

MAKE HALF YOUR GRAINS WHOLE CONFERENCE

April 20-22, 2009, Alexandria, VA

WHOLE GRAIN STANDARDS AND DEFINITIONS

The definition of a whole grain is quite well established and accepted internationally. The Whole Grains Council, AACC International, the U.S. Food and Drug Administration (FDA), Europe's HealthGrain project, and many other entities all agree that a whole grain includes all of the bran, germ, and endosperm of the original grain kernel, in their original proportions – even if that kernel has been crushed, rolled, flaked or otherwise processed.

We may all agree on what a whole grain *ingredient* is, but there's far less consensus on what a whole grain *food* is. It's easy if all the grains in a product are whole grain. Beyond that, however, there's a wide range of opinions – and a surprisingly wide range of U.S. government standards – on when a food qualifies as “whole grain.”

In this section we'll explore those standards, with

- A quick two-question quiz to check your knowledge of key definitions
- A table that compares standards for a “whole grain” food at a glance
- Details on each standard listed in the table
 1. The Whole Grain Stamp
 2. The FDA Whole Grain Health Claim
 3. The HealthierUS School Challenge
 4. FSIS Interim Policy Guidance on Whole Grain Claims
 5. IOM Report on Competitive Foods for Schools
 6. WIC Interim Final Rule
 7. Danish Standard for Whole Grains
- Characteristics of a Fair Standard for Whole Grain Foods
- A guide to worldwide dietary guidelines on whole grains
- The WGC's Compilation of Recent Whole Grains Research
(*Summary tables and references only; full version including one-page summaries of most studies is available on the WGC website.*)

A QUICK QUIZ ON WHOLE GRAINS

Question #1:

When can a food be called a “whole grain food?”

1. When at least 51% of its grain ingredients are whole grains, as long as it contains at least 8g of whole grain per standard serving size.
2. When at least 51% of *all* ingredients are whole grains, and it's moderate in total fat, low in saturated fat, contains “no” trans fats, and has at least 5.61% fiber from any source.
3. When at least 51% of *all* ingredients are whole grains, as long as it's moderate in total fat, low in saturated fat, contains “no” trans fats, and it's a single-ingredient product.
4. When the first ingredient is a whole grain.
5. When it contains a serving of whole grain
6. When... “the [product] ... is made entirely from whole grain flours or whole wheat flours.”
7. When refined grains make up no more than 3% of the total grain ingredients by weight.
8. All of the above.

The answer? All of the above are current U.S. government standards

1. USDA FSIS, Interim Policy Guidance, October 2005
2. FDA, Whole Grain Health Claim, 1999 and 2003
3. FDA, Whole Grain Health Claim, 2008
4. USDA FNS, WIC Interim Final Rule, 2007 (for tortillas only)
5. IOM Report, Nutrition Standards for Foods in Schools, 2007
6. FDA, Draft Guidance, 2006
7. FDA, Standard of Identity for whole wheat bread

Question #2:

What amount of whole grain ingredients constitutes a “whole grain serving?”

1. 28g, if it's in ready-made cereal, or 27g if the cereal is hot instead of cold
2. 25g, if it's in pasta, or 24g if it's in the form of popcorn
3. 29g, if it's in brown rice or other cooked grains
4. 16g, if it's in a slice of bread.
5. an “ounce-equivalent”
6. 14.75g most of the time, but 25g sometimes
7. 16g, no matter what grain is used or what product it's in
8. All of the above

The answer is, once again, all of the above.

- 1-4 USDA CNPP, equivalents of kitchen measurements used in the Dietary Guidelines.
5. An “ounce-equivalent” is the term used in the 2005 Dietary Guidelines.
6. USDA FNS. 14.75g is a grain serving for school foods and other child nutrition programs. Except when it's 25g for grains like rice.
7. 16g is widely recognized as a “serving's-worth” of whole grain ingredients:
USDA FSIS, Interim Policy Guidance, October 2005
USDA CNPP, Serving Definitions of the Food Guide Pyramid, CNPP-12, 2002
Whole Grains Council, 2005
AACC International, letter to FDA, April 17, 2006

Original documents for all these standards are referenced later in this section.

WHOLE GRAIN STANDARDS AT A GLANCE

This table gives a thumbnail description of major existing standards for a “whole grain” food. On the following pages, we will describe each of these standards in more detail.

Where + When	Who + What	What Qualifies as a Whole Grain Food	Other restrictions
International 2005	Whole Grains Council Basic Stamp	At least 8g WG per serving	None
International 2005	Whole Grains Council 100% Stamp	At least 16g WG per serving All the grain is whole grain	None
USA 1999 / 2003 / 2008	FDA Whole Grain Health Claim	At least 51% of the total weight must be WG	Limits on fats and cholesterol; fiber requirement
USA 2004 / 2009	USDA / FNS HealthierUS School Challenge	All WG ingredients, together, must be the primary ingredient; or (less often) must contain more whole grain than refined grain.	Food must contain at least 14.75g of total grain (25g for grains such as rice)
USA 2005	USDA / FSIS Interim Policy Guidance	At least 8g WG per serving and At least 51% of the grain is WG	None
USA 2007	IOM Report on Competitive Foods	Requires foods to be (or contain a serving of) fruits, vegetables or whole grains but does not clearly define "serving."	Limits on fat, sugar, calories and sodium.
USA 2007-2009	USDA / FNS WIC Interim Final Rule	In general WG must be the first ingredient and foods must qualify for the FDA whole grain health claim	Only certain grain products qualify; no added sugar, salt, or oil allowed in rice, barley, bulgur or oatmeal; sugar restriction and iron requirement for breakfast cereals.
Denmark 2008	DTU (Danish National Food Institute) Fuldkorn (Whole grain) report	Flours and grains must be 100% WG. For breads, crisp breads, breakfast cereals, pasta and noodles, at least 51% of the dry weight must be WG. (i.e., 35% of total weight for bread, 55% of total weight for other categories)	Only foods listed can be called whole grain. Also fat, salt, sugar, and fiber guidelines.

