



Cornell University Program on Breast Cancer and Environmental Risk Factors in New York State (BCERF)

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FACT SHEET #36

Whole Grains, Fiber, And Breast Cancer Risk

Eating whole grains may be linked to a small reduction in breast cancer risk. Total fiber in the diet appears to have little or no association with breast cancer risk, although the fiber component of fruit and vegetables has been connected with decreased risk. Nonetheless, whole grains have been associated with a decrease in the risk of other cancers and health problems, including heart disease. These nutritious and beneficial foods should be included in everyone's diet.

What are whole grains and fiber?

Whole grains are the unrefined products of various cereal plants including wheat, oats, rye, corn, rice, millet, sorghum and barley. They contain the grain's starchy endosperm, the bran, and the germ. Refined grains and flour are composed of the starchy endosperm of the grain. The bran of grains contains most of the fiber. Fiber is made up of the material composing the walls of the cells of whole grains, fruits and vegetables. The germ is the sprouting part of the grain.

Does eating whole grains affect a woman's risk of breast cancer?

The results of epidemiological studies to date suggest that eating whole grains may be associated with a small decrease in the risk of breast cancer. The uncertainty in this conclusion comes from the differing results of the studies examining this association. The majority of the studies, as well as the most carefully conducted studies, indicated a small decrease in breast cancer risk associated with eating whole grains. However, several studies also showed no association of whole grains with breast cancer risk.

Does eating fiber affect a woman's risk of breast cancer?

The results of the studies of breast cancer risk and eating dietary fiber show that fiber may be associated with a small decrease in breast cancer risk, but it possibly has no association with risk at all. These studies were not in agreement. Four out of five cohort studies indicated no association between the fiber consumption and breast cancer risk. Cohort studies are designed to minimize bias and have the best potential for correct evaluation. In contrast to the cohort studies, 11 out of 14 case-controlled studies showed a link between dietary fiber and a small decrease in the risk of breast cancer. No studies found increased risk.

Does the source of fiber matter?

Fiber from different sources has different effects on breast cancer risk. Fruits, vegetables and whole grains all contribute fiber to the diet. The studies described above included all three types of

fiber. Several studies differentiated the types of fiber. Fiber from fruits and vegetables was clearly associated with decreased risk of breast cancer in these studies. See also BCERF Fact Sheet #18 on *Fruits and Vegetables and the Risk of Breast Cancer*. Examination of fiber from whole grains did not give such clear results. Two studies saw no association of grain fiber with risk of breast cancer, and two studies saw a decrease in risk. At this time, it is uncertain if eating fiber from grains is associated with a decrease in breast cancer risk.

Why do the results of these studies differ?

The lack of agreement among the studies examining the association between whole grains and fiber and breast cancer risk could be tied to these explanations:

- People eat a wide variety of foods and separating out the effect of single groups of food, such as grains and fibers, is difficult.
- The studies were conducted in different countries. The case-control studies were conducted in the United States, Australia, Uruguay, China, Holland, Russia, and a number of other countries. Different grains are favored in the diets of each country, for example wheat in the United States, corn in Uruguay, rice in China, and rye in Holland. In addition, people in different countries may be exposed to different life-style factors related to breast cancer risk.
- Researchers examined grains at different levels of refinement. The fiber and most of the potential anticancer compounds in grain are lost when grains are refined. Although some studies did define the level of refinement of the grains studied, the majority did not and were thus examining both refined and unrefined grains together.
- Almost all of the studies examined adult diets. Studies in animals indicate that eating patterns during childhood and adolescence may play a role in breast cancer development.
- The design of the studies was different. Some studies had a broad focus or one that was not aimed directly at whole grains and fiber. These studies collected and analyzed less information on specific whole grains and fiber.



- The studies differed in the type of fiber they were examining. Some of the studies differentiated the sources of fiber but most grouped all fibers together. Different sources of fiber may not have the same effect on breast cancer risk.

Has the effect of fiber on breast cancer been studied in animals?

Dietary fiber has been shown to inhibit mammary (breast) tumor formation in rats. In a typical study, addition of wheat bran (a rich source of dietary fiber) to the animals' diet decreased the number of animals that developed tumors by 27% and almost halved the number of tumors in the animals that did get tumors.

