

Review

The importance of cereals (Poaceae: Gramineae) nutrition in human health: A review

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This article presents some of the latest research endeavors that aim to improve our understanding of how the various grain components can be manipulated to improve contributions of cereals to human health. The health benefits of wholegrain cereal products are now widely recognized and considered due to the presence of a wide range of bio-active components. Cereals in their natural form (as whole grain) are rich source of vitamins, minerals, carbohydrates, fats, oils, and protein. Also, such cereals are chosen for consumption and they have the higher fiber which is an important nutrient that helps to prevent weight gain and heart disease. For best results, fruits, vegetables and whole grains may be eaten every day to provide extra nutrition and fiber. The meal can be made healthier by eating high-fiber whole-grain cereals that has low sugar. However, eating a variety of cereals rather than just feeding on one item is more helpful to health.

Key words: Cereal, grain, human, health, diet, Pakistan.

INTRODUCTION

The term cereal is a derivative from Latin word 'cereal' meaning 'grain' which is botanically, a type of fruit called a caryopsis, composed of the endosperm, germ, and bran. The cereals are annual common grass members of the grass family (a monocot family Poaceae, also known as Gramineae), which usually have long, thin stalks, such as wheat, rice, maize, sorghum, millet, barley and rye, whose starchy grains are used as food. The term cereal is not limited to these grains, but, also refers to foodstuff prepared from the starchy grains of cereal like flours, breads and pasta. Cereal science is a study concerned with all technical aspects of cereal. It is to study the nature of the cereals and the changes that occur naturally, and as a result of handling and processing.

Amazingly, the foods human beings eat most are grasses all around the world. Cereal grains were the first agricultural attempts by early man, and people still enjoy them today depending on where they live and what grows there well. Cereal grains are grown in greater quantities and provide more food energy worldwide than any other type of crops; they are therefore staple food crops. In their natural form (as in whole grain), they are a rich source of vitamins, minerals, carbohydrates, fats, oils and protein. However, when refined by the removal of the bran and germ, the remaining endosperm is mostly carbohydrate and lacks the majority of the other nutrients. As human food, cereals are usually marketed in raw grain form or as ingredients of food products. As animal feed,

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they are consumed mainly by livestock and poultry, which are eventually rendered as meat, dairy and poultry products for human consumption. They are also used industrially in the production of a wide range of substances, such as glucose, adhesives, oils and alcohols. Cereals provide more food for human consumption than any other crops. Generally, four miscellaneous groups of foods prepared from the cereals grains are:

- (1) Baked products, made from flour or meal, include breads, pastries, pancakes, cookies and cakes.
- (2) Milled grain products, made by removing the bran and usually the germ (or embryo of the seed), include polished rice, farina, wheat flour, cornmeal, hominy, corn grits, pearled barley, semolina (for macaroni products), prepared breakfast cereals, soup, gravy and other thickenings.
- (3) Beverages made from fermented grain products and from boiled, roasted grains.
- (4) Whole-grain products include rolled oat, brown rice, popcorn, shredded and puffed grains, and breakfast foods (Sarwar, 2008).

NUTRITIONAL FACTS OF CEREALS

All cereal grains have high energy values, mainly from the starch fraction, but, also from the fat and protein portions. Apart from moisture content and inedible substances such as cellulose, cereal grains contain carbohydrates- mainly starches (comprising 65 to 75% of their total weight), as well as proteins (6 to 12%) and fat (1 to 5%) along with traces of minerals and vitamins.

HOW TO PICK OUT A HEALTHY CEREAL

Some cereals are made from whole grains that have been ground into flours and combined with thickeners, flavorings, vitamins and other ingredients during the cereal-making process. These cereals still may be very healthy, but, when heavily processed, these lose some of the nutritional benefits. Studies have shown that "intact" grains- grain kernels that are eaten in their pure form are better as lowering cholesterol and maintaining heart health than highly processed whole grains. There are many delicious whole grain cereal options to choose from a variety of cereals, so, a wide variety of nutrients from these tasty grains could be taken. Here is what to look for when taking a cereal:

- (1) At least 3 gm of fiber per 100 calories (so if a cereal has 200 calories per serving, it should have at least 6 of fiber) - this is a sign that the cereal is truly whole grain.
- (2) Six or less gm of sugar per serving (cereals with raisins or other dried fruit will have more), that is alright.
- (3) Organic or natural brands that are made with

responsibly grown ingredients (natural foods sector offer healthier cereals made with healthier ingredients). Raisins or other dried fruits will add a lot of grams of sugar to the listing on the nutrition panel; they are not distinguished from added sugars, so the amounts can only be estimated.

WHOLE GRAIN CEREALS

The most healthful cereals are made with whole grains. If a person is trying to lose weight, controls cholesterol or diabetes, or just needs a lot of energy, the best bet is a hot cooked cereal of whole grains. It can be flavored with raisins or other dried fruits, or may be a handful of nuts. If someone prefers cold cereal, it is needed to check the list of ingredients carefully. And the first ingredient should be a whole grain. It is recommend that foods with partially hydrogenated oils (or trans fats), and they still show up in a few cereals should be avoided. Cereals and wholegrain foods can reduce the risk of developing certain diseases including coronary heart disease, colon cancer, diabetes and diverticular disease.

