Whole grain, definition
and recommendations for consumption

Jan Willem van der Kamp

TNO

HEALTHGRAIN Forum

jan-willem.vanderkamp@tno.nl
Content

Introduction

HEALTHGRAIN Whole Grain Definition

Dietary recommendations

- For whole grain - based on food epidemiology studies
- For whole grain – including its contribution to fibre intake

Whole grain foods - intake in practice

Conclusions
Whole grain: endosperm + bran + germ

- White bread/yellow pasta – flour mainly from endosperm
- Wholemeal (or wholegrain) bread/pasta – flour from entire kernel
- Wholemeal vs. white flour. Fibre/other bioactive compounds - levels 2.5 - 5

Bran (12-17%)
- Dietary fibre,
- B vitamins,
- Trace minerals,
- Phytochemicals (e.g., anti-oxidants)

Germ (~ 3%)
- Germ oil
- Antioxidants,
- Vitamin E,
- B vitamins

Endosperm (80-85%)
- Starch,
- Protein
- (dietary fibre, vitamins)

The wheat kernel
Global new food & drink launches with “whole grain" claim by product category (from 2000 to 2010)

Adapted from data of the Whole Grains Council
The need for a Whole Grain Definition

- Growing consumption of whole grain foods, also in countries without whole grain tradition. Next to bread also pasta, biscuits, breakfast cereals

- Whole grain / whole meal not defined in most countries – or short definition:
  "Whole grain foods include the entire germ, endosperm and bran. Grains subjected to processing such as milling are also included."

- Actions at national levels for more complete definitions (e.g. UK, Denmark) including list of grains included and processes allowed.

- HEALTHGRAIN Consortium (2008) : Need for one definition in Europe

- Expected to be useful in the context of nutrition guidelines, recommendations and nutrition claims
Whole Grain Definition
Developed by the HEALTHGRAIN Consortium

- 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 they exist in the intact kernel.

- Small losses of components - i.e. less than 2% of the grain/10% of the bran - that occur through processing methods consistent with safety and quality are allowed.

The definition is
- covering current industrial practices – modern and traditional
- Text similar to USA/FDA definition (USA does not include 2nd part)

The definition document describes:
- List of cereal grains included in the definition
- Milling and processing aspects

See also www.healthgrain.org/regulatory_issues/whole_grain
Production of whole meal (= whole grain) flour
Current industrial practices

- > 90% of flour are produced by ‘modern milling’:
  
  **Breaking** of kernels → **separation into milling streams:**
  
  white flour, germ, (various fractions) bran

- **Recombination:** fixed ratio’s of milling streams:
  
  - germ (often after heat treatment/ inactivation of ‘rancidity promoting enzymes’),
  
  - white flour and
  
  - bran

- Germ, bran and white flour may originate from different batches (and cultivars), but should be of one species (e.g. wheat, or rye).

- **Modern milling contributes to constant quality at low costs**
  
  (composition, processability)

**Notes:**

- **Health benefits shown in food epidemiology research of whole grain foods**
  
  = whole grain foods produced by modern milling

< 10% of flour made by stone grinding: no separation of fractions
The adding together, after temporary separation, of the three whole grain constituents as separate ingredients, in the correct proportion at both the milling and baking stages, is consistent with longstanding food industry technological and safety practices.

Production of those flours and products must follow appropriate quality systems (e.g. Good Manufacturing Processes, GMP etc.) in compliance with food safety regulations in the European Union.
### Whole grain intake – National recommendations

