cracked, or flaked kernel after the removal of inedible parts, such as the hull and husk. The principal anatomical components—the starchy endosperm, germ, and bran—are present in the same relative proportions as those which exist in the intact kernel. Small losses of components, that is, >2% of the grain or 10% of the bran that occurs through processing methods consistent with safety and quality are allowed. Grains that are included in the definition are cereal grasses, wheat, rice, barley, maize, rye, oats, millet, sorghum, teff, triticale, canary seed, Job’s tears, and fonio, and the pseudocereals amaranth, buckwheat, quinoa, and wild rice.

Current Labeling Regulations and Recommendations

Several countries and institutions have existing guidance on minimum requirements for when a food product may be called a “whole-grain food” (see http://wholegrainscouncil.org/whole-grains-101/existing-standards-for-whole-grains) with a highly diverse range of requirements ranging from the amount of whole-grain ingredients per serving to a certain percentage of a food product. Even within the European Union, neighboring countries have very different requirements for labeling whole-grain foods, if any exist at all. Some examples of guidelines and regulations are shown in Table 1. This lack of consensus on what constitutes a whole-grain food serves only to confuse the public, create uncertainty in product development for the food industry, and complicate the work of scientists researching the link between whole grains and health. This article is an attempt to provide a science-based guidance for defining whole-grain foods, taking into account traditional and modern manufacturing processes. This guidance should serve as a starting point for discussion by stakeholders (e.g., regulatory authorities, scientists, consumer organizations, and food industry) for setting labeling standards and requirements for whole-grain foods. Agreement on a whole-grain food definition can play an important role in encouraging the general public to improve their nutrition by including more whole grains in their diet.

The minimum levels of whole grain shown in Table 2 follow 2 general principles:

1. Whole-grain amounts need to be substantial enough that consumers can be guaranteed that a product labeled “whole grain” (on the front of the pack) will have a nutrient content that will deliver the nutritional benefits of whole grain (e.g., higher fiber, micronutrient and phytochemical content) that a consumer would expect.

2. Some sensory aspects of foods with high whole-grain content are not universally appreciated by consumers, and food manufacturers need some flexibility to produce foods that will not only be high in whole grain but will also be liked by consumers.

These somewhat contradictory aspects may explain why the present recommendations vary between different countries. Denmark has chosen a relatively low starting point for whole-grain content to qualify for the label “whole grain,” whereas Germany and Netherlands have set limits that effectively allow only bread and pasta that have almost all

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>The Healthgrain definition of whole grain</th>
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<tbody>
<tr>
<td>Whole grains shall consist of the intact, ground, cracked, or flaked kernel after the removal of inedible parts, such as the hull and husk. The principal anatomical components—the starchy endosperm, germ, and bran—are present in the same relative proportions as those which exist in the intact kernel. Small losses of components, that is, &gt;2% of the grain or 10% of the bran that occurs through processing methods consistent with safety and quality are allowed. Grains that are included in the definition are cereal grasses, wheat, rice, barley, maize, rye, oats, millet, sorghum, teff, triticale, canary seed, Job’s tears, and fonio, and the pseudocereals amaranth, buckwheat, quinoa, and wild rice.</td>
<td></td>
</tr>
</tbody>
</table>

1 Adapted with permission from reference 15.
2 Some definitions include wild rice as a true cereal because it is part of the grass family. In the original Healthgrain definition it is included as a pseudocereal.
whole-grain flour to be labeled “whole grain,” with an allowance for small amounts of additives commonly used to improve baking quality. Other countries where whole grains are not frequently consumed have even lower thresholds for allowing whole grain–content claims. The French biscuit industry has introduced guidance for its members that allows communication on the whole-grain content when the recipe contains >15% of the total ingredients based on the following criteria (23):

- 15–39% of the recipe is whole grain (based on QUID): “Source of whole grain.”
- >39% of the recipe is whole grain (based on QUID): “Rich in whole grain.”

Although these are industry guidelines rather than mandated by the French government, they give an idea about the differences in acceptance between countries. Setting the threshold too low would not be acceptable in countries with a tradition of eating food with close to 100% whole grain; mandating that only products with >50% whole grain be labeled as such would position whole-grain products in a niche market and not something to be consumed by all people every day in countries where whole grain is still a novelty. In formulating guidelines for “whole-grain food” definitions that cross national and cultural borders, a balance must be found between ensuring that products made with whole grains are popular with consumers and consumed regularly with the need to ensure that such products do contribute meaningfully to total whole-grain intake. If lower thresholds for whole-grain labeling are used as a compromise, how can consumers be guided to choose those products that have a higher amount of whole grain?

### Why Do We Need a New Definition?

The plethora of new product launches incorporating whole grains over the past decade has led to greater exposure to the importance of whole grains in a healthy diet, although at the same time made it harder for consumers to easily choose products with the most whole grain because of unclear labeling thresholds, especially for front-of-pack communication. Over the period 2000–2011, there were >19,000 product launches worldwide that included whole grains (25). This gives an idea of the wide range of products from which consumers have to choose and understand whether they really contribute a substantial amount of whole grains to their diet. The inclusion of whole grains in a product is done predominantly to improve its nutrition and health image. This has resulted in the introduction of some products with small added amounts of whole grain

### TABLE 2

Current whole-grain labeling guidelines or regulations in 5 countries for bread, pasta, and biscuits

<table>
<thead>
<tr>
<th>Country</th>
<th>Guidelines/Regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands (17)</td>
<td>All grain ingredients must be whole grain (legal requirement).</td>
</tr>
<tr>
<td>Germany (18–20)</td>
<td>90% of the final ingredients, apart from water, must be whole grain.</td>
</tr>
<tr>
<td>Denmark (21)</td>
<td>There must be ≥50% whole-grain ingredients based on dry matter and ≥30% in the final product.</td>
</tr>
<tr>
<td>Italy (22)</td>
<td>Whole-grain flour must come from the mill.</td>
</tr>
<tr>
<td>France (23)</td>
<td>For moist breads, 10% of the final weight “contains whole grains,” and 30% of the final weight must be “rich in whole grains.” For rusks, 15% of the final weight “contains whole grains,” and 40% of the final weight must be “rich in whole grains.”</td>
</tr>
<tr>
<td>Pasta (dry)</td>
<td>There are no regulations or guidelines.</td>
</tr>
<tr>
<td>Biscuits</td>
<td>≥50% of the grain component is whole grain.</td>
</tr>
</tbody>
</table>

1 This information comes from the Danish public-private partnership for a whole-grain logo on food products (24). The Danish Veterinary and Food Administration does not have an official policy for criteria for labeling whole-grain products.

