

Dietary Fibre: Dr. J. S. Pai

What is Dietary Fibre

This is plant material like carbohydrates and other substances that are resistant to digestion and absorption by humans and may include polysaccharide, oligosaccharide, lignin and associated substances. It promotes beneficial effects like preventing constipation, helping to manage cholesterol and glucose levels in blood. It is mainly found in cereal foods, legumes, fruits and vegetables. Modern diet is mostly consisting of products made of refined flours and of animal sources like meat, fish, poultry, eggs and milk products. All of these lack fibre and there are many ailments associated with lack of fibre are quite prevalent in modern society. Various organisations including American Dietetic Association, National Academy of Science, British Nutrition Foundation etc. have recommended increasing the dietary fibre in the diets recommending up to 35g fibre per day. US Food & Drug Administration has given approval for making health claims for fibre on labels of food products rich in it.

Types of Dietary Fibre

There are basically two types, insoluble and soluble fibre. The difference is based on solubility in water. There are three types of insoluble fibres: cellulose, hemicellulose and lignin. These are also sometimes referred to as roughage. Foods that contain good amounts of insoluble fibre include wheat bran, whole grain products, and vegetables. These help in promoting laxation preventing constipation.

Soluble fibres are mostly composed of gums, pectins and mucilages. These form gels with water and promote softer stool. They slow down the passage of food through the GI tract and this action is believed to help in regulation of cholesterol and glucose levels of blood by affecting their absorption rates. Good sources of soluble fibre are beans, oats, barley and many fruits and vegetables.

Although traditionally not thought of as fibre, resistant starch behaves in similar manner as dietary fibre. It is found in many cereals and pulses. Some amount of resistant starch is produced during processing of starch containing products like baking of bread and other cereal products.

Sources of Fibre

Soluble Fibre: Oatmeal, oat bran, nuts & seeds, legumes (dried peas, beans, lentils), fruits (apple, pear, strawberries, blueberries), vegetables (ladies fingers, guar)

Insoluble Fibre: Whole grain foods (whole wheat breads, barley, brown rice, whole grain breakfast cereals, wheat bran), nuts & seeds, vegetables (cucumber, green beans, cauliflower, celery, tomatoes)

Fibre Contents of Some Common Foods

Food, Standard Amount	Dietary Fiber (g)	Food, Standard Amount	Dietary Fiber (g)
Kidney beans, canned, ½ cup	8.2	Pumpkin, canned, ½ cup	3.6
Split peas, cooked, ½ cup	8.1	Spinach, cooked, ½ cup	3.5
Lentils, cooked, ½ cup	7.8	Almonds, 1 oz	3.3
Lima beans, cooked, ½ cup	6.6	Apple with skin, raw, 1 medium	3.3
White beans, canned, ½ cup	6.3	Brussels sprouts, cooked, ½ cup	3.2
Chickpeas, cooked, ½ cup	6.2	Banana, 1 medium	3.1
Cowpeas, cooked, ½ cup	5.6	Orange, 1 medium	3.1
Soybeans, mature, cooked, ½ cup	5.2	Guava, 1 medium	3.0
Sweet potato, baked, with peel, 1 medium (146 g)	4.8	Pearled barley, cooked, ½ cup	3.0
Green peas, cooked, ½ cup	4.4	Tomato paste, ¼ cup	2.9
Pear, 1 small	4.3	Broccoli, cooked, ½ cup	2.8
Mixed vegetables, cooked, ½ cup	4.0	Turnip greens, cooked, ½ cup	2.5
Raspberries, ½ cup	4.0	Carrots, 1 cup	3.0
Potato, baked, with skin, 1 medium	3.8	Okra, frozen, cooked, ½ cup	2.6
Soybeans, green, cooked, ½ cup	3.8	Peas, edible-podded, cooked, ½ cup	2.5
Figs, dried, ¼ cup	3.7	Brown rice, cooked, 1 cup	3.5
Dates, ¼ cup	3.6	Whole-wheat bread, one slice	1.9

