

A Monthly e Magazine
ISSN:2583-2212
June 2024 Vol.4(6), 2107-2115

Popular Article

Malted Barley: Potential power of the Perfect Grain

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<https://doi.org/10.5281/zenodo.11548517>

Abstract

One of the most significant cereal crops grown in all of the world's agricultural regions is barley. Barley is rich in fats, vitamins, minerals, proteins and carbs, including beta glucan. Low density lipoprotein cholesterol and total cholesterol may be decreased by eating barley. Additionally rich in antioxidants, barley may aid in blood sugar regulation. For those at risk of cardiovascular disease, it is considered a helpful addition to a balanced diet. It has been demonstrated that barley possesses anticancer effects by immune system regulation and inhibition of cancer cell growth and spread. Malting is the process of steeping, germinating and drying grain to convert it into malt. Malting is the partial germination and drying step that gets barley ready for brewing. It increases in availability of vitamins and minerals and decrease in levels of anti-nutritional factors like phytates and tanins. Its dietary fiber helps reduce insulin activity and decrease the risk of cardiac disease. This procedure causes the grain cell wall to become softer and increase the synthesis of diastatic enzymes, which turn starch into malt extract.

Keywords: Barley grain, Malting, cholesterol, beta- glucan, germination.

Introduction

One of the most important food grains has been barley (*Hordeum vulgare*, family Poaceae) from ancient times. Because it contains more proteins, lipids and soluble dietary fibre, barley without the hull has a better nutritional value than barley with the hull. Different varieties of barley have unique physical and chemical properties that impact how they process and how well they work in the end. Because barley includes a wide range of minerals such as calcium, iron, potassium,

phosphorous and zinc. It is high in nutrients. Magnesium, found in barley, modulates muscle and nerve function and aids in the maintenance of healthy bones. Barley has a lot of phosphorus, which is necessary for the development and maintenance of body's structures and cells (Acar *et al.*, 2020). Zinc, which is found in barley, helps the body fight infection and mend wounds. Haemoglobin, a protein found in red blood cells that transports oxygen throughout the body, requires iron, and barley is a strong supply of this mineral. Potassium, which is found in barley, helps to maintain normal blood pressure regulation as well as neuron and muscle performance. Numerous research conducted in the last few years have demonstrated that eating meals containing barley improves human glucose metabolism. Barley has a lower glycemic index (GI) of 34–70 than other cereals (GI of 55–85 for rice, 52–75 for wheat, and GI of 46–80 for maize). However, food processing and combination can alter a product's GI value (Suman, 2019). Hulled barley, which has a tough, fibrous husk covering it, is mostly used for malting and brewing.

Health benefits

The primary reasons for barley's health benefits are its increased levels of tocals and dietary fibre, namely β -glucan. Grain β -glucan concentration in barley is substantial, almost ten times greater than that of wheat on average (Geng *et al.*, 2022). It is a well-established fact that eating a diet high in β -glucan helps strengthen the body's defences against cardiovascular disease, hypertension, stroke, and type 2 diabetes (Collin, *et al.*, 2021). The final application of barley grains directly affects their chemical makeup. High protein barley is appropriate for use in human diet and animal feed, whereas low protein barley is predicted for use in brewing or malting. Overall, the primary ingredients of barley grains are minerals, lipids, proteins, carbohydrates, and a variety of secondary metabolites, including vitamin and phenolic compounds. It slows the absorption of utilised oils by making the small intestine more viscous. Furthermore, β -glucan has the ability to attach to bile acids and eliminate them from the body, eventually dissolving and substituting cholesterol. Consuming pure β -glucan derived from barley seeds or oats has the potential to reduce blood cholesterol levels, especially LDL levels (Poutanen, 2020). Barley is a wonderful food since it is packed with fibre, vitamins, and minerals, among other beneficial ingredients. There are minerals like iron, zinc, magnesium, and phosphorus; there's also vitamin E and the B-complex vitamins. Barley has a lot of beta-glucan, a kind of soluble fibre that has been connected to lower cholesterol and a lower risk of heart disease. Barley is a great option for those with diabetes because of its ability to help control blood sugar levels due to its fibre content. The high fibre content of barley may also help promote regular bowel movements and relieve constipation (Biswas, and