2 Agreement made long before 2000 between the biscuit industry and the Food Inspection Authority.

### TABLE 3

A summary of the criteria for front-of-pack whole-grain labeling proposed by the Healthgrain Forum

<table>
<thead>
<tr>
<th>Criteria</th>
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<tbody>
<tr>
<td>There must be ≥30% whole-grain ingredients based on total-product dry weight and a greater proportion of whole-grain ingredients than refined-grain ingredients.</td>
</tr>
<tr>
<td>In mixed products (e.g., pizza or ready-to-eat meals with a cereal component and a noncereal component), a whole-grain label can be used, provided the whole-grain ingredients make up ≥30% of total ingredients based on dry weight and there are more whole-grain than refined-grain ingredients.</td>
</tr>
<tr>
<td>The amount stated on the whole-grain label should be based on the cereal component of the food.</td>
</tr>
</tbody>
</table>

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that could be considered to add only marginally to overall whole-grain intake. This has raised the question of whether it is misleading to label a food “whole grain” if it in fact contains more refined grains. Recently the American Association of Cereal Chemists International issued the following characterization of a whole-grain food: “A whole-grain food must contain 8 g or more of whole grain per 30 g of product.” Thirty grams is considered a standard serving of a cereal product. This characterization was proposed based on input from a wide variety of scientific experts and people within the food industry (26) and as yet has not been adopted by any public agency. Since the release of this proposed definition, there have been some concerns raised. These were succinctly summarized in a letter to the FDA from the Oldways Whole Grains Council (27), a US-based non-profit educational organization funded by industry aiming to encourage greater whole-grain intake.

Their main concerns were:

- The proposed definition made no mention of wet weight or dry weight. Many ready-to-eat whole-grain foods have a substantial water content that would put them below the 8 g/30 g threshold—even if the main ingredient aside from water is whole grain. Bread, with a moisture content of usually ~35–40%, would be required to have a much higher whole-grain content than crispbreads and crackers (moisture content ~5%) to be called “whole grain,” purely because of the amount of water in the final product.
- Is it misleading to label a food “whole grain” if it contains more refined-grain ingredients than whole-grain ingredients?

Instead, the Whole Grains Council proposed 3 different levels of labeling that would help consumers easily identify which foods had the most whole grain. These are 1) 100% Whole-Grain Foods (food in which all of the grain is whole; 16 g/serving minimum); 2) Whole-Grain Foods (foods in which ≥50% of the grain is whole; 8 g/serving minimum); and 3) Foods Contributing Whole Grains (foods with ≥8 g whole-grain ingredients/labeled serving). Although this approach is attractive because it is clear about the whole-grain content, experience from within the Healthgrain Forum suggests that consumers find too many levels of labeling confusing, for example, distinguishing between “made with whole grain” and “whole grain” (CJ Seal, unpublished results, 2016). However, 2 levels of labeling are used for nutrition claims in the European Union, and these appear to be well understood by consumers. There is also a lack of clarity for this type of labeling for foods that mix grain ingredients with other food groups (e.g., pizza or ready-to-eat meals).

The Healthgrain Forum believes that there is still a strong need for a whole-grain food definition that allows consumers to easily identify and choose foods with a high whole-grain content. The current suggestion made by the American Association of Cereal Chemists International is a good start and is attractive in its simplicity. However, a food category as diverse as cereal foods requires a definition that addresses the complexity to encourage greater use of whole grains in foods yet avoids misleading consumers.

Whole-Grain Product Labeling: Issues to be Addressed in Formulating a Whole-Grain Food Definition

Universal guidelines for labeling whole-grain products need to account for the following key issues:

- How much whole grain does there need to be in a product for a whole-grain label to not be misleading to the public?
- Should foods with high moisture content (e.g., bread, fresh pasta) be able to label whole-grain content based on their dry weight?
- Should nutritional guidelines for healthy eating be included in a whole-grain food definition, especially for acceptable levels of salt, sugar, and saturated fat, so that the public is not misled about the health value of whole-grain foods?
- How should whole-grain content be calculated for multicomponent foods such as pizza or ready-to-eat meals?
- How can labeling guidelines be best developed so that they play a role in encouraging the public to eat more whole grains and inducing the industry to improve the range of whole-grain foods available?
- Should a definition also account for the different types of processing used for grains, given that different processing methods can lead to different physiochemical properties compared with the starting material?

Proposed Whole-Grain Food Definition

A whole-grain food is one for which the product is made with ≥30% whole-grain ingredients on a dry-weight basis and more whole-grain ingredients than refined-grain ingredients.