Oat bran, raw, ¼ cup	3.6	Strawberries, 1 cup	3.0
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From: USDA Dietary Guidelines 2005

Dietary fibre contents of some Indian varieties of certain common foods and given per 100g rather than per common household measure like cup show following values: wheat 12.5g, rice 4.1g, jowar 9.7g, bajra 11.3g, Bengal gram (dal) 15.3g, black gram (dal) 11.7g, lentil (whole) 15.8g, red gram (whole) 22.6g & (dal) 9.1g, agathi 8.4g, curry leaves 16.3g, drumstick leaves 9g, spinach 2.5g, carrot 4.4g, potato 1.7g, colocasia 3g, sweet potato 3.9g, bitter gourd 4.3g, brinjal 6.3g, broad bean 8.9g, cauliflower 3.7g, guar 5.7g, drumsticks 5.8g, ladies fingers 3.6g, green peas 8.6g, tomato 1.7g, coconut 13.6g, gingelly (sesame) seeds 16.8g, groundnut 11g, mustard 13.6g, cinnamon 48.5g, coriander seeds 47.4g, cumin seeds 30g, fenugreek 48.6g, turmeric 20g, papaya 2.6g, banana 1.8g, dates 7.7g, fig 5g, grapes 1.2g, guava 8.5g, pear 4.3g, apple 3.2g, sapota 10.9g. (Nutritive Value of Indian Foods by Gopalan and others, 2004).

Health Benefits of Dietary Fibre

Diets with high fibre contents have been considered to improve gastrointestinal health, improve glucose tolerance and the insulin response, reduce hyperlipidemia, hypertension and other coronary heart disease risk factors, reduction in the risk of developing some cancers and increase satiety and help to some degree in weight management. Evidence of dietary fibre reducing risks of colorectal cancer is mixed. Some studies have shown benefit while the others have not shown any benefits. However, there are benefits of fibre especially the insoluble type preventing constipation. This produces bulk and laxation. Soluble fibre makes stool softer. As fibre absorbs good amount of water, drinking plenty of water along with high fibre diet is necessary.

Another common disorder especially in older people is diverticulitis, an inflammation of intestine. Eating dietary fibre particularly insoluble fibre was associated with about 40% lower risk of diverticulitis. A high fibre diet also lowers risk of other disorders of GI tract such as irritable bowel syndrome and hemorrhoids.

Coronary heart disease is one of the leading cause of death for both men and women. There is cholesterol-filled plaque build up in arteries especially those supplying blood to heart. This causes atherosclerosis narrowing and hardening the arteries eventually causing blockage. When coronary artery gets blockage it produces heart attack. High dietary fibre has been linked to a lower risk of cardiovascular disease as has been shown in a number of large studies. High dietary fibre intake has been shown to reduce the risk of coronary heart disease by 40% compared to low fibre intake. Fibre intake has also been linked to many factors that increase the chances of developing heart disease and diabetes. They include high blood pressure, high insulin levels, excess weight, high triglyceride levels and low levels of HDL or good cholesterol. Higher intake of fibre alleviates all these problems lowering further the chances of heart disease.

Today, type 2 diabetes is the most common form of diabetes. In this insulin production is low and/or its effectiveness is reduced hence blood sugar is not controlled causing high levels. Besides several important factors like healthy weight, physical activity and not smoking that lower the risks of type 2 diabetes, dietary factors especially high fibre diet seems also to lower its risk. Soluble fibre is more effective in lowering both the risks of heart disease and diabetes since substances like gums and pectin have shown the ability to control both cholesterol and glucose levels in blood.

A high fibre diet may also help with weight management. High fibre foods usually need more chewing time giving body time to register when satisfied, so one is less likely to overeat. Also high fibre food remains in stomach longer so feeling of fullness is for a longer time. High fibre foods also will be having less calories for the same volume of food. All these help consume less food and calories, all amounting to weight management.