Fiber is composed of soluble and insoluble parts and grains differ in the amount of these parts they contain. For example, oats contain a large amount of soluble fiber and wheat contains a lot of insoluble fiber. One study evaluated whether soluble or insoluble fiber was more effective in preventing tumor formation. In this study, the most effective prevention of mammary tumor formation was seen when animals were fed diets high in both soluble (psyllium) and insoluble (wheat) fibers. This indicates that both types of fiber work best in combination and supports eating a well-rounded diet rather than adding a fiber supplement of one type or the other.

How might whole grains and fiber affect breast cancer risk?

It is not clear how whole grains and their associated fiber may affect the risk of breast cancer, but a number of potential ways have been proposed. Most of the research associated with whole grains has examined fiber. Although the epidemiological studies described earlier do not conclude that fiber alone has a role in breast cancer risk reduction, these studies suggest that it has the possibility to function along with other potential anticancer factors in whole grains. Studies suggest that fiber in the diet decreases the levels of estrogens in the body (see below). It is well established that breast cancer risk increases with the level and time of exposure to estrogens.

Fiber may reduce levels of estrogens by increasing their elimination in bile. Bile is produced by the liver and emptied into the small intestine. It aids in digestion and also functions as a pathway for the elimination of various chemicals, such as the estrogens. Fiber in the intestines can bind to the estrogens in the bile and ensure their elimination. Fiber can also decrease the type of bacteria in the intestine that lead to reabsorption of estrogens from the bile into the body. Also see BCERF Fact Sheet #9 on *Estrogen and Breast Cancer Risk: What is the Relationship?* and BCERF Fact Sheet #10 on *Estrogen and Breast Cancer Risk: What Factors Might Affect a Woman's Exposure to Estrogen?*

Does eating a high fiber diet change women's estrogen levels?

Five intervention studies reported lower levels of estrogens in the blood of premenopausal women fed a high fiber diet. These intervention studies placed women on a high fiber diet for two weeks to two months and then compared their blood estrogen levels before and after the diet change. Although blood estrogens were lowered in these studies, the types of estrogens that were reduced were different. This difference may be explained by the fact that various sources of fiber were used and their binding to different types of estrogens varies. One study examined wheat, corn, and oat fiber and found wheat fiber to be the most effective in reducing estrogen levels. Most of these studies also reduced the level of fat in these women's diets at the same time. However, two of the studies did not reduce fat levels and had similar results to those that did reduce fat.

Two other studies examined the effect of a high fiber diet in postmenopausal women. They saw no change in the already low circulating estrogens in the body.

Studies in rats, examining whether circulating estrogen levels were reduced on a high fiber diet, have not seen the decreases reported in women. The reason for this difference is still being debated.

These studies present encouraging evidence that diets high in fiber may lower circulating estrogen levels in humans. More studies are needed in this area.

Are there other health benefits of eating a diet rich in whole grains and fiber?

Whole grains are foods of high nutritional value. They are high in fiber, low in fat, and are good sources of complex carbohydrates, vitamins, and minerals. Besides these benefits toward basic nutrition, whole grains and fiber have been found to decrease the risk of a number of diseases including heart disease and cancers of the stomach, colon, rectum, endometrium, and pancreas. The United States Department of Agriculture's Food Guide Pyramid recommends that most adults eat 9 to 11 servings of grains a day, especially whole grains.

Does eating refined grains change a woman's risk of breast cancer?

Only one study has investigated the use of refined grain products, such as white bread and pasta, and breast cancer risk. This study was conducted in Italy and saw an association of starch from refined grains with increased breast cancer risk. Refined grains in the United States (US) are supplemented with vitamins and it is uncertain how this would affect a similar



study of US women. Further study in this area is needed, as refined grains comprise a large part of the diet of Western cultures.

Could other components of whole grains help reduce the risk of breast cancer?

There are a number of components of whole grains that have been shown to have anticancer activity in animals. It is important to note that most of these compounds are found in the bran (fiber rich portion) or germ portion of cereals or grains, emphasizing the importance of whole grains and cereals.

