

# Fiber

## Background

Dietary fiber is carbohydrates from plants and whole grains that can not be digested by humans. Some sources of fiber include fruits, vegetables, and grains, but there is no fiber in animal products such as meat, fish, poultry, milk products or eggs.

There are two basic types of dietary fiber; soluble and insoluble fiber. Both soluble and insoluble fiber is indigestible by humans, but the difference is soluble fiber partially dissolves in water and insoluble fiber does not. In the body, soluble fiber forms a gelatin-like substance in the intestines and increases the water content in stool and insoluble fiber ads bulk to the stool softening it. Soluble fiber can be further classified into fermentable and non-fermentable types. Fermentable soluble fiber helps to feed our "healthy" intestinal bacteria that help us digest and absorb nutrition from our food. Many fiber-rich foods contain both soluble and insoluble fiber in varying proportions, but one type of fiber usually dominates.

Diets rich in dietary fiber have been shown to have a number of beneficial health effects including decreasing the risk of coronary heart diseases, some types of cancer, and complications of type 2 diabetes. Despite popular belief it still has yet to be proven that a diet high in fiber is strongly associated with reduced risk for either colon cancer or polyps (a precursor to colon cancer).

## Benefits of Soluble Fiber

The benefits of soluble fiber include reducing your “bad” or LDL cholesterol, helping your digestive system run more smoothly, and regulate post-meal blood sugar levels in diabetics. First, soluble fiber is the type of fiber responsible for lowering the level of plaque-forming LDL ("bad") cholesterol in your blood. As soluble fiber passes through the gastrointestinal tract, it binds to fatty acids and carries them through the intestines, thereby limiting the amount of cholesterol the body absorbs. However, the degree of possible reduction in your LDL cholesterol level depends on a number factors in addition to your daily intake of soluble fiber. As a result, soluble fiber is considered a valuable tool in reducing the risk of heart disease because of its potential effects on cholesterol levels. Secondly, soluble fiber is effective in maintaining the proper functioning of the digestive system by promoting regularity, which in turn helps to protect against diverticulitis, irritable bowel syndrome, and the development of gallstones. Diverticulitis is a common digestive disorder particularly found in the large intestine. Diverticulitis develops from diverticulosis, which involves the formation of pouches (diverticula) on the outside of the colon. When the pouches become infected or inflamed, the condition is called diverticulitis. Diverticulosis and diverticulitis are also called diverticular disease. Lastly, soluble fiber helps in the management of diabetes by slowing the absorption of glucose from the small intestine and therefore lowers post-meal blood sugar levels.

Types of soluble fiber include pectin, which occurs in fruits (apples, strawberries, citrus fruits); beta-glucans, found in oats, barley and rye; gums, found in beans, cereals (barley, oats, rice), seeds and seaweed; and arabinose, found in legumes. For this reason good sources of

soluble fiber include apples, barley, dried beans, beets, blueberries, carrots, cranberries, red currants, gooseberries, grapefruit, concord grapes, oats (oat bran, oatmeal), oranges, peaches, pears, sour plums, prunes, psyllium husk, quinces, rye, strawberries, and nuts and seeds such as sesame seeds. Legumes (dry beans, lentils, and peas) are especially rich in fiber and should be consumed several times per week. They are considered part of both the vegetable group and the meat and beans group as they contain nutrients found in each of these food groups.

## **Benefits of Insoluble Fiber**

Insoluble fiber passes through the intestines completely intact and for this reason its benefits include preventing constipation, possible weight loss as well as better diabetes control. First, since insoluble fiber is indigestible it increases the bulk of stool in the intestines as it absorbs water as well as allowing the body to eliminate unhealthy toxins that would otherwise continue to build in the system. Bulk helps to maintain the proper functioning of the intestines by keeping bowels regular preventing constipation. It is important, however, for people increasing their fiber intake to drink more water in order to get the benefit of using dietary fiber to prevent constipation. In addition, by softening stools, insoluble fiber may help to prevent hemorrhoids and diverticulitis. Secondly, a diet that is high in insoluble fiber and low in fat may help with weight control. The bulk that is created in the intestines as insoluble fiber absorbs water can reduce your appetite by making you feel full faster. Lastly, like soluble fiber, insoluble fiber helps in the management of diabetes by slowing the rate at which your body absorbs glucose after meals.