Dietary Guidelines & Recommended Fibre Intake

There are many scientific bodies recommending high intakes of dietary fibre. Indian traditional diets with many vegetables, whole grain cereals products including roti, chapatti, brown (parboiled) rice etc., dals and other pulses like kidney beans (rajmah), lentils (masoor), bengal gram (channa), peas, etc. along with fruits would give adequate amounts of both soluble and insoluble fibre. However, Indians have been slowly getting away from this traditional diet to more westernised diet with new lifestyle foods that have much less fibre. High fibre foods not only gave enough fibre but also contained other nutrients like vitamins and minerals. Thus diet was overall more nutritious and healthful.

There is a need for increasing fibre intake not only to prevent certain age-related diseases like diabetes and heart disease but also obesity that affects all ages. Childhood obesity can be curtailed to a great extent if fibre content of the diet is increased. Children feel full earlier and for a longer period and so tendency to overeating is reduced. Low fibre foods also have the tendency to increase the blood glucose sharply and then dropping it also sharply compared to high fibre foods of similar carbohydrate contents. This sharp drop also fails to supply energy for a longer time without replenishing again with more food.

When enough fibre is there, especially the soluble fibre, absorption of glucose from intestine to blood is more gradual and for a longer time. Hence there is a continuous supply of energy needed for mental and/or physical activity. Children especially need it as they are more active than adults. When they feel lacking in energy they eat or drink beverages supplying calories. Thus total caloric intake is much more and they put on weight.

American Dietetic Association has recommended 20-35g fibre per day for a healthy adult depending on the caloric intake. Children are recommended an intake equal to their age plus 5 (i.e. a six year old should take $6+5 = 11$ g per day). British Nutrition Foundation has recommended 12-24 g of fibre intake per day for healthy adults. National Academy of Sciences' Institute of Medicine has recommended up to 50 years of age, for men 38g and women 25g per day while older men are recommended 30g and women 21g.

Fibre Supplements

When it is difficult to get a meal containing good amount of fibre, it is possible to get fibre supplement that may be either consumed separately or use it to mix in the food being eaten to make it fibre rich. Psyllium seed husk is a rich source of fibre and may be taken to reduce risk of heart

disease by lowering cholesterol levels. It also gives relief from irritable bowel syndrome and may be used as bulk forming laxative. Oat and barley fibre is also prepared as supplement containing beta glucans that might help in heart disease.

Fructooligosaccharide is also used as supplement and with its sweet taste it may be used both as a sugar substitute as well as fibre since it is not digested. It also has additional advantage of being a prebiotic, being able to allow proliferation of probiotic bacteria.

There are some gums that have been used as fibre supplements in food. Gums are easily dispersed in water or milk. Guar gum is used for cholesterol management and irritable bowel syndrome. Gum acacia has an advantage of not altering the viscosity of beverage much when added.

Some Adverse Effects of Dietary Fibre

While weight management requires feeling of fullness to come at the earliest, it can also be a negative aspect when young growing children need to be fed adequate food to supply energy for their high physical activity. Convalescing patients also need enough calories to regain their health. If the diet contains more fibre they feel full much earlier and may not consume enough of food that may be necessary. Thus depending on the situation feeling of fullness can be a benefit or an adverse effect.

There are some other adverse effects that may be experienced such as bloating, gastritis and flatulence accompanying high fibre diet. Dietary fibre also must be accompanied by adequate water intake or else they may cause impaction and intestinal obstruction due to lack of fluidity or softness. When persons not used to high fibre diets, they should gradually increase their fibre intake to avoid most of the above problems.

Conclusion

Dietary fibre is an essential part of the diet to maintain health and prevent many diseases. Due to the changes in dietary, there are deficiencies experienced in daily consumption of dietary fibre. This adds to other factors leading to many problems like obesity, GI tract diseases, possibly colon cancer, diabetes and cardiovascular diseases. Many of these may be prevented and some may even be managed by adequate dietary fibre intake through foods. Various foods give different types of dietary fibres effective for different physiological benefits. Consuming a wholesome diet containing many components like fruits, vegetables, whole grain products, pulses etc. may provide sufficient amounts of beneficial fibres. If diets do not provide enough fibre, there are supplements available that could be added to foods being consumed or taken like vitamin supplements.

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