

Food Uses of Barley

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Abstract:

Barley grain is used as feed, malt, and food. Our ancestors depended on barley as a staple food more than we do now. Barley played an important role in the origin and development of the Neolithic culture. Since its domestication barley was the staple food of the masses, and it had a reputation for building strength. Nowadays barley is an important staple food in several developing countries; generally it is the most viable option in places characterized by harsh living conditions and home to some of the poorest farmers in the world. Morocco is the largest consumer of food barley, with a large variety of dishes, including soups, bread, and couscous made from barley grain. Barley accounts for over 60% of the food of the people in the highlands of Ethiopia, where it is used in diverse recipes that have deep roots in culture and tradition. Barley is the preferred grain, after tef, for making the traditional bread called *Injera*. In Yemen, barley grain is used in various dishes and local drinks. In the Andean Region barley 'rice,' coarsely broken grain, is used for soups, while barley flakes are eaten for breakfast. Use of barley in human food is very limited in developed countries, representing less than 5% of the total production. In the past two decades there has been a renewed interest in food uses of barley. Barley products include blocked, pot, and pearled barley, barley flakes, and flour, although most of the use has been largely confined to pearled barley in soup and to flakes in breakfast cereals. 'Barley coffee' is very popular in Europe. Most efforts in barley breeding have focused on feed and malting barley. There is a scope for the development of food barley varieties with higher and stable yield, better grain quality, and high nutritive barley varieties. Food barley research will have a direct impact on the livelihood of the rural population in the regions where barley is a staple food not only by increasing sustainable crop productivity but also by improving nutritional quality, and developing barley-based local industry.

Key Words:

Barley, food

Introduction:

Barley (*Hordeum vulgare* L. emend. Bowden) was one of the earliest crops domesticated about 10,000 years ago in the Fertile Crescent of the Near East (1), at sites not far from where today ICARDA's Headquarters are located, from wild forms morphologically identical to present day *Hordeum spontaneum*. From this origin, barley is now grown over a broader environmental range than any other cereal from 70°N in Norway to 46°S in Chile. Also, in Tibet, Ethiopia and the Andes, it is cultivated higher on the mountain slopes than other cereals. Today barley is grown on about 57 million hectares of which 32 million hectares in the developing countries, including those of Central Asia and the Caucasus.

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Barley was the energy food of the masses with a reputation for building strength. It was awarded to the champions of the Eleusian games. Gladiators of the Roman Empire were called *hordearii*, barley-men, because barley was the main component of their training diet.

Early barley remnants from Mesopotamia and Egypt are much more abundant than those of wheat, and the earliest literature suggests that barley was more important than wheat for human food. The Sumerians had a god for barley but none for wheat. In the Near East and Mediterranean, the shift to wheat as human food came in classical times, and by the first century A.D. barley was already mostly fed to animals. In northern Europe barley remained the main food cereal until the 16th century.

Barley is still a major staple food in several regions of the world: in some areas of North Africa and Near East, in the highlands of Central Asia, in the Horn of Africa, in the Andean countries and in the Baltic States. These regions are characterised by harsh living conditions and are home to some of the poorest farmers in the world who depend on low productive systems.

At present very little barley is used as human food in developed countries. In the last two decades we have seen a rediscovery of food preparations with barley. In several countries there has been a renewed interest in food barley as healthy food in general and as a source of soluble fibre implicated in hypocholesterolemia and hypoglycaemia in non-insulin-dependent diabetes.

Food barley status:

In Morocco, Algeria, Libya and Tunisia, average annual national consumption of food barley in 2002 was 35.6, 15.4, 12.7 and 6.5 kg/person, respectively (2). Although specific statistics for food barley within countries are lacking, it is widely recognized that the consumption is much higher in certain areas within a country, e.g. Gamal region in Algeria, Tensift in Morocco, Sfax in Tunisia. In the rest of the world, barley is also consumed as food in the highlands of Ethiopia, Eritrea, Peru and Ecuador (12.9, 3.9, 4.1 and 1.7 kg/person/y, respectively), in East Europe (Estonia, Moldova, Latvia, Lithuania: 13.4, 19.5, 19.5 and 17.8 kg/person/y, respectively) and in the highlands of Central Asia (3.4 kg/person/y).

