The benefits of whole grain
1. Introduction to whole grain
   - What is whole grain?
   - Nutrients in whole grain wheat flour and white flour and differences in contribution of macronutrients and micronutrients to Guidelines Daily Amounts (GDA) and to Recommended Daily Allowances (RDA)

2. Health effects of whole grain food
   - The situation in Europe: overweight, obesity, diabetes, cardiovascular disease, and colorectal cancer
   - Health protective mechanisms of whole grain
   - Epidemiological evidence of the correlation between whole grain intake and the reduced risk of developing nutrition-related diseases

3. Whole grain and balanced diet
   - Different national recommendations for daily intake of whole grain
   - How to identify whole grain foods and how to increase the daily consumption of whole grain foods.
Effects of whole grain consumption on risk reduction of nutrition-related diseases

Whole grain

Healthy weight
Healthy heart
Healthy diet
Healthy lifestyle

Obesity
Cardiovascular diseases
Diabetes
Colorectal cancer
A food is “made with whole grain” when the grain components (starchy endosperm, germ and bran) are present in the same relative proportions as in the original intact grain kernel.

Source: HEALTHGRAIN definition: http://www.healthgrain.org/regulatory_issues
The wheat grain kernel and its composition

- The kernel has 3 major parts:
  - Bran
  - Germ
  - Starchy Endosperm

- Whole grain flour contains 100% of the original germ and bran

- Bran and germ have a high content of fibre, micronutrients (vitamins, minerals, trace-elements) and bioactive plant compounds (antioxidants, sterols, etc).

Differences in the contribution of macronutrients from wheat flour (whole grain vs. white flour) to Guidelines Daily Amounts (GDA)

Source: National Nutrient Database for Standard Reference (Release 24), ARS, USDA
Differences in the contribution of micronutrients from wheat flour (whole grain vs. white flour) to Recommended Daily Allowances (RDA)

Source: National Nutrient Database for Standard Reference (Release 24), ARS, USDA
Contribution of macronutrients from crude wheat bran to GDA

- Fiber, total dietary (g): 171
- Protein (g): 31
- Carbohydrate (g): 25
- Energy (kcal): 11
- Saturated fat (g): 3
- Sugars (total) (g): 0

Source: National Nutrients Database for Standard Reference (release 24), ARS, USDA
Contribution of micronutrients from crude wheat bran to RDA

Source: National Nutrients Database for Standard Reference (release 24), ARS, USDA
Contribution of macronutrients from crude wheat germ to GDA

- Fiber, total dietary (g): 53%
- Protein (g): 46%
- Carbohydrate (g): 20%
- Energy (kcal): 18%
- Saturated fat (g): 8%

Source: National Nutrients Database for Standard Reference (release 24), ARS, USDA
Contribution of micronutrients from crude wheat germ to RDA

- Thiamin (mg): 171%
- Zinc (mg): 123%
- Phosphorus (mg): 120%
- Vitamin B-6 (mg): 93%
- Magnesium (mg): 64%
- Iron (mg): 45%
- Potassium (mg): 45%
- Niacin (mg): 43%
- Riboflavin (mg): 36%
- Calcium (mg): 5%

Source: National Nutrients Database for Standard Reference (release 24), ARS, USDA
Overweight – a growing European problem

Percentage of males overweight (BMI ≥ 25) 2010

- ≥ 80%
- ≥ 70%
- ≥ 60%
- ≥ 50%
- ≥ 40%

WHO Global Database on Body Mass Index 2010
Obesity - a major risk factor for chronic inflammation involved in etiology of diabetes, cardiovascular disease and maybe cancer

Percentage of males obese (BMI ≥30) 2010

WHO Global Database on Body Mass Index 2010
Diabetes – growing national prevalence

The main cause of death in the EU is Cardiovascular disease (CVD).

- Coronary heart disease (CHD) and stroke are the main forms of CVD.
- 45% deaths in women and 38% of deaths in men stem from CVD.

Source: European Cardiovascular Disease Statistics (2008)
Colorectal cancer is the second most common cause of cancer death in both men and women!

