



Health Benefits of Whole Grains and the Role of Intact Grains

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Disclosures



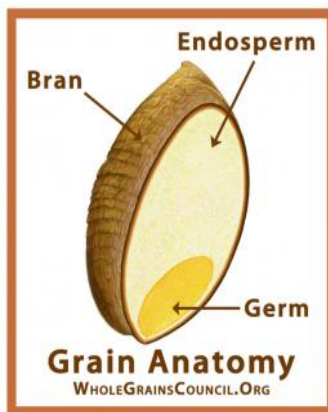
- ❑ Supported in part by an Investigator-Initiated Research Grant from the General Mills Bell Institute of Health and Nutrition
- ❑ Funding from ILSI-North America
- ❑ Scientific Advisor for the Whole Grains Council
- ❑ All views expressed in this talk are my own



Outline



- ❑ What are whole grains?
- ❑ Why do we need whole grains in our diet?
- ❑ How much whole grain do we consume?
- ❑ How do they vary in nutrient composition ?
- ❑ What do we know about whole grains & health?



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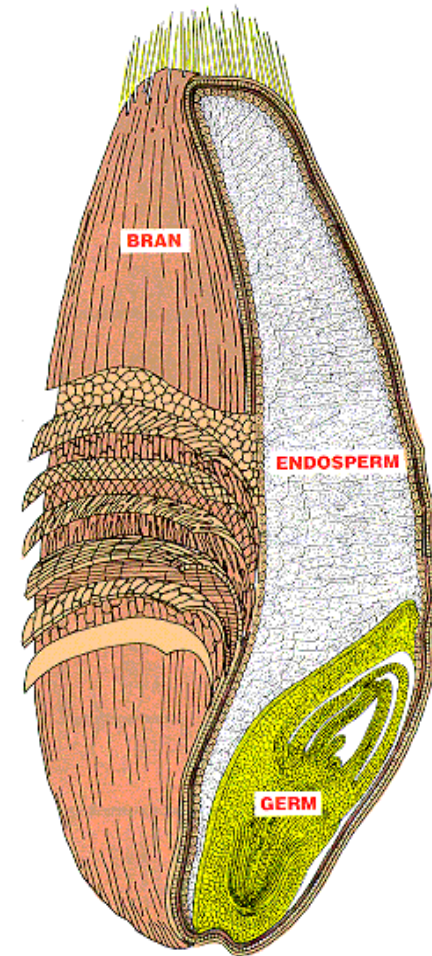


What is a Whole Grain?

❑ American Association of Cereal Chemists International (AACCI) :

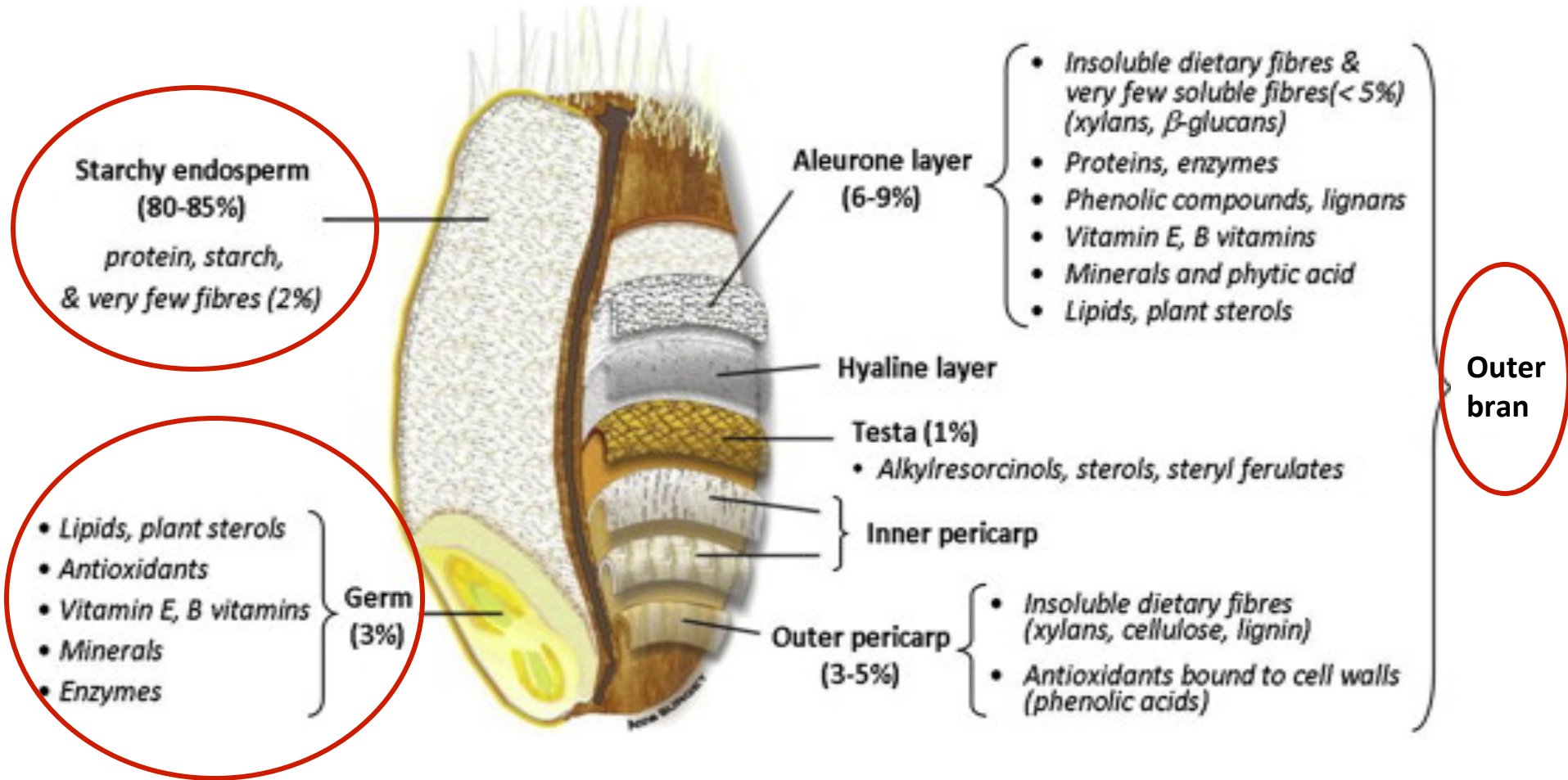
“Whole grains shall consist of the intact, ground, cracked or flaked kernel (caryopsis), whose principal anatomical components – the starchy endosperm, germ and bran – are present in the same relative proportions as they exist in the intact caryopsis”