Insoluble dietary fiber includes cellulose and lignin which occur in whole grains (especially wheat bran), and hemicellulose found in whole grains, nuts, seeds, fruits and vegetables. Wheat bran also contains phytates which are chemicals that attach themselves to minerals and make them unavailable for the body. In order to avoid calcium and other mineral deficiency, it's best to get your fiber from a variety of good sources. Some good sources of insoluble fiber include Brazil nuts, whole-grain breads and cereals, barley, seeds, carrots, cucumbers, zucchini, celery, tomatoes, fruits and vegetables with skins, peanuts, popcorn, couscous, brown rice, and bulgur.

## **Recommended Dosage of Fiber**

The Institute of Medicine and the Dietary Guidelines for Americans 2005 recommends that children (ages 1 and up) and adults consume 14 grams of fiber for every 1,000 calories of food they eat each day. That means a person who eats 2,500 calories each day should get at least 35 grams of fiber daily, while a person who eats 1,700 calories each day needs somewhat less fiber - about 24 grams. A toddler who eats only 1,300 calories each day needs about 18 grams of fiber. At the onset, some Americans will find it challenging to achieve this higher level of intake of fiber. However, making fiber-rich food choices more often will move people toward this goal and is likely to give significant health benefits.

The majority of servings from the fruit group should come from whole fruit (fresh, frozen, canned, dried) rather than juice. Increasing the proportion of fruit that is eaten in the form of whole fruit rather than juice is desirable to increase fiber intake. However, inclusion of some juice, such as orange juice, can help meet recommended levels of potassium intake. Consuming at least half the recommended grain servings as whole grains is important, for all ages, at each calorie level, to meet the fiber recommendation. Consuming at least 3 ounce-equivalents of whole grains per day can reduce the risk of coronary heart disease, may help with weight maintenance, and may lower risk for other chronic diseases. Thus, at lower calorie levels,

adults should consume more than half (specifically, at least 3 ounce-equivalents) of whole grains per day, by substituting whole grains for refined grains.

There are some considerations for specific parts of our population such as older adults as dietary fiber is important for comfortable bowel movements. Since constipation may affect up to 20% of people over 65 years of age, older adults should choose to consume foods rich in dietary fiber. Other causes of constipation among this age group may include drug interactions and lack of appropriate hydration. Another population group that fiber is especially important is in children. Carbohydrate intakes of children need special considerations with regard to obtaining sufficient amounts of fiber, avoiding excessive amounts of calories from added sugars, and preventing dental caries. Several cross-sectional surveys on U.S. children and adolescents have found inadequate dietary fiber intakes, which could be improved by increasing consumption of whole fruits, vegetables, and whole-grain products.

## **Side Effects of Fiber**

Although fiber is largely indigestible, the human digestive system does react with it. Bacteria in the digestive tract attack it, causing methane gas to be released in the process, which can cause bloating and flatulence. Cramping, diarrhea, and intestinal gas are some of the problems associated with a sudden increase in fiber intake. Gradually increasing your fiber intake over a period of six to eight weeks can minimize undesirable effects. These side effects result not only from how much fiber you eat, but how quickly you eat. If you are adding higher-fiber foods to your diet, incorporate them slowly to allow your body time to adjust to the increase. Chew more slowly to break down the fiber compounds, making digestion easier. In addition, excessive soluble fiber may attract too much water from the intestinal cells, thus impeding cell-function. For these reasons, it is best to increase your water intake with your fiber to at least the recommended eight glasses a day. An excessive fiber intake can also cause fiber to bind with certain essential minerals and cause them to be eliminated instead of absorbed into the bloodstream.

## **Fiber Supplements**

While it is difficult to receive too much fiber from foods, an overuse of supplements could result in an extremely high and dangerous level of fiber intake, but if used properly they can help you reach your fiber goals. Over the counter fiber supplements can also be called laxatives and they are organized into categories based upon the action the chemical agent has on the body. Some of these categories include bulk forming (fiber) laxatives, hyperosmotic laxatives, lubricant laxatives, stimulant laxatives, stool softeners (emollient laxatives), and combination Laxatives.