In this table, WG is an abbreviation for whole grain.

Original documents for all these standards are referenced later in this section.

WHAT: THE WHOLE GRAIN STAMP
WHO: THE WHOLE GRAINS COUNCIL, A 501(C)3 NON-PROFIT
WHEN: 2005

The Whole Grain Stamp was introduced in January of 2005, as a packaging symbol aimed at helping consumers follow the whole grain recommendations of the 2005 Dietary Guidelines for Americans.

Qualifying foods: The general requirements for the Whole Grain Stamp are:

- a. The food must contain at least 8g of whole grain ingredients per labeled serving.
- b. The 100% banner can be added to the Stamp if *all* the grain ingredients are whole grains, and the whole grain content reaches a minimum of 16g per labeled serving.

The Stamp is used widely, under various regulatory jurisdictions, and these general rules are modified as necessary. For example:

U.S. / FSIS: For foods containing meat and poultry and falling under the jurisdiction of the U.S. Department of Agriculture's Food Safety Inspection Service (FSIS), the rules are:

- a. The food must contain at least 8g of whole grain ingredients per labeled serving and per RACC and 51% or more of the grain must be whole grain.
- b. Qualifications for the 100% banner are the same, but no trace amounts of refined grains (e.g., cornstarch as a release agent) are allowed.

Canada: Qualifications are the same, except for the 100% banner. In the U.S. this banner is used if all the *grain* ingredients are whole grain. In Canada, it may be used only when *all* ingredients are whole grain – effectively limiting the 100% banner to a sack of flour, a bag of brown rice, etc. Canadians use a bilingual French / English graphic.

International: Minimum qualifications for use of the Stamp are the same, around the world. Countries with no standard serving sizes must verify whole grain content per U.S. FDA RACC but may use "per 100g" – a common labeling regime – for the text on the Stamp. Currently English, Polish, and Spanish versions of the Stamp graphic are in use outside of North America.

For more information: Download the appropriate Stamp Usage Guide(s) at <http://wholegrainscouncil.org/for-members/how-to-use-the-stamp>

WHAT: WHOLE GRAIN HEALTH CLAIM
WHO: FDA / GENERAL MILLS / KRAFT / USA RICE FEDERATION
WHEN: 1999, 2003, 2008

A. Original “Low Fat” Whole Grain Health Claim: In March 1999 General Mills submitted to FDA a notification of a prospective claim about the relationship of whole grain foods and heart disease and certain cancers. Under the Food and Drug Modernization Act Of 1997 (FDAMA), manufacturers may submit a notification of a health claim based on an authoritative statement from an appropriate federal agency of the National Academy of Sciences (NAS). If FDA does not act to prohibit or modify such a claim within 120 days, the claim may be used. This claim became effective in July 1999.

Claim wording: “Diets rich in whole grain foods and other plant foods and low in total fat, saturated fat, and cholesterol, may help reduce the risk of heart disease and certain cancers.”

Qualifying foods: To be considered “whole grain,” a food must contain 51% or more whole grain ingredients by weight per RACC, using 11% dietary fiber as a compliance marker for the whole grains. Foods must also be low in total fat and in cholesterol.

B. “Moderate Fat” Whole Grain Health Claim: In August 2003 Kraft Foods submitted a notification to FDA of a modified version of the 1999 Whole Grain Health Claim, based on increasing evidence that moderate amounts of “good” fats can be healthy. The claim became effective in December, 2003.

Claim wording: “Diets rich in whole grain foods and other plant foods, and low in saturated fat and cholesterol, may help reduce the risk of heart disease.”

Qualifying foods: To be considered “whole grain” enough to use the health claim, a food must contain 51% or more whole grain ingredients by weight per RACC, using 11% dietary fiber as a compliance marker for the whole grains. Food must also:

- a. be low in saturated fat (\leq 1 gram of saturated fat per RACC)
- b. be low in cholesterol (\leq 20 milligrams of cholesterol per RACC)
- c. qualify as “zero transfat” (\leq 0.5 grams transfat per RACC)
- d. be moderate in total fat (\leq 6.5 grams of total fat per RACC)

C. Brown Rice Whole Grain Health Claim: The original compliance marker for whole grain content, set at 11% dietary fiber and based largely on the fiber content of wheat, meant that some whole grains, even in their original unprocessed state, did not qualify to use the Whole Grain Health Claim. Whole grains vary widely in fiber content, and research since 1999 has demonstrated that the health benefits of whole grain derive from more than just their fiber. Accordingly, in May of 2008 FDA expanded the scope of the Whole Grain Health Claim, by agreeing that brown rice and any other single-ingredient whole grain foods qualify to use the claim. In essence, FDA stated that foods that have no ingredient other than accepted whole grains do not need to *prove* compliance; they are intrinsically qualified as whole grains.