This definition means that 100% of the original kernel – all of the bran, germ, and endosperm – must be present to qualify as a whole grain



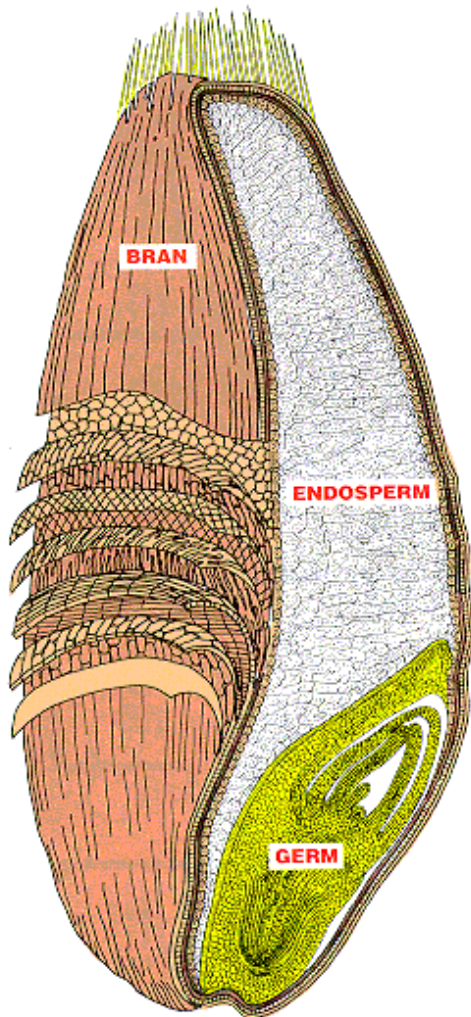
<http://www.aaccnet.org/definitions/wholegrain.asp>

Whole Grain Kernel is Nutrient Dense



Brouns et al. (2013); Surget & Barron (2005)

Effects of Grain Milling (i.e., removal of the bran and germ)



Whole vs. Refined Grain Wheat Flour

Protein	↓ 14%
Fiber	↓ 83%
Magnesium	↓ 81%
Manganese	↓ 75%
Potassium	↓ 75%
Vitamin E	↓ 95%
Vitamin B6	↓ 87%
Folate	↑ 250%*
Thiamine	↑ 80%*
Iron	↑ 10%*

*Increased due to enrichment of cereal grain products

True Grains

(*Poaceae* or *Gramineous* family)

- Wheat
 - Spelt
 - Farro
 - Kamut
 - Einkorn
- Oats
- Brown Rice
- Corn (maize, popcorn)
- Barley (hulled)
- Rye
- Canary Seed
- Millet
- Wild rice
- Triticale
- Sorghum
- Teff
- Fonio
- Job's Tears

Gluten Free

Pseudocereal Grains

“.... are not botanically true grains but are typically associated with the grain family due to **their similar composition**”

- Amaranth*
- Buckwheat*
- Quinoa*

** Gluten Free*



Eat a Variety of Grains

Oats *



High in β -glucans

Rich in mono- and pufa acids, oligosaccharides, plant sterols and other phytochemicals