Estimated age-standardized incidence rates per 100,000 of colorectal cancer in 2008

Source: European Cancer Observatory 2008
Health effects of whole grain food

- Intake of bran from wheat, rye, oats and barley increases the faecal bulk and moisture, thereby reducing the transit time and constipation (EFSA 2011)

- Regular whole grain and cereal fibre consumption contributes to reducing risks of developing major chronic diseases:
  - Diabetes type-2
  - Cardiovascular diseases
  - Colorectal cancer

Whole grain food bioactivity

Whole meal vs. white flour: 2.5 - 5 x higher levels

- Allylresorcinols
- Enzyme inhibitors
- Phytochemicals
- Cholesterol-lowering
- Lignans
- Phytoestrogens
- Ferulic acid
- Antioxidant
- Phytate
- Antioxidant
- Vitamin E
- Antioxidant
- Oligo-
- Saccharides
- Prebiotic
- Folate Choline,
- betaine
- Methyl donors

Synergistic effects
Beneficial physiological effects in humans

Whole Grain, Bran, and Germ Intake and Risk of Type 2 Diabetes: A Prospective Cohort Study and Systematic Review

Jeroen S. L. de Munter1,2, Frank B. Hu1,3,4, Donna Spiegelman3,5, Mary Franz1, Rob M. van Dam1,2,4*

1 Department of Nutrition, Harvard School of Public Health, Boston, Massachusetts, United States of America, 2 Institute of Health Sciences, Vrije Universiteit Amsterdam, Amsterdam, The Netherlands, 3 Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts, United States of America, 4 Channing Laboratory, Department of Medicine, Brigham and Women’s Hospital and Harvard Medical School, 5 Department of Biostatistics, Harvard School of Public Health, Boston, Massachusetts, United States of America

- Data of 6 pooled studies, incl. 286.125 persons and 10.944 cases of type 2 diabetes
- Associations for bran intake were similar to those for total whole grain intake
- No significant association was observed for germ intake

- Two servings of whole grain/day is associated with 21% decrease in risk of developing type 2 diabetes!
  - One serving of whole grains corresponds to a ~30g slice of 100% whole wheat bread (US Department of Agriculture)

Whole grain intake and cardiovascular disease: A meta-analysis

Philip B. Mellen a,*, Thomas F. Walsh a, David M. Herrington b

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b Department of Internal Medicine, Section of Cardiology, Wake Forest University Health Sciences, Medical Center Blvd., Winston-Salem, NC 27157, USA

- Consistent demonstration of reduced cardiovascular disease risks when consuming more whole grain!

- Analysis of data from 149,000 individuals show that 2.5 whole grain servings/day, compared to low intake, reduces cardiovascular disease risk by 21%
A high intake of dietary fibre, in particular from cereals and whole grains, is associated with a reduced risk of colorectal cancer.

Systematic review and meta-analysis of prospective observational studies suggest:

- 10% reduction in risk of colorectal cancer for each 10g/day intake of total dietary fibre and cereal fibre
- 20% reduction for each three servings (90g/day) of whole grains daily
- further reductions with higher intake.
"A higher intake of whole grains is associated with lower body mass index and body weight gain; whole grain consumption can be recommended as one of the features of the diet that may help control body weight."
High intake of whole-grain products or dietary fibre from cereal products, respectively, is associated with a lower risk of type 2 diabetes mellitus and coronary heart disease.

Increased consumption of whole grain products reduces the plasma levels of total and LDL cholesterol.

There is a risk-reducing association between the intake of dietary fibre from cereal products and the risk of colorectal cancer.

The few existing cohort studies suggest that increased whole grain product intake is possibly accompanied by a reduced risk of obesity.
Whole grain foods supply food components that help maintain health.
### Recommended whole grain consumption

<table>
<thead>
<tr>
<th>Country</th>
<th>National recommendations for a 2,000 kcal diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>3 servings (= 48g) or more of whole grains every day (DM, dry matter) (2010 Dietary Guidelines for Americans).</td>
</tr>
<tr>
<td>Denmark/Sweden</td>
<td>62g whole grain (DM) daily (National Food Institute/ National Food Administration)</td>
</tr>
<tr>
<td>Netherlands</td>
<td>6 slices of bread daily, preferably whole grain ≈ 115g whole grain (DM) (Netherlands Nutrition Centre)</td>
</tr>
<tr>
<td>Germany</td>
<td>“At least 30g of dietary fibre daily, especially from whole-grain products, are recommended” (German Nutrition Society (DGE))</td>
</tr>
<tr>
<td>Switzerland</td>
<td>At least 2 portions daily of whole grain products (Swiss Society for Nutrition Food Pyramid)</td>
</tr>
</tbody>
</table>
How to identify whole grain foods

