



HEALTHGRAIN • FORUM

THE BENEFITS OF WHOLE GRAIN



STRUCTURE OF THE PRESENTATION

1. Introduction to whole grain

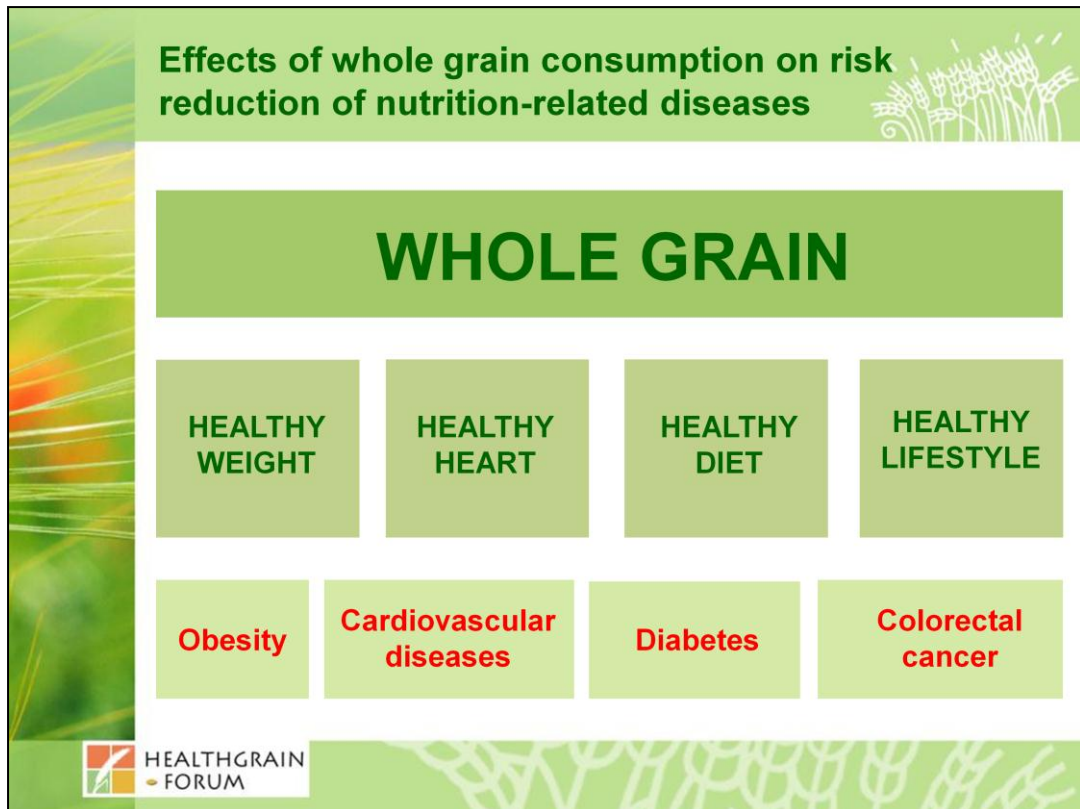
- What is whole grain?
- Nutrients in whole grain wheat flour and white flour and differences in contribution of macronutrients and micronutrients to Guidelines Daily Amounts (GDA) and to Recommended Daily Allowances (RDA)

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.



Whole grain consumption is also related to other health effects (besides those mentioned in this slide) e.g. laxation, gut functioning and other types of cancer.

This presentation will focus on healthy weight, heart health, diabetes (healthy glucose metabolism) and colon cancer.

What is whole grain?

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.

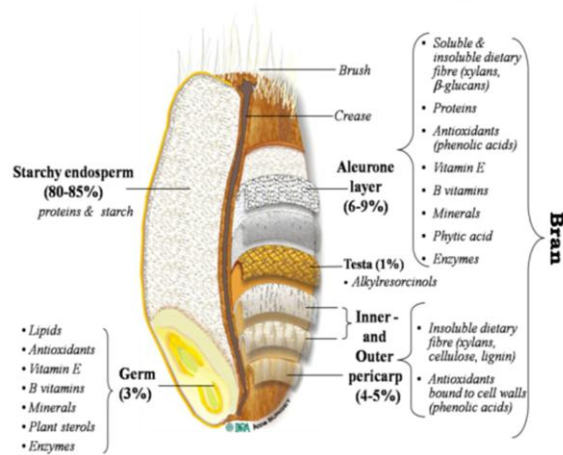


Source: HEALTHGRAIN definition:
http://www.healthgrain.org/regulatory_issues

The wheat grain kernel and its composition

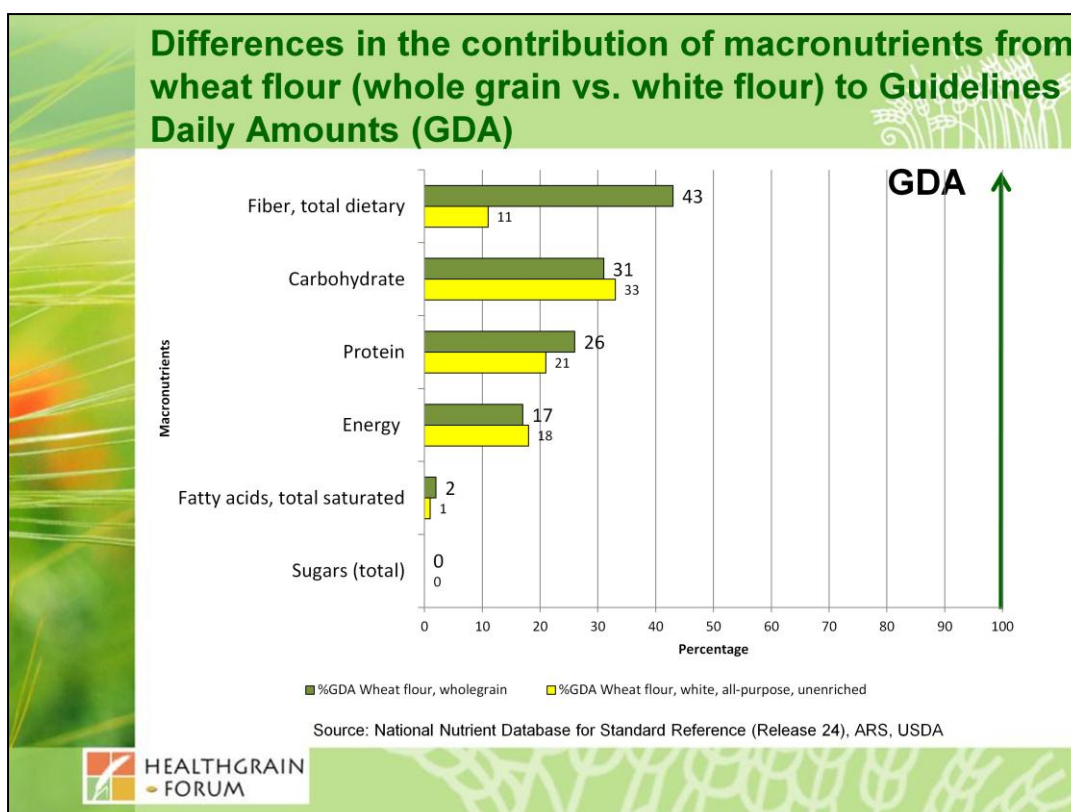
- The kernel has 3 major parts:
 - Bran
 - Germ
 - Starchy Endosperm
- Whole grain flour contains 100% of the original germ and bran
- Bran and germ have a high content of fibre, micronutrients (vitamins, minerals, trace-elements) and bioactive plant compounds (antioxidants, sterols, etc).