Excellent source of magnesium, phosphorus, manganese

Linked to lower risk of CVD risk factors

Kamut / Khorasan wheat

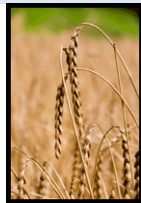


Higher in protein compare to other wheats

Excellent source of selenium and zinc

Lower lipids/reduce inflammation

Rye



High in fiber, high antioxidant activity

Rich in bioactive compounds

Linked to lower risk of CVD risk factors

Barley



Soluble fiber β -glucan

Linked to lower risk of CVD risk factors

* Gluten Free

Ancient Grains Are Making a Comeback

- ❑ Grains that have survived intact for centuries and are not altered by modern plant science breeding practices
- ❑ 44% of adults reported eating an ancient grain in the past 3 months

Ancient Grains

Amaranth*



Staple grain of the Aztecs, eat toasted or puffed as cereal

High in phytosterols (cholesterol lowering properties); Mineral rich (high in calcium, iron, magnesium, phosphorus, and potassium); Excellent protein source

Quinoa*



Cultivated in pre-Columbian Andes region. Eat as a grain dish like rice

Complete protein source (lysine and isoleucine)
High in MUFAs
Mineral rich

Buckwheat *



Used as a breakfast grain, in soba noodles, or in cold salad

Good source of magnesium and fiber
Excellent protein source
Lower glycemic index
Prebiotic-like benefits?

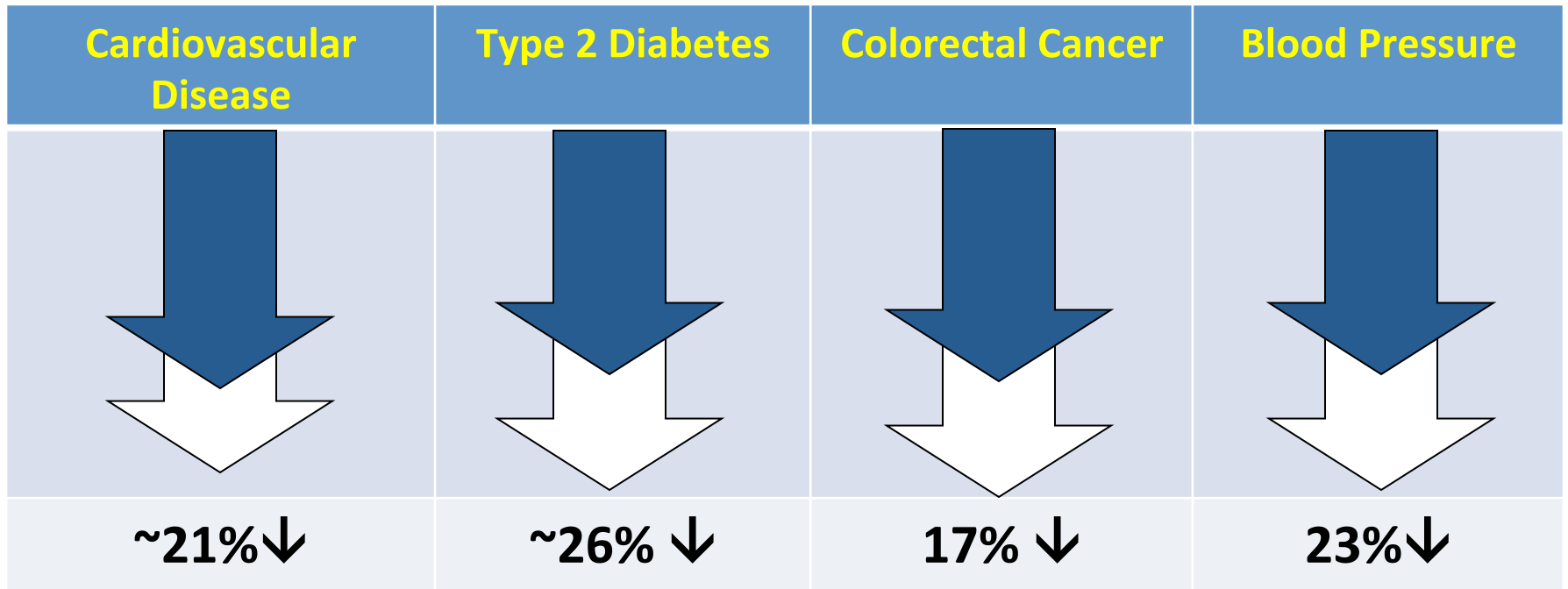
Teff *



Ethiopian injera bread, often used as a gluten-free flour

Calcium (1 cup=123 mg)
High in vitamin C
Resistant starch, iron

Health Benefits of Whole Grains



Ye, et al J Nutr (2012); Dagfinn et al. BMJ (2011)

Whole Grains Are Food For Our Microbiota

Whole grains provide **dietary fiber, oligofructose and resistant starch** that are available to the gut microbes (↑ bifidobacteria)

- ❑ ↑ Fecal Bulk
- ❑ ↑ Transit time
- ❑ ↑ SCFA production (butyrate)
- ❑ ↓ pH
- ❑ Modulation of immunity
- ❑ Modulation of inflammation
- ❑ Enhance the bioavailability and uptake of minerals (Ca, Mg, Fe)

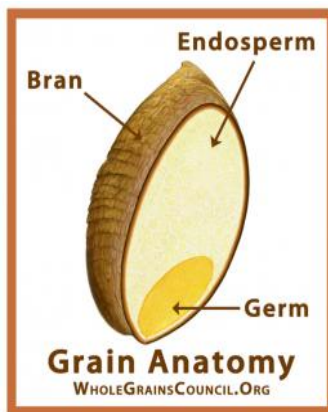


Let's not starve our Microbes!