Ansari, 2023). It has been demonstrated that the antioxidants in barley strengthen immunity and guard against the harm caused by free radicals. Certain studies have connected the antioxidant content of barley to a decreased risk of cancer, especially colon cancer. Due to its low calorie and fat content, high fibre content, and potential to prolong feelings of fullness, barley is a fantastic choice for anybody attempting to lose weight. All things considered, eating barley may contribute to a healthier diet and more nutrient-dense diet (Chin, et al., 2016).

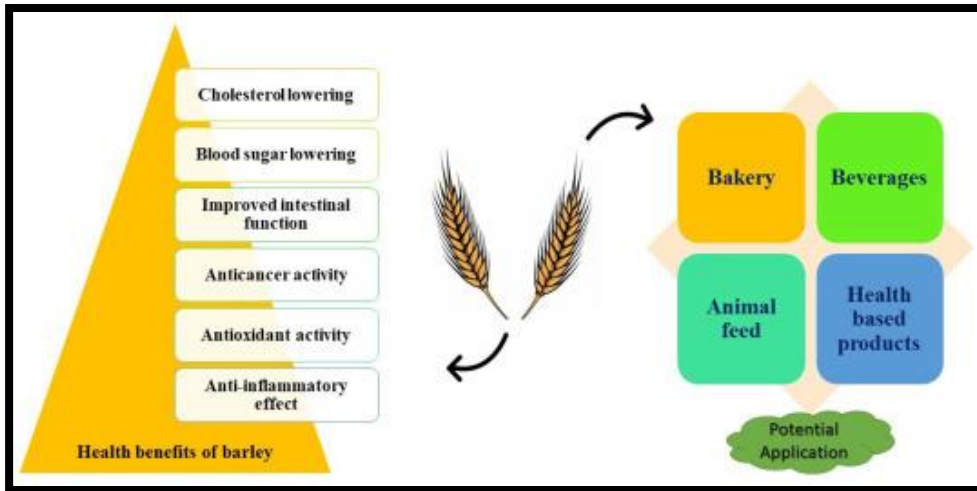


Fig: Health Benefits of Barley

Table: Nutrition Composition of barley

| Nutrients | Amount (per 100gm) |
|--------------------|--------------------|
| Energy | 354 kcal |
| Total fat | 2.3g |
| Saturated fat | 0.5g |
| Cholesterol | 0mg |
| Sodium | 12 mg |
| Potassium, | 452mg |
| Total carbohydrate | 73g |
| Dietary fiber | 17 g |
| Sugar | 0.8g |
| Protein | 12g |
| Vitamin C | 0g |
| Iron | 1.9mg |
| Vitamin B6 | 1.5mg |
| Magnesium | 3.3mg |

Source: USDA



Malting

Malting is the method of causing any cereal grain to germinate by soaking it in water and then drying it with hot air to prevent further germination. Small quantities of other sugars, such as fructose and sucrose, which are not byproducts of starch modification, are also present in malt. Barley is the most common cereal used for the production of malt since it has a high starch to protein ratio and adhering husk that contribute to the economic yield and ease of processing. Malting aims to convert or modify the physical structure of the barley grain and allow synthesis or activation of a series of enzymes. (Mallet, 2014).

Steeping

The steeping step, which raises the moisture content of the wheat to around 42-47 percent by immersing dry grains in water, is the first step in the malting process. During the process of steeping, water is submerged for two to four days at a time, and then the water is drained and carbon dioxide (CO₂) is removed with the use of fans during an air-rest phase. During the steeping process, the steep vessel must be adequately aerated with water at a controlled temperature (12°C for partially dormant grains and 16–18°C for less dormant grains) while effectively removing CO₂. This is because insufficient oxygen causes microbial development, anaerobiosis, and souring, while excessive aeration causes unwanted growth and starch loss (Geng *et al.*, 2022).