Food barley consumption has decreased considerably in the last 40 years with the increase of urban population and, often, the introduction of national policies supporting wheat consumption. This is the case of Morocco where food barley consumption has decreased from 87 kg/person/y in 1961 to 36 in 2002. In the case of Algeria, Libya and Tunisia, food barley consumption in 1961 was 27, 35 and 15 kg/person/y, respectively.

In Europe the average consumption of food barley decreased from 1.6 kg/person/y in 1961 to a minimum of 0.9 in 1991, when it started to increase and reached 1.6 kg/person/y in 2002.

Traditional uses of barley:

Over the years, there has been accumulated local knowledge on preparation, health and nutritious attributes of food barley. Food barley cultivars have particular characteristics appreciated by consumers that make them irreplaceable by feed or malting barley. This local knowledge and the unique genetic material need to be preserved for future generations.

Barley products utilized for traditional preparations can be classified in:

- a) Whole grain;
- b) Cracked grain;
- c) Raw-grain flour (fine and coarse);
- d) Whole roasted grain;
- e) Roasted-grain flour (fine and coarse).

Morocco is the largest consumer of barley as food. There the crop has played a significant role in food security of households throughout history. Since the beginning of the second millennium succeeding dynasties have relied on large barley grain storage facilities as bulwarks against hunger. About 20% of barley grain in Morocco is used as food, mainly in the mountainous and southern parts of the country. Consumption is higher in dry years. Barley grain is mainly used as food in the rural mountain and southern areas of Morocco with an average annual consumption of 54 kg per person, compared with 5.5 kg per person in the cities (3). Barley is used as flour, as semolina, and as whole-dehulled grain (4). A large variety of dishes, including soups, bread, and couscous are made from barley products. Preparations include both product from fully mature grains and grains harvested at physiological maturity (*Azenbou*). Barley grain stored underground for over three years is called *Aballagh* and is used to produce both flour and semolina (coarse flour) (4).

Barley accounts for over 60% of the food of the people in the highlands of Ethiopia (5); it is used in diverse recipes that have deep roots in culture and tradition. Some recipes, such as *Besso* (fine flour of well-roasted barley grain moistened with water, butter or oil), *Zurbegonie* (same type of flour used for *besso* dissolved in cold water with sugar) and *Chiko* (*besso* soaked with butter alone), which have long shelf life, can only be prepared from barley grain. Other recipes, such as *Genfo* (thick porridge), *Kolo* (de-hulled and roasted barley grain served as snack), *Kinche* (thick porridge) are most popular when made from barley grain, but can be prepared from other cereals also. Barley is the preferred grain, after tef, for making the traditional bread called *Injera*, which can be used either solely or in combination with tef flour or other cereal flours. Other recipes, such as *Dabbo* (bread), *Kitta* (thin, unleavened, dry bread) and *Atmit* (soup) can be prepared with only barley or blended with other cereal flours. Among local beverages *Tella* and *Borde* are prominent, and best made from barley grain. Barley spikes both unripe at milk or dough stage and ripe and dry are also roasted over flame and the grain is eaten as snack called *Eshete* or *Wotelo* if the spikes are unripe or *Enkuto*

if the roasted barley spikes are dry (6). Barley is also traditionally used in the preparation of a gruel utilized as weaning food.

In Yemen, barley is grown at 1,800-3,000 meters above sea level, and the grain is used in various dishes and local drinks. *Maloog* and *Matany* are two types of bread made from a blend of barley flour and bread wheat flour the earlier, and barley flour and lentil flour the latter. *Nakia* is a local drink made from boiled barley grain (7).

In the Andes of Colombia, Ecuador, Peru and Bolivia, barley is the staple food of farmers at altitudes between 2,200 and 4,000 meters above sea level. It is the crop best adapted to high altitudes, drought, salinity, and aluminium toxicity. Its earliness and cold tolerance make it suited to the short frost-free growing seasons in the high altitudes (8). In this area barley is roasted and finely ground into *Machica* or *Pito*; *barley rice*, coarsely cracked barley, is used for soups; and barley flakes, a relatively recent product, are eaten for breakfast. Hull-less barley is preferred, and earns a higher price than regular barley. For example, in Ecuador, variety 'Atahualpa', with its larger and lighter hull-free kernels, is paid 10% more than other varieties (8).

