



NIBIO

NORSK INSTITUTT FOR
BIOØKONOMI

COUNTLESS POSSIBILITIES FOR BARLEY PRODUCTS – REVIEW OF OUTCOMES

Hilde Halland, NIBIO Holt
Tromsø in northern Norway



Northern Periphery and
Arctic Programme
2014–2020



EUROPEAN UNION

Investing in your future
European Regional Development Fund



Food trends:

- Local – food traceability
- Traditional – back to the roots
- Healthy
- Convenience





«Korn på staur» ca 70°N. Sorten Fløya. Holt, Tromsø, 1938

Historical barley production and use in northern Norway – before 1945, farming for self-sufficiency

Pollen analysis show cereal production in the Bronze age about 1.400 - 1.100 B.C. (Mikkelsen, 1979).

Fjærvoll (1961)

Total yearly yield in Hålogaland in the 17th century = ca 800 tonns cereal per year.
On average each person in Hålogaland had 23,4 kg of cereal
This would equal 11 % of the calories needed.

“conidering the fact that in the 17th century they were far more cautious in the use of flour than today, it is reason to believe that many managed with the food grain they grew, especially in good years”.

Topographical maps in the scale 1:50000
we find 3-5 mill rivers or mill streams in the place names on each map sheets
(Lindahl, 2009).



Traditional use of barley for food in northern Norway

Grøttland (2001):

Barley bread is one of the oldest known types of bread in Northern Norway

(The barley-bread) could not be made from bought-barley, but of homegrown barley milled at the local mill. Then the bread keep soft and tasted good. The flour was whole grain and nutritious. Both the grain and the flour was fresh, not old and life-less.

The barley bread was a 15 cm round bread clapped relatively flat and made of 100 % barley flour. Flatbread and lefse made of respectively 2/3 and 1/3 barley (the rest being rye from Russia). Barley-porridge made of barley flour was also an important part of the everyday diet.



Barley is not just barley!

Barley is produced all over the world in different climates and for different end uses.

Feed is the main use of barley world-wide, followed by malt and seed.

Only 1 % of the barley production is used for food.

Grain quality is a diverse parameter, the meaning varies depending on your place in the value chain:

- The farmer is mainly interested in a good yield and a cereal that is little susceptible to diseases
- The industry is interested in a grain that is good to process, with good baking quality
- The consumer is mainly interested in taste, history and health-components

In addition, chemical qualities such as nutritional value and processing properties including sensory properties differ among different barley varieties.

For example, the content of beta-glucans can vary from 2-11 % in different varieties.



Lack of quality criteria for barley as a food grain

No clear quality criteria for barley as a food grain, and no proper sorting or separation based on different barley grain qualities. -Thus, all the barley usually end in one silo.

This result in variations in barley flour quality used in the bakeries and thus provide variations in product quality.

Challenges in food production: Adjusting the process between the batches might be necessary to keep a stable product quality.

Large diversity in barley varieties provides great potential for product variation!

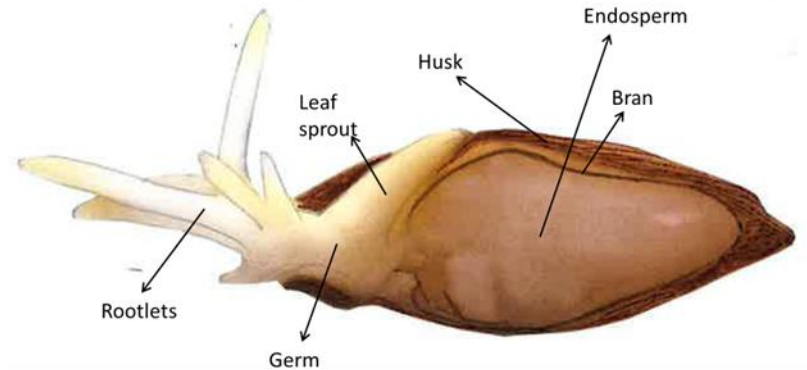


Photo: Nofima

Barley is healthy

Barley contains:

- a high amount of fiber
- a high content of antioxidants
- important vitamins and minerals
- low in fat



There are two types of fiber in barley;

water-soluble fiber (beta-glucan) and water-insoluble fiber (arabinoxylan, cellulose etc.)

Both are important, as they have different physiological properties and thus will have different health effects. Optimal is therefore a good balance between both soluble and insoluble fiber.

Normal content of beta-glucan in northern barley varieties is approximately 3-4 %.

Table 1 Amount of different dietary fibre in different cereals (measured in % of dry matter)

Cereal	Soluble fiber (beta-glucan)	Insoluble fiber (Arabinoxylan)
Barley	2-11	3-11
Rye	1-3	6-12
Wheat	<1	4-6
Oat	3-7	2-4

Health claims

The European Food Safety Authority (EFSA) has approved three health claims associated with barley.

*Article 13: Describes a component significance to maintain the bodies functions. This includes weight control, increased satiety and reduced calorie content.

Article 14: Describe the reduction of a risk factor for disease development.