Germination

The development of the embryo, which is indicated by the expansion of the rootlets and an increase in shoot length, together with the concurrent change of endosperm, is what characterises the germination process. In order to maintain the grains' looseness, provide sufficient ventilation, prevent matting, and stop the grains from warming due to respiratory heat, the steeped grains are spread out on the floor and the grain bed is manually flipped over (Carvalho, *et al.*, 2018). Pneumatic systems are being used in containers of various sizes and forms, such as rectangular Saladin boxes or drums with circular germination tanks, to carry out this procedure. Depending on the raw material and process parameters, germination takes place in humid, aerobic conditions at 16–20°C for three to six days (Poutanen, 2020).

Kilning

In order to destroy the embryo and stop the germination process, the green malt is moved into the kilning chamber and heated air is blasted. The purpose of the kilning process is to stop internal alterations, bring the malt's moisture level down to less than 5 percent, guarantee product stability for transportation and storage, and stop enzyme denaturation (Guido and Moreira



2013). Additionally, kilning encourages the nonenzymatic Maillard reaction between amino acids and sugars, which results in the synthesis of melanoidins. Due to their high hygroscopic nature, the dried rootlets or culms are removed after the kilning process. Malt is matured for a minimum of three weeks before to being stored in a bin to ensure that any residual moisture is distributed evenly throughout the grain (Howe, 2020).

Advantages of malting

Malting offers several advantages, particularly in brewing and distilling industries (Bello, *et al.*, 2020). Here are the primary benefits:

1. **Enzyme Activation:** Malting activates enzymes like amylase, which are crucial for converting starches into fermentable sugars during the brewing process.
2. **Flavor Development:** The malting process develops complex flavors and colors in grains. This is essential for producing the distinctive tastes of various beers and whiskeys.
3. **Nutrient Availability:** Malting breaks down complex proteins and starches, making nutrients more accessible to yeast during fermentation. This enhances the efficiency and effectiveness of fermentation.
4. **Improved Digestibility:** In food products, malting can improve the digestibility of grains, making them easier for humans and animals to absorb nutrients.
5. **Aroma and Color:** The kilning stage of malting can impart different aromas and colors to the malt, which are crucial for the sensory properties of the final product.
6. **Shelf Stability:** Properly malted and kilned grains have improved shelf stability, reduced the risk of spoilage and extended the storage life of the raw materials.

Overall, malting is a vital process that enhances the functionality, flavor, and quality of grains used in brewing, distilling, and various food applications.

Disadvantage of Malting

Malting, the process of germinating cereal grains by soaking them in water and then drying them, has several disadvantages:

1. **Cost and Labor Intensive:** Malting requires specialized equipment and skilled labor, increasing production costs.
2. **Time-Consuming:** The malting process can take several days, which slows down the overall production timeline for brewing or other uses.



3. **Quality Control:** Ensuring consistent quality can be challenging, as variations in temperature, moisture, and grain quality can affect the final product.
4. **Energy Consumption:** The drying and kilning stages of malting are energy-intensive, leading to higher energy costs and environmental impact.
5. **Storage and Handling:** Malted grains require careful storage to prevent spoilage or pest infestations, adding to logistical challenges.
6. **Nutrient Loss:** Some nutrients may be lost during the malting process, which can affect the nutritional profile of the final product.