- If they exist, national regulations regarding whole-grain labeling are paramount to this definition.
- We strongly advise that whole-grain foods should meet accepted standards for healthy foods, for example not being high in sodium, saturated fat, and added sugars, based on local regulations.
- We strongly encourage food manufacturers to report the percentage of whole grain in a product in any front-of-pack labeling.
- Based on available data, we do not see any need for restriction on the type of processing for whole grains, unless the processing leads to a >10% reduction in the dietary fiber content (as an indicator of the amount of beneficial components within the whole grain). Country-specific criteria should be observed, however, because some countries do not consider sprouted grains as whole grain (e.g., Denmark).
Proposed Labeling for Whole-Grain Foods

Generic statements about whole-grain content should be allowed based on the following:

- For $\geq 30$ g whole grain/100 g dry weight of the overall product, where there are more whole-grain ingredients than refined grain ingredients on a dry weight basis, the product can be labeled as a “whole-grain food.” It can display a whole-grain logo, with a factual statement on the proportion of whole-grain content (either grams or a percentage).
- Whole-grain ingredients are those defined according to the Healthgrain definition of “whole grain” (12).
- QUID regulations still apply for labeling the amount of whole grains in the ingredients list.

A Minimum Amount for Whole-Grain Content Claims

It is outside the scope of this definition to specify a minimum amount for whole-grain content claims, which will be the topic of a future position article. We strongly encourage the clear labeling of whole-grain content as a percentage of the product on a dry-weight basis to allow consumers to easily decide between different products and product categories based on their whole-grain content. We recommend that whole-grain content claims are carried only on products that contribute a significant amount of whole grain in the diet, although we recognize that there is no agreed-on definition of what a “significant amount” is for whole grains. Several US-based organizations have suggested 8 g/serving as a significant amount (26, 28). A significant amount should factor in the type of product, whether it is frequently eaten and in which amount, what consumers would expect to be in a food with a whole-grain label, and the likelihood that it will help the public reach local guidelines for the recommended minimum whole-grain intake as part of a normal healthy diet, if they exist.

There are several issues with using the idea of a significant amount and with using 8 g/serving as a significant amount specifically. Initial population-based studies (also called observational or epidemiological studies) looking at whole-grain intake and risk of disease used an arbitrary value of 25% whole-grain ingredients as a threshold for whole-grain breakfast cereal to defined as a whole-grain food (29–31). At this amount, a greater intake of whole-grain foods was associated with a reduced risk of cardiovascular disease (30). Since these early studies, a strong body of evidence associating whole-grain intake with reduced risk of many diseases has been assembled. However, the estimation of whole-grain intake in these studies is poor, because it has been based on FFQs with low correlations with food diaries for whole-grain intake (32) and usually based on estimations of whole-grain foods rather than actual whole grain. In much of the epidemiological literature on whole grains and health, a whole-grain food could contain anywhere between 25% and 100% whole-grain ingredients. Dietary fiber intake has also been used to extrapolate a relevant serving of whole grains for disease reduction, but on top of the variation in dietary fiber measurements, the range of dietary fiber in whole grains is from 3% for brown rice to $\geq 15\%$ for rye and barley. So the scientific evidence base is not yet strong enough to state a minimum amount of whole grain before a product can be labeled “whole grain” or to set a minimum amount for any kind of front-of-pack whole-grain labeling. We have selected 30% as a starting point for whole-grain food labeling based on the observational evidence that foods with $\geq 25\%$ whole grain lead to disease risk reduction, with an additional 5% “safety margin” to ensure that the recommendation is well within a range where there is current evidence for long-term health benefits. We also acknowledge that there is insufficient evidence to state that 30% of a product is a “significant amount” for health and underline that this definition does not aim to set thresholds for health claims.

Recent research has found that foods with $>10\%$ and $<50\%$ whole grain contributed 45% of total whole-grain intake in adults and 53% of total whole-grain intake in children in the United Kingdom (33). Furthermore 35% of adults and 40% of children/teenagers consume no foods containing $>51\%$ whole grain, which has been the effective threshold for labeling most products “whole grain.” This research indicates that foods with a relatively low amount of whole grain still make up an important part of current whole-grain intakes, and that foods with 30–50% whole grains could still be important contributors to overall whole-grain intake, and thus there is justification for highlighting this content by calling the food “whole grain.” To objectively determine a relevant lower limit of whole grain for a whole-grain food definition related to health outcomes, a meta-analysis comparing the disease risk reduction from the intake of foods with 25–50% whole grain with those $>51\%$ whole grain would be required. This has not been done to date largely because of a lack of products that fit into the latter category in the countries where major observational studies have been carried out.

During the work on this definition, it has become clear that there is a need for more research and clearer reporting of whole-grain intake in intervention and observational studies (34). This will be necessary for defining a lower limit for whole grain–content claims based on scientific evidence.

Appropriate Nutrition Criteria for a Front-of-Pack Whole-Grain Label

Food products that wish to carry a “whole grain” label should also meet generally accepted criteria for healthy food. Various nutrient profiling systems have been proposed with the general purpose of preventing disease and promoting health. There is a substantial amount of heterogeneity in the way these profiling systems are designed depending on their application, which can include the regulation of nutritional and health claims (35), marketing to children (36),...
product promotion at the point of sale (37, 38), front-of-package labeling (36, 39–42), and product innovation or renovation by food companies (43). Because none of these systems has been universally recognized, we cannot recommend that whole-grain labeling be tied to one or another of these guidelines, but we emphasize that whole-grain labeling should not be used on foods that are unhealthy based on general and local recommendations. This is to avoid the use of whole-grain labeling to make products that are unhealthy appear healthier, which otherwise risks reducing consumer confidence in a whole-grain label as they look for healthy foods. This should not discourage manufacturers from including whole grains in their foods because generally foods made with whole grains have a healthier nutrient profile than equivalent foods made with the refined grains.

We also note that while this whole-grain food definition is not food-category specific (e.g., different criteria for bread, pasta, biscuits, snacks), dietary guidelines often are food-category specific, and appropriate nutrient profiles for each category should be followed.

Whole-grain products should also be aligned with public health nutrition recommendations for whole-grain intake. In a review of the whole-grain intake recommendations of 30 countries almost all recommended either having at least half of grain foods be whole grain or that whole-grain products be chosen in preference to refined-grain products (6). To achieve this recommendation to eat more whole grains than refined grains, it follows that a whole-grain product should contain more whole grains than refined grains. Including this criteria in the definition helps ensure that products labeled as “whole grain” will help people meet the recommendation to eat more whole grains than refined grains.