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Current Dietary Recommendations

“...all adults eat at least half their grains as whole grains – that's at least 3 to 5 servings of whole grain”



Easy to Achieve

- ❑ 1/2 cup cooked oatmeal
- ❑ 1/2 cup cooked 100% whole-grain pasta
- ❑ 1/2 cup cooked brown rice or whole-grain barley or any other cooked whole grain
- ❑ 1 regular slice of 100% whole-grain bread
- ❑ 1 cup of whole-grain ready-to-eat cereal (flakes or rounds) or 1¼ cup puffed



Yet most people are not consuming enough whole grains!

Whole Grain Consumption NHANES 2009-10

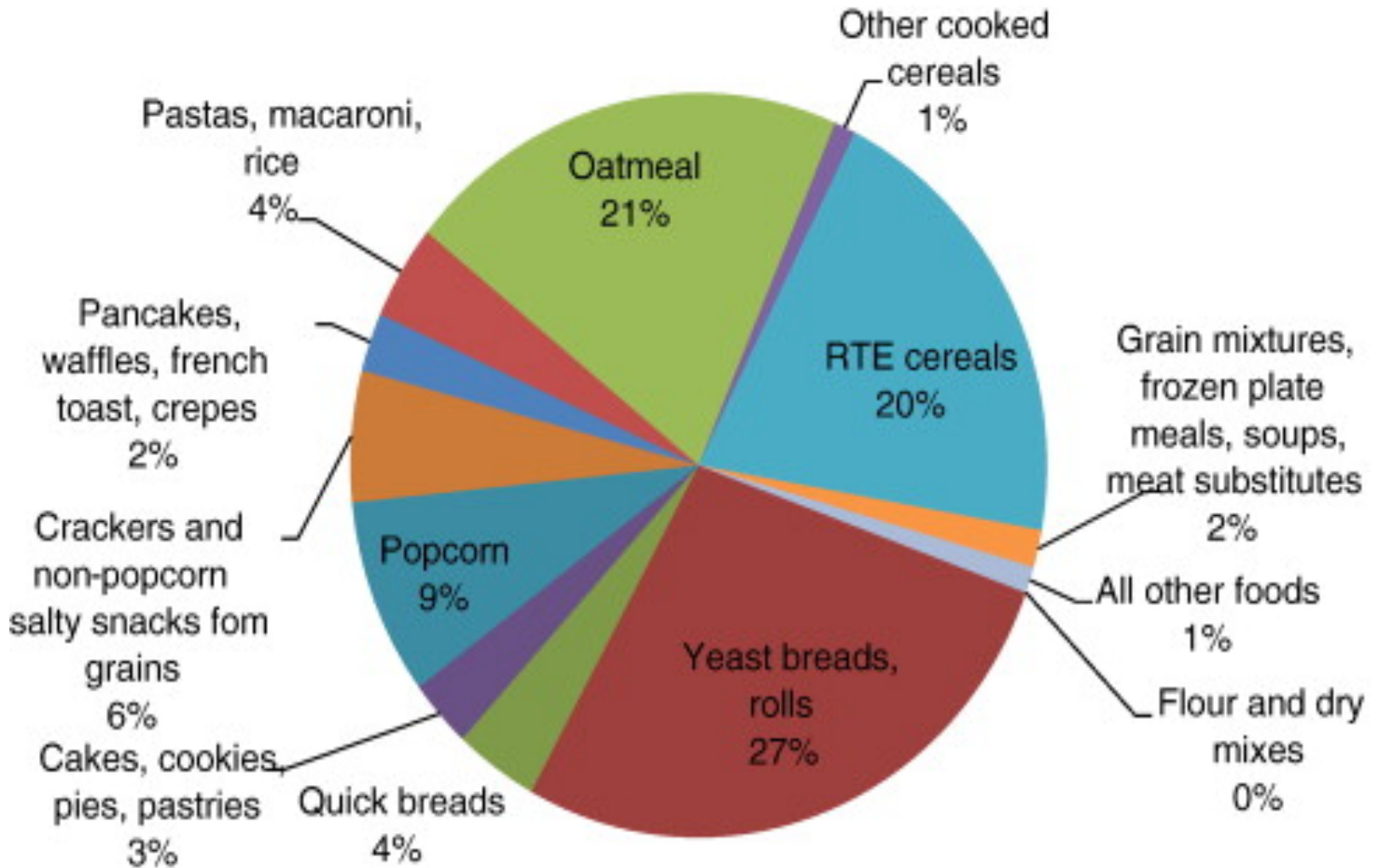
(Reicks et al Nutr Res. 2014;34:226)

	WG intake group (oz eq*/d)		
	None (0)	Low (>0-<3)	High (≥3)
Children/adolescents	n = 1321	n = 1720	n = 83
Mean	0.0	0.79	3.99
Percentage	38.8	58.3	2.9
Adults	n = 2677	n = 2853	n = 388
Mean ± SE	0.0	0.96	4.38
Percentage	41.9	50.4	7.7

*Ounce equivalent serving size: 1/2 cup cooked brown rice, hot cereal, such as oatmeal or other cooked grain; 1 slice 100% whole grain bread; 1 cup 100% whole grain ready-to-eat cereal.