The wheat grain kernel and its components:



Source: Surget A, Barron C. Histologie du grain blé. Industries des Céréales. 2005; 145:3-7.

The figure shows the wheat grain anatomy and location of some specific compounds (INRA, Anne Surget, adapted from Surget and Barron, 2005).



Macronutrients (whole grain vs white flour)

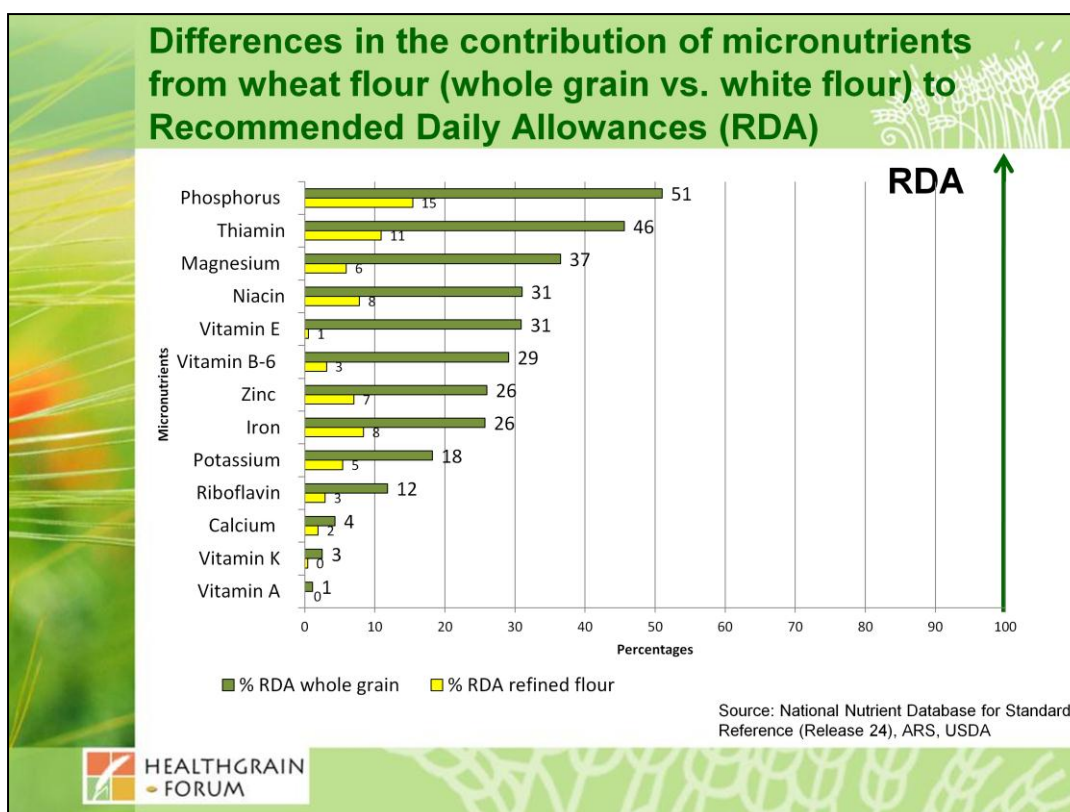
The data in the bars show how much the consumption of 100g of whole grain wheat flour accounts for in comparison to the GDA (*EFSA Scientific Opinion of the Panel on Dietetic Products, Nutrition and Allergies, EFSA Journal (2009) 1008, 1-14*).

For fibre, 25g fibre is the amount defined by EFSA as adequate for normal laxation in adults. EFSA mentions that there is evidence in adults of benefit to health associated with consumption of diets rich in fibre-containing foods at dietary fibre intakes greater than 25g/day, e.g. reduced risk of coronary heart disease and type 2 diabetes and weight maintenance (*EFSA Scientific Opinion on Dietary Reference Values for Carbohydrates and Dietary Fibre, EFSA Journal (2010); 8(3):1462*).

For instance, the consumption of 100g whole grain wheat flour accounts for 43% of GDA on fibre whereas refined wheat flour accounts for 11% of GDA on fibre.

In Regulation EC 1924/2006 ([http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1924R\(01\):EN:HTML](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1924R(01):EN:HTML)) a claim stating that a product is a SOURCE OF FIBRE can be made when the product contains at least 3g fibre per 100g. For the claim HIGH FIBRE at least the double amount is required. So wholemeal wheat flour is high in fibre. Note: upon processing flour with water and heat (e.g. baking, extrusion) some starch is converted to fibre (resistant starch)

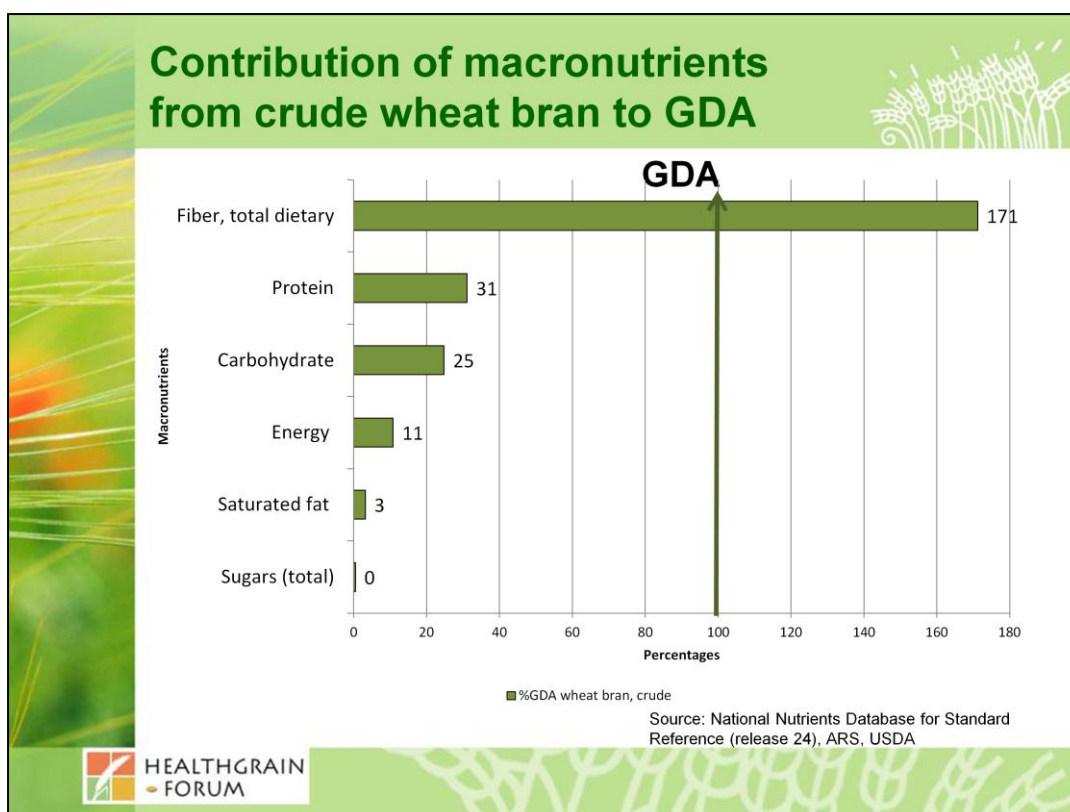
	Wheat flour, white, all-purpose, unenriched	Wheat flour, wholegrain	GDA	%GDA Wheat flour, white, all-purpose, unenriched	%GDA Wheat flour, wholegrain
Fiber, total dietary (g)	2,7	10,7	25	11	43
Carbohydrate (g)	76,31	71,97	230	33	31
Protein (g)	10,33	13,21	50	21	26
Energy (kcal)	364	340	2000	18	17
Fatty acids, total saturated (g)	0,155	0,43	20	1	2
Sugars (total) (g)	0,27	0,41	90	0	0