Applying the Whole-Grain Food Definition
Although the definition that has been developed for whole-grain foods is simple, interpreting the definition for the purposes of applying it for labeling or regulation could lead to differences in how it is applied. To avoid such situations, we have explained how the definition should be used in detail in a question-and-answers format (Supplemental Information 1), along with examples of how different types of theoretical cereal foods should be labeled based on the proposed whole-grain food definition (Supplemental Table 1).

A number of products also include added bran, especially in the breakfast cereal category, and it is important to clarify the status of bran for the purposes of this whole-grain food definition. Bran is not included in the Healthgrain whole-grain definition (15), and the relative benefits of bran compared with whole grains remains a topic of debate (34). In this definition, added bran is considered a cereal ingredient but not a refined cereal ingredient. A product may be described as both “whole grain” (based on the ratio of whole-grain to refined-grain content) and as “containing added bran” (when bran is itemized as a separate ingredient).

Conclusions
A whole-grain food definition is necessary to allow fair comparison of whole-grain content between different products. We have strived to make a definition that both protects consumers from statements about trivial amounts of whole grains, while allowing enough room for food manufacturers to create new innovative products that incorporate more whole grains (Table 3). Worldwide there is very different knowledge about the benefits of replacing refined grains with whole grains in the diet, consumer preference for whole grains, and very different availability of whole-grain products that would make this simple positive dietary change possible. Public-private campaigns to increase awareness of whole grains and encourage greater intake of whole grains have been demonstrated to be very effective in Denmark, where whole-grain intake was increased over a period of 4 y by an average of 20 g/d per person. This is in part through clear labeling of whole-grain foods that made it easy for consumers interested in increasing their consumption of whole-grain products to find them on the shelves (44). As a consortium of experts in cereal science and nutrition from academia and industry, the Healthgrain Forum sees this definition as an important step in providing a clear framework for whole-grain labeling that will ultimately be a key component in achieving population-wide higher whole-grain intake.

Acknowledgments
The authors’ responsibilities were as follows—ABR: coordinated the writing of the paper; and all authors: contributed to the content and writing of this perspective paper and read and approved the final manuscript.

References


Supplemental Information 1: Questions and answers about the Whole Grain Food Definition

- What is the minimum amount of whole grain required for a product to be labelled as ‘whole grain’?
  - A product needs to be made with at least 30% whole-grain ingredients on a dry weight basis, including non-cereal component(s), and more whole-grain ingredients than refined grain ingredients.
    - This is to avoid whole-grain claims on products with a low overall proportion of components with a high whole grain content.
    - Examples:
      - Bread made with 35% whole-grain wheat flour and 60% refined wheat flour, and 5% other ingredients (dry weight basis) would not be able to be labelled ‘whole-grain bread’.
      - Bread made with 55% whole-grain wheat flour and 40% refined wheat flour (dry weight basis) and 5% other ingredients would be able to be labelled as ‘whole-grain bread’, and be able to carry the message ‘Made with 55% whole grain’.

- What definition of ‘whole grain’ should be used?
  - We recommend the use of the HEALTHGRAIN whole-grain definition, which allows for small losses of the bran during processing and recognises the widely used practice of reconstitution of milling streams to make whole-grain flour (1).

- How do you define ‘refined grain ingredients’?
  - Refined grain ingredients are the white flour from grains (i.e. the starchy endosperm).
  - Other non-whole-grain cereal components such as the bran or germ, or fractions of these should not be included in the calculation of either refined grain ingredients or whole-grain ingredients, but are included in the total grain component.

- Why dry weight?
  - Grain-based foods are often sold with a low moisture content (e.g. rice, pasta, rolled oats), but eaten with a high moisture content (e.g. cooked rice or pasta, or oat porridge). The use of dry weight allows for the whole grain content of dry foods such as breakfast cereal to be fairly compared with cooked or fresh foods such as porridge or bread.
  - Dry weight is the weight of the food with all water removed. Dry weight can be calculated based on standard values for moisture/water for each ingredient (e.g. local food composition tables), or by gravimetric determination of the actual dry weight after drying.
  - Should the dry matter calculation result in higher than 100% (e.g. for foods that are dried during processing), then the maximum amount that can be stated on pack is 100% whole grain.
  - Quantitative Ingredient Declaration (QUID), the standard for listing ingredients on the back of packaging, stipulates that ingredients be labelled based on the weight before cooking (e.g. flour) expressed as a percentage of the final weight of the product. This can lead to large differences for foods with a large change in water content during cooking (e.g. bread). Declaring whole grain content on this basis could lead to misleading comparisons.
between different foods which have the same amount of whole grain on a dry weight basis, but different amounts of water added or lost during processing. The whole-grain food definition is targeted at ‘front of pack’ labelling, so need not conflict or contradict ‘back of pack’ labelling based on QUID criteria.

- We acknowledge that this system would potentially lead to different reporting of whole grain amount between a front of pack whole-grain label, and a back of pack QUID-based ingredient label, and could lead to consumer misunderstanding.
  - Labelling whole grain on a dry weight basis has been used for many years in Sweden without any apparent consumer misunderstanding.
  - Many on-pack communications of nutrition are not easily deciphered or understood by consumers in a shop, yet remain an excellent way of intuitively communicating an aspect of a product – for example the Keyhole labelling in the Nordic countries and the proposed Traffic Light system in the United Kingdom.

• Why 30 % whole grain as a minimum for ‘whole-grain food’?
  - This definition must cover a broad range of products produced to very different recipes across many countries. In some countries, products with close to 100 % whole-grain ingredients have widespread acceptance and preference, whereas similar products would be seen to be niche health foods in other countries. A 30 % minimum allows scope for introducing whole grains in products aimed at the general public in many countries, and there is population-based evidence that this level of whole grain in foods will still reduce risk of disease. Additionally, foods with a relatively low amount of whole grains still contribute a high proportion of whole-grain intake in some countries (see main text).