For more information: See the following web addresses:

- A. Original Claim: at <http://vm.cfsan.fda.gov/~dms/flgrains.html>
- B. Moderate-Fat Claim: at <http://www.cfsan.fda.gov/~dms/flgrain2.html>
- C. Single-Ingredient Claim: at http://www.usarice.com/index.php?option=com_content&view=article&id=593&catid=84:industry-news-releases&Itemid=327

WHAT: HEALTHIERUS SCHOOL CHALLENGE
WHO: USDA / FNS (FOOD AND NUTRITION SERVICE)
WHEN: 2004, 2009

The HealthierUS School Challenge is a voluntary program run by USDA's Food and Nutrition Service (FNS), under which schools can earn awards of distinction based on their support of healthy food and physical activity. One of the required components is serving whole grain foods at least three days a week (for the Bronze or Silver award) or every day (for the Gold or Gold of Distinction award).

Qualifying Foods: In general, foods are considered qualifying whole grains under this program if they "constitute a whole grain serving" AND meet one of two criteria. For Child Nutrition Programs, a serving of most foods like breads, crackers, etc. is defined as 14.75g of grain ingredients; for rice and other "straight grains" it's defined as 25g of dry ingredients.

Once a serving is established, a food must meet one of these criteria:

- A. Whole grains are the primary ingredient by weight, which can be determined two ways
 - 1. If a whole grain is the first ingredient listed, the food automatically qualifies.
 - 2. If all whole grain ingredients added together would qualify as the primary ingredient, the food qualifies.

- B. There is more whole grain than refined grain in the product (or, whole grain is the primary *grain* ingredient by weight).

"A" foods above can count as *any or all* of the required whole grain servings.

"B" definition for whole grain can only be used on some (less than half) of the required whole grain servings.

For more information: A copy of the Whole Grain Resource for this program is at <http://www.fns.usda.gov/tn/healthierus/wholegrainresource.pdf> and is also included in Section 5 of this conference program book.

**WHAT: STATEMENT OF INTERIM POLICY GUIDANCE: USE OF THE USDA
MYPYRAMID REFERENCE ON MEAT AND POULTRY LABELING AND
WHOLE GRAIN CLAIMS**
WHO: USDA / FSIS (FOOD SAFETY INSPECTION SERVICE)
WHEN: 2005

While FDA has jurisdiction over labeling and packaging of most products, foods that contain meat or poultry fall under the jurisdiction of USDA's Food Safety Inspection Service, or FSIS.

FSIS operates on a pre-approval basis where all words and claims on a package – not just those related to the meat or poultry content – must be approved before the product can appear on the market. This means that the packaging for a pepperoni pizza with a whole grain crust, a chicken pot pie with a whole grain biscuit topping, or a ham-and-cheese breakfast wrap in a whole grain tortilla will require pre-approval from FSIS.

Accordingly, on October 14, 2005, FSIS released “interim policy guidance” that clarified which foods can be called whole grain.

Qualifying Foods:

FSIS states that a “food component” may be “characterized as whole grain” if:

1. At least 51% of the *grain components* are whole grain. (Note that this differs from the FDA Whole Grain Health Claim, where 51% of *all ingredients* must be whole grain.)
2. The food contains at least 8g of dry whole grain ingredient per labeled serving and per RACC.¹

On August 2, 2006, FSIS approved the use of the Whole Grain Stamp on foods that meet the standards listed above.

For more information: A copy of this Interim Policy Guidance can be downloaded at www.fsis.usda.gov/OPPDE/larc/Claims/Food_Guide_MYPyramid_Policy.pdf

¹ RACC stands for Reference Amount Customarily Consumed, which is basically a standard FDA serving.

WHAT: IOM REPORT ON COMPETITIVE FOODS
WHO: IOM (INSTITUTE OF MEDICINE OF THE NATIONAL ACADEMY OF SCIENCE)
WHEN: 2007

In April 2007, the Institutes of Medicine (IOM) published its recommendations for foods that should be served in schools, outside of the organized school breakfast and lunch meals. The IOM's report was an attempt to present clear guidelines for foods that would support the 2005 Dietary Guidelines for Americans.

The report starts with a simple premise: “..if competitive foods are available, they should consist of nutritious fruits, vegetables, whole grains, and nonfat or low-fat milk and dairy products, consistent with the 2005 Dietary Guidelines for Americans (DGA), to help children and adolescents develop healthful lifelong eating patterns.”

Qualifying Foods: In general, a food qualifies as whole grain if it offers a serving of whole grain. With the exception of a few foods only available after school to high school students, the IOM report recommends that “foods and beverages must provide at least one serving of fruit, vegetables and/or whole grains, or nonfat/low-fat dairy products.”

Although the report did not define “serving” specifically, its frequent references to the 2005 Dietary Guidelines for Americans make it likely that it assumes the same definition of serving as in the DGA.

For more information: A copy of the full IOM report can be downloaded at www.iom.edu/CMS/3788/30181/42502.aspx

WHAT: WIC INTERIM FINAL RULE
WHO: USDA / FNS (FOOD AND NUTRITION SERVICE)
WHEN: 2007 (FOR IMPLEMENTATION BY OCTOBER 2009)

The Special Supplemental Nutrition Program for Women, Infants, and Children – known as WIC – provides Federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant women, new mothers, and kids up to age five at nutritional risk.

Qualifying Foods: WIC's definition of "whole grain" varies by food.