Micronutrients (whole grain vs white flour)

The data in the bars show how much the consumption of 100g of whole grain wheat flour accounts for in comparison to the RDA (*Directive 2008/100/EC*). For instance, the consumption of 100g whole grain wheat flour accounts for 37% of the RDA on magnesium whereas refined wheat flour accounts for 6%. In Regulation EC 1924/2006 on Nutrition and health Claims ([http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1924R\(01\):EN:HTML](http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32006R1924R(01):EN:HTML)) a claim stating 'food product X is a source of vitamin Y and/or mineral Z', may only be made where the product contains at least a significant amount as defined in the Annex to the Nutrition Labelling Directive (90/496/EEC). Generally, a significant amount is 15 % of the Recommended Daily Allowance (RDA) per 100 g or 100 ml. So wholemeal flour is a source. For a claim *high in vitamin X and/or mineral Y*, the double amount is required. So wholemeal wheat flour as listed by USDA is a source of Vitamin B6, Zn, Fe and K and High in P, Mg, Vitamin B1, B3 and E. Upon processing amounts of vitamins may change to some extent due to formation of B vitamins during fermentation or due to breakdown during heating.

	Wheat flour, white, all-purpose, unenriched	Wheat flour, wholegrain	RDA	% RDA refined flour	% RDA whole grain
Phosphorus (mg)	108	357	700	15	51
Thiamin (mg)	0,12	0,502	1,1	11	46
Magnesium (mg)	22	137	375	6	37
Niacin (mg)	1,25	4,957	16	8	31
Vitamin E (mg)	0,06	3,71	12	1	31
Vitamin B-6 (mg)	0,044	0,407	1,4	3	29
Zinc (mg)	0,7	2,6	10	7	26
Iron (mg)	1,17	3,6	14	8	26
Potassium (mg)	107	363	2000	5	18
Riboflavin (mg)	0,04	0,165	1,4	3	12
Calcium (mg)	15	34	800	2	4
Vitamin K (µg)	0,3	1,9	75	0,4	3
Vitamin A (µg)	0	9	800	0	1

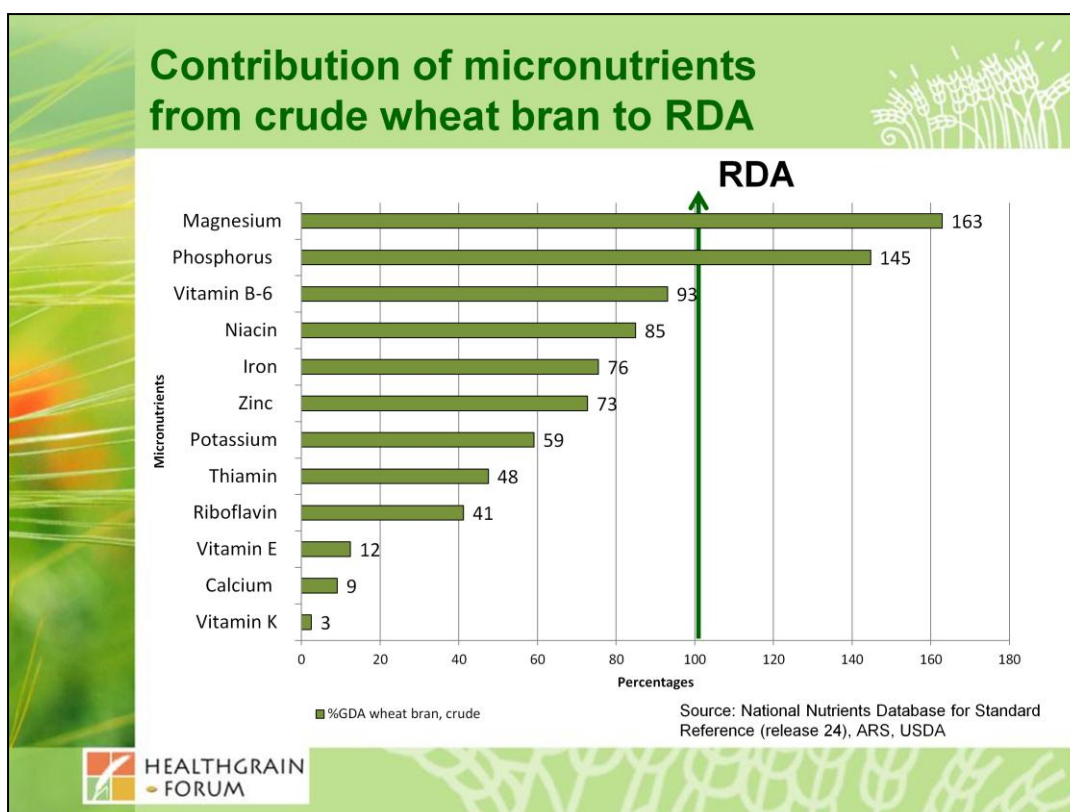


Macronutrients from crude wheat bran

The data in the bars show the contribution of macronutrients from crude wheat bran to the GDA (*EFSA Scientific Opinion of the Panel on Dietetic Products, Nutrition and Allergies, EFSA Journal (2009) 1008, 1-14*) and (*EFSA Scientific Opinion on Dietary Reference Values for Carbohydrates and Dietary Fibre, EFSA Journal (2010); 8(3):1462*).

For instance, 100g of crude wheat bran contributes to 31% of GDA on protein.

	Wheat bran, crude	Reference intakes adults (Regulation 1169/2011)	%GDA wheat bran, crude
Fiber, total dietary (g)	42,8	25	171
Protein (g)	15,55	50	31
Carbohydrate (g)	64,51	260	25
Energy (kcal)	216	2000	11
Saturated fat (g)	0,63	20	3
Sugars (total) (g)	0,41	90	0