There are several warnings that need to be followed when using over the counter laxatives. For example, when taking bulk forming laxatives one must drink at least 16 ounces of water with each dose to avoid the formation of a blockage in the esophagus that can cause choking or rupture the esophagus. Fiber laxatives should not be given to individuals with swallowing difficulties. Dehydration, electrolyte imbalances, and severe weight loss may occur when using some laxative products. Evacuation of the bowel can be sudden resulting in "accidents" when using hyperosmotics. Stimulant laxatives evacuation of the bowl can be rapid and cause a feeling of pressure or urgency to defecate repeatedly within a relatively short period of time. A tolerance to some stool softeners will develop if used for longer than 7-10 days and all laxatives are not intended for long term use because they over-empty the bowel thereby

promoting laxative dependency. Finally, never attempt to create your own combination laxative as some combinations may be unsafe.

Bulk forming (fiber) laxatives work as they pass through the body undigested by attracting water to the intestine and then absorbing the water in order to swell and form a soft, bulky stool. The bulky mass stimulates the intestinal muscles and speeds the stool transit time through the colon. Bulk-forming (fiber) laxatives will not work without increased fluid intake and can complicate constipation if water intake is not increased. Fiber laxatives that contain only one type of fiber can produce stools of poor quality. Over use of these products can lead to dependency.

Hyperosmotic laxatives are a fast acting stimulant laxative. They encourage bowel movements by drawing water into the bowel from surrounding body tissues. This provides a soft stool mass and a rapid increase in bowel action, usually within 1-6 hours and the evacuation is watery. There are two types of oral hyperosmotic laxatives: Saline & Lactulose. The Saline type (often called "salts") produces an osmotic effect mainly in the small intestine. Saline types are used for rapid emptying of the lower intestine and bowel. They are not used for repeated or long term correction of constipation. The Lactulose type is a special sugar like laxative that produces an osmotic effect in the colon.

Lubricant laxatives coat the entire gastro intestinal tract with a thin waterproof film that acts to lubricate the passage of the stool through the colon. This waterproof film also coats the stool, helping to retain moisture in the stool. The coated stool remains soft as it passes through the colon. Emulsification of the mineral oil also enhances its ability to soften the stool mass. Mineral oil allows for the passage of the softened stool without straining (which may be important following surgery or injury). Mineral oil is currently the only agent in this category. Mineral oil can be toxic. It is obtained from petroleum refining and has serious health consequences if abused or misused.

Stimulant laxatives are also known as "Irritant" or "contact" laxatives as they work by irritating the intestinal wall to stimulate intense intestinal contractions as the body works urgently to rid itself of the irritating agent and any else in its path. Action occurs in 6 to 12 hours and evacuation can be solid, semi fluid, or watery. Stimulant laxatives are more likely to have side effects than other forms of laxatives.

Stool softeners are also known as emollient laxatives and they work by causing moisture and fat to penetrate stool to prevent dry hard stool masses. The lubricant effect makes the stools easier to pass. Because this type of laxative changes the quality of the stool mass, it allows for the passage of the softened stool without straining (which may be important following surgery or injury).

Combination laxatives are laxatives that contain more than one type of laxative ingredient. The most common type is a combination stimulant laxative and stool softener. It is intended to soften the stool and speed its passage through the colon. Among the "natural" blends, a fiber such as psyllium, may be combined with the stimulant agent senna. Laxative ingredients of the same type may be combined (i.e. stimulant laxatives: senna & cascara) but these are not considered combination laxatives since the action of the ingredients is so similar. It is important to note that the combination of their "double" action may intensify both their "intended" purgative effect and multiply their side effects. It is recommended to use combination laxatives with caution.

### **Types of Bulk Forming (Fiber) Laxatives**

1. Calcium polycarbophil  
(Equalactin®; Fiber-Lax®; Fiber-

Tab<sup>s</sup>™; FiberCon®; Konsyl® Fiber  
Caplets)

2. Fructan (Fiber Choice Chewable®)  
3. Malt soup extract (Maltsupex®)

4. Methylcellulose (Citrucel® Fiber Shake; Citrucel® Fiber Smoothie; Citrucel®)
5. Psyllium (Fiberall®; Fibro-Lax; Fibro-XL; Genfiber®; Hydrocil® Instant; Konsyl-D®; Konsyl® Easy Mix; Konsyl® Orange; Konsyl®; Metamucil® Plus Calcium; Metamucil® Smooth Texture; Metamucil®; Modane® Bulk; Natural Fiber Therapy; Reguloid®; Serutan®)