Under WIC, a bread is whole grain if

1. a whole grain is the first ingredient AND
2. it meets all qualifications for the Whole Grain Health Claim (moderate fat version)
 - a. whole grain ingredients must comprise 51% or more of the weight of the product
 - b. low in saturated fat (no more than 1g saturated fat per RACC²)
 - c. low in cholesterol (no more than 20mg cholesterol per RACC)
 - d. moderate in total fat (no more than 6.5g total fat per RACC)
 - e. contains no more than 0.5g trans fat per RACC

(The RACC for bread is 50 grams)

Under WIC, a cereal is whole grain if

1. It meets all the qualifications for bread, above, BUT
2. It must also contain at least 28 mg of iron per 100g, and no more than 21.2g of sugar per 100g.

(The RACC for cereals varies from 15g to 55g, depending on type of cereal)

Under WIC, a tortilla qualifies as whole grain if

1. It is a soft whole corn or whole wheat tortilla.
 2. The first ingredient must be whole grain corn or whole wheat.
- (Tortillas are not required to meet the Whole Grain Health Claim standard)

Under WIC, an "unprocessed whole grain" qualifies as a whole grain if

1. It is one of four grains: brown rice, oats, bulgur, whole barley.
2. It has no added fats/oils, no added salt, and no added sugars.

For more information: A copy of the WIC Interim Final Rule can be downloaded at www.fns.usda.gov/WIC/regspublished/foodpackages-interimrule.htm

² RACC stands for Reference Amount Customarily Consumed, which is basically a standard FDA serving.

WHAT: DANISH STANDARD FOR WHOLE GRAIN
WHO: DTU (DANISH NATIONAL FOOD INSTITUTE)
WHEN: 2008

While this is not a U.S. government standard, we are including it here because it offers a detailed and clear (but, in some ways, limited) approach to defining whole grain.

In 2008 the Danes created a major campaign to increase whole grain consumption for better health, which launched in early 2009. For the campaign, foods could qualify for a packaging symbol designating them as whole grain foods to be encouraged.

Qualifying Foods: In general, at least 51% of the *dry* weight of a food must be whole grain. Basing the standard on dry ingredients creates a more level playing field for moist foods like breads. By food categories this means that:

- Flours and grains must be 100% whole grain.
- Breads must be at least 35% whole grain by total weight
- Breakfast cereals, pastas, noodles, and crisp breads must be at least 55% whole grain by total weight.

Only the foods listed above – flours, grains, breads, cereals, pastas, noodles, and crisp breads – qualify, so no whole grain cookies, cakes, waffles, etc.

Another anomaly of the Danish standard is that it includes as whole grains only those that are in the Poaceae family; the “pseudocereals” amaranth, buckwheat, and quinoa are not considered whole grains in Denmark.

For more information:

The website of the Danish campaign is at www.fuldkorn.dk/index.php?pageid=15
The English summary of Danish objectives is on the Whole Grains Council website at www.wholegrainscouncil.org/whole-grains-101/whole-grain-guidelines-worldwide

CHARACTERISTICS OF A FAIR STANDARD

All of the standards for a “whole grain food” on the previous pages were created with the same positive motive: to increase consumption of whole grains for better health. In the aggregate, however, they may be counter-productive, as conflicting standards can cause both consumers and manufacturers to give up in confusion.

The Whole Grains Council believes that a fair standard for whole grains would have the following characteristics:

1. It would provide a level playing field for all food types.

One limitation of the FDA Whole Grain Health Claim (and programs that rely on it, such as WIC) is that it “discriminates” against foods with a high moisture content. While it seems on the surface that all foods must meet the same 51%-of-weight standard, this means that much of the grain in a qualifying cracker could be refined grain, but bread could contain little or no refined grain – and that a whole grain doughnut would be possible but a whole grain pancake or English muffin might not be, as the table below illustrates.

<i>Food</i>	<i>Total grain in this food, as % of weight³</i>	<i>% of grain as whole grain, to qualify for health claim</i>
Pasta, dry	100%	51%
Cracker	85%	60%
Cereal, ready to eat	70%	73%
Pie crust	63%	81%
Pizza Crust	58%	88%
Doughnut	52%	98%
Bread	51%	100%
Cake	24%	Not possible
Cookie	20%	Not possible
English muffin	50%	Not possible
Muffin, blueberry	25%	Not possible
Pancake, waffle	50%	Not possible

A Fair Approach: Specify any whole grain requirement as a percent of dry ingredients, or as a percent of total grain.

2. It would guarantee a minimum whole grain content that is “significant.”

While research shows that all incremental additions of whole grain in the diet may contribute to health, allowing whole grain labeling/claims on products with very little whole grain does not support the goals of the 2005 Dietary Guidelines for Americans to “make at least half your grains whole” and to limit calories.

A Fair Approach: Set half a serving as the minimum, to encourage consumers to get at least three servings of whole grain when they eat the six servings of grains recommended for most adults. Or, label foods as whole grain only when “half the grain is whole” for the same reason.

³ “Gradual Incorporation of Whole-Grain Flour into Grain-Based Products, Marquart L et al.. Cereal Foods World, May-June 2006, Vol 51, no. 3 DOI: 10.1094/CFW-51-0114.

Note: The Whole Grains Council supports both these approaches. We allow the Whole Grain Stamp only on foods that meet the 8g (half a serving) minimum and we also advise companies to use “whole grain” in the name of a food only if it contains more whole grain than refined grain.