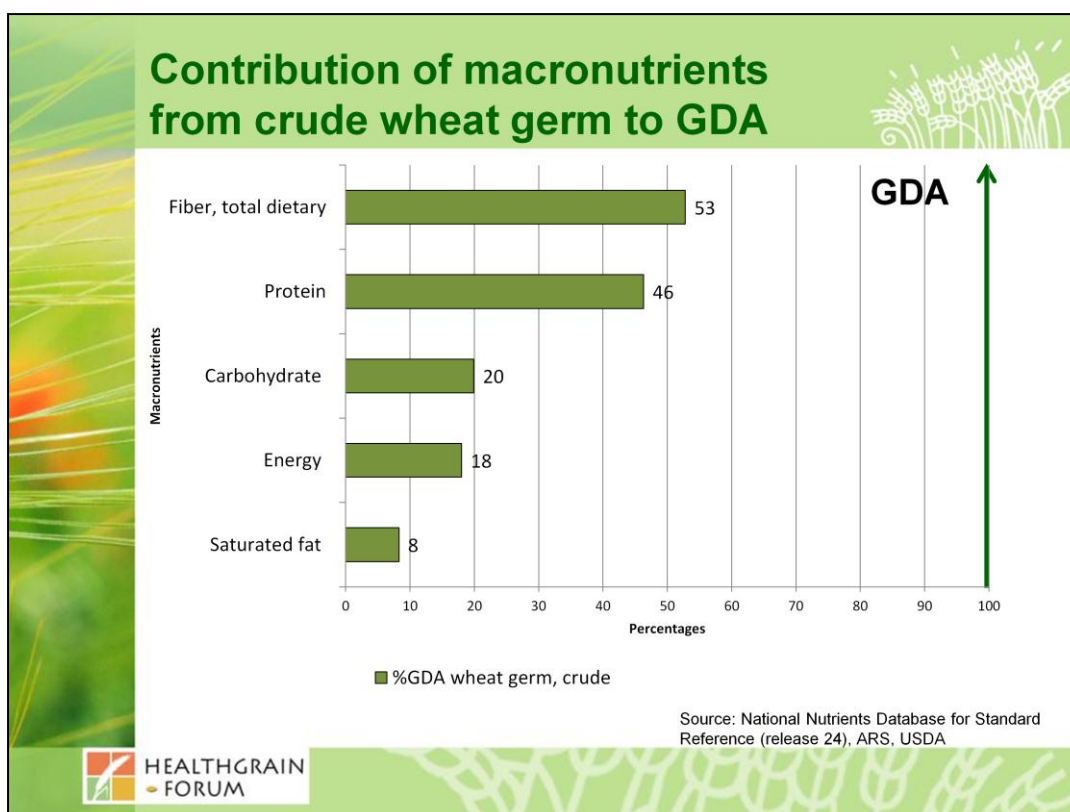


Micronutrients from crude wheat bran

The data in the bars show the contribution of micronutrients from crude wheat bran to the RDA (*Directive 2008/100/EC*).

For instance, 100g of crude wheat bran contributes to 93% of RDA on vitamin B6.

	Wheat bran, crude	Recommended Daily Allowances (RDA) (Directive 2008/100/EC)	%RDA wheat bran, crude
Magnesium (mg)	611	375	163
Phosphorus (mg)	1013	700	145
Vitamin B-6 (mg)	1,303	1,4	93
Niacin (mg)	13,578	16	85
Iron (mg)	10,57	14	76
Zinc (mg)	7,27	10	73
Potassium (mg)	1182	2000	59
Thiamin (mg)	0,523	1,1	48
Riboflavin (mg)	0,577	1,4	41
Vitamin E (mg)	1,49	12	12
Calcium (mg)	73	800	9
Vitamin K (µg)	1,9	75	3

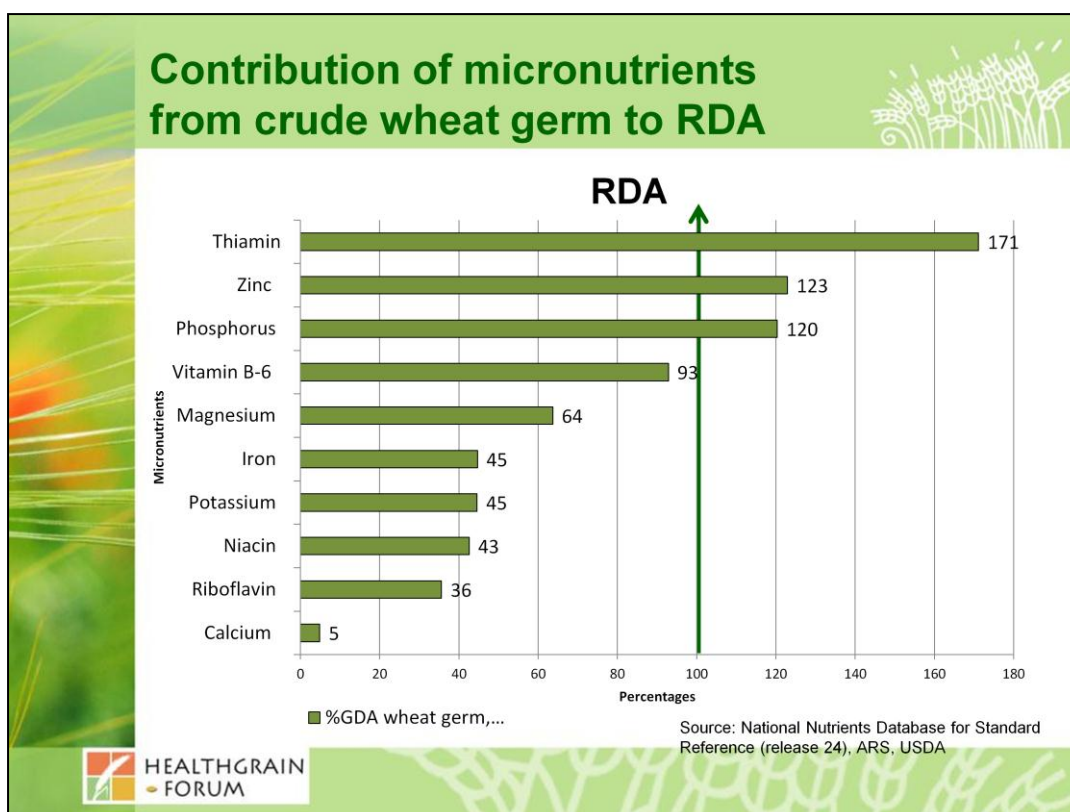


Macronutrients from crude wheat germ

The data in the bars show the contribution of macronutrients from crude wheat germ to the GDA (*EFSA Scientific Opinion of the Panel on Dietetic Products, Nutrition and Allergies, EFSA Journal (2009) 1008, 1-14*) and (*EFSA Scientific Opinion on Dietary Reference Values for Carbohydrates and Dietary Fibre, EFSA Journal (2010); 8(3):1462*).

For instance, 100g of crude wheat germ contributes to 46% of GDA on protein.

	Wheat germ, crude	Reference intakes adults (Regulation 1169/2011)	%GDA wheat germ, crude
Fiber, total dietary (g)	13,2	25	53
Protein (g)	23,15	50	46
Carbohydrate (g)	51,8	260	20
Energy (kcal)	360	2000	18
Saturated fat (g)	1,665	20	8