• Why must there be more whole grain than refined grain ingredients in a whole-grain food?
  - We consider that it is misleading to consumers to label a food as ‘whole grain’ if it contains more refined grain ingredients, especially for those looking to reduce their intake of refined carbohydrates. The requirement to have more whole grains than refined grains (i.e. >50 % whole grain) is a part of the whole-grain definition in the United States for making whole-grain health claims (http://www.fda.gov/Food/IngredientsPackagingLabeling/LabelingNutrition/ucm073634.htm), and for use of the Danish ‘Choose Whole Grains First’ logo (http://www.fuldkorn.dk/media/171905/Fuldkorn_logomanual_godkendt_070313.pdf). Many other public health recommendations for whole grain intake also include statements that people should eat more whole grains than refined grains, or choose whole grains in preference to refined grains. The requirement that there be more whole grain ingredients than refined grain ingredients ensures that the definition aligns with these recommendations.

• How does the definition work for foods that are not only based on cereals? Like pizza, sandwiches and ready meals?
  - If a product is made from ingredients from several food groups (e.g. pizza comprising of a dough base, and topped with tomato and cheese), the entire product must have at least 30 % whole-grain ingredients on a dry weight basis and more whole grain than refined grain, but for the purposes of labelling the whole grain content, only the grain-based part of the product is considered.
This aspect of the guidelines is only for those products composed of several food groups – e.g. this does not apply to bread, but does apply to a ready-made sandwich.

- The ≥ 30 % limit for the overall food is to ensure that products with only a small cereal component cannot claim ‘whole grain’ on their packaging based on a proportionally small amount of whole grain. Reporting the amount or percentage of whole grain is only based on the grain component as a consumer would not expect the overtly non-grain parts of a food to contribute to the overall amount of whole grain.

**Examples:**

- **Pizza:**
  - Overall, the pizza must have ≥ 30 % whole-grain ingredients on a dry weight basis (e.g. including flour, yeast, oil, tomato paste and cheese, but not any added water), and not more refined grains than whole-grains.
  - Only the dough is considered for the calculation of the percentage whole grain, and not the entire pizza as only the dough will be highlighted as being ‘whole grain’ (see next point).
  - Only the dough can be labelled ‘whole grain’.
    - ‘Whole-grain pizza’ would not be acceptable
    - ‘Pizza with whole-grain crust’ would be acceptable

- Ready meal made with whole-grain rice:
  - Overall, the meal must have ≥ 30 % whole-grain ingredients on a dry weight basis (e.g. including meat, vegetables, rice and sauce) and more whole-grain rice than white rice.
  - Only the rice is considered in the calculation of whole grain content, and not the other meal components.
  - For example, a ready meal that includes brown rice may use the statement ‘…and 100 % whole-grain rice’ in the description of the meal.

- Supplemental Table 1 gives several examples of how different foods could be labelled.

**What is the ‘grain component’?**

- The grain component is the part of the food that is mainly made from cereal ingredients or would be associated with cereals, as defined in Box 1. Pulses and seeds are not cereal grains and not included in this definition.

- For example:
  - Bread: all of a loaf of bread would count as the ‘grain component’
  - Sandwich: The slice(s) of bread would count as the ‘grain component’, but not the topping/filling. A consumer could be expected to know that a whole-grain label would not apply to the topping/filling
  - Pizza: The pizza base would count as the ‘grain component’, including any added fat or other ingredients.
  - Pasta salad: The pasta used in the pasta salad would count as the ‘grain component’

- The ingredients in the grain component include whole-grain flour, refined flour, bran and germ.
Milling fractions of cereals are acceptable as part of the grain component, but highly purified fractions are not.

Such purified fractions include isolated fibres from grain kernels, such as resistant starch from maize and resistant maltodextrin from wheat, and the cellulosic fibres isolated from wheat straw or from the husks of oats. These cellulosic fibres should not be called ‘wheat fibre’ or ‘oat fibre’ since they contain only cellulosic components and no or negligible amounts of other fibres (e.g. arabinoxylans and β-glucans) nor any of the phytochemicals that are commonly associated with dietary fibre of cereal grains (2).

Why is there a connection between whether a food can be labelled whole grain, and the overall nutritional content of the food?

Intake of whole grains is encouraged to improve health, while public health authorities recommend cutting down on certain nutrients – e.g. sodium/salt, sugar and saturated fat intake. Therefore it is incongruous to label a product high in sodium/salt, sugar or saturated fat ‘whole grain’. In making a new definition it is crucial that the credibility behind whole grains and health is not undermined.

There are no universally accepted criteria for healthy foods at present, but there needs to be an unambiguous message that whole-grain labelling should not be used on foods that can be considered unhealthy.

Some foods which tend to be considered unhealthy can also be excellent vehicles for whole grain intake, and are undoubtedly improved nutritionally if they are formulated to contain whole grains rather than refined grains or other starch sources. In this case, national guidelines for healthy nutritional profiles in different product categories should be used.

If there are uncertainties about what constitutes a healthy nutrient profile, local regulations are always paramount.

Can a product state ‘good-’ or ‘excellent source of whole grain’ if it is made with a high proportion of whole-grain ingredients?

We do not recommend this approach to labelling whole-grain content. In principle such ‘value’ statements about food are reserved for measurable nutrients that are essential for health (e.g. calcium, fibre, protein, vitamin D). All these compounds can be measured in a food after it has been prepared, and can be verified. This is not possible for whole grains.

European Union legislation on health claims explicitly states that such claims are for nutrients (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:012:0003:0018:EN:PDF) while the United States Food and Drug Administration specifically states that terms that imply a particular amount such as ‘excellent source’ or ‘high in’ are not allowed for labelling whole grain content (http://www.fda.gov/OHRMS/DOCKETS/98fr/06d-0066-gdl0001.pdf).

