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Structure, health benefits and value added products of barley

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Abstract

Barley, the scientific name of barley is "*Hordeum vulgare*", it belongs to the grass family and it is one among the four cereal crops worldwide which are rice, corn and wheat. There are three main parts of barley grain which are embryo, endosperm and the covering layers of maternal origin. Barley provides health benefits of lowering serum cholesterol by the formation of high viscosity solution in intestine which delays intestinal absorption of glucose and lipids, it also helps in fighting against constipation and diarrhea, facilitate weight loss, blood sugar level management, promote heart health and by controlling hormone levels helps in prevention of hormone-related cancers and prevent formation of gallstones.

Keywords: *Hordeum vulgare*, endosperm, barley grain, absorption

Introduction

Barley, the scientific name of barley is "*Hordeum vulgare*", it belongs to the grass family and it is one among the four cereal crops worldwide which are rice, corn and wheat, which are the member of the Poaceae family. In the Europe, barley is used as one of the most important raw material for the production of beer and it is also used as feed for farm animals such as poultry. As barley contains more fiber and less protein it will be used as good replacement for wheat as feed. Due to low content of gluten barley is easily digestible but it contain high concentration of lysine, thiamine and riboflavin which makes it's nutritional quality suoperior^[1]. On the bases of rows barley is classified in two classes one is the two row barley and other is six rows barley.

- Two-row barley: It contains two rows of seeds which locate on each spike and has one fertile floret per node of rachis
- Six-row barley: It contains six rows of seeds which locate on each spike and it has six fertile floret per node of rachis^[2].

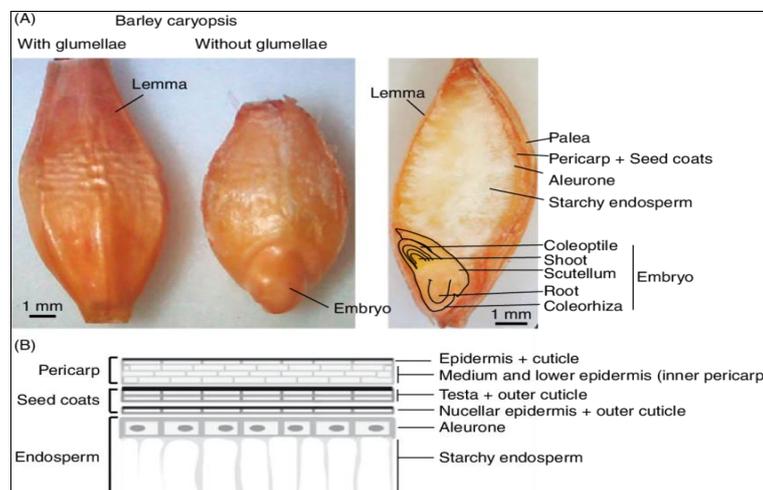


Fig 1: Structure of Barley

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The three main parts of the barley grain are as follows:

- The Endosperm
- The Embryo
- The layers covering maternal origin

1. Endosperm

The endosperm is made up of the starchy endosperm which is surrounded by aleurone layer. The starchy endosperm covers the largest part of the grain that is about 75% of the grain's weight. The function of starchy endosperm is to supply nutrients during germination for development of the embryo. This is made up of dead cells which contain starch granules embedded in the protein matrix. The cell wall is made up of mixed-linkage of (1-3, 1-4) beta-D- glucan (75%) and arabinoxylan (20%).

The covering layer of starchy endosperm is the subaleurone layer which contains more storage protein than other starchy endosperm cells. The endosperm is of irregular shape.

2. The embryo

The embryo consists of an acrospire which is a nodal region between the root and shoot, a primary root is covered by coleorhizae. During germination the embryo is separated from the endosperm by means of scutellum and it is referred as modified cotyledon. The outermost layer of the scutellum is called as scutellar epithelium that covers the endosperm which is made up of compressed cell wall material.

3. The covering layers of maternal origin

The innermost layer of the endosperm is the nucellar epidermis which consists of hyaline and covers the endosperm and the embryo. It supplies nutrients to the embryo and endosperm for their development at the early stage of grain development. There is absence of pigment in the nucellar epidermis.