Lignans. Grains contain a group of chemicals called lignans (a type of phytoestrogen, see BCERF Fact Sheet #1 on *Phytoestrogens and the Risk of Breast Cancer*). One of the lignans, secoisolariciresinol diglycoside (SD), has been shown to inhibit mammary (breast) tumors in rats. This chemical also has the anticancer effect of causing maturation of mammary cells (terminal end bud differentiation). However, SD may also have undesired effects. At higher doses, SD has been observed to increase estrogen levels, which could lead to an increase in breast cancer risk. In addition, when SD or flaxseed were added to the diet of pregnant and lactating rats, reproductive birth defects were found in the newborn rats. Flaxseed has very high concentrations of lignans, 70 to 800 times that found in other foods. Until more is known, it is a good idea for pregnant and nursing mothers to limit the amounts of flaxseed they eat on a regular basis.

The lignans are thought to act as either antioxidants or as phytoestrogens. As antioxidants these chemicals can inactivate free radicals, very reactive chemicals which can damage cells. Acting as phytoestrogens, the mammalian lignans may change the metabolism of estrogens or increase the level of a protein that binds estrogens in the blood.

Phytic Acid. Grains also contain a sugar-like chemical known as phytic acid. This chemical has been shown to reduce the number of mammary tumors in rats. How phytic acid works is unclear but it may act through changes in liver metabolism, as an antioxidant, as an agent to eliminate harmful metals, or by action on the communication between cells.

Flavonoids. Grains, fruits and vegetables are all good sources of chemically complex molecules, known as flavonoids. Flavonoids from grains have been studied very little. Nonetheless, flavonoids from other plants limit the growth of breast tumor cells, and a large cohort study found a decrease in all types of cancer with higher levels of flavonoids in the diet.

Phenolic Acids. Grains also contain phenolic acids. These chemicals are also found in fruits and vegetables and are often responsible for their flavor. Phenolic acids have been shown to limit tumor formation in animals. These compounds may

act by preventing the activation of cancer-causing chemicals in the body.

Short Chain Fatty Acids. Some of the carbohydrates in grains are broken down by the bacteria in the intestines producing short chain fatty acids. These chemicals may have anticancer activity in the colon, but their anticancer effect on other tissues is in doubt.

Selenium. Grain products are also a good source of selenium, however, the levels of this mineral may be low if the grains are grown in soils containing little selenium. This mineral has been associated with decreased risk of a number of cancers, including prostate cancer. Although in animals it is an effective inhibitor of mammary tumor formation, selenium has not been associated with a similar decrease in breast cancer risk in humans.

Should breast cancer survivors change the amount of grains and fiber they eat?

One study has reported that eating breads and cereals increases the survival of women with breast cancer, especially postmenopausal women. It is unclear what role whole grains and fiber played in this result. The questionnaire used to assess the women's diets in this study only allowed for a crude separation of diet into refined and whole grain categories; the authors made no mention of this aspect of their findings. In addition, this was a small study that only examined 149 women. The results are encouraging but tentative at this point. More studies need to be conducted.

How can I increase the amount of whole grains that I eat?

Look for products that contain only whole grains or at least have whole grains as the major ingredient. The order of the ingredients on the content list begins with the largest ingredient and ends with the smallest; the first thing listed is the major ingredient. Several easy substitutions would include whole wheat bread products for white bread products, whole grain breakfast cereals for refined breakfast cereals, brown rice for white rice, and whole grain flours for part of the refined flours in baking.

What studies need to be done?

The following areas need further research:

- The ability of wheat bran and potentially other sources of dietary fibers to reduce circulating estrogens
- The potential association of eating refined grain products with increased breast cancer risk
- The effect of whole grains and fiber on the survival of women with breast cancer



- Studies of chemicals in whole grains and fiber which may have anticancer activity

What can women do now?

- Eat more whole grain products, such as whole wheat bread, whole grain crackers, whole grain breakfast cereals and brown rice.
- Increase their total fiber intake by eating more fruits, vegetables, including beans, and whole grains.

An extensive bibliography on *Whole Grains, Fiber, and Breast Cancer Risk* is available on the BCERF web site: <http://www.cfe.cornell.edu/bcerf/>

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