3. It would support incremental change and “transitional foods.”

The 2005 Dietary Guidelines represented a strong step forward in encouraging whole grains, but they described a “serving of whole grain” only in terms of foods that are 100% whole grain. We need a clear definition of the amount of whole grain that contributes a MyPyramid serving from “transitional foods” that may mix whole and refined grains.

Just as the Dietary Guidelines support both low-fat and skim milk, it makes sense to support both 100% whole grain foods and transitional foods that begin to accustom consumers to the fuller, nuttier taste of whole grains in a gradual way. Too many consumers given the choice between all and nothing will choose nothing.

A Fair Approach: Specify the amount of whole grain ingredients that constitutes a MyPyramid whole grain serving, and clearly label that amount on food. (16 grams has been widely adopted as this amount by consumer groups, scientific groups, manufacturers and some government agencies, based on USDA guidelines in 2002.)

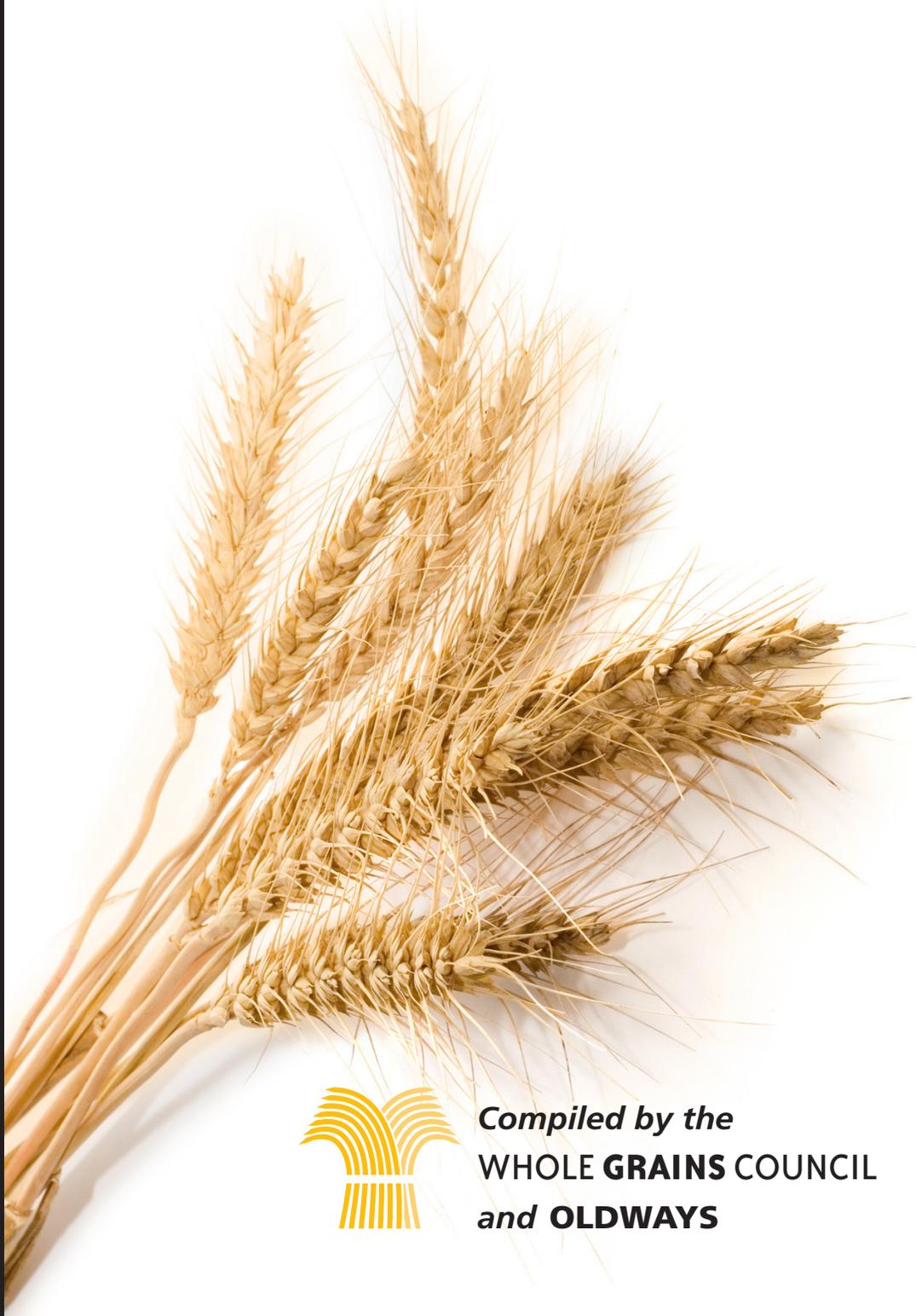
WHOLE GRAIN DIETARY RECOMMENDATIONS AROUND THE WORLD

Curious to know what other countries are recommending for whole grain consumption? Here's a sampling of dietary guidelines from other countries. As you'll see below, most countries are just at the "try to eat whole grains" stage, similar to the wording of the 2000 Dietary Guidelines for Americans.

