Dietary Fiber: The Most Important Nutrient
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Katie Ferraro, MPH, RD, CDE

BIOGRAPHY:

Katie Ferraro is a Registered Dietitian, Certified Diabetes Educator, and an Assistant Clinical Professor of Nutrition at the UCSF School of Nursing and the School of Nursing at the University of San Diego. Katie specializes in nutrition education program and curriculum development and her professional areas of interest include diabetes education and dietary fiber. She is a Consultant Dietitian with the San Francisco Sheriff’s Department and the author of the forthcoming book “Diet Therapy for Advanced Practice Nurses” to be published by McGraw Hill later this year.

BIBLIOGRAPHY:

Welcome to the Future...of Fiber

Getting Friendly with Fiber: Today’s Talk Highlights

<table>
<thead>
<tr>
<th>What?</th>
<th>Introduction to nature's favorite nutrient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why?</td>
<td>Health benefits of a high fiber diet</td>
</tr>
<tr>
<td>Where?</td>
<td>Preferred sources of dietary fiber vs. “fake” fibers</td>
</tr>
<tr>
<td>How?</td>
<td>Meeting your individual fiber needs</td>
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</tbody>
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Did You Know?

- 65% of the world’s population live in countries where overweight and obesity kill more people than underweight
- More people are overweight than underweight in the world

Achieving Wellness

Proper Diet + Positive Lifestyle = Wellness

Poor Diet + Negative Lifestyle = Death & Disease

World Health Organization, Media Centre, Obesity and Overweight, May 2012
Centers for Disease Control and Prevention, 2011
The Cost of Poor Nutrition

<table>
<thead>
<tr>
<th>Chronic Disease Risk</th>
<th>Reduced Quality of Life</th>
<th>Significant Financial Impact</th>
</tr>
</thead>
</table>

What is Fiber?
- Plant matter
  - Not digested by human digestive enzymes
  - Some can be digested by GI tract bacteria
- Includes
  - Polysaccharides: cellulose, hemicellulose, pectins, gums, and mucilages
  - Nonpolysaccharide: lignins
- Classified as soluble or insoluble

Soluble vs. Insoluble Fiber

<table>
<thead>
<tr>
<th>Soluble Fiber</th>
<th>Insoluble Fiber</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolves in water</td>
<td>Does not dissolve in water</td>
</tr>
<tr>
<td>Can form gels</td>
<td>Does not form gels</td>
</tr>
<tr>
<td>Digested by gut bacteria</td>
<td>No gut bacteria activity</td>
</tr>
<tr>
<td>Pectins, gums, hemicelluloses</td>
<td>Cellulose, some hemic., lignin</td>
</tr>
<tr>
<td>Oats, apples, beans</td>
<td>Rye bran, broccoli, celery</td>
</tr>
<tr>
<td>Heart health</td>
<td>Gut health</td>
</tr>
</tbody>
</table>

Health Benefits of Dietary Fiber

<table>
<thead>
<tr>
<th>Health Benefit</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>Heart health</td>
<td>Lowers LDL, lowers total cholesterol, lowers TGs</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Stabilizes blood sugar regulation</td>
</tr>
<tr>
<td>Gut health</td>
<td>Alleviates constipation, hemorrhoids, diverticular disease</td>
</tr>
<tr>
<td>Cancer</td>
<td>High fruit/vegetable intake implicated in cancer prevention</td>
</tr>
<tr>
<td>Weight</td>
<td>Promotes satiety</td>
</tr>
</tbody>
</table>
Fiber and Heart Health

- Soluble fiber associated with ↓ CVD risk
- Viscous soluble fibers modestly ↓ LDL
- Occurs in conjunction with diet ↓ in saturated fat and trans fat and cholesterol

Soluble Fiber and Heart Health

Soluble fiber improves hyperlipidemia through combined effects of:
- ↓ gastric emptying
- ↑ excretion of bile acids
- ↓ hepatic cholesterol synthesis

Soluble Fiber: Gastric Emptying

↓ gastric emptying
- Soluble fiber-containing foods take longer to digest
- Plays role on satiety and weight control
- May also have beneficial effect on insulin sensitivity

Soluble Fiber: Bile Acid Excretion

↑ excretion of bile acids
- Soluble fiber binds with bile acids in small intestine and remove from the body
- This reduces rate of bile acid recycling
- The loss of bile acids in stool stimulates liver to ↑ uptake from circulation to replenish supply
- Result: serum total and LDL cholesterol are ↓ (but HDL and triglycerides are generally unaffected)
Soluble Fiber: Hepatic Chol Synthesis