Health claims relate to the total amount of beta-glucan. Thus, the total amount of beta-glucan in the finished products is important to know to be able to use these health claims in the marketing of a barley products.

Duga AS is a Norwegian company producing different barley products. They use the approved health claims to market their products on their web page (<http://duga.no/helse/>).

Fiber	Health claim	Article*	Dose
Beta-glucan from barley or oats	Reduction of parandial glycemic response.	13	>4 g per 30 g available carbohydrate
	Maintenance of normal blood LDL-cholesterol concentrations	13	At least 1 g /meal : information about necessary daily dose of 3 g/day
Oat and barley grain fibre	Increased faecal bulk	13	At least "high in fiber" (6g/100g)
Barley and oat beta-glucan	Lowering blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease	14	>3 g/day; 1 g/portion

Duga byggkorn er en helt ny generasjon næringsrikt og smakfullt byggkorn med dokumentert helseeffekt. Byggkornet har et naturlig meget høyt innhold av kostfiberet betaglukan. Betaglukaner er løselige fibre som har vist seg å ha gunstig effekt på helsa vår på flere områder. Gullbygg-serien til COOP, med nakenbygg fra DUGA, har mange gode matvarer/produkter som inneholder mye av dette betaglukanet.

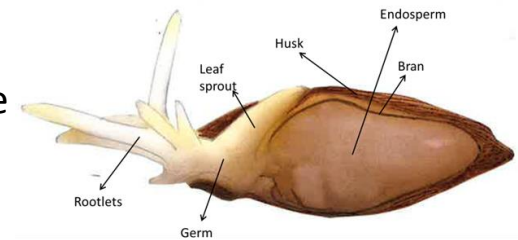
- Betaglukan reduserer kolesterolet
- Bygg regulerer blodsukkeret
- Kostfiber og helse

EU-kommisjonens fellesskapsregister for godkjente og avslåtte helsepåstander

Processing dried grain

When setting up a milling system the capacity of each part (the seed cleaner, the dehuller, the mill and the packing equipment) in the process line should match each other.

Important to know the grain physiology and contents to be able to produce a product that has the desired baking and cooking properties, the desired taste and the desired health properties.



!Dust is a problem in mills worldwide. This can create health problems for millers!

Cleaning and sorting

The first step is to clean the grains from impurities such as stones or weed seeds etc. Various cleaning steps are employed by mills; magnets, separators and air systems.

Sorting may be useful to ensure a good result. Especially when pearling the barley, it is best to have grain that is uniform in size and weight.

Dehulling and pearling

Before the milling process, the hull must be removed.

The pearling rate determines how much of the outer layers are removed.

A 10 % pearling rate eliminates much of the outer hard hull (husk)

A 30 % pearling rate the pearled grain is devoid of any outer layer

In general, the whiter the grain, the more of the bran has been removed.



The by-products of this process is used for fibre and vitamin enrichment of other foodstuffs.

The husks as a by-product can be used as biofuel.

Milling

In whole grain the bran is milled together with the endosperm.

The extraction rate is 100 % for whole grain flour and it is further separated into the percentage of bran and white flour.

Much of the wholesomeness and the baking traits of the flour depend on the percentage of bran incorporated in the flour.

Many types of mills on the market; hammer mill, pin mill, stone mill.

Stone mills were historically the only system for milling flour, and many mills still use this system.

On stone mills the whole fraction of the grain is ground together as whole grain flour, or the bran is removed before milling to ensure whiter flour.

The pressure on the stones determines the coarseness of the flour. The flour is sieved after the milling process to remove unprocessed grain or other debris.



Other processing

After the grain is hulled or pearled it is also possible to make cracked/grits products from barley.

Another processing method for whole dehulled grains is flaking. The grains are then first softened by partially cooking them in steam, and thereafter pressed or rolled into flakes before drying.

Cooked and dried grain may also be cracked, milled or ground to granules or powder and used as a ready-to-eat snack or furthered processed .

Malt is germinated and dried grain. In the drying process, the grains get a darker colour and, according to the drying temperature, the sugar can be caramelized.

Milling malt gives a flour with a different taste and a darker colour.

Packaging

The packaging of the final product from the mill (whole grain, pearled barley, grits, flakes or different types of flour) is the last step before it leaves the mill for the bakery, grocery store or other sales outlets.

The sizes of the sacks or bags depend on who is the end customer. Individual consumer units tend to be smaller.



Small scale equipment for processing

Photo: Dyrk mølle



Barley food products

- Product development and value creation

- Economy? –adding value through:
local, traditional, sustainable, healthy
- Short value chains?
- Convenience?



Northern Periphery and Arctic Program
Northern Cereals – New Markets for a Changing Environment

Barley food product development

Deliverable T3.1.1.



May 2016

Northern Periphery and Arctic Programme
Northern Cereals – New Markets for a Changing Environment

Small-Scale Equipment for Processing of Cereals

Deliverable under Activity T3.1



Hilde Halland, Ólafur Reykdal, Peter Martin and Vanessa Kavanagh

2018