Country	Guidelines
United States (2005) Dietary Guidelines for Americans	"All age groups should consume at least half the grains as whole grains...". At least three servings of whole grains are recommended for all Americans age 9 and up.
Canada (2007) Canada's Food Guide	"Make at least half of your grain products whole grain each day. Eat a variety of whole grains such as barley, brown rice, oats, quinoa and wild rice. Enjoy whole grain breads, oat-meal or whole wheat pasta." At least three servings of whole grains are recommended for all Canadians age 9 and up.
United Kingdom Guidelines for a Healthy Diet	"Remember that to have a healthy diet, most people should be eating... plenty of starchy foods such as rice, bread, pasta (try to choose wholegrain varieties when you can) and potatoes."
Australia (2003) Dietary Guidelines for Adults	"Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain."
France (2002) Health Comes from Eating La Santé Vient en Mangeant	"Eat bread and starchy foods at every meal... Whole grains are ... rich in fiber. Bread [should be] preferably whole grain or semi-whole grain."
Germany (2005) 10 Guidelines of the German Nutrition Society (DGE)	"Plenty of cereal products - and potatoes. Bread, pasta, rice, grain flakes preferably made of whole grain, and potatoes contain nearly no fat, but plenty of vitamins, minerals, trace elements as well as dietary fibre and phytochemicals. Combine these products with low-fat food items."
Denmark (2008) Fulkorn (Whole Grain) Report	"The scientific documentation is sufficient to recommend a wholegrain intake in Denmark of 4 portions per day, equal to minimum 75 g wholegrain / 10 MJ [2400 calories] under Danish conditions."
Mexico (2004) Norm for Nutrition Guidance	"Consumption of cereals should be recommended, preferably whole grains or their derivatives and starchy roots. Their fiber and energy content should be highlighted."
Singapore (2007) Dietary Guidelines for Children and Adolescents	Guidelines for children through the age of 18 recommend that parents introduce whole grains to babies at age 7-12 months, and make sure their kids are getting at least one serving of whole grain daily.

More guidelines are on our website at <http://www.wholegrainscouncil.org/whole-grains-101/whole-grain-guidelines-worldwide>

Summary of Recent Research On Whole Grains and Health



Compiled by the
WHOLE GRAINS COUNCIL
and OLDWAYS

Introduction

Since the deliberations of the last Dietary Guidelines Advisory Committee in 2003–2004 and the release of the 2005 Dietary Guidelines for Americans, a great many studies have been published that deepen our knowledge of the health benefits of whole grains.

The Whole Grains Council has compiled a summary of major research since 2004 in the area of whole grains and health, and has made it available to the new Dietary Guidelines Advisory Committee and to anyone else who can benefit from this compilation.

This summary consists of:

- a. *Six tables*, which depict the research at a glance. The six tables are:
 1. Summary of studies of whole grain intake and morbidity and mortality
 2. Summary of studies of whole grain intake and surrogate markers of disease
 3. Summary of clinical trials of whole grains
 4. Summary of studies comparing dietary patterns with morbidity and mortality
 5. Summary of studies comparing dietary patterns with surrogate markers of disease
 6. Summary of systematic reviews
- b. *A list of references*, in order of the studies in the six tables.
- c. *One-page overviews* of 30 of the 45 studies included in the tables — especially the most recent ones in the first three tables — making it possible to review the study in more depth. The overview pages are listed in alphabetical order by the author cited in the tables.

This compilation is designed as a companion to another excellent research review created by the Bell Institute of Health and Nutrition of General Mills, entitled “Whole Grains and Health” Get the Whole Story: A Self-Study Guide for Health Professionals. (<http://tinyurl.com/BellInstituteSummary>)

The Whole Grains Council would like to thank Heather Katcher for her help in compiling this summary. For more information about this summary, please contact Cynthia Harriman, Director of Food and Nutrition Studies, Oldways and the Whole Grains Council, 617.896.4820 or cynthia@oldwayspt.org. We also invite you to visit www.WholeGrainsCouncil.org.

About Oldways and the Whole Grains Council



Oldways is a 501(c)3 non-profit educational organization dedicated to changing the way people eat through practical and positive programs grounded in science and tradition. Best known for creating the Mediterranean Diet Pyramid in 1993, Oldways develops and organizes a wide variety of effective programs and materials about healthy, traditional and sustainable food choices for consumers, scientists, the food industry, health professionals, chefs, journalists and policy makers.



The Whole Grains Council (WGC) was founded and is managed by Oldways. The WGC's many initiatives help consumers to find whole grain foods and understand their health benefits; help manufacturers to produce delicious whole grain products; and help the media to create accurate, compelling stories about whole grains. In 2005, the WGC created the Whole Grain Stamp, a packaging symbol now on almost 2,500 foods that offer at least half a serving of whole grain ingredients. As of early 2009, the Whole Grain Stamp is used in the United States, Canada, Mexico, the Dominican Republic, the U.K. and Poland.