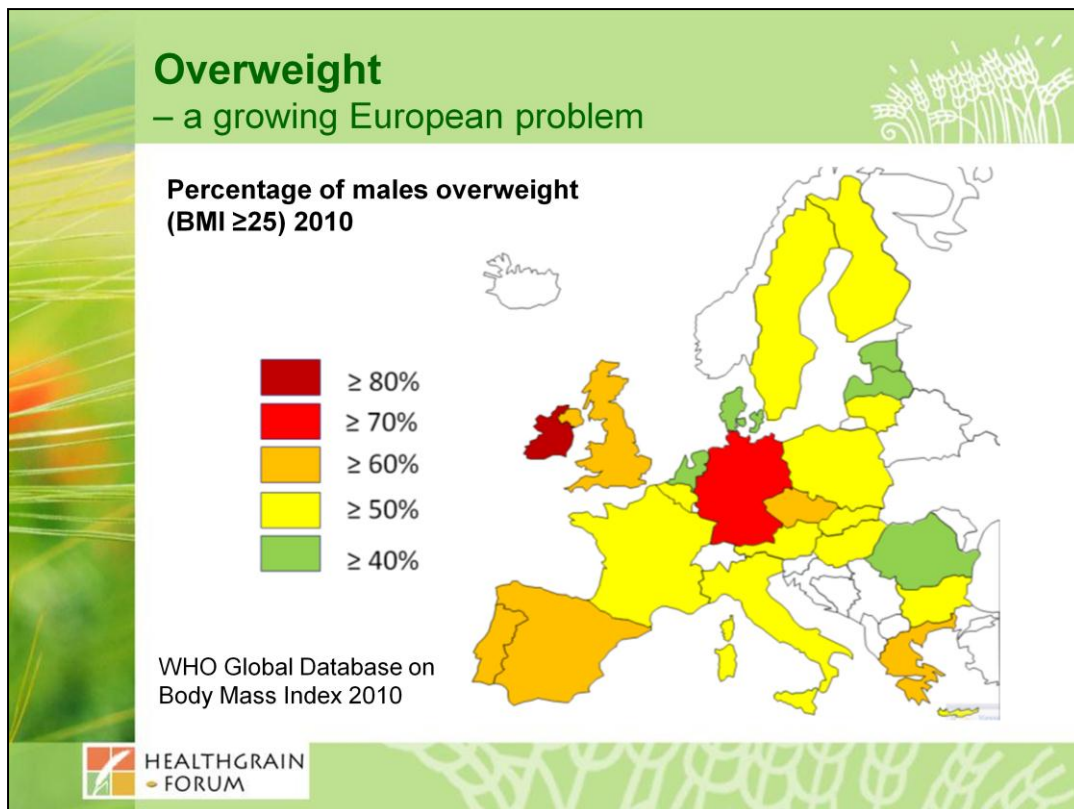


Micronutrients from crude wheat germ

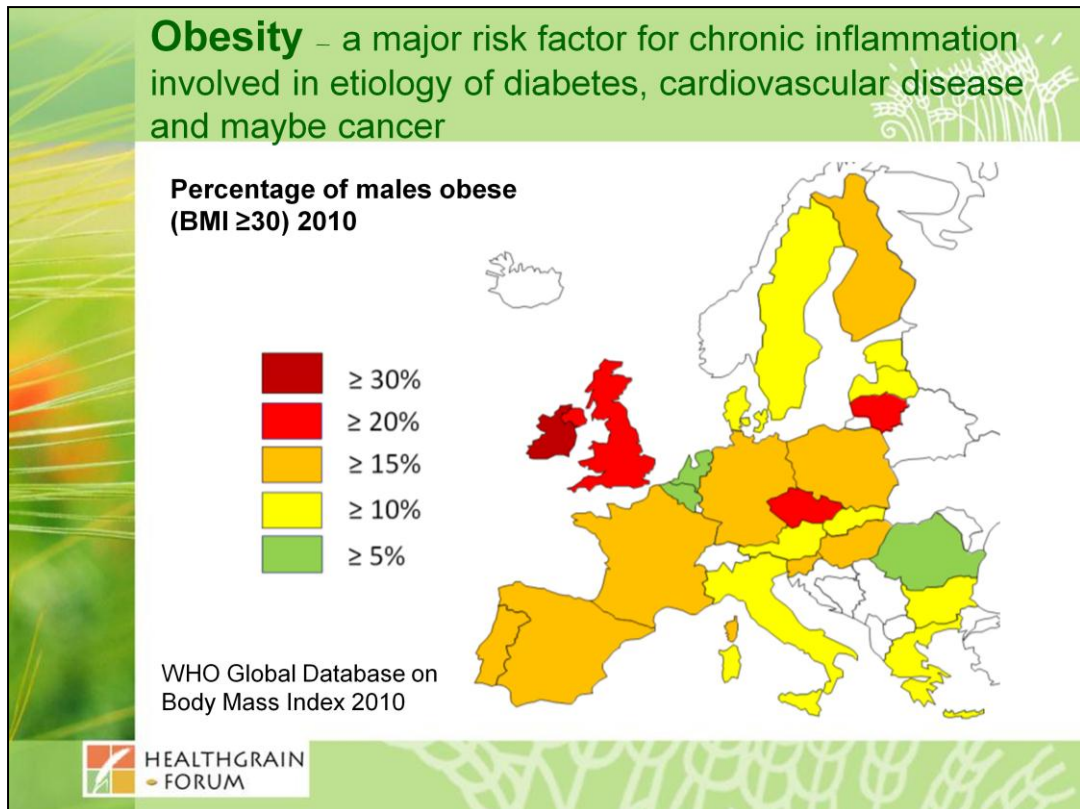
The data in the bars show the contribution of micronutrients from wheat germ, crude, to the RDA (*Directive 2008/100/EC*).

For instance, 100g of crude wheat germ contributes to 64% of the RDA on magnesium.

	Wheat germ, crude	Recommended Daily Allowances (RDA) (Directive 2008/100/EC)	%RDA wheat germ, crude
Thiamin (mg)	1,882	1,1	171
Zinc (mg)	12,29	10	123
Phosphorus (mg)	842	700	120
Vitamin B-6 (mg)	1,3	1,4	93
Magnesium (mg)	239	375	64
Iron (mg)	6,26	14	45
Potassium (mg)	892	2000	45
Niacin (mg)	6,813	16	43
Riboflavin (mg)	0,499	1,4	36
Calcium (mg)	39	800	5

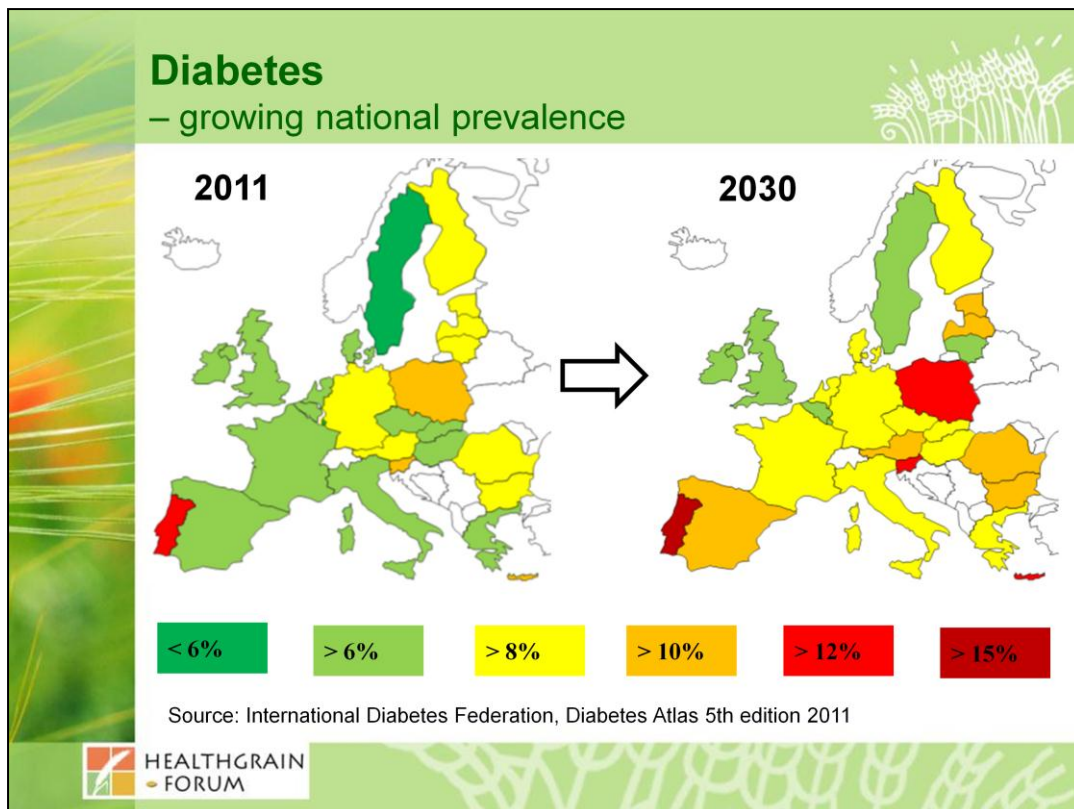


- On average, overweight affects between 25-80% of adults in the EU
- In Ireland, more than 80% of all males are overweight
- In Germany, 75% of the male population
- Approximately 20% of all EU children and adolescents are overweight and a third of these are obese (*Fact sheet 5 - Childhood obesity surveillance in the WHO European Region*).



