LITERATURE REVIEW

PHYSICAL CHARACTERISTICS OF BARLEY GRAIN

Barley grain, should be clean, bright yellow-white, plump, thin hulled, medium hard and uniform in size, is generally suitable for food uses and preferred for pearling (29). The shallow crease of the barley grain is an advantage in the production of pearled barley that is used as a rice extender.

Clean, white grains are common physical characteristics required for the initial processing of barley. Unlike wheat, barley bran shatters easily during the roller milling process (22), making it extremely difficult to produce white flour free of bran particles.

Roller milled barley flour of about 70% extraction contains greater than 1% ash, twice as high as the ash content of wheat flour (10). Cereal grains can be separated on their mass, that is, by weighing individual kernels and sorting them into fractions.

CHEMICAL COMPOSITION OF BARLEY GRAIN

The chemistry of barley grain consists of (19, 31) -

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starch</td>
<td>65-68%</td>
</tr>
<tr>
<td>Protein</td>
<td>10-13.6%</td>
</tr>
<tr>
<td>β -Glucan</td>
<td>4-9%</td>
</tr>
<tr>
<td>Lipids</td>
<td>2-3%</td>
</tr>
<tr>
<td>Minerals</td>
<td>1.5-2.5%</td>
</tr>
<tr>
<td>Total dietary fiber</td>
<td>11-34%</td>
</tr>
<tr>
<td>Soluble dietary fiber</td>
<td>3-20%</td>
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</tbody>
</table>
Pearling reduces the contents of insoluble fiber, protein, ash, and free lipids, but increases the contents of starch and β-Glucan by the removal of outer layers, including the hull (palea and lemma), bran (pericarp, testa) and germ (embryo), which are richer in insoluble fiber, protein, ash, and lipids and poorer in starch and β-Glucan than the endosperm (27,28).

Generally, hulled barley is preferred to hulless barley for malting and brewing because of the contribution of the hull to beer flavor and as a filtering aid during brewing.

In addition to its robust flavor, barley's claim to nutritional fame is based on its being a very good source of dietary fiber and a good nutritional source of Iron, Calcium, Magnesium, Selenium, Copper, Boron, Zinc, Molybdenum and a better source of Protein, Carbohydrates and Lipids.

SOIL AND NUTRIENTS

Soil may be defined as a thin layer of earth’s crust which serves as a natural medium for plants. It is the unconsolidated mineral matter that has been subjected to, and influenced by, genetic and environmental factors like parent material, climate, organisms, and topography. Thus, some soils are red, some are black, some are deep and some are shallow; some are coarse textured and some are fine textured.

Soil serves as a reservoir of nutrients and water for crops, provides mechanical anchorage and favorable tilth. The chemistry of soil consists of mineral matters, organic matter, water and air; their proportions vary with the environment. The 18 essential nutrients essential for the plants growth can be classified as:

1. Major non-mineral macronutrients: these are 90-95% of dry plant weight, and are supplied to the plant by water absorption and photosynthesis, C, H, and O.
2. Primary macronutrients, N, P, K
3. Secondary macronutrients, Ca, Mg,
4. Micronutrients, B, Cu, Fe, Mo, Zn, Cl, Co, Mn, Ni.

There are three major factors which also contribute the nutrition to the plants are:

1. The amount of nutrients in the soil
2. The soil’s ability to supply the nutrients to plants
3. Environmental factors that affect nutrients availability and their absorption.

HEALTH BENEFITS OF BARLEY

When the weather's cold, a big pot of soup simmering on the stove warms the heart as well as the hearth \(^{(1,3)}\). Adding some whole grain barley to the pot will improve the health along with the flavor of soup or stew is to be cooked.

Barley gives intestinal health a boost. In addition to providing bulk and decreasing the transit time of fecal matter, it decrease the risk of colon cancer and hemorrhoids, barley's dietary fiber also provides food for the "friendly" bacteria in the large intestine. When these helpful bacteria ferment barley’s insoluble fiber, they produce a short-chain fatty acid called butyric acid, which serves as the primary fuel for the cells of the large intestine and helps maintain a healthy colon. These helpful bacteria also create two other short-chain fatty acids, prop-ionic and acetic acid, which are used as fuel by the cells of the liver and muscles. The prop-ionic acid produced from barley's insoluble fiber also partly responsible for the cholesterol-lowering properties of fiber.

In animal studies, prop-ionic acid has been shown to inhibit HMG-Co-A reductase, as an enzyme involved in the production of cholesterol by the liver.
By lowering the activity of this enzyme, prop-ionic acid helps lower blood cholesterol levels. In addition, barley’s dietary fiber \(^{(7, 9)}\) is high in \(\beta\)-Glucan, which helps to lower cholesterol by binding to bile acids and removing them from the body via the feces. Bile acids are compounds used to digest fat that are manufactured by the liver from cholesterol.

When they are excreted along with barley’s fiber, the liver must manufacture new bile acids and uses up more cholesterol, thus it lowers the amount of cholesterol in circulation. Soluble fiber may also reduce the amount of cholesterol manufactured by the liver. A study published in the American Journal of Clinical Nutrition \(^{(8, 12)}\) suggests barley’s fiber has multiple beneficial effects on cholesterol.

The study of 25 individuals with high cholesterol (postmenopausal women, premenopausal women, and men), adding barley diet resulted in a significant lowering in total cholesterol in all subjects, plus their amount of large LDL and intermediate HDL fractions (which are considered less atherogenic) increased, and the smaller LDL and VLDL cholesterol (the most dangerous fractions) greatly decreased \(^{(11, 13)}\).

Barley's fiber can prevent a number of different conditions. For example, when barley's fiber binds to and removes cholesterol-containing bile, this can be very beneficial for people struggling with heart disease since it forces the body to make more bile by breaking down cholesterol, thus lowering cholesterol levels.

According to the Archives of Internal Medicine confirms that eating high fiber foods, such as barley, helps prevent heart disease. People eating the dietary fiber, 21 grams per day, had 12% less coronary heart disease (CHD) and 11% less cardiovascular disease (CVD) compared to those eating the least, 5 grams daily. Those eating the most water-soluble dietary fiber fared even better with a 15% reduction in risk of CHD and a 10% risk reduction in CVD. The fiber in
barley also helps to prevent blood sugar levels from rising too high in people with diabetes. Some other important benefits of barley are as follows:

(i) Additional Protection against Atherosclerosis $^{(18)}$

(ii) Significant Cardiovascular Benefits for Postmenopausal Women $^{(18)}$

(iii) Prevent Heart Failure with a Whole Grains Breakfast $^{(16,17)}$

(iv) Barley and Other Whole Grains Substantially Lower Risk of Type-2 Diabetes $^{(32)}$.

(v) A Better Breakfast Choice for Persons with Type-2 Diabetes $^{(32)}$.

(vi) Cereal and Fruit Fiber Protective against Postmenopausal Breast Cancer $^{(29)}$

(vii) Barley Can Help Prevent Gallstones and Whole Grains is Highly Protective against Childhood Asthma $^{(30)}$.

(viii) Promote Optimal Health with Barley's Fiber, Selenium and Lignin’s Protect against Cancers and Heart Disease $^{(24,34)}$. 