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Summary Tables

Summary of studies of whole grain intake and morbidity and mortality

TABLE 1	STUDY	SAMPLE SIZE	TYPE OF STUDY	DISEASE STUDIED	DIFFERENCE IN RISK
					0%  60%
	Nettleton et al., 2008 ¹	14,153	Prospective	Heart Failure	-7% ^a
	Schatzkin et al., 2008 ²	492,321	Prospective	Small intestinal cancer	-41% ^{b,c}
	Chan et al., 2007 ³	532 cases, 1701 controls	Case-control	Pancreatic cancer	-40% ^d
	DeMunter et al., 2007 ⁴	161,737	Prospective	Type 2 diabetes	-27% to -30% ^b
	Djoussé et al., 2007 ⁵	21,376	Prospective	Heart Failure	-29% ^e
	Jacobs et al., 2007 ⁶	27,312	Prospective	Noncardiovascular, noncancer death	-34% ^b
	Schatzkin et al., 2007 ⁷	489,611	Prospective	Colorectal cancer	-21% ^b
	Wang et al., 2007 ⁸	28,926	Prospective	Hypertension	-11% ^b
	Merchant et al., 2006 ⁹	34,160	Prospective	Periodontitis	-23% ^b
	Sahyoun et al., 2006 ¹⁰	535	Prospective	Death from cardiovascular disease	-52% ^f
	"	"	Cross-sectional	Metabolic syndrome	-54% ^f
	Van Dam et al., 2006 ¹¹	41,186	Prospective	Type 2 diabetes	-31% ^b
	Esmailzadeh et al., 2005 ¹²	827	Cross-sectional	Metabolic syndrome	-32% ^f
	"	"	"	Hypertension	-16% ^f
	Larsson et al., 2005 ¹³	61,433	Prospective	Colon cancer	-33% ^b
	Jensen et al., 2004 ¹⁴	42,850	Prospective	Coronary heart disease	-18% ^b
	Slattery et al., 2004 ¹⁵	952 cases, 1205 control	Case-control	Rectal cancer	-31% ^g

^a Per serving of whole grains

^b Highest vs. lowest quintile

^c P = 0.06

^d ≥ 2 servings/day vs. < 1 serving/day

^e ≥ 7 servings cereal/week vs. 0 servings

^f Highest vs. lowest quartile

^g Controls vs. cases

Summary Tables

Summary of studies of whole grain intake and surrogate markers of disease

TABLE 2	STUDY	SAMPLE SIZE	TYPE OF STUDY	ENDPOINT(S)	DIFFERENCE IN RISK
	Good et al., 2008 ¹⁶	2,092	Cross-sectional	BMI, waist circumference	↓
	Lutsey et al., 2007 ¹⁷	5,496	Cross-sectional	BMI, homocysteine, insulin, insulin resistance (HOMA)	↓
	Mellen et al., 2007 ¹⁸	1,178	Cross-sectional	Common carotid artery intima media thickness	↓
	Newby et al., 2007 ¹⁹	1,516	Cross-sectional	BMI, total and LDL-C, 2-hour glucose	↓
	Rose et al., 2007 ²⁰	159	Cross-sectional	BMI	↓
	Van de Vijver et al., 2007 ²¹	4,237	Cross-sectional	BMI	↓
	Jensen et al., 2006 ²²	938	Cross-sectional	Insulin, homocysteine, total cholesterol, c-peptide	↓
	Qi et al., 2006 ²³	902	Cross-sectional	CRP, TNF-R2	↓
	Sahyoun et al., 2006 ¹⁰	535	Cross-sectional	BMI, glucose	↓
	Bazzano et al., 2005 ²⁴	17,881	Prospective	Body weight and weight gain	↓
	Erkkilä et al., 2005 ²⁵	229	Prospective	Change in minimum coronary artery diameter	↓
	Esmailzadeh et al., 2005 ^{12, 26}	827	Cross-sectional	Triglycerides, 2-hour glucose, diastolic BP, waist circumference	↓
	Koh-Banerjee et al., 2004 ²⁷	27,082	Prospective	Weight gain	↓

BMI = body mass index, HOMA = homeostasis model assessment, LDL-C = low-density-lipoprotein cholesterol, CRP = c-reactive protein, TNF-R2 = tumor necrosis factor-alpha receptor-2, BP = blood pressure

Summary Tables

Summary of clinical trials of whole grains

TABLE 3	STUDY	SAMPLE SIZE	STUDY TYPE AND DURATION	TREATMENT	RESULTS
	Alminger et al., 2008 ²⁸	13	Randomized block design, 2-hour postprandial	Glucose solution vs. tempe fermented whole-grain barley and oat	↓ glucose, ↓ insulin
	Costable et al., 2008 ²⁹	31	Crossover, 3 weeks per diet	Wheat bran vs. whole grain breakfast cereal	↑ bifidobacteria, ↑ lactobacilli
	Hsu et al., 2008 ³⁰	11	Crossover, 6 weeks per diet	White rice vs. pre-germinated brown rice	↓ glucose ↓ total cholesterol ↓ triglycerides, ↓ fructosamine
	Katcher et al., 2008 ³¹	50	Parallel-arm, 12 weeks	Reduced-calorie diet with refined grains vs. reduced-calorie diet with whole grains	↓ CRP, ↓ Abdominal fat
	Lammert et al., 2008 ³²	14	Prospective, 2 days, 4-week follow-up	Standard diet vs. standard diet + oatmeal	↓ glucose, ↓ insulin, ↓ leptin, ↓ adiponectin
	Andersson et al., 2007 ³³	30	Crossover, 6 weeks per diet	Habitual diet with refined grains vs. whole grains	No change in IL-6, CRP, BP, insulin sensitivity, or lipids.
	Rave et al., 2007 ³⁴	31	Crossover, 4 weeks per diet	Hypocaloric diet containing meal replacements (Slim Fast) vs. whole grain double-fermented wheat	↓ insulin and insulin resistance after adjusting for weight loss
	Behall et al., 2006 ³⁵	16	Latin square design, 5 weeks per diet	Step 1 diet vs. Step 1 diet with 20% of energy replaced with brown rice, whole wheat, and/or barley	↓ Systolic and diastolic BP
	Panlasigui et al., 2006 ³⁶	19	Crossover, 3-hour postprandial	White rice vs. brown rice	↓ glucose
	Karmally et al., 2005 ³⁷	152	Parallel-arm, 6 weeks	Corn vs. oat cereal	↓ total and LDL-C
Behall et al., 2004 ³⁸	18	Latin square design, 5 weeks per diet	Step 1 diet vs. Step 1 diet with 20% of energy replaced with brown rice, whole wheat, and/or barley	↓ total and LDL-C, ↑ HDL-C	

CRP = c-reactive protein, IL-6 = interleukin-6, BP = blood pressure , LDL-C = low-density-lipoprotein cholesterol, HDL-C = high-density-lipoprotein cholesterol

Summary Tables

Summary of studies comparing dietary patterns with morbidity and mortality

The studies in this table include whole grains as part of a dietary pattern. While all show positive health benefits for diets that include whole grains, the effect may be due to foods other than whole grains. For each study, all patterns are listed, but only those results pertaining to whole grain are included.