- Obesity affects 10-30% of adults in the EU
- 31% of all males in Ireland are obese
- 23,89 % of all males in the Czech Republic are obese
- 22,3 of all males in the UK are obese
- In addition to causing various physical disabilities and psychological problems, excess weight drastically increases a person's risk of developing a number of non-communicable diseases (NCDs), including cardiovascular disease, cancer and diabetes. The risk of developing more than one of these diseases (co-morbidity) also increases with increasing body weight (*WHO-Obesity, European Region*).

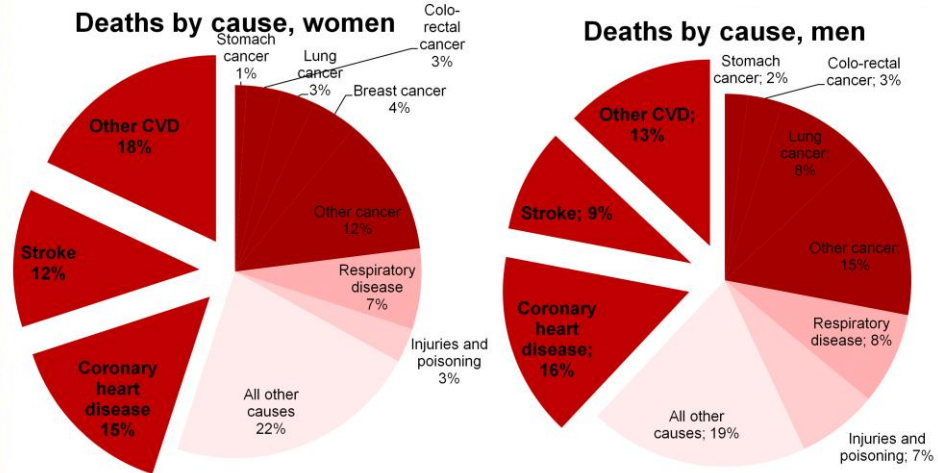
The results of studies on health benefits of whole grain presented in this and subsequent slides are being used widely for dietary recommendations. However, more research is needed for elucidation of mechanisms contributing to risk reduction and for obtaining more information on physiological effects of different cereal grains, products thereof and of bioactive compounds such as dietary fibre, and all other compounds mentioned in slide 17.



Main differences in the national prevalence of diabetes from 2011-2030:

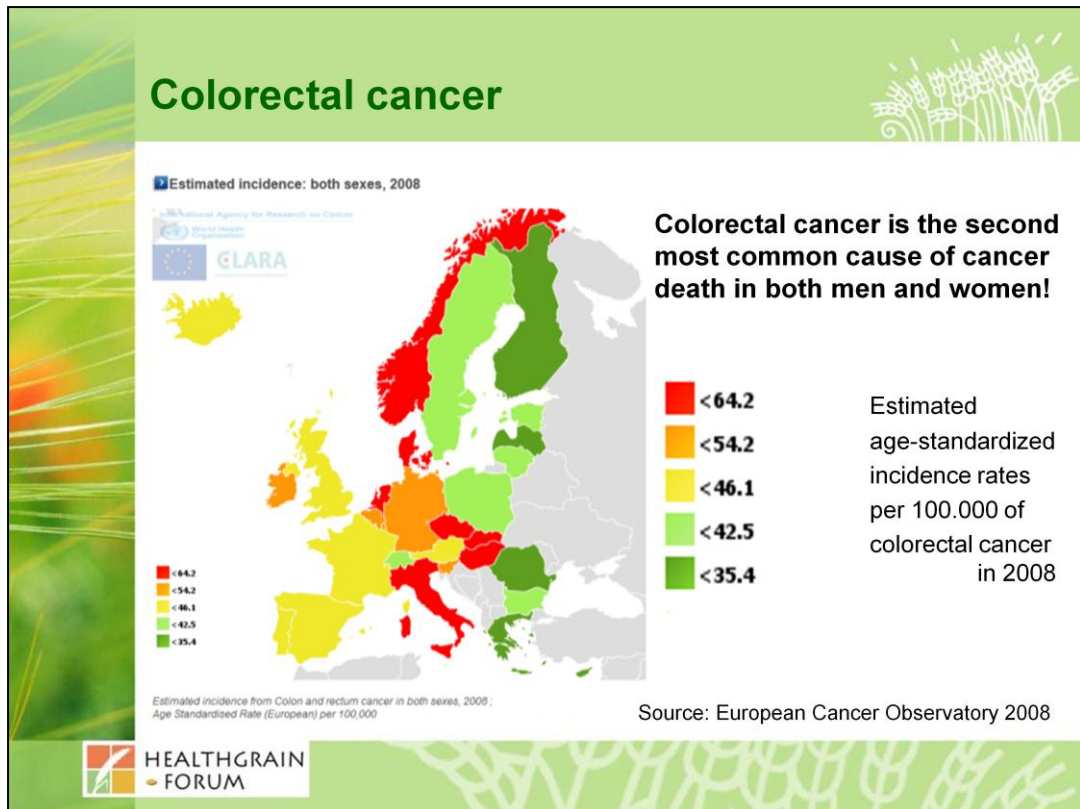
- In 2011 there are no EU countries in the upper red category
- In 2030 it is estimated that the prevalence of diabetes in Portugal will have arisen to more than 15% of the national population.
- In 2030 the national prevalence of diabetes in Cyprus, Slovenia and Poland is estimated to lie between 12-15% of the population
- In 2030 no EU countries are estimated to account for a national prevalence of diabetes below 6%.