<table>
<thead>
<tr>
<th>Look for the word „whole“ on the package</th>
<th>Look at the list of ingredients</th>
</tr>
</thead>
<tbody>
<tr>
<td>„whole grains“</td>
<td>Cracker made with whole grains:</td>
</tr>
<tr>
<td>„whole wheat“</td>
<td>Cereals 94,5% (whole wheat flour</td>
</tr>
<tr>
<td>„whole wheat flour“</td>
<td>54%, wheat flour 37,5%, wheat</td>
</tr>
<tr>
<td>„whole oats“</td>
<td>bran), vegetable fat, yeast,</td>
</tr>
<tr>
<td>„whole barley“</td>
<td>whole milk powder, salt, barley</td>
</tr>
<tr>
<td></td>
<td>malt extract, raising agent</td>
</tr>
<tr>
<td></td>
<td>(sodium hydrogen carbonate).</td>
</tr>
</tbody>
</table>

Look for a logo on the packaging

![Logos](image)
# Whole grain sources

<table>
<thead>
<tr>
<th>Cereals</th>
<th>Pseudocereals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheats</strong>, including spelt, emmer, faro, einkorn, kamut, durums</td>
<td>Amaranth</td>
</tr>
<tr>
<td>Rice</td>
<td>Buckwheat, tartar buckwheat</td>
</tr>
<tr>
<td>Barley, including hull-less or naked barley but not pearled</td>
<td>Quinoa</td>
</tr>
<tr>
<td>Maize (corn)</td>
<td></td>
</tr>
<tr>
<td>Rye</td>
<td></td>
</tr>
<tr>
<td>Oats, including hull-less or naked oats</td>
<td></td>
</tr>
<tr>
<td>Millets</td>
<td></td>
</tr>
<tr>
<td>Sorghum</td>
<td></td>
</tr>
<tr>
<td>Teff (tef)</td>
<td></td>
</tr>
<tr>
<td>Triticale</td>
<td></td>
</tr>
<tr>
<td>Canary seeds</td>
<td></td>
</tr>
<tr>
<td>Job's tears</td>
<td></td>
</tr>
<tr>
<td>Fonio, black fonio, Asian millet</td>
<td></td>
</tr>
<tr>
<td>Wild rice</td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Healthgrain Consortium Wholegrain definition (2010)
## How to increase the everyday consumption of whole grain foods

| Breakfast cereals made with whole grain | ▪ Whole oat flakes  
▪ Porridge  
▪ Whole grain müsli  
▪ Certain breakfast cereals |
|-------------------------------|-----------------------------------------------|
| Bread made with whole grain | ▪ Whole grain wheat bread  
▪ Rye bread (e.g. Pumpernickel)  
▪ Certain bread substitutes (rusks, crackers) |
| Biscuits and other snacks made with whole grain | ▪ Whole rice or oat cakes  
▪ Certain biscuits and snacks  
▪ Certain cereal bars |
| Flours made with whole grain | ▪ Whole wheat flour  
▪ Buckwheat flour  
▪ Whole rye and barley flour |
| Side dishes made with whole grain | ▪ Brown rice  
▪ Whole wheat pasta |
The whole (grain) benefit package

- Regular whole grain consumption
- Reduced risk of developing disease
- Enjoy wellness and quality of life
The HEALTHGRAIN EU Integrated Project (2005-2010) - the largest cereal project ever – has substantially strengthened the scientific basis for a new generation of cereal products with enhanced health benefits.

The Healthgrain Forum ([www. healthgrain. org](http://www. healthgrain. org)) has been initiated in 2010 for continuing HEALTHGRAIN’s research, networking and communication activities. Currently (status October 2012) 60 member organisations joined, with an even balance between academia, research organisations, industry and members focusing on communication on grains and health.

The Healthgrain Forum will evaluate and update this presentation annually. For questions and suggestions please contact: line.lindner@icc.or.at or jan-willem.vanderkamp@tno.nl