Factual statements on whole grain content (e.g. 51 %, 100 %, ‘made with x g of whole-grain flour) are encouraged.

Some groups suggest that phrases such as ‘good source of whole grains’ are acceptable (e.g. the USDA for school meals (http://www.fns.usda.gov/sites/default/files/WholeGrainResource.pdf), and the Grains and Legumes Nutrition Council, Australia; http://www.glnc.org.au/codeofpractice/whole-grain-ingredient-content-claims/), but at this stage we do not support such phrases for the reasons outlined above.
In the future if there is agreement on how to measure whole grains in a prepared food (i.e. independently of QUID), then value statements could be proposed in countries where increased consumption of whole grains is recommended as part of dietary guidelines. The disagreements about how to handle this type of labelling suggests that an unambiguous system based on the actual percentage whole-grain ingredients is the best strategy.

- Can I state ‘contains x % whole grain’ instead of ‘made with x % whole grain’?
  - We do not recommend this approach, though we realise that this distinction may be difficult in some languages.
  - ‘Made with’ is a statement about what is added into the mix to make a product, and as such whole grain can be measured and documented (e.g. 50.3 kg of whole-grain flour was added to the dough mix’).
  - ‘Contains’ refers to what is in the final product. As whole grain is not a measurable entity that can be independently analysed, compared with e.g. vitamin E or calcium, it is not appropriate to state ‘contains x % whole grain’.

- The limit for labelling whole grain in the Healthgrain Forum proposal is lower than that mandated by my national regulations. Which rules/guidelines should I follow?
  - You should always follow the national rules/guidelines.

- My product has at least 30 % whole grain on a dry weight basis. There are no national regulations regarding the labelling of whole-grain foods. Can I label the whole grain content based on the Healthgrain Forum whole-grain food definition?
  - The Healthgrain Forum whole-grain food definition is a good place to start if there are no regulations regarding the labelling of whole-grain foods in your country.
  - While it carries no legal weight, it has been developed by a wide consortium of scientists with the main aim of ensuring that consumers can easily choose whole-grain foods for a healthier diet.
  - The definition strongly supports communicating actual whole grain content on the front of packaging. The more whole grain you add to your product compared with your competitors, the easier it will be for consumers looking for whole grains to choose your product over others with less whole grain or no whole-grain label at all.

- What should I do if my product is traditionally called ‘whole grain’, yet does not meet the criteria for being called ‘whole grain’ (i.e. ≥30 % whole grain on a dry weight basis, more whole-grain ingredients than refined grain)?
  - Some products may traditionally be called ‘whole grain’, such as whole-grain or wholemeal bread\(^1\), or whole-grain pasta, yet are made with a substantial amount of refined flour.
  - If a country adopts a whole-grain food definition based on the Healthgrain whole-grain food definition, these products would no longer be able to be called ‘whole grain’ on the basis that it would be misleading to the consumer.
  - Factual statements about the whole grain content would still be allowed.
  - Producers are strongly encouraged to raise the whole grain level to the level mentioned in the definition. Gradual changes in product formulations – e.g. less salt, less sugar, more unsaturated and less saturated and trans fatty acids and more whole grain – have been applied with success in many products and countries.

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\(^1\) In the United Kingdom, ‘wholemeal’ can only refer to 100 % whole grain flour or a product based on 100 % whole-grain flour (http://www.legislation.gov.uk/uksi/1998/141/made?view=plain).
National regulatory authorities are strongly encouraged to work towards raising the requirements for whole-grain labelling to the level proposed in the definition.

Statements that could be misleading such as ‘Sourdough bread made with whole-grain flour’ are not allowed.

- Factual statements such as ‘Sourdough bread made with 20 % whole-grain flour’ are generally allowed based on local regulations

Consumers will be confused by differences between QUID and dry weight labelling for foods such as bread and fresh pasta

- Dry weight-based labelling of whole grain content has been used for many years in Sweden without problem.
- For many foods there is a disconnect between what goes into a food and the QUID without any apparent problem for consumers – for example: ‘2 kg of tomatoes used to make 1 kg tomato sauce’.

Some products have very little moisture content, such as breakfast cereals and crispbreads. Do these need to be corrected for dry weight?

- Adjusting for dry weight is critical for products with a high amount of water in the form they are sold in. Products with generally ≤10 % water do not need to adjust for the water content for whole-grain labelling.
- Dry weight measured gravimetrically (by weighing) after drying overnight at 105-110 °C and cooling in a desiccator remains the standard by which dry matter is measured. Any queries about the moisture content of a whole-grain food need to be resolved using this reference method.

Dry weight calculation by estimation:

- (Total weight of all ingredients – (added water + water in foods with >10 % water))/Total weight of all ingredients) x 100 = percentage dry weight
- Ingredients with ≤10 % water are considered to have a negligible amount of water which does not need to be factored into the calculation
- Flour has an average water content of 12 %, which does need to be factored into the dry weight estimation.

For example, for determining the whole grain content of bread based on dry weight:

- 250 g whole grain flour + 250 g refined wheat flour + 333 g water + 10 g salt + 5 g dry yeast = total weight 848 g
- Added water = 333 g
- Water in 500 g flour with average 12 % water content: 500 x 0.12 = 60 g
- Negligible water in salt and dry yeast
- Total water = 393 g
- (848 g total weight - 393 g water/848 g total weight) x 100 = 53.7 % dry weight

Why is there no mention of amount of whole grain per serving?

- Serving sizes are used in a number of nutritional recommendations, especially in the United States, with the aim to express the amount of a food component in a size that is meaningful to the consumer. Serving sizes vary widely for different foods, and make comparison between different foods overly complex when serving sizes vary. A percentage based on dry weight makes it possible to easily compare different foods.
It is acceptable to include a whole-grain label based on serving size or amount normally consumed, provided the percentage whole grain is also stated on the front of pack.