Whole Grain Food Sources - NHANES 2009-10

(Reicks et al Nutr Res. 2014;34:226)

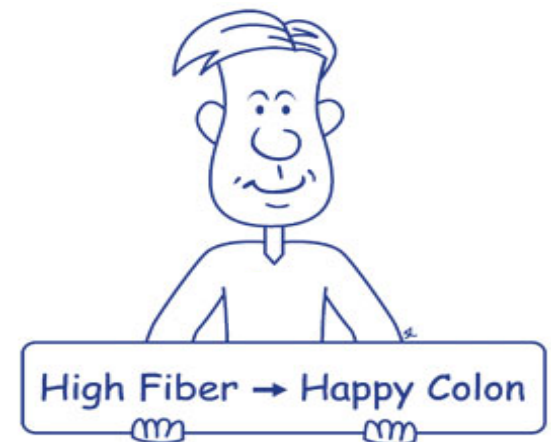


Increase Consumer Awareness of Differences Between Intact (minimally processed) versus Processed Whole Grains



Eat more Whole Grains that Are Intact (Natural) Grains (i.e Minimally Processed)

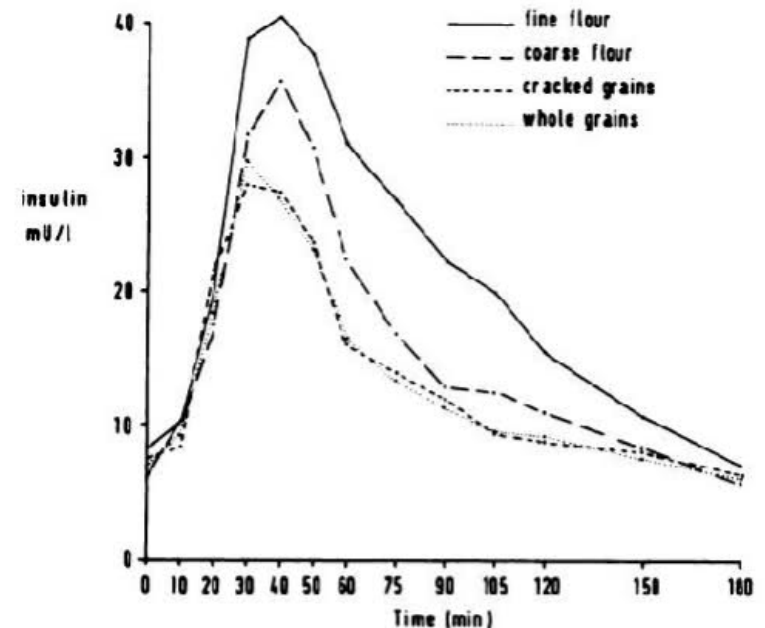
- ❑ Unmilled and intact grains provide nutrient-rich fibers, nutrients, and phytochemicals but also **provide benefits attributable to their physical form**
- ❑ Evidence suggests that the **physical form** of undigested food particles may be more important (than either the fermentation or water-holding capacity of fiber) in **controlling stool bulk**
- ❑ **Intact seeds** prevents the digestive enzymes from reaching the nutrient-rich germ and starchy endosperm which helps **deliver substrates to the gut for bacteria fermentation**



Eat more Whole Grains that Are Intact (Natural) Grains (i.e Minimally Processed)

☐ Controlled metabolic studies on whole grain wheat showed that breads including whole kernels **increased satiety** more than breads made with whole grain flour.

☐ Preservation of the intact botanical structure of cereal grains has been shown to **lower the insulin response**



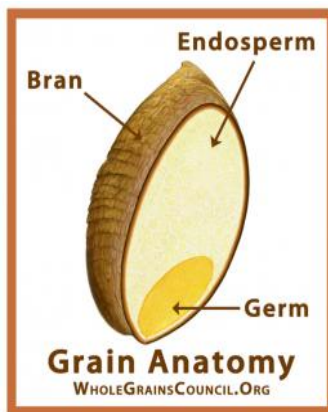
Mean plasma insulin concentration in 10 normal subjects after four isocaloric whole-wheat meals of different particle size. (1 mU/L = 7.175 pmol/L.)