TABLE 4	STUDY	SAMPLE SIZE	DIETARY PATTERN STUDIED	DISEASE STUDIED	DIFFERENCE IN RISK	
	Brunner et al., 2008 ³⁹	7,731	1. Unhealthy (white bread, processed meat, fries, full-cream milk)	Coronary death or nonfatal myocardial infarction	-29% for unhealthy vs. healthy dietary pattern	
			2. Sweet (white bread, biscuits, cakes, processed meat, high-fat dairy products)	Incident diabetes	-26% for unhealthy vs. healthy dietary pattern	
			3. Mediterranean-like (fruit, vegetables, rice, pasta, wine)	All-cause mortality	No association	
			4. Healthy (fruit, vegetables, whole-meal bread, low-fat dairy, little alcohol)			
	Heidemann et al., 2008 ⁴⁰	72,113	1. Prudent (higher intakes of vegetables, fruit, legumes, fish, poultry, and whole grains)	Cardiovascular mortality	-28% for highest vs. lowest quintile of prudent diet	
			2. Western (higher intakes of red meat, processed meat, refined grains, French fries, and sweets/desserts)	Cancer mortality	Not significant for highest vs. lowest quintile of prudent diet	
				All-cause mortality	-17% for highest vs. lowest quintile of prudent diet	
	Nettleton et al., 2008 ⁴¹	5,011	1. Fats and processed meats	Type 2 diabetes	-15% for highest vs. lowest quintile of whole grains and fruit dietary pattern	
			2. Vegetables and fish			
			3. Beans tomatoes, and refined grains			
			4. Whole grains and fruit (whole grains, fruit, nuts/seeds, green leafy vegetables, low-fat dairy)			-13% for highest vs. lowest quintile of low-risk food pattern
			5. Low-risk food pattern – sum intake of 10 food groups			

Summary Tables

Summary of studies comparing dietary patterns with surrogate markers of disease

The studies in this table include whole grains as part of a dietary pattern. While all show positive health benefits for diets that include whole grains, the effect may be due to foods other than whole grains. For each study, all patterns are listed, but only those results pertaining to whole grain are included.

TABLE 5	STUDY	SAMPLE SIZE	DIETARY PATTERN STUDIED	BIOMARKERS ASSESSED	DIFFERENCE IN RISK
	Nettleton et al., 2008 ⁴²	5,089	1. Comprehensive Healthy Dietary Pattern – sum of weighted categorical ranks of 36 food groups 2. Simplified Healthy Dietary Pattern – sum of weighted categorical ranks of 6 food groups	Markers of subclinical atherosclerosis, inflammation, renal disease, lipids, vascular compliance, glucose, and insulin.	↓ urinary albumin:creatinine ratio, common carotid artery intima-media thickness, triglycerides, insulin, CRP, IL-6, and homocysteine for highest vs. lowest quintiles of both patterns
	Nettleton et al., 2006 ⁴³	5,089	1. Fats and processed meats 2. Vegetables and fish 3. Beans, tomatoes, and refined grains 4. Whole grains and fruit (whole-grain bread, rice, and pasta, fruit, seeds, nuts, peanut butter, green leafy vegetables, and low-fat milk)	CRP, IL-6, homocysteine, sICAM-1, and soluble E-selectin.	↓ CRP, IL-6, homocysteine and sICAM-1 with the whole grains and fruit dietary pattern
	Lopez-Garcia, 2004 ⁴⁴	732	1. Prudent (higher intake of vegetables, fruit, legumes, fish, poultry, and whole grains) 2. Western (higher intakes of red and processed meats, sweets, desserts, French fries, and refined grains.)	C-reactive protein, E-selectin, IL-6, sICAM-1, and sVCAM-1.	↓ CRP and E-selectin with the prudent diet

Summary of systematic reviews

These two systematic reviews document positive associations between whole grains and health. We have listed them separately to make clear that they do not represent primary research.

TABLE 6	STUDY	SAMPLE SIZE	ENDPOINT ASSESSED	RESULTS
	Harland et al., 2008 ⁴⁵	15 observational studies (n = 119,829)	Body weight	↓ BMI (-0.6 kg/m ²), waist circumference (-2.7 cm), and waist:hip ratio (-0.023) with the highest vs. lowest intake of whole grains
	Priebe et al., 2008 ⁴⁶	11 prospective cohort studies and 1 randomized control trial	Type 2 diabetes	The prospective studies consistently showed a reduced risk (27% to 30%) for developing type 2 diabetes with a high intake of whole grain foods. The randomized trial reported a slight improvement in insulin sensitivity.

BMI = body mass index



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Those marked with an asterisk (*) also have an overview page, following.

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