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)



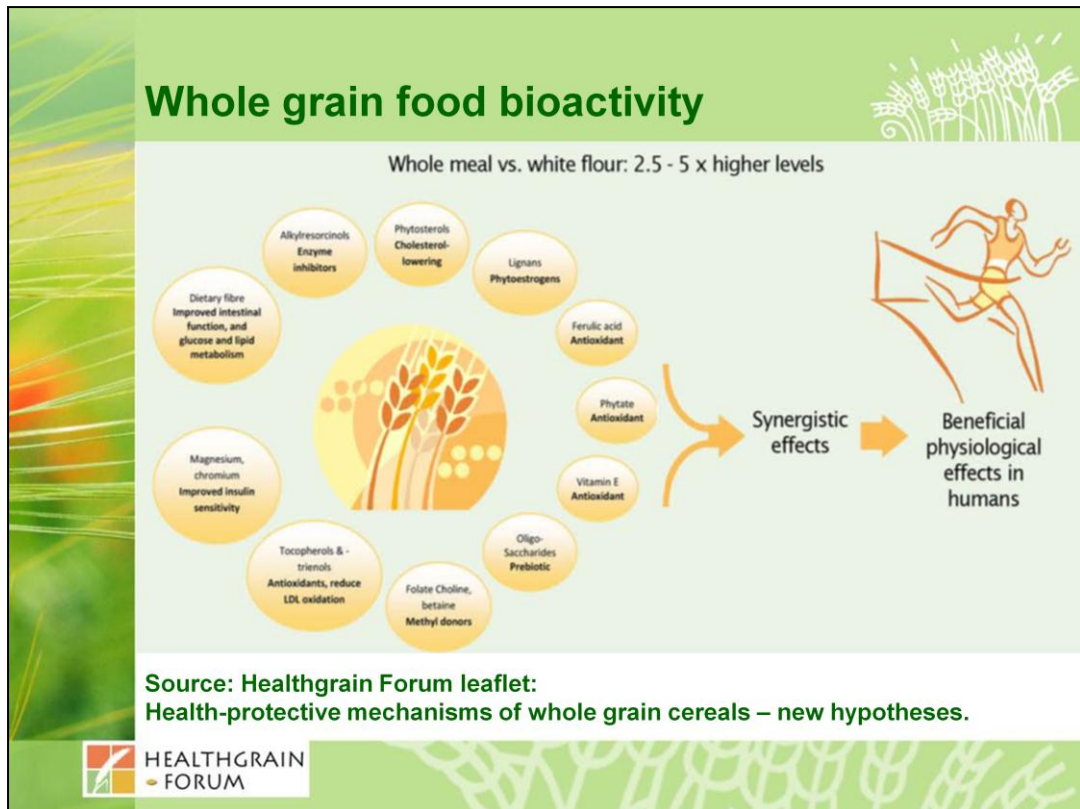
- In 2008, 2.5 million people were diagnosed with cancer in the European Union (EU27). Cancer is also the second most common cause of death in the EU (29% of deaths for men or 3 out of 10 deaths, 23% for women or 2 out of 10 deaths) – a figure that is expected to rise due to the ageing European population. The most frequently occurring forms of the disease in the EU are colorectal, breast, prostate and lung cancers. In both men and women, colorectal cancer is the second most common cause of cancer death (*European Commission* http://ec.europa.eu/health/major_chronic_diseases/diseases/cancer/index_en.htm)

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

Source: Hauner et al. Ann Nutr Metab 2012;60 (suppl 1):1–58.



In the Healthgrain Forum leaflet „*Health-protective mechanisms of whole grain cereals – new hypotheses*“, prepared by Dr A. Fardet, it is suggested that:

„The contents of individual bioactive compounds in whole grain may seem too low for them to have any significant or lasting physiological effects. It is becoming more and more evident that the synergetic action of several bioactive compounds contributes to health protection and/or the maintenance of one physiological function, not just one compound.“

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

Jeroen S. L. de Munter^{1,2}, Frank B. Hu^{1,3,4}, Donna Spiegelman^{3,5}, Mary Franz¹, Rob M. van Dam^{1,2,4*}

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)

Source: PLoS Medicine 2007;4(8):e261




In the article by *de Munter et al. (2007)* the authors evaluate intakes of whole grain, bran and germ in relation to type 2 diabetes in prospective cohort studies.

The authors followed 161,737 US women of the Nurses' Health Studies (NHSs) I and II, without history of diabetes, cardiovascular disease, or cancer at baseline. The age at baseline was 37–65 y for NHSI and 26–46 y for NHSII. Dietary intakes and potential confounders were assessed with regularly administered questionnaires. They documented 6,486 cases of type 2 diabetes during 12–18 y of follow-up. Other prospective cohort studies on whole grain intake and risk of type 2 diabetes were identified in searches of MEDLINE and EMBASE up to January 2007, and data were independently extracted by two reviewers. The median whole grain intake in the lowest and highest quintile of intake was, respectively, 3.7 and 31.2 g/d for NHSI and 6.2 and 39.9 g/d for NHSII. After adjustment for potential confounders, the relative risks (RRs) for the highest as compared with the lowest quintile of whole grain intake was 0.63 (95% confidence interval [CI] 0.57–0.69) for NHSI and 0.68 (95% CI 0.57–0.81) for NHSII (both: *p*-value, test for trend <0.001). After further adjustment for body mass index (BMI), these RRs were 0.75 (95% CI 0.68–0.83; *p*-value, test for trend <0.001) and 0.86 (95% CI 0.72–1.02; *p*-value, test for trend 0.03) respectively. Associations for bran intake were similar to those for total whole grain intake, whereas no significant association was observed for germ intake after adjustment for bran. Based on pooled data for six cohort studies including 286,125 participants and 10,944 cases of type 2 diabetes, a two-serving-per-day increment in whole grain consumption was associated with a 21% (95% CI 13%–28%) decrease in risk of type 2 diabetes after adjustment for potential confounders and BMI.


The US Department of Agriculture defines one serving of whole grains as 16g of whole grain ingredients, the equivalent of the content of a 28.4g slice of 100% whole wheat bread (*de Munter et al. 1393*).

Nutrition, Metabolism & Cardiovascular Diseases (2008) 18, 283–290

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www.elsevier.com/locate/nmcd





Whole grain intake and cardiovascular disease: A meta-analysis

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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%

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The authors have identified observational studies that evaluated the association between whole grain intake and clinical cardiovascular events and found that the inverse relationship has been consistently demonstrated in multiple observational studies. In analyses reflecting cardiovascular events from over 149,000 participants, they found that consumption of 2.5 servings of whole grains was associated with a 21% lower risk of incident CVD compared to 0.2 servings/day.

Dietary fibre, whole grains, and risk of colorectal cancer: systematic review and dose-response meta-analysis of prospective studies

 OPEN ACCESS

Dagfinn Aune *research associate*¹, Doris S M Chan *research associate*¹, Rosa Lau *research associate*¹, Rui Vieira *data manager*¹, Darren C Greenwood *senior lecturer in biostatistics*², Ellen Kampman *professor of diet and cancer*³, Teresa Norat *principal investigator*¹

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BMJ/2011;343:d6617 doi: 10.1136/bmj.d6617 (Published 10 November 2011)

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- 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.


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In a systematic review (*PubMed*), seven studies were included in the study of total whole grain (including whole grain rye breads, whole grain breads, oatmeal, whole grain cereals, high fibre cereals, brown rice, and porridge) intake and risk of colorectal cancer.



Nutrition, Metabolism and Cardiovascular Diseases

Volume 21, Issue 12, December 2011, Pages 901-908





Viewpoint

Whole grain intake in relation to body weight: From epidemiological evidence to clinical trials

R. Giacco^a, G. Della Pepa^b, D. Luongo^c, G. Riccardi^b

□ "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".



Annals of
Nutrition & Metabolism

Ann Nutr Metab 2012;60(suppl 1):1-58
DOI: [10.1159/000335326](https://doi.org/10.1159/000335326)


Published online: January 23, 2012

Evidence-Based Guideline of the German Nutrition Society: Carbohydrate Intake and Prevention of Nutrition-Related Diseases

Hans Hauner^a Angela Bechthold^b Heiner Boeing^c Anja Brönstrup^b
Anette Buyken^d Eva Leschik-Bonnet^b Jakob Linseisen^e Matthias Schulze^c
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- 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.