↓ hepatic cholesterol synthesis
- Some soluble fibers belong to class of compounds called oligosaccharides
- These are fermented in the lower gut into short-chain fatty acids (SFCA) and gases
- These SCFAs enter the circulatory system and may inhibit liver from producing cholesterol

Insoluble Fiber

- Promotes motility in gut and ↑ stool bulk
- Also linked to ↓ CVD risk – less so than soluble
  - Promotes satiety, linked to healthy weight
  - May help lower blood pressure or risk of clots
  - Lowers inflammation
- Sources include whole-wheat flour, wheat bran, nuts, beans and vegetables

FDA Health Claim

“Diets low in saturated fat and cholesterol and rich in fruits, vegetables, and grain products that contain some types of dietary fiber, particularly soluble fiber, may reduce the risk of heart disease, a disease associated with many factors.”

Quick Cooking Oats

### Research: Fiber and Heart Disease

- 1986, Harvard study, n=43,757 US male health professionals age 40-75, free from diagnosed CVD & DM
- Detailed 131-item questionnaire looking at total dietary fiber from food
- 6 year f/u, found an inverse association between fiber intake and heart attack
- High total dietary fiber intake linked to 40% lower risk of coronary heart disease
- Cereal fiber (from grains) particularly beneficial

*Image: JAMA 1996 Feb 14;275(6):447-51*

### Fiber and Diabetes

- Fiber slow absorption of carbohydrate
- Leads to less marked increase in blood sugar
- Less demand for insulin
- Satiating effect promotes healthy weight

### Research: Fiber & DM Prevention

- 1986: 65,173 US women age 40-65
- 1997: 42,759 US men age 40-75
- All had no CVD, cancer, diabetes
- Results: Those who report eating most fiber from grains (8 grams/day) had a 30% lower risk of diabetes than those who ate least fiber from grains (3 grams/day)

*Image: Jose Paolo S. Barronero*
Research: Fiber & DM Prevention
- 2007: 15,000 men and women, age 35-65
- Average follow-up period of 7 years
- Questionnaire about dietary intake
- Results: those who ate the most cereal fiber (average of 16.6 grams per day) had 27% lower risk of type 2 than those who ate least (6.6 g)
- No relationship found between total fiber intake or other fibers from fruits, veg and diabetes risk

Research: Fiber Intake in Diabetes
- 2000, Randomized, crossover study
- 13 patients with Type 2 to follow 1 of 2 diets:
  - Moderate fiber: 24 g total, 8 g soluble, 16 g insoluble
  - High fiber: 50 g total, 25 g soluble, 25 g insoluble
- No fortified fiber foods (all naturally occurring)
- Results: 6th week, high fiber diet groups’ mean preprandial glucose levels were 13 mg/dL lower
- Total chol ↓ 6.7%, TG ↓ 10.2% and VLDL ↓ 12.5%

Fiber and Gut Health
- Diverticulosis
- Constipation
- Hemorrhoids
- Colon cancer

Fiber and Cancer

World Cancer Research Fund/American Institute for Cancer Research
Fiber and Weight Management

- Fiber promotes satiety: absorbs water from digestive juices, swelling of stomach, delay of hunger, reduced food intake
- Fiber rich foods: low in fat & added sugars
- People with 3+ whole grain servings/day have lower body & abdominal fatness over time
Where is fiber...and where it's not

Contains fiber:
- Fruits
- Vegetables
- Whole grains
- Legumes
- Nuts, seeds

Fiber free:
- Meat
- Cheese, dairy, & eggs
- Oils & fats
- Most beverages
- Refined grain products

Anatomy of a Whole Grain

Top Calorie Sources in the US
1. Grain-based desserts
2. Yeast breads
3. Chicken & chicken-mixed dishes
4. Soda, energy drinks, & sports drinks
5. Pizza
6. Alcoholic beverages
7. Pasta & pasta dishes
8. Mexican mixed dishes
9. Beef & beef dishes
10. Dairy desserts
### Some Whole Grains to Try Out

<table>
<thead>
<tr>
<th>Grain Type</th>
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<th>Grain Type</th>
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</thead>
<tbody>
<tr>
<td>Amaranth</td>
<td>Millet</td>
<td>Sorghum</td>
</tr>
<tr>
<td>Barley</td>
<td>Quinoa</td>
<td>Teff</td>
</tr>
<tr>
<td>Buckwheat</td>
<td>Rice</td>
<td>Triticale</td>
</tr>
<tr>
<td>Bulgur</td>
<td>Rye</td>
<td>Wheat</td>
</tr>
<tr>
<td>Corn (incl. popcorn)</td>
<td>Oats</td>
<td>Wild rice (reed plant)</td>
</tr>
</tbody>
</table>