Generally in Europe, ingredient and nutrient contents are given on a percent or per 100 g basis. This definition is in keeping with this norm.

Can foods made with fermented, germinated or otherwise processed whole grains be called ‘whole grain’?

Essentially all cereal foods that we eat are processed (e.g. milled or boiled). Studies finding an association between whole grain intake and better health outcomes have been based on food products that are made with processed whole grains, and there is no clear evidence that any of the commonly used processing methods for grains present any danger to long-term health, with the exception of acrylamide formation when starch and sugar rich foods are heated.

Germination (e.g. malting) and fermentation (e.g. the use of yeast and/or lactic acid bacteria, either native or added to flour to make bread) have been long accepted processing methods to make cereal products (e.g. bread). These processes are known to have an effect on the nutrient composition of the resulting products – generally the partial degradation of starch to mono- and disaccharides, and of proteins to peptides and amino acids. Limited degradation of fibre may also take place.

In accordance with guidelines from an expert group from the American Association of Cereal Chemists International (AACCI) (3), and accepted by the United States Department of Agriculture, germinated grains may be called ‘whole grain’ as long as the sprout is not longer than the grain itself (4) provided there are no concerns about safety.

Many fermentation processes now use purified enzymes to perform the same reactions that traditionally have been carried out by yeast or bacteria. Food products that are produced using fermentation processes that include purified enzymes can still be labelled ‘whole grain’ provided they meet the requirement for proportion of whole grain.

To avoid the use of enzymatic processes that also break down fibre and other key nutrients within whole grains, any process that reduces the content of dietary fibre by more than 10 % cannot be used on a product labelled ‘whole grain’.

The effects of different processing methods on cereal product composition have not been fully defined and are an area of active research. As this is better understood, changes as necessary will be incorporated into future updates to this definition.

Does the type of whole grain used need to be stipulated along with the whole-grain label?

No, though it is encouraged to include the name of the grain(s) used: e.g. ‘Whole-grain bread made with 50 % whole-grain rye’

Is there any place for other terms that imply ‘whole grain’? Like ‘multigrain’?

Several terms are used to imply ‘whole grain’, without necessarily including whole-grain ingredients. Common examples are ‘multigrain’, ‘granary’, ‘stone milled’, ‘ancient grains’, ‘dark bread’, ‘coarse bread’, ‘brown bread’.

These terms are not encouraged as they are likely to mislead consumers who think they are getting whole-grain-based products, when the product may be made with a negligible amount of whole grains, or even none at all.
Fact-based statements using these terms along with whole grains are acceptable. For example: ‘Made with 60 % multi-whole grains’, ‘100 % stone milled whole-grain flour’.

- I am a scientist doing research on whole grains. What does this definition mean for me?
  - This definition is primarily designed to guide food manufacturers as to what products can be labelled ‘whole grain’. When reporting on whole-grain intake and similar parameters, researchers should report the intake of whole-grain ingredients, rather than the amount of whole-grain products, irrespective of whether the product is labelled ‘whole grain’ or not.
  - The move to reporting percentage of whole-grain ingredients on packaging will help researchers determine whole-grain intake. For further guidelines on reporting whole grains in scientific research, please see these recent recommendations (5).

**Supplemental References**

Supplemental Table 1: Examples of how to apply the whole grain food definition in practice.

<table>
<thead>
<tr>
<th>Product</th>
<th>Whole-grain ingredients</th>
<th>Refined grain ingredients</th>
<th>Non-cereal ingredients</th>
<th>Can be labelled a whole-grain food?</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread example 1</td>
<td>10 %</td>
<td>85 %</td>
<td>5 %</td>
<td>Not a whole-grain food</td>
<td>The amount of whole grain is too low for this bread to be labelled ‘Whole-grain bread’.</td>
</tr>
<tr>
<td>Bread example 2</td>
<td>40 %</td>
<td>45 %</td>
<td>15 %</td>
<td>Not a whole-grain food</td>
<td>More than 30 % of the total product dry weight is whole grain, but there is not more whole-grain than refined grain ingredients. Therefore this bread does not qualify as ‘whole grain bread’.</td>
</tr>
<tr>
<td>Bread example 3</td>
<td>75 %</td>
<td>24 %</td>
<td>1 %</td>
<td>Can be labelled ‘whole-grain bread’</td>
<td>More than 30 % of the total product dry weight is whole grain, and there are more whole grains than refined grains. Therefore this product qualifies as ‘whole grain bread’. Note that healthy nutrition guidelines need to be considered.</td>
</tr>
<tr>
<td>Pasta</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasta</td>
<td>10 %</td>
<td>85 %</td>
<td>0 %</td>
<td>Not a whole-grain food</td>
<td>The amount of whole grain is too low for this pasta to be labelled ‘whole-grain pasta’.</td>
</tr>
<tr>
<td>High fibre pasta</td>
<td>0 %</td>
<td>90 %</td>
<td>10 % wheat bran</td>
<td>Not a whole-grain food</td>
<td>Wheat bran is not a whole grain, therefore this product cannot be labelled ‘whole-grain pasta’</td>
</tr>
<tr>
<td>Egg pasta</td>
<td>45 %</td>
<td>45 %</td>
<td>10 %</td>
<td>Not a whole-grain food</td>
<td>More than 30 % of the total product dry weight is whole grain, but there is not more whole-grain than refined grain ingredients. Therefore this pasta cannot be labelled as ‘whole-grain pasta’.</td>
</tr>
</tbody>
</table>
### Egg pasta with vegetables

<table>
<thead>
<tr>
<th>45%</th>
<th>40%</th>
<th>15%</th>
<th>Can be labelled ‘whole-grain pasta’</th>
</tr>
</thead>
</table>

As the amount of non-cereal ingredients (e.g. egg, vegetables) has increased, and there is more whole-grain than refined grain ingredients, it is possible to label this as ‘whole-grain pasta’. Note that healthy nutrition guidelines need to be considered.