Heaton et al (1988); Holm et al (1992);
Hiebowicz et al. 2008

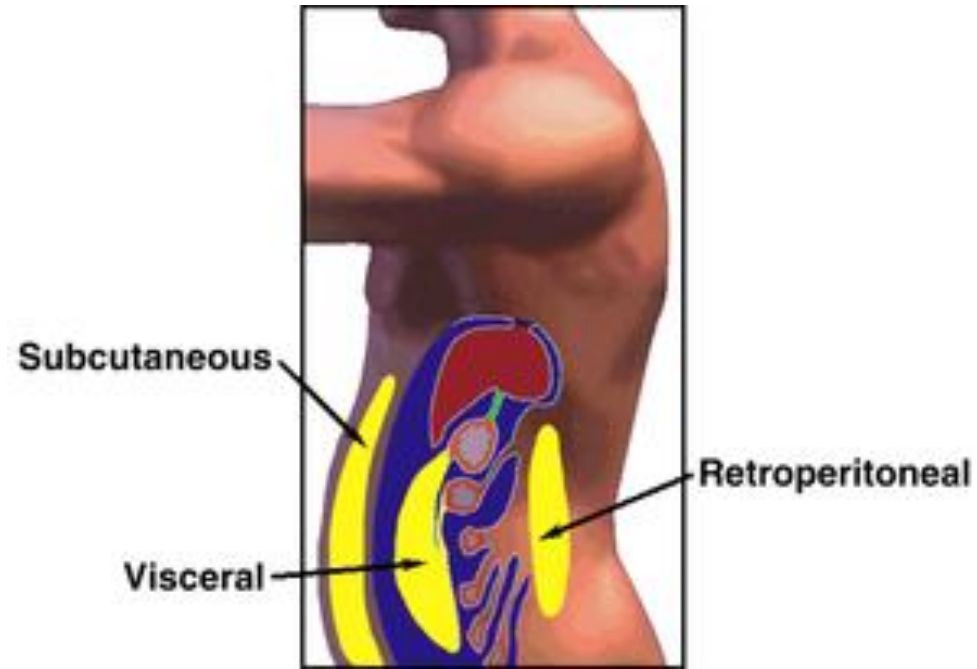
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Abdominal Obesity: The Critical Adipose Depot