The middle layer consist of two layers namely Testa and Pericarp. The Testa also referred as "seed coat" which very thin and it surrounds the nucellar epidermis. The Testa is made up of two layers which are having cells of different angles. The cells of inner layer are arranged as parallel to the crease, while the cells of outer layer of testa are at right angle to the crease. The Pericarp is also called as "fruit coat", which is present above the Testa. The most cells of pericarp layer of matured barley grain are dry and empty. There is presence of large intra cellular space between these cells. The Testa and Pericarp layers are differentiated by a thick cutin layer and this maintains the water impermeability of the barley grain.

The outermost layer of the barley grain is called as "husk." This covers the 13% weight of the grain which is second largest part of the grain just after the starchy endosperm. The husk is made of two covering layers one lemma that covers the grain ventrally and the other is palea that covers the grain dorsally [3].

Health benefit

The health benefits of barley are as follows

- A. Barley contains soluble fiber namely beta-glucan this facilitates lowering of serum cholesterol, by the formation of high viscosity solution in intestine which delayed intestinal absorption of glucose and lipids and inhibition of absorption and re absorption of cholesterol and bile acids accompanied by increased excretion of bile acids [4, 12].
- B. The total fiber present in barley helps in the prevention of constipation and diarrhea by formation of bulk in the

digestive tract. Hence regulating the bowel movement [6, 15].

- C. The beta-glucan fiber present in the barley help us for weight loss [7, 16].
- D. The barley fiber delays the absorption of sugar in the blood stream by this it property it makes barley as the better grain choice for the persons with the complaint of diabetes and other metabolic syndromes [8, 13, 14, 5].
- E. The Barley has high source of soluble fiber which gives it the quality of heart health benefits because it inhibits the amount of bad cholesterol that can be absorbed by the intestines. This will be done by the beta glucan soluble fiber of barley, which bind bile in the digestive tract to cholesterol and therefore to help pull it through the colon and out of the body in stool [9, 17, 18].
- F. Barley contains an antioxidant called lignin, which promotes the enterolactone's serum level as that is responsible for balancing the hormone levels in over body, hence provides strength to the body in fighting against hormone related cancers [10, 17].
- G. Barley fiber will aid in the dissolution of gallstones in by aiding in metabolism of bile and cholesterol in our body. As these two, bile and cholesterol are responsible for the formation of gallstones, so by metabolizing these two, barley fiber will prevent formation of gallstones [11, 19].

Value Added barley products

- **Barley infusion:** This is a substitute of coffee but it will not containing any caffeine in it, as it is prepared by the toasting and grinding of barley grains. This is very popular in Europe and Italy as the name Barley Coffee.
- **Barley water:** This beverage is prepared by boiling the barley grains in water and to this beverage flavor can be given by the addition of various fruits as per the choice in it the time of boiling it or after boiling.
- **Barley tea:** This is prepared by steeping the lightly toasted barley grains in hot water. In Asai it is famous by the name "mugicha".
- **Malted beverage:** This beverage is prepared by the boiling of barley malt in the water preferably spices can be added to impart the taste in this beverage. Mostly this beverage is used as weaning food [20].
- **Barley Biscuits**
- **Barley Breads** [21]

Conclusion

Barley, the scientific name of barley is "*Hordeum vulgare*", it belongs to the grass family and it is one among the four cereal crops worldwide which are rice, corn and wheat, which are the member of the Poaceae family. There are three main parts of barley grain which are embryo, endosperm and the covering layers of maternal origin.

Barley provides health benefits of reducing the chances of CVD, obesity by lowering serum cholesterol levels and reduces chances of diabetes mellitus. Due to the antimicrobial property of barley, it is used in the treatment of cough, bladder inflammation, cholera, and diabetes and dermatitis disease. The barley also helps to fight constipation and diarrhea. Barley also helpful in prevention of cancer and gallstones and barley also used as diet for weight loss.

Value added products of barley are barley infusion, barley tae, barley water, malted beverages, barley bread and barley biscuits.

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