

## New Utilization of Barley as Human Healthy Food

**Maher Noaman M\***

Field Crops Research Institute, Agricultural Research Center, Giza, Egypt

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**\*Corresponding author:**  
Maher Noaman M

✉ mahernoaman@yahoo.com

Field Crops Research Institute, Agricultural Research Center, Giza, Egypt.

**Tel:** +39.06.5705.3413

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### Editorial

Cereals are among the most widely cultivated crops in North Africa and in the world, where they are the main source of carbohydrates for the majority of the population. Barley (*Hordeum vulgare* L.) is the fourth most important cereal crop, after maize (*Zea mays* L.), wheat (*Triticum aestivum* L., *Triticum durum*) and rice (*Oryza sativa* L.) Barley is grown both for human consumption and animal feed, but wheat remains the main staple food in Egypt. Therefore, barley has been used almost exclusively as animal feed. However, due to the increasing demand for cereals and the lack of adequate supply to meet this demand, there is a need for an increase in the production of cereal crops, especially those with high drought tolerance and low water demand that better suit the arid and semi-arid regions in Egypt and other areas of North Africa. Due to its relative tolerance to drought and other stress conditions and low water requirement, barley is regaining attention for cultivation instead of other water-consuming cereals, namely wheat, corn and rice.

Current efforts are directed at improving barley yields, which are as less than 1 t ha<sup>-1</sup> compared to a potential yield of 3 t ha<sup>-1</sup>. This low yield has been attributed to factors such as biotic and abiotic stresses, poor management, inappropriate irrigation practices and the lack of access to information about the latest cropping system technologies. There is an escalating need to improve the productivity of barley crop in order to combat widespread problems such as malnutrition, food shortage and poverty prevalent in North African countries.

Barriers preventing the widespread cultivation of barley and hence limiting the production capacity, include abiotic stresses such as drought, salinity and low soil fertility and biotic stresses such as viral, bacterial and fungal diseases. Since barley cultivation in Egypt is mainly found in the rainfed areas and in the newly reclaimed lands, where there is a shortage in water supply, low soil fertility and high salinity at some areas, much of the attention directed at improving barley yields has been focused on combating abiotic stresses, namely drought and salinity.

### Chemical composition of barley grain

Whole barley grain consists of about 65% to 68% starch, 10% to 17% protein, 4% to 9% *B*-glucan, 2% to 3% free lipids and 1.5% to 2.5% minerals. Total dietary fiber ranges from 11% to

34% and soluble dietary fiber from 3% to 20%. Hull-less or de-hulled barley grain contains 11% to 20% total dietary fiber, 11% to 14% insoluble dietary fiber and 3% to 10% soluble dietary fiber. Pearling reduces the contents of insoluble fiber, protein, ash and free lipids, but increases the contents of starch and *B*-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 *B*-glucan than the endosperm. The composition and physical characteristics of barley grain have large influences on the processing properties and product quality of foods prepared from or incorporated with pearled barley and/or barley flour. Hull-less barley requires little or no effort to remove the hull during threshing or processing and would be more suitable for processing and human consumption than hulled barley.

### The economic impact

With the global food problems and environmental changes, the demand on cereals, especially those that are drought tolerant such as wheat and barley has increased tremendously. The economic impact of increasing barley productivity in Egypt is tremendous from various aspects. Barley is limited to animal feed in Egypt although it has a high nutritional value and can serve as human food. It is a rich source of carbohydrates and beta-glucan compared to other cereals. Accordingly, the increase in productivity of barley using the virus-resistant and high-quality genotypes will, not only shift barley from being animals feed in Egypt, but will also provide wheat alternative for bread and other

bakery products. With constant increase of barley production, Egypt will save millions of dollars spent on wheat import and can reach self-sufficiency in both cereals. As a result, this will decrease the consumption prices of various wheat and barley depending products. This can be a step towards barley and other cereals export and will shift the economical balance to Egypt's favor.

Taking into consideration that diabetes and high-cholesterol related syndromes are among the major health problems in Egypt, barely was proved to reduce blood cholesterol and glucose concentration in patients. These findings will encourage further research on barley's medicinal importance coming out with new treatments for these problems. Consequently, this will improve the health of individuals and increase productivity, accordingly. As a result, this will lead to an effective increase in labor hand's power and affecting economy at all levels (i.e. industry, agriculture and commerce).

## Products from barley flour

1. Simplified roller milling procedure that gives a high yield of a Fiber-Rich Fraction (FRF) from hull-less barley. FRF can be successfully incorporated into pasta. Incorporation of FRF into pan bread to produce a satisfactory product is more challenging, particularly for straight-dough processes. We investigate incorporating FRF as a high DF ingredient in two-layer flat bread. Additionally, the effects of particle size reduction of FRF by pin milling on FRF functional properties are being studied.
2. Flat breads are better able to accommodate high DF ingredients than pan or hearth bread without loss of quality because of more modest flour quality requirements. Barley can be successfully incorporated into single layer flat breads. Two-layer flat bread is widespread in Middle Eastern and North African countries, and is becoming increasingly popular in western countries. Two-layer flat bread is commonly produced from high extraction flour, making it likely to find widespread acceptance as a high DF food.
3. Soluble Beta-Glucan (BG) may have a negative effect on

bread volume, although their effect will depend on the level of supplementation and quality of wheat flour as well as on the intrinsic properties of BG, such as their molecular weight.

4. Production of several bakery products as biscuits, flakes, cookies, crackers and pasta.

## Health claims for barley

One such important cereal grain not used mostly by youngsters is barley. It is a good old grain with so many health benefits. Barley has received attention from health professionals for its fiber content, particularly  $\beta$ -glucan, which has been shown like weight reduction, decreasing blood pressure, blood cholesterol, and blood glucose in Type 2 diabetes and preventing colon cancer. It is easily available and cheap grain. It contains both soluble and insoluble fiber, protein, vitamins B and E, minerals, selenium, magnesium and iron, copper, flavonoids and anthocynins. Barley contains soluble fiber, *beta*-glucan binds to bile acids in the intestines and thereby decreasing plasma cholesterol levels. Absorbed soluble fiber decreases cholesterol synthesis by liver and cleansing blood vessels. Insoluble fiber provides bulkiness in the intestines, thereby decreasing appetite. It promotes intestinal movements relieving constipation, cleansing colonic harmful bacteria and reduced incidence of colonic cancer. It is a good source of niacin, reducing LDL (low density lipoprotein) and increasing HDL (high density lipoprotein) levels. Minerals such as selenium and vitamin E provide beneficial antioxidant effects. Magnesium, a co-factor for many carbohydrate metabolism enzymes and high fiber content contributes for its blood glucose reducing effect in Type 2 diabetes. It has good diuretic activity and is useful in urinary tract infections.

However, the substitution of barley flour for part of the wheat flour can provide sufficient soluble dietary fiber to make a significant improvement in human health. Beta-Glucans (BG), the major fiber constituents in barley, have been shown to lower plasma cholesterol, reduce glycemic index and reduce the risk of colon cancer. Their efficacy in reducing the risk of coronary heart diseases (CHD) has recently been recognized by the Food and Drug Administration (FDA).