↑ Dyslipidemic

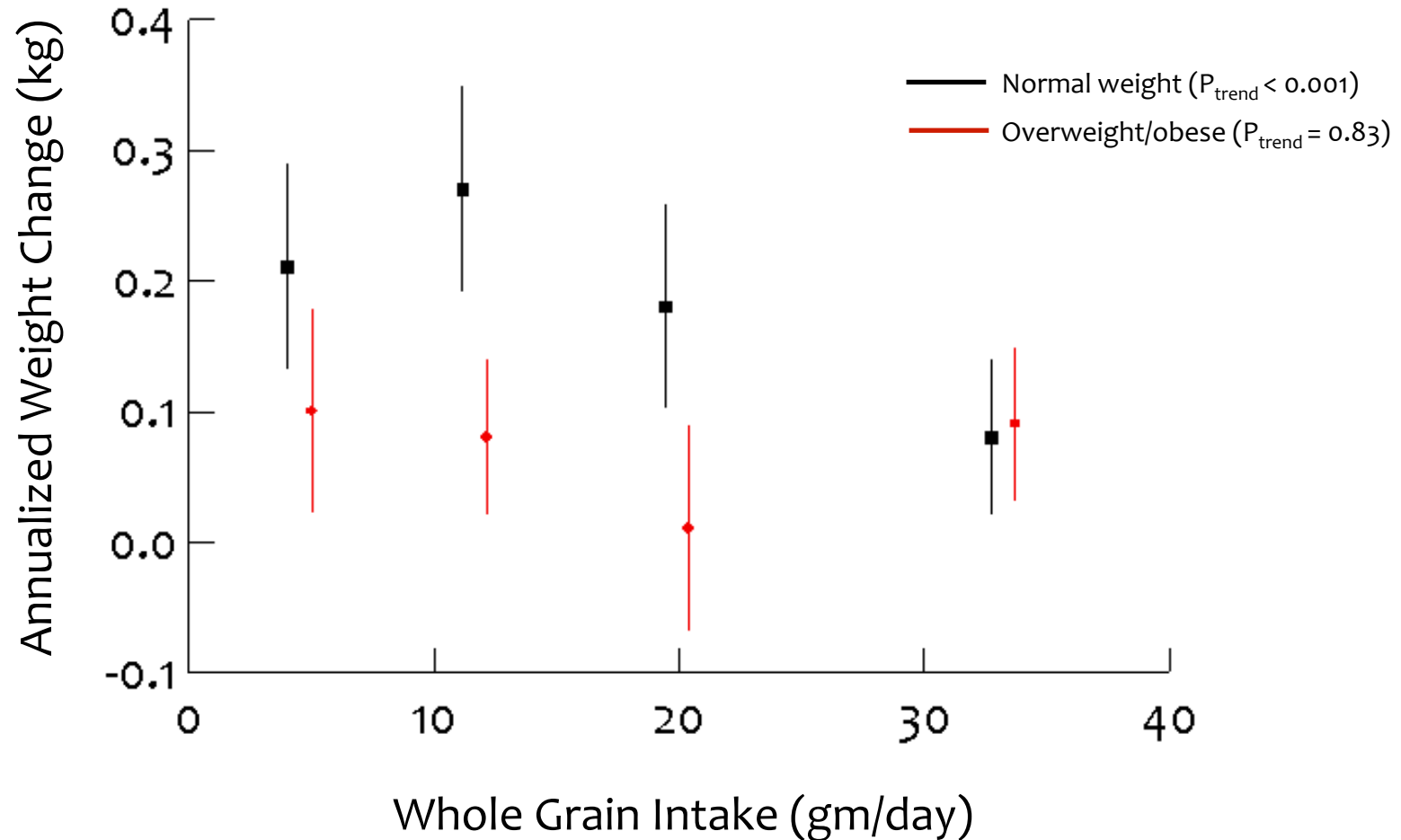
↑ Blood Pressure

↑ Inflammation

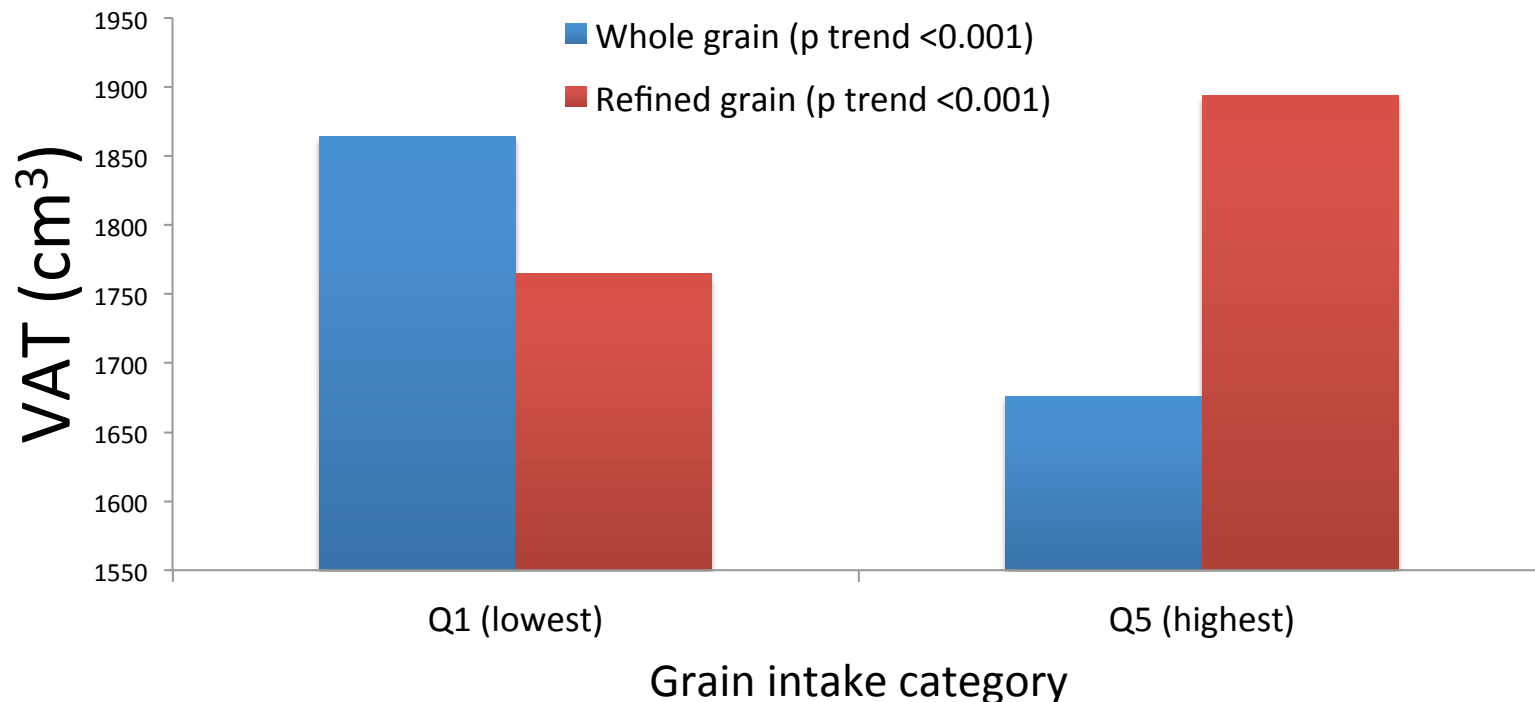
↑ Insulin resistance

Després J et al. *Arterioscler Thromb Vasc Biol.* 2008;28:1039-1049.