Nutritional contents of whole grain cereals

The grains consist of three major parts which are:

- (1) Bran: The outer layer of the grain (fiber omega-3 fatty acids, vitamins and dietary minerals).
- (2) Endosperm: The main part of the grain (mainly starch), and
- (3) Germ: The smallest part of the grain (vitamin E, folate, thiamine, phosphorus, magnesium).

The whole grains contain all three layers of the grain. The wholegrain cereals are a rich source of many essential vitamins, minerals and phyto-chemicals. The typical cereal food is low in saturated fat, but, is a source of polyunsaturated fats, including omega-3 linolenic acid, cholesterol free, high in both soluble and insoluble fiber and resistant starch, an excellent source of carbohydrates, a significant source of protein, a good source of B-complex vitamins, including folate, a good source of many minerals such as iron, magnesium, copper, phosphorus; zinc, and a good source of antioxidants and phytochemicals that can help to lower blood cholesterol levels. The wholegrain cereals contain many different phytochemicals that have been linked to significant health benefits. These phytochemicals include:

- (1) Lignans: Can lower the risk of coronary heart disease, and regress or slow cancers in animals.
- (2) Phytic acid: Reduces the glycaemic index of food, which is important for people with diabetes, and helps to protect against the development of cancer cells in the colon.

(3) Saponins, phytosterols, squalene, oryzanol and tocotrienols have been found to lower blood cholesterol.

(4) Phenolic compounds: Have antioxidant effects (Sarwar, 2008, 2009; Sarwar et al., 2004).

Cereal grains have been the principal component of human diet and have played a major role in shaping human civilization for thousands of years. Around the world; rice, wheat, and maize, and to a lesser extent, sorghum and millet are important staples and critical to daily survival of billions of people. More than 50% of world's daily caloric intake is derived directly from cereal grains consumption. Most of the grains used for human food are milled to remove the bran (pericarp) and germ, primarily to meet sensory expectations of consumers. The milling process strips the grains of important nutrients including dietary fiber, phenolics, vitamins and minerals which are beneficial to health (Awika, 2011). The studies have shown that whole grains consumption are associated with diminished risk of serious diet-related diseases. These conditions include coronary heart disease, certain cancers (especially of the large bowel), inflammatory bowel disease and disordered laxation. Carbohydrates are important contributors to the health benefits of whole grains. Insoluble non-starch polysaccharides (major components of dietary fiber) are effective laxatives. While soluble non-starch polysaccharides (especially mixed-link β -glucans) has lower plasma cholesterol and so can reduce heart disease risk, but, the effect is inconsistent (Topping, 2007).

Non-starch polysaccharides occur naturally in many foods. The physiochemical and biological properties of these compounds correspond to dietary fiber. Non-starch polysaccharides show various physiological effects in the small and large intestine and therefore have important health implications for humans. The remarkable properties of dietary non-starch polysaccharides are water dispersibility, viscosity effect, bulk and fermentability into short chain fatty acids. These features may lead to diminish risk of serious diet related diseases which are major problems in Western countries and are emerging in developing countries with greater affluence. These conditions include coronary heart disease, colo-rectal cancer, inflammatory bowel disease, breast cancer, tumor formation, mineral related abnormalities, and disordered laxation. Insoluble non-starch polysaccharides (cellulose and hemicellulose) are effective laxatives, whereas, soluble non-starch polysaccharides (especially mixed-link β -glucans) lower plasma cholesterol levels and help to normalize blood glucose and insulin levels, making these kinds of polysaccharides a part of dietary plans to treat cardiovascular diseases and diabetes.

Moreover, a major proportion of dietary non-starch polysaccharides escapes the small intestine nearly intact, and is fermented into short chain fatty acids by commensal microflora present in the colon and cecum, and promotes normal laxation. Short chain fatty acids

have a number of health promoting effects and are particularly effective in promoting large bowel function. Certain non-starch polysaccharides through their fermented products may promote the growth of specific beneficial colonic bacteria which offer a prebiotic effect (Kumar et al., 2012).

Wheat is considered a good source of protein, minerals, B-group vitamins and dietary fiber that is an excellent health-building food. Thus, it has become the principal cereal, being more widely used for the making of bread than any other cereal because of the quality and quantity of its characteristic protein called gluten. Gluten makes bread dough, sticks together and gives it the ability to retain gas. Wheat has several medicinal virtues; starch and gluten in wheat provide heat and energy, the inner bran coats, phosphates and other mineral salts, the outer bran, the much-needed roughage, indigestible portion that helps easy movement of bowels, the germ, vitamins B and E, and protein of wheat helps to build and repair muscular tissue. The wheat germ, which is removed in the process of refining, is also rich in essential vitamin E, and its lack can lead to heart disease. The loss of vitamins and minerals in the refined wheat flour has led to widespread prevalence of constipation and other digestive disturbances and nutritional disorders. The whole wheat, which includes bran and wheat germ, therefore, provides protection against diseases such as constipation, ischaemic, heart disease, disease of the colon called diverticulitis, appendicitis, obesity and diabetes (Kumar et al., 2011).