### **Types of Hyperosmotic Laxatives**

1. Dibasic/Monobasic Sodium Phosphates (Visicol®, Oral Saline Laxative®, Rite Aid Phospha-Lax®, Quality Choice Phosphate Laxative®, OsmoPrep®)
2. Lactulose (Constulose; Enulose; Generlac; Kristalose®)
3. Magnesium Citrate (Citroma®)
4. Magnesium Hydroxide (Phillips'® Chews; Phillips'® Milk of Magnesia)

### **Types of Lubricant Laxatives**

1. Mineral Oil (Fleet® Mineral Oil Enema; Kondremul®; Liqui-Doss®)

### **Types of Stimulant Laxatives**

1. Aloe Vera (Aloe Vera Juice®; Nature's Remedy®; Nature's Way Natralax®)
2. Bisacodyl (Alophen®; Bisac-Evac™; Bisolax™; Correctol® Tablets; Dacodyl™; Doxidan®;

- Dulcolax®; ex-lax® Ultra; Fematrol; Femilax™; Fleet® Bisacodyl; Fleet® Stimulant Laxative; Veracolate)
3. Casanthranol (Doxidan Liquid Gels®; Fleet Stool Softener & Laxative®; Nature's Way Natralax®; Peri-Colace Combination®; Schein Casanthranol & Docusate®)
4. Cascara Sagrada (Brevilax®; Colamin®; Legapas® 100; Péristaline®; Sagrada-Lax®)
5. Castor Oil (Swann Castor Oil)
6. Dehydrocholic Acid (Bilax®; Cholan-HMB®; Decholin®; Ronantase Tablets®; Trilax®)
7. Senna & Sennosides (Black-Draught Tablets; Evac-U-Gen; ex-lax® Maximum Strength; ex-lax®; Fletcher's®; Perdiem® Overnight Relief; Senexon; Senna-Gen®; Sennatural™; SenokotXTRA®; Senokot®; Uni-Senna)

### **Types of Stool Softeners (Emollient Laxatives)**

1. Docusate Sodium/Calcium (Colace®; D-S-S®; Diocto®; Docusoft-S™; DOK™; DOS®; Dulcolax® Stool Softener; Enemeez®; Fleet® Sof-Lax®; Genasoft®; Phillips'® Stool Softener Laxative; Silace; Surfak®)
2. Poloxamer 188 (Codolax®; Codolax Forte®; Co-Danthramer®; Co-Danthrusate®)

<b>Example of a High Fiber Diet</b>
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### **1. BREADS & GRAINS** 6-11 servings each day

- Whole grain breads, muffins, bagels, or pita bread
- Rye bread
- Whole wheat crackers or crisp breads
- Whole grain or bran cereals
- Oatmeal, oat bran, or grits

- Barley, dry
- Wheat germ
- Whole wheat pasta
- Brown rice

**2. VEGETABLES** 3-5 servings each day

- All vegetables such as asparagus, broccoli, cabbage, carrots, green beans, green pepper, onions, peas, potatoes with skin, snow peas, spinach, squash, sweet potatoes, tomatoes, zucchini

**3. FRUIT** 2-4 servings each day

- All fruits such as apple, banana, berries, grapefruit, nectarine, orange, peach, pear

**4. MILK & DAIRY** 2-3 servings each day

- All dairy products

**5. MEAT & MEAT SUBSTITUTES** 2-3 servings or total of 6 oz daily

- All beans and peas such as garbanzo beans, kidney beans, lentils, lima beans, split peas, and pinto beans
- All nuts and seeds such as almonds, peanuts, Brazil nuts, cashews, peanut butter, walnuts, sesame and sunflower seeds
- All meat, poultry, fish, and eggs
- If you are following a low fat diet, use nuts and seeds only in moderation.

**6. FATS & SNACKS** Eat in moderation

- Popcorn, whole-wheat pretzels, baked tortilla corn chips or trail mix made with dried fruits, nuts, and seeds
- Cakes, breads, and cookies made with oatmeal, fruit, and nuts
- Bean dip

<b>Conclusions</b>
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- Eat the minimum recommended amount of dietary fiber per day (14g/1000 calories eaten) by choosing fiber-rich fruits, vegetables, nuts and legumes, and whole-grains often.
- Increase fiber gradually to avoid any painful side effects such as bloating and gas.
- Ninety percent of your daily fiber should come from the foods that you eat and the other ten percent can come from a fiber supplement.
- Increase your water intake so you are getting half of your body weight in ounces daily.