Table: Nutritional impact of Barley after malting process

| Nutrients | Amount (per 100gm) |
|--------------------|--------------------|
| Energy | 361 kcal |
| Total fat | 1.8g |
| Saturated fat | 0.4g |
| Cholesterol | 0mg |
| Sodium | 11 mg |
| Potassium, | 224mg |
| Total carbohydrate | 78g |
| Dietary fiber | 7 g |
| Sugar | 0.8g |
| Protein | 10g |
| Vitamin C | 1 gm |
| Iron | 2.6mg |
| Vitamin B6 | 3.5mg |
| Magnesium | 2.4mg |

Source: USDA

Conclusion

Specifically, barley is considered a desired healthy food since it may fulfil the requirements of a diet that is high in fibre, low in calories, and rich in probiotics. It is generally known what the constituent qualities, nutritional value, and health benefits of barley grain. More work has to be put into developing new food items that are well liked by customers and markets, improving the quality of barley so that it is more suited for food processing and better using these qualities in barley food processing. Barley is one of the most significant cereals due to its high bioactive components. Because of their beta glucan content, which helps control blood sugar, cholesterol and belly fat,



these foods ought to be promoted more and diminishes the chance of colon cancer. In less developed and rural regions, it is acknowledged as a rich source of protein and minerals, especially given its ability to flourish in adverse settings. Malted barley supports digestive health by promoting probiotic growth and aiding nutrient absorption. Barley malt is also associated with improved heart health, as it helps regulate cholesterol levels. Additionally, malted barley is rich in nutrients, reduce antinutrients, and contains compounds that stimulate mood and well being when consumed in moderation.

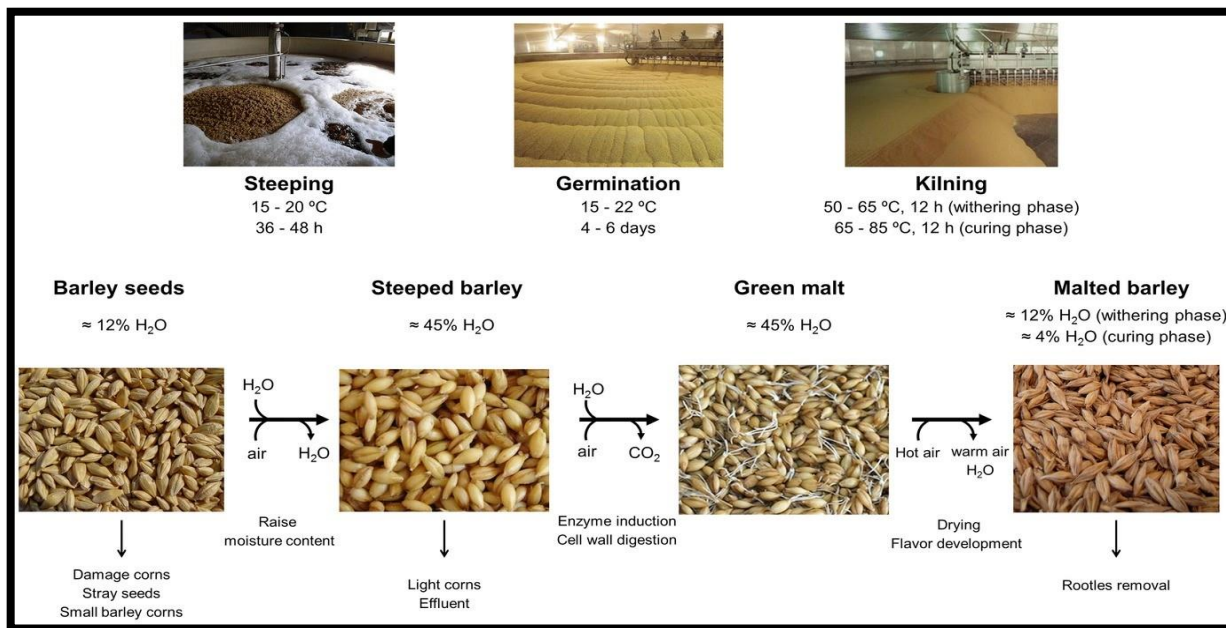


Fig: Malting Process

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