Hull-less barley is the main staple food crop in Tibet, where it accounts for 56% of the total food production, and about 2.1 million people consume barley (9). The main product of hull-less barley is a roasted barley flour known as *Tsangpa*; *Chang* brewed from hull-less barley is the major alcoholic beverage. In addition barley is used for cakes, soups, porridge and snack foods. To prepare *Tsangpa* the grain is carefully cleaned, washed and roasted with fine sand. The sand is needed to distribute the heat evenly and prevents the barley kernels from burning. After roasting the sand is sieved off and the remaining roasted barley grain (called *Yue*) is ground into *Tsangpa* using a water mill. *Tsangpa* can be eaten as such (mixed with sugar) or can be the basic ingredient for the preparation of soups, cakes, and beverages (9).

Food uses of barley in developed countries:

In most developed countries the use of barley in human food is very limited, less than 5% of the total production (10). However in the past two decades there has been a renewed interest in food uses of barley, even in countries where barley never had a prominent position as a food crop. The whole barley grain can be processed to produce blocked, pot, and pearled barley, barley flakes, and flour (11). Barley products are suitable for use in many food preparations, including different types of bread, pasta, rice extender, and for baby foods, although most of the use has been largely confined to pot or pearled barley in soup and to flakes in breakfast cereals.

Roasted barley can be used as coffee-substitute. 'Barley coffee' is very popular in Europe. In Italy, known as *Caffe d'orzo*, is commonly used as a breakfast drink for children, often mixed with milk.

The potential benefit of soluble dietary fibre such as the β -glucan in lowering the cholesterol level and postprandial blood glucose and insulin response has been reported by several authors (12). Tocols (tocopherols and tocotrienols) are also reported to lower the total cholesterol and the low density lipoprotein cholesterol (13). Barley grain is a good source of both β -glucan and tocopherols. This has generated a great interest in food uses of barley, with the development of several recipes based on barley products (14).

Food barley improvement:

Most efforts in barley breeding have focused on feed and malting cultivars. International and national agricultural research has almost completely neglected the improvement of food barley, particularly the quality aspects. Attributes such as kernel weight, size, and colour, and protein content are often recorded routinely in breeding program, but many more characters are associated with the use of barley as human food. In response to the request from several national programs, the Barley Project at the International Center for Agricultural Research in the Dry Areas (ICARDA) began a program to improve the adaptation and quality of food barley, based mainly, but not exclusively, on hull-less germplasm. β -glucan content, kernel hardness, husk percentage, and cooking time have been introduced as screening procedures.

Information on milling quality of barley, use, functionality, and interaction of barley preparations is still fragmented or lacking.

One recent area of research is the production of biofortified crops - varieties bred for increased mineral and vitamin content - to mitigate the problem of micronutrient deficiency that affects hundreds of millions of people in developing countries, especially women and children. The HarvestPlus Challenge Program is an international, interdisciplinary, research program that seeks to reduce micronutrient malnutrition by harnessing the powers of agriculture and nutrition research to breed nutrient dense staple foods. ICARDA receives support by HarvestPlus to identify barley germplasm with high concentration of iron and zinc in the

grain. A collection a barley landraces and improved lines was screened recently at ICARDA, the content of zinc in the grain varied from 23 to 50 ppm, the content of iron from 26 to 67 ppm. The hull-less barley variety 'Atahualpa' with an average value of 47 ppm of zinc and 55 ppm of iron, is particularly promising. Eventually, the development of micronutrient-dense barley varieties will supply more micronutrients, in those areas where barley is already in the food systems.

Conclusions:

While barley has been largely forgotten as a food grain in the developed countries, it is still a major staple food in some of the poorest region of the world. The common feature being that research has almost completely neglected the improvement of food barley, particularly the quality aspects. More information is needed on users and consumers preferences, and more applied and basic research needs to be conducted on the quality traits required for different products under different processing conditions. In the last two decades we have seen a rediscovery of food preparations with barley, and as a consequence more attention has been paid to the improvement of food barley. In addition barley is a typical crop of less favoured, low input, stressful environments, able to withstand poor soil fertility and poor agronomic management better than other cereals. Therefore barley can play an important role in organic agriculture and can help in reducing the pressure on the use of natural resources. There is a scope for the development of food barley varieties with higher and stable yield, better grain quality, and high nutritive value. Eventually food barley research will have a direct impact on the livelihood of the rural population in the regions where barley is a staple food not only by increasing sustainable crop productivity but also by improving nutritional quality, and developing barley-based local industry.

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