### Breakfast cereals

<table>
<thead>
<tr>
<th>Cereal flakes 1</th>
<th>35% whole-grain wheat</th>
<th>40% refined flours</th>
<th>25% sugar and salt</th>
<th>Not a whole-grain food</th>
</tr>
</thead>
</table>

Although there are more than 30% whole-grain ingredients, there is more refined grain ingredients than whole grain, so this breakfast cereal cannot be called ‘whole grain’.

<table>
<thead>
<tr>
<th>Cereal flakes 2</th>
<th>50% whole grain wheat</th>
<th>20% refined wheat</th>
<th>30% sugar and salt</th>
<th>Can be labelled ‘whole grain breakfast cereal’</th>
</tr>
</thead>
</table>

More than 30% whole-grain ingredients and more whole-grain ingredients than refined grains, so qualifies as a ‘whole-grain breakfast cereal’. Note that healthy nutrition guidelines need to be considered.

<table>
<thead>
<tr>
<th>Muesli</th>
<th>60% mixed whole grains</th>
<th>10% refined cereal flakes</th>
<th>30% fruit and nuts</th>
<th>Can be labelled ‘whole-grain breakfast cereal’</th>
</tr>
</thead>
</table>

More than 30% whole-grain ingredients and more whole-grain ingredients than refined grains, so qualifies as a ‘whole-grain breakfast cereal’. Note that healthy nutrition guidelines need to be considered.

<table>
<thead>
<tr>
<th>Whole-grain wheat based breakfast cereal</th>
<th>97% whole-grain wheat</th>
<th>0%</th>
<th>3%</th>
<th>Can be labelled ‘whole-grain breakfast cereal’</th>
</tr>
</thead>
</table>

More than 30% whole-grain ingredients and more whole-grain ingredients than refined grains, so qualifies as a ‘whole-grain breakfast cereal’. Note that healthy nutrition guidelines need to be considered.

### Ready meals

<table>
<thead>
<tr>
<th>Soup with croutons</th>
<th>Croutons with 100% whole grain wheat make up 55% of soup (dry matter)</th>
<th>0%</th>
<th>45% soup dry matter</th>
<th>Can be labelled ‘soup with whole-grain croutons’</th>
</tr>
</thead>
</table>

The croutons are made with whole-grain flour and no refined flour. More than 30% of the total product dry weight is whole grain, and there are more whole grains than refined grains. Therefore this product qualifies for a ‘whole grain label’. Note that healthy nutrition guidelines need to be considered.
<table>
<thead>
<tr>
<th>Pizza example 1</th>
<th>Crust made with 60 % whole grain dry matter basis</th>
<th>Crust made with 30 % refined grain dry matter basis</th>
<th>Overall proportion of whole grain in pizza on a dry weight basis is 35 %</th>
<th>Can be labelled ‘Pizza made with a whole-grain crust’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pizza example 2</td>
<td>Crust made with 45 % whole grain dry matter basis</td>
<td>Crust made with 40 % refined grain dry matter basis</td>
<td>Overall proportion of whole grain in pizza on a dry weight basis is 25 %</td>
<td>Cannot be labelled as ‘Pizza made with whole-grain crust’</td>
</tr>
<tr>
<td>Ready meal example 1</td>
<td>100 % brown rice used</td>
<td>No refined cereal ingredients</td>
<td>The proportion of brown rice to meat, vegetables and sauce on a dry weight basis is 35 %</td>
<td>Can be labelled as ‘Made with whole-grain rice’</td>
</tr>
<tr>
<td>Ready meal example 2</td>
<td>51 % whole-grain wheat (in pasta)</td>
<td>49 % refined wheat (in pasta)</td>
<td>The proportion of pasta in the meal is 55 % dry weight basis</td>
<td>Can be labelled ‘Pasta made with 51 % whole-grain ingredients’. Cannot be labelled ‘Ready meal with whole-grain pasta’.</td>
</tr>
</tbody>
</table>

The pizza crust is made with 60 % whole grain, and overall the pizza is >30 % whole grain, therefore the pizza crust can be labelled ‘whole grain’. Note, the pizza cannot be labelled a ‘whole-grain pizza’, and that healthy nutrition guidelines need to be considered.

Although the pizza crust by itself would qualify for a ‘whole-grain pizza crust’ label, overall the whole-grain ingredients are less than 30 % of the total dry weight. The product cannot carry a whole-grain label.

More than 30 % of the total dry weight of the meal is whole grain, therefore the whole-grain component can be labelled as such on the front of the packaging. Note that healthy nutrition guidelines need to be considered.

Although the pasta by itself would qualify as ‘whole-grain pasta’, the proportion of whole grain in the overall meal is only 28 % (55 % x 51 %), so the pasta cannot be highlighted as ‘whole-grain pasta’ on the front of the packaging.

Snacks and biscuits
<table>
<thead>
<tr>
<th>Biscuit example 1</th>
<th>12%</th>
<th>38%</th>
<th>50%</th>
<th>Not a whole-grain food</th>
<th>The amount of whole grain is too low for this biscuit to be labelled ‘whole-grain biscuit’.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biscuit example 2</td>
<td>25%</td>
<td>30%</td>
<td>45%</td>
<td>Not a whole-grain food</td>
<td>Made with &lt;30% whole grain and more refined grain than whole grain. Therefore this product does not qualify as a ‘whole-grain biscuit’.</td>
</tr>
<tr>
<td>Biscuit example 3</td>
<td>31%</td>
<td>25%</td>
<td>44%</td>
<td>Can be labelled as a ‘whole-grain biscuit’</td>
<td>More than 30% of the total product dry weight is whole grain, and there are more whole grains than refined grains. Therefore this product qualifies as a ‘whole-grain biscuit’. Note that healthy nutrition guidelines need to be considered.</td>
</tr>
</tbody>
</table>