**Approximate range: 3 - 7 servings** (serving~slice of bread)

<table>
<thead>
<tr>
<th>Countries</th>
<th>National recommendations for the “bread, cereals, starchy food” category</th>
<th>National recommendations for whole grains and whole grain foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>France [<a href="http://www.mangerbouger.fr/">www.mangerbouger.fr/</a>]</td>
<td>3 portions /day (one at each meal)</td>
<td>Prefer cereals in whole grain form</td>
</tr>
<tr>
<td>Great Britain [<a href="http://www.eatwell.gov.uk">www.eatwell.gov.uk</a>]</td>
<td>3 portions /day (one at each meal)</td>
<td>Prefer cereals in whole grain form</td>
</tr>
<tr>
<td>Switzerland [<a href="http://www.sge-ssn.ch">www.sge-ssn.ch</a>]</td>
<td>3 portions /day (one at each meal)</td>
<td>When possible 2 of which in whole grain form</td>
</tr>
<tr>
<td>The Netherlands [<a href="http://www.voedingscentrum.nl">www.voedingscentrum.nl</a>]</td>
<td>For bread: 5-7 slices</td>
<td>Preferably whole grain</td>
</tr>
<tr>
<td>Denmark, Sweden [<a href="http://www.food.dtu.dk">www.food.dtu.dk</a>] [<a href="http://www.slv.se">www.slv.se</a>]</td>
<td></td>
<td>The equivalent of 75g whole grains per 10MJ (2,400 kcal) equivalent to 62g for a reference 2,000 kcal diet</td>
</tr>
<tr>
<td>The United States [<a href="http://www.health.gov/dietaryguidelines/">www.health.gov/dietaryguidelines/</a>] [<a href="http://www.mypyramid.gov">www.mypyramid.gov</a>]</td>
<td>6 ounce-equivalent serving of cereals for a 2,000kcal diet per day</td>
<td>At least half of cereal intake to be consumed in whole grain form, equivalent to at least 3 ounce-equivalent servings of whole grain foods per day for individuals over 9 years. “Make half your grains whole”</td>
</tr>
<tr>
<td>Australia [<a href="http://www.nhmrc.gov.au">www.nhmrc.gov.au</a>]</td>
<td>“Eat plenty of cereals”; For women 4-9 servings For men 6-12 servings</td>
<td>Prefer cereals in whole grain form</td>
</tr>
<tr>
<td>Canada [<a href="http://www.hc-sc.gc.ca">www.hc-sc.gc.ca</a>]</td>
<td>6 to 8 servings per day</td>
<td>Of which half in whole grain form</td>
</tr>
</tbody>
</table>

Of which half in whole grain form 6 to 8 servings per dayCanada
[www.hc-sc.gc.ca]
Prefer cereals in whole grain form

“Eat plenty of cereals”; For women 4-9 servings For men 6-12 servings
Prefer cereals in whole grain form

For men 6-12 servings
Of which half in whole grain form

Non-western recommendations

- Chinese Dietary Guidelines and Pagoda
  “Consume a diversified range of foods, with grains - both coarse and fine - as the base. Daily consumption of total grains, cereals, legume around 250 - 400 gram, among them around 50-100g are coarse and wholegrain”
  Chinese Nutrition Society 2005

- The Healthy Diet Pyramid for Adults - Singapore
  “You should consume 2-3 servings of whole grain foods daily (equivalent to about 50g of whole grains)”. National Dietary Guidelines for Singapore 2009

- Nutrition recommendations for the general population - Mexico
  “Consumption of cereals should be recommended, preferably whole grains or their derivatives and starchy roots. Their fibre and energy content should be highlighted”.
  Mexican Health Ministry 2004
Recommendations by disease associations

- American Diabetes Association (ADA) - 2008
  *The ADA Nutrition Recommendations and Interventions for Diabetes recommend an increase in whole grain intakes as a strategy to both prevent and manage diabetes*

- American Cancer Society (ACS) - Kushi et al 2006
  *The ACS Nutrition and Physical Activity Guidelines for both primary prevention and tertiary treatment of cancer include “choose whole grains in preference to refined grains, and choose whole grain rice, bread, pasta, and cereals”*

- American Heart Association (AHA) – Lichtenstein 2006
  *Choose Whole-Grain, High-Fiber Foods*
  *Dietary patterns that are high in whole-grain products and fiber have been associated with increased diet quality. (...) The AHA recommends that at least half of grain intake come from whole grains*
Danish Whole Grain Campaign

many recommendations
Recommendations - overview

48 g whole grain /day correspond with 3 servings of whole grain foods

- 3 servings show consistently beneficial effects in food epidemiology studies (Seal and Brownlee, 2010, de Munter et al., 2007)

- 3 servings — 3 ~ 30g slices of bread with ~55 – 60% whole grain → 48g whole grain

Denmark: 62 - 75 g WG/day (Fuldkorn report 2008)

Netherlands: ~ 120 g WG/day (5 – 7 slices of whole grain bread) Linked to national recommendation for fibre intake www.voedingscentrum.nl
USA dietary goals and practice

Whole grains intake: 15% of goal

Refined grains intake: 100% above limit
### Whole grain (WG) - actual intake information
Intake far below recommendations