People Who Eat More Whole Grains Gain Less Weight



People Who Eat More Whole Grains Have Less Visceral Abdominal Fat

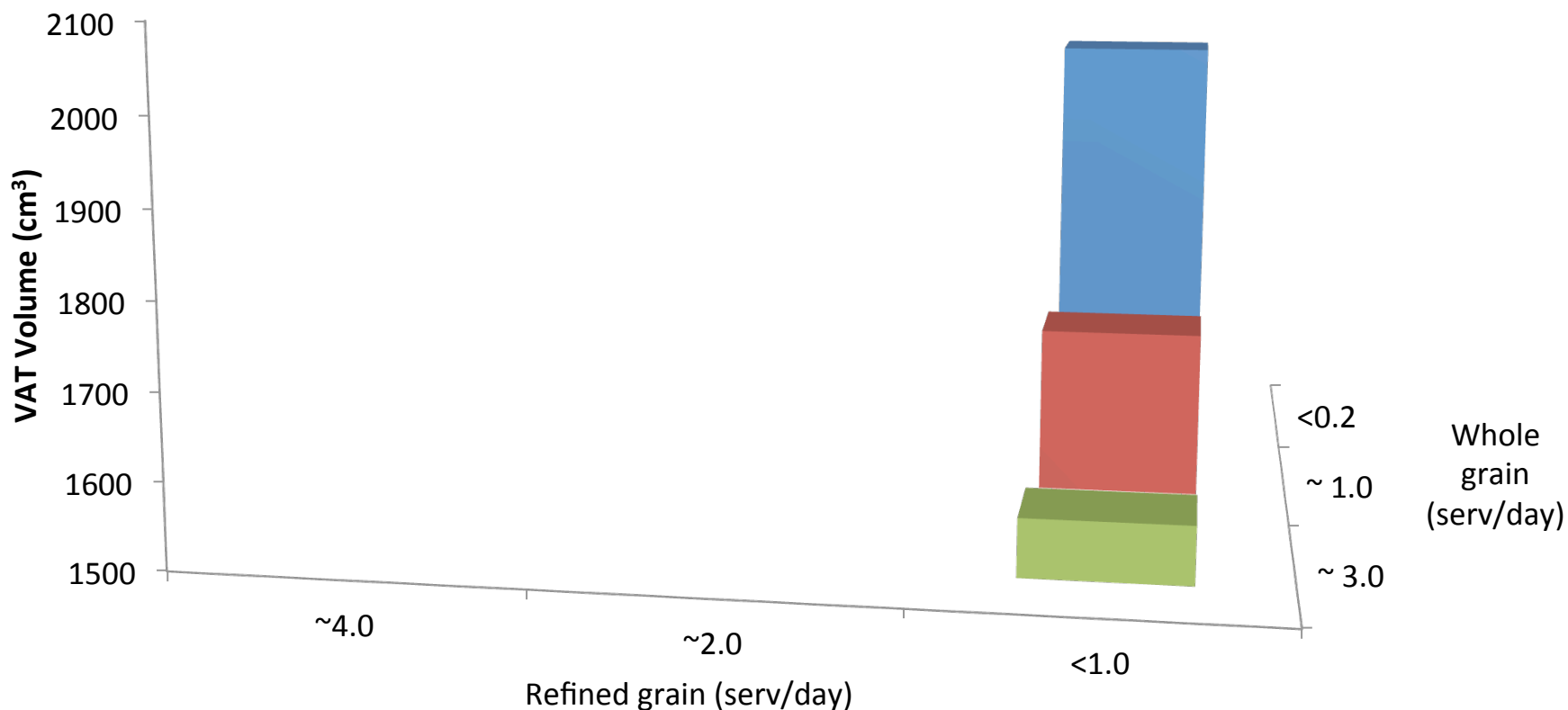


Mean multivariate-adjusted* VAT by whole and refined intake quintile categories

McKeown et al. AJCN 2010 Nov;92(5):1165-71

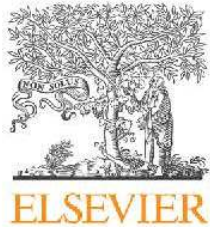
*adjusted for age, sex, smoking status, total energy, alcohol intake, SAT

Substitute Whole Grains for Refined Grains for Lower VAT



McKeown et al. AJCN 2010 Nov;92(5):1165-71

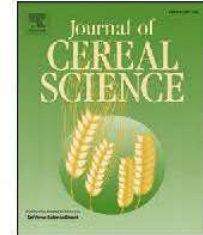
Whole Grains & Obesity Conclusion



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Review

Does wheat make us fat and sick?☆

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“Based on the available evidence, we conclude that whole-wheat consumption cannot be linked to increased prevalence of obesity in the general population”

OBESITY HAS A MULTIFACTORIAL CAUSATION

The Balance Between Unhealthy & Healthy Carbohydrates: The Scales Have Been Tipped



Dietary Fiber

38 grams for men

25 grams for women

Average intake is 15g/d



Whole Grains

3 or more servings/d

Average intake is 1 serving



Added Sugars

100 to 150 calories per day

- 25% or less of calories

Average intake is ~350 kcal/d



Refined grains

Average intake is 3 serving



Dietary Advice on Whole Grains

- ❑ **Gluten free does not mean grain free**
Amaranth, buckwheat, corn, millet, most oats, quinoa, rice, sorghum, teff, wild rice
- ❑ **Replace refined grains with whole-grains**
- ❑ **Eat a variety of whole grains**
- ❑ **Try to incorporate intact grains into your diet!**