**Some tips for increasing fiber intake:**

- Eat whole fruits instead of drinking fruit juices.
- Replace white rice, bread, and pasta with brown rice and whole-grain products.
- Choose whole-grain cereals for breakfast.
- Snack on raw vegetables instead of chips, crackers, or chocolate bars.

- Substitute legumes for meat two to three times per week in chili and soups.
- Experiment with international dishes (such as Indian or Middle Eastern) that use whole grains and legumes as part of the main meal (as in Indian dahls) or in salads (for example, tabbouleh).

<b>Food High in Dietary Fiber Chart</b>
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**Category A (more than 7 grams per serving)**

<b>FOOD</b>	<b>AMOUNT</b>	<b>TOTAL FIBER (grams)</b>
Avocado	1 medium	11.84
Black beans, cooked	1 cup	14.92
Bran cereal	1 cup	19.94
Broccoli, cooked	1 cup	10.97
Green peas, cooked	1 cup	8.84
Kale, cooked	1 cup	7.20
Kidney beans, cooked	1 cup	13.33
Lentils, cooked	1 cup	15.64
Lima beans, cooked	1 cup	13.16
Navy beans, cooked	1 cup	11.65
Oats, dry	1 cup	12.00
Pinto beans, cooked	1 cup	14.71
Split peas, cooked	1 cup	16.27
Raspberries	1 cup	8.34
Rice, brown, uncooked	1 cup	7.98
Soybeans, cooked	1 cup	7.62

**Category B (more than 3 grams per serving)**

<b>FOOD</b>	<b>AMOUNT</b>	<b>TOTAL FIBER (grams)</b>
Almonds	1 oz.	4.22
Apples, w/skin	1 medium	5.00
Banana	1 medium	3.92
Blueberries	1 cup	4.18
Cabbage, cooked	1 cup	4.20
Cauliflower, cooked	1 cup	3.43
Corn, sweet	1 cup	4.66
Figs, dried	2 medium	3.74

Flax seeds	3 tsp	6.97
Garbanzo beans, cooked	1 cup	5.80
Grapefruit	1/2 medium	6.12
Green beans, cooked	1 cup	3.95
Olives	1 cup	4.30
Oranges, navel	1 medium	3.40
Papaya	1 each	5.47
Pasta, whole wheat	1 cup	6.34
Peach, dried	3 pcs.	3.18
Pear	1 medium	5.08
Pistachio nuts	1 oz	3.10
Potato, baked w/ skin	1 medium	4.80
Prunes	1/4 cup	3.02
Pumpkin seeds	1/4 cup	4.12
Sesame seeds	1/4 cup	4.24
Spinach, cooked	1 cup	4.32
Strawberries	1 cup	3.98
Sweet Potato, cooked	1 cup	5.94
Swiss chard, cooked	1 cup	3.68
Turnip greens, cooked	1 cup	5.04
Winter squash	1 cup	5.74
Yam, cooked cubes	1 cup	5.30

**Category C (less than 3 grams per serving)**

<b>FOOD</b>	<b>AMOUNT</b>	<b>TOTAL FIBER (grams)</b>
Apricot	3 medium	0.98
Apricots, dried	5 pieces	2.89
Asparagus, cooked	1 cup	2.88
Beets, cooked	1 cup	2.85
Bread, whole wheat	1 slice	2.00
Brussels sprouts, cooked	1 cup	2.84
Cantaloupe, cubes	1 cup	1.28
Carrots, raw	1 medium	2.00
Cashews	1 oz.	1.00
Celery	1 stalk	1.02



Collard greens, cooked	1 cup	2.58
Cranberries	1/2 cup	1.99
Cucumber, sliced w/ peel	1 cup	0.83
Eggplant, cooked cubes	1 cup	2.48
Kiwifruit	1 each	2.58
Mushrooms, raw	1 cup	1.36
Mustard greens, cooked	1 cup	2.80
Onions, raw	1 cup	2.88
Peanuts	1 oz	2.30
Peach	1 medium	2.00
Peppers, sweet	1 cup	2.62
Pineapple	1 cup	1.86
Plum	1 medium	1.00
Raisins	1.5 oz box	1.60
Romaine lettuce	1 cup	0.95
Summer squash, cooked	1 cup	2.52
Sunflower seeds	1/4 cup	3.00
Tomato	1 medium	1.00
Walnuts	1 oz.	2.98
Zucchini, cooked	1 cup	2.63

This chart can be viewed online at <http://www.bellaonline.com/articles/art49482.asp>

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