Wheat is considered as utmost among the cereals largely due to the fact, that its grain contains protein with unique chemical and physical properties. Besides being a rich source of carbohydrates, wheat contains other valuable components such as protein, minerals (P, Mg, Fe, Cu and Zn), and vitamins like thiamine, riboflavin, niacin and vitamin E (Siddiqui and Sarwar, 2002; Sarwar and Sattar, 2007). Certain wheat varieties of Pakistan are grown over a wide agro-climatic range and as such are anticipated to exhibit good yield and quality production. It is therefore, necessary to investigate the nutritional status of wheat varieties in terms of biochemical and physiochemical characteristics available for food and nutritional purposes in Pakistan or elsewhere. Such study is significant in providing an opportunity to explore the available wheat varieties and to further improve their nutritional excellence and also essential for setting nutritional regulations for domestic and export purposes. Physiochemical characteristics like ash, total grain mass and moisture are important parameters in the study of nutritional and agricultural aspects (Ali et al., 2009, 2011).

CONCLUSION

The most important consideration for a good health is to incorporate at least 30 min of daily physical exercise in conjunction with eating cereal that is a good way to burn

more calories than to consume. Eating the same foods all the time could result in boredom, so, a person should always try different kinds of cereal to keep things exciting. Eating only cereal for two meals a day could result in a lack of consumption of foods from other food groups. Diabetics can eat all kinds of food, including many commercial cereals. According to experts the diabetics should eat cereals with 3 g or more of dietary fiber and 5 g or less of total sugar. When choosing a healthy breakfast cereal, usually limit intake of added sugar by skipping granolas and cereals with marshmallows, frosting, dried fruits and chocolate flavoring. Also, choose cereals that are higher in fiber. Fiber is an important nutrient which is helpful to prevent weight gain and heart disease. For best results, eat fruit, vegetables and whole grains every day to provide extra nutrition and fiber. The meal can be made healthier by eating high-fiber wholegrain cereals that has low sugar. Also, eating a variety of cereals is helpful to health rather than just feeding on one item.

REFERENCES

- Ali A, Sarwar M, Khanzada S, Abro GH (2009). Reaction of Certain Wheat Varieties to the Action of Red Flour Beetle, *Tribolium castaneum* (Herbst) (Coleoptera) Under Insectary Conditions. Pak. J. Zool. 41(1):51-56.
- Ali A, Sarwar M, Khanzada S, Abro GH (2011). Evaluating Resistance of Wheat Germplasms to Attack by Red Flour Beetle, *Tribolium castaneum* (Herbst) (Coleoptera). Pak. J. Zool. 43(4):793-797.
- Awika JM (2011). Major Cereal Grains Production and Use around the World. In: Advances in Cereal Science: Implications to Food Processing and Health Promotion (Editors: J.M. Awika, V. Piironen, S. Bean. 1089:1-13.
- Kumar P, Yadava RK, Gollen B, Kumar S, Verma RK, Yadav S (2011). Nutritional Contents and Medicinal Properties of Wheat: A Review. Life Sci. Med. Res. 22:1-10.
- Kumar V, Amit KS, Gudrun B, Klaus B (2012). Dietary Roles of Non-Starch Polysachharides in Human Nutrition: A Review. Crit. Rev. Food Sci. Nutr. 52(10):899-935.
- Sarwar M (2008). Laboratory studies on different wheat genotypes for their resistance against Khapra Beetle *Trogoderma granarium* Everts (Coleoptera: Dermestidae). Pak. J. Seed Technol. 2(11&12):46-53.
- Sarwar M (2009). Evaluating wheat varieties and genotypes for tolerance to feeding damage caused by *Tribolium castaneum* (Herbst) (Coleoptera: Tenebrionidae). Pak. J. Seed Technol. 2(13&14):94-100.
- Sarwar M, Ahmad N, Rajput AA, Tofique M (2004). Search for Varietal Resistance within Stored Wheat Genotypes against the Infestation of Red Flour Beetle, *Tribolium castaneum* Herbst (Coleoptera: Tenebrionidae). Proce. 4th Inter. Congress of Entomological Sciences, University of Agric., Faisalabad, September, 22-23. pp. 23-27.
- Sarwar M, Sattar M (2007). Varietals assessment of different wheat varieties for their resistance response to Khapra beetle *Trogoderma granarium*. Pak. J. Seed Technol. 1(10):1-7.
- Siddiqui QH, Sarwar M (2002). Pre and Post harvest losses in wheat. Pak. Gulf Econ. XXI(6):30-32.
- Topping D (2007). Cereal complex carbohydrates and their contribution to human health. J. Cereal Sci. 46:220-29.