### Whole Grain “Tweeners”

<table>
<thead>
<tr>
<th>Grain Type</th>
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</thead>
<tbody>
<tr>
<td>Barley</td>
</tr>
<tr>
<td>Pearled barley is not a whole grain since processing removes some bran</td>
</tr>
<tr>
<td>Dehulled barley (not pearled) is a whole grain</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grain Type</th>
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</thead>
<tbody>
<tr>
<td>Durum Wheat</td>
</tr>
<tr>
<td>(High protein, yellow flour used in pasta)</td>
</tr>
<tr>
<td>Durum wheat used in semolina and flour is not whole grain</td>
</tr>
<tr>
<td>100% durum wheat or whole durum wheat is a whole grain</td>
</tr>
</tbody>
</table>

### Not Quite Whole Grains

<table>
<thead>
<tr>
<th>Grain Type</th>
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<tbody>
<tr>
<td>Legumes are not whole grains...but they are still high in fiber</td>
</tr>
<tr>
<td>Soybeans</td>
</tr>
<tr>
<td>Chickpeas</td>
</tr>
<tr>
<td>Oilseeds (i.e. sunflower seeds)</td>
</tr>
<tr>
<td>Roots derived from legumes (i.e. arrowroot)</td>
</tr>
</tbody>
</table>

### Isolated Fibers

- Also called functional, added, or nondigestible fibers
- Fibers from other plant sources added to traditionally low-fiber foods
-Examples: high fiber yogurt, ice cream sandwich bars
Isolated Fibers

Commonly used isolated fibers:
- Maltodextrin
- Inulin (chicory root)
- Polydextrose
- Oat fiber
- Resistant starch
- Pectin
- Gum

Isolated Fibers: do they “work”?

The Academy of Nutrition & Dietetics’ Position Paper on Dietary Fiber:

"Whether isolated, functional fibers provide protection against cardiovascular disease remains controversial...Longer-term studies of fiber intake which examine the effects of both intrinsic [intact] and functional [isolated] fibers...are required."
**Fiber Intake Recommendations**

<table>
<thead>
<tr>
<th>IOM Recommendations</th>
<th>Age 50 or younger</th>
<th>Age 51 or older</th>
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<tbody>
<tr>
<td>Men</td>
<td>38 grams</td>
<td>30 grams</td>
</tr>
<tr>
<td>Women</td>
<td>25 grams</td>
<td>21 grams</td>
</tr>
</tbody>
</table>

**Tips for Increasing Fiber**

- Go slow
  - Add only a few more grams fiber per day
- Drink water
  - Aim for 6-8 glasses of water per day
- Eat your fruit, don’t drink it
- Make half of grain intake whole grains

**Harvard’s 10:1 Whole Grain Rule**

- Identifies the most healthful whole grain products
- 10:1
- Ratio of carb to fiber in whole grain, unprocessed wheat

**How to Eat 30g Fiber per Day**

<table>
<thead>
<tr>
<th>Meals + Snacks</th>
<th>Fiber</th>
</tr>
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<tbody>
<tr>
<td>Breakfast: 1 Egg, hard-boiled (0g) + 1 slice whole wheat toast (3g) + 1 pear (5g)</td>
<td>8 grams</td>
</tr>
<tr>
<td>Lunch: 1 cup lentil soup (8g) + 1 cup long grain brown rice (4g) + 1 cup boiled greens (3g)</td>
<td>15 grams</td>
</tr>
<tr>
<td>Snack: 1 cup lowfat yogurt (0g) + 1 cup berries (6g)</td>
<td>6 grams</td>
</tr>
<tr>
<td>Dinner: 2 oz chicken breast (0g) + ½ cup soba noodles (1g) + 1 cup carrots (3g)</td>
<td>4 grams</td>
</tr>
<tr>
<td>Snack: ½ cup ice cream (0g)</td>
<td>0 grams</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>33 grams</strong></td>
</tr>
</tbody>
</table>
## For More Information

- *Harvard Fiber: Start Roughing It!*  
- American Heart Association Whole Grains and Fiber:  
  [http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Whole-Grains-and-Fiber_UCM_303249_Article.jsp](http://www.heart.org/HEARTORG/GettingHealthy/NutritionCenter/HealthyDietGoals/Whole-Grains-and-Fiber_UCM_303249_Article.jsp)
- MedlinePlus - Dietary Fiber:  
- WebMD “Fiber-o-Meter” Dietary Fiber Calculator:  
- Fiber is the Future blog:  
  [www.fiberisthefuture.com](http://www.fiberisthefuture.com)
- Katie Ferraro, MPH, RD, CDE:  
  [katie.ferraro@nursing.ucsf.edu](mailto:katie.ferraro@nursing.ucsf.edu)