<table>
<thead>
<tr>
<th>Country</th>
<th>Actual whole grain intake vs. national recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>6% consume the recommended 75g/day</td>
</tr>
<tr>
<td></td>
<td>Average WG intake 32g/day - mainly rye bread</td>
</tr>
<tr>
<td></td>
<td>(Fuldkorn report 2008)</td>
</tr>
<tr>
<td>Finland</td>
<td>Bread consumption 42 kg p.p.p.year Average WG bread intake 33g/day</td>
</tr>
<tr>
<td></td>
<td>45% WGbread 55% white bread</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Bread consumption ~58 kg p.p.p.year → WGbread intake ~45 - 50g (NBC, 2010)</td>
</tr>
<tr>
<td></td>
<td>(~30% white incl. small breads; ~20% WG, 50% mixed)</td>
</tr>
<tr>
<td>Germany</td>
<td>Kids (2 -18): 20 – 33 g/day WG – Downward trend</td>
</tr>
<tr>
<td></td>
<td>Wholemeal bread: 10% of bread market</td>
</tr>
<tr>
<td></td>
<td>(Alexy et al. 2010)</td>
</tr>
<tr>
<td></td>
<td>(GFK consumer panel)</td>
</tr>
<tr>
<td>Great Britain</td>
<td>1/3 of adults never eat whole grain</td>
</tr>
<tr>
<td></td>
<td>(Thane et al. 2007)</td>
</tr>
<tr>
<td>USA</td>
<td>95% below national recommendation</td>
</tr>
<tr>
<td></td>
<td>However, the situation is improving (whole grain campaign)</td>
</tr>
<tr>
<td></td>
<td>(USDA, 2010)</td>
</tr>
<tr>
<td></td>
<td>(Lipson, 2009)</td>
</tr>
<tr>
<td>Southern Europe</td>
<td>Low WG intake    WG pasta and bread introduced</td>
</tr>
<tr>
<td></td>
<td>Breakfast cereals and biscuits with more WG introduced</td>
</tr>
</tbody>
</table>
### Recommended dietary fibre intakes for adults linked to whole grain foods

<table>
<thead>
<tr>
<th>Body</th>
<th>Intake</th>
<th>Dietary Fibre Intake – and conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHO 2003</td>
<td>&gt; 25 g/day</td>
<td>Total dietary fibre from wholegrain cereals, fruit and vegetables,</td>
</tr>
<tr>
<td>Health Council (NL)</td>
<td>32-45 g/day</td>
<td>DF via a mixed diet: products not enriched with isolated and purified DF. There is evidence to suggest that the use of whole-grain products and fibre from fruit, in particular, leads to a lower risk of coronary heart disease.</td>
</tr>
<tr>
<td>EFSA (2010)</td>
<td>25g or more</td>
<td>- 25 g DF: adequate for normal laxation &lt;br&gt;25g: Evidence of benefit to health: diets rich in fibre-containing foods at DF intakes &gt;25 g per day. <em>e.g. reduced risk of coronary heart disease and T-2 diabetes and improved weight maintenance.</em> &lt;br&gt;<em>Such evidence should be considered when developing food-based dietary guidelines</em></td>
</tr>
</tbody>
</table>
Required intake of whole grain foods resulting from guidelines for fibre

- Recommended fibre intake: 35 g/day
- % fibre intake from whole grain: 33%
- Fibre content of 1 whole grain serving (= 1 30g slice bread = 2 g DF)
- 1/3 of 35g fibre requires 6 slices of whole grain bread = 6 WG servings

CONCLUSION:
WITH A CONTRIBUTION OF 1/3 OF TOTAL FIBRE INTAKE FROM WHOLE GRAINS:

6 SERVINGS OF WHOLE GRAIN FOODS REQUIRED FOR CONTRIBUTING TO RECOMMENDED INTAKE OF DIETARY FIBRE

The currently often recommended 3 servings (48g) whole grain foods is in fact too modest
Recommendations vs actual intake of whole grain
Factors influencing the gap

1. Tradition of ‘white’ products
2. *Taste and texture
3. Costs (wholemeal flour more expensive than white)
4. *Nutrition and health Information
5. *Mindset (how to change?)
6. *Availability (more products, higher levels in products)

*HEALTHGRAIN Forum activities and their spin-off
The HEALTHGRAIN Forum
From science to action!
HEALTHGRAIN whole grain definition:
- Whole grain defined including traditional and current modern production practices
- Describing WG as it is in the great majority of products (with health benefits indicated in observational studies)

Nutrition recommendations for whole grain foods.
- Qualitative recommendations: prefer cereals in whole grain form
- Quantitative: range 3 - 7 servings/day (~ 50 - 120 g WG raw ingredients).
- Past decade: non-western countries and disease associations started with WGF recommendations
- WG included in recommendations for fibre intake as one of the preferred foods
- 6 WGF servings required for contribution (33%) to a recommended intake of dietary fibre of 35g/day

Actual WGF intake:
- most parts of the world << recommended intake (USA: ~ ½ serving/day)
- MULTIPLE ACTIONS REQUIRED!!