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In a systematic literature review Hauner et al. investigate the relationship between the quantity and quality of carbohydrate intake and the development of nutrition-related diseases.

- Relationship between intake of dietary fibre and whole grains and diabetes (Hauner et al. p.19): The prospective cohort studies indicate with high consistency that high intake of whole-grain products or dietary fibre from cereal products, respectively, causes a lower risk of diabetes. The evidence regarding this association is judged as probable .

- According to a Cochrane review including 10 controlled intervention studies with a duration of 4-8 weeks, the consumption of whole grain products (8 of them oat-meal based) resulted in significant decrease in the plasma total cholesterol concentration compared with the control diet. The plasma concentration of LDL cholesterol, too, was significantly lower at the end of the studies than the baseline (Hauner et al., p.29)

- In conclusion: With probable evidence, high total dietary fibre intake lowers the risk of obesity in adults, as well as of hypertension and CHD. There is possible evidence that a high total dietary fibre intake lowers the risk of dyslipoproteinaemia (by lowering total and LDL cholesterol concentrations) and of colorectal cancer. High intake of dietary fibre from cereal products lowers the risk of type 2 diabetes mellitus and of colorectal cancer with probable evidence; the risk of CHD and stomach cancer is lowered with possible evidence. If only whole grain products are considered, there is probable evidence that a high intake reduces the risk of type 2 diabetes mellitus, hypertension and CHD. A high intake of whole-grain products lowers the concentrations of total and LDL cholesterol with convincing evidence (Hauner et al., p.49).


- The scientific evidence for overweight/obesity is less strong compared to CVD and diabetes type 2. Here more research is needed.

Whole grain foods supply food components that help maintain health



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Recommended whole grain consumption	
National recommendations for a 2,000 kcal diet	
USA	3 servings (= 48g) or more of whole grains every day (DM, dry matter) (2010 Dietary Guidelines for Americans).
Denmark/Sweden	62g whole grain (DM) daily (National Food Institute/ National Food Administration)
Netherlands	6 slices of bread daily, preferably whole grain \approx 115g whole grain (DM) (Netherlands Nutrition Centre)
Germany	“At least 30g of dietary fibre daily, especially from whole-grain products, are recommended” (German Nutrition Society (DGE))
Switzerland	At least 2 portions daily of whole grain products (Swiss Society for Nutrition Food Pyramid)

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The national recommendations as presented here are based on a 2,000 kcal diet which is the approved EU guideline for the average population. Whole grain is the preferred way for fibre intake (Germany). The same is the case for the Netherlands where a high whole grain bread consumption is based on the official policy of high fibre intake from grains, fruits and vegetables.

How to identify whole grain foods



Look for the word
„whole“
on the package

- „whole grains“
- „whole wheat“
- „whole wheat flour“
- „whole oats“
- „whole barley“

Look at the list of
ingredients

Cracker made with whole grains:

Cereals 94,5% (**whole wheat flour 54%**, wheat flour 37,5%, wheat bran), vegetable fat, yeast, whole milk powder, salt, barley malt extract, raising agent (sodium hydrogencarbonate).

Look for a logo on the
packaging



Whole grain sources	
Cereals	Wheats , including spelt, emmer, faro, einkorn, kamut, durum s
	Rice
	Barley , including hull-less or naked barley but not pearled
	Maize (corn)
	Rye
	Oats , including hull-less or naked oats
	Millet s
	Sorghum
	Teff (tef)
	Triticale
	Canary seeds
	Job's tears
	Fonio , black fonio, Asian millet
	Wild rice
	Pseudo-cereals
Buckwheat, tartar buckwheat	
Quinoa	



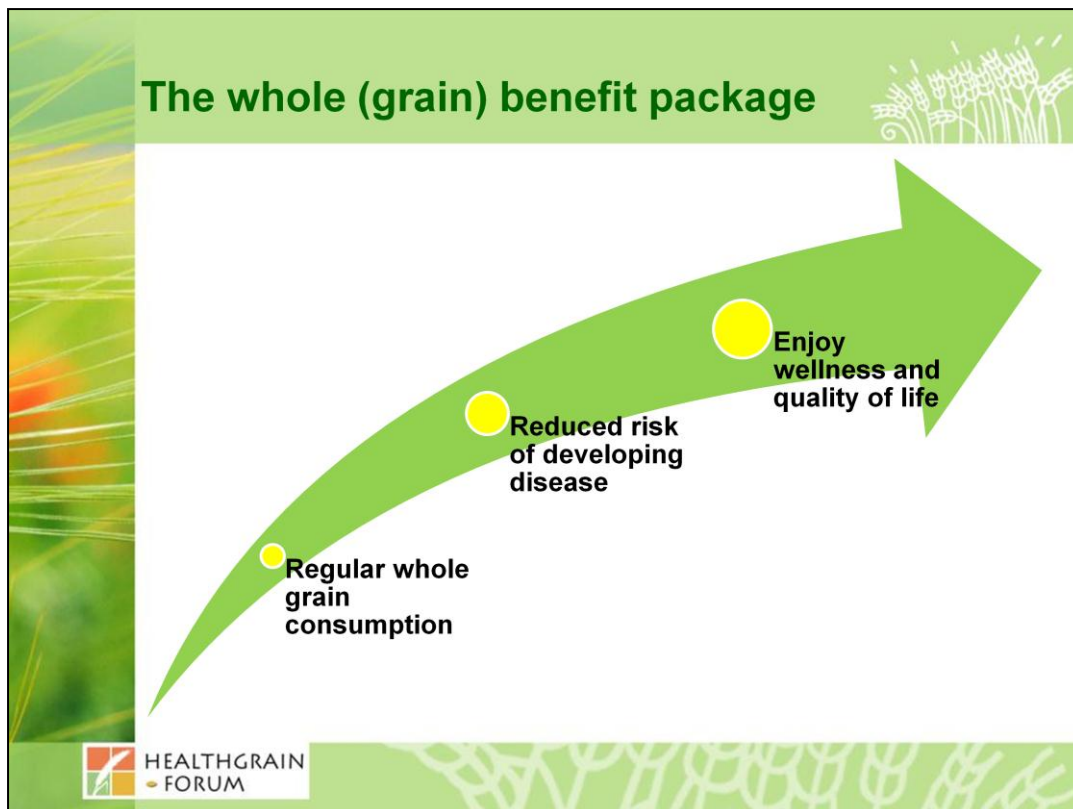
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Source: Healthgrain Consortium
Wholegrain definition (2010)

How to increase the everyday consumption of whole grain foods



Breakfast cereals made with whole grain	<ul style="list-style-type: none"> ▪ Whole oat flakes ▪ Porridge ▪ Whole grain müsli ▪ Certain breakfast cereals
Bread made with whole grain	<ul style="list-style-type: none"> ▪ Whole grain wheat bread ▪ Rye bread (e.g. Pumpernickel) ▪ Certain bread substitutes (rusks, crackers)
Biscuits and other snacks made with whole grain	<ul style="list-style-type: none"> ▪ Whole rice or oat cakes ▪ Certain biscuits and snacks ▪ Certain cereal bars
Flours made with whole grain	<ul style="list-style-type: none"> ▪ Whole wheat flour ▪ Buckwheat flour ▪ Whole rye and barley flour
Side dishes made with whole grain	<ul style="list-style-type: none"> ▪ Brown rice ▪ Whole wheat pasta



THANK YOU FOR YOUR ATTENTION!

For more information please visit www.healthgrain.org



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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) 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:

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