



Contents lists available at ScienceDirect

## Journal of Cereal Science

journal homepage: [www.elsevier.com/locate/jcs](http://www.elsevier.com/locate/jcs)

# Barley bread with normal and low content of salt; sensory profile and consumer preference in five European countries



M. Rødbotten, O. Tomic<sup>1</sup>, A.K. Holtekjølen, I.S. Grini, P. Lea<sup>\*</sup>, B.S. Granli<sup>2</sup>, S. Grimsby, S. Sahlstrøm

Nofima, Norwegian Institute of Food, Fisheries and Aquaculture Research, P.O. Box 6122 Langnes, N-9291, Tromsø, Norway

## ARTICLE INFO

### Article history:

Received 20 December 2013

Received in revised form

6 May 2015

Accepted 11 May 2015

Available online 13 May 2015

### Keywords:

Barley

Salt

Consumer

Sensory

## ABSTRACT

Sensory quality and consumer attitudes towards bread made with different barley/wheat fractions and with normal and low content of salt have been studied. Barley was included in the recipe, in the form of 40% flour and 20% whole grains or flakes. Salt (1.3% or 0.6% of flour weight) was added to the recipes.

All the consumer groups were more positive to breads containing barley after being informed of positive health effects by consuming barley, but not very positive to lowering the salt content in breads.

A sensory trained panel conducted a descriptive profile of the breads, and consumers in the Czech Republic, Estonia, Norway, Scotland and Spain evaluated the bread samples for liking.

The sensory panel judged breads made with a fraction of whole grains as more grainy, coarse, firm and moist compared to breads with flakes or with only flour in addition to wheat flour. Breads containing whole grains also had the most typical barley odour and flavour. Norwegian consumers liked the breads with the whole grains the best and consumers in the Czech Republic, Estonia and Scotland preferred the control bread containing only flour. Spanish consumers had no preference for any of the breads.

© 2015 Elsevier Ltd. All rights reserved.

## 1. Introduction

For thousands of years barley has been used as a nourishing food. Presumably, barley was first used as human food, but later evolved to be primarily grown for feed, malt and brewing purposes. In recent times, about two-thirds of the barley crop has been used for feed, one-third for malting and only about 2% for human consumption (Baik and Ullrich, 2008). Comparisons of the sensory quality between barley-based and wheat- or rice-based products have noticeably reduced the preference for barley products (Newman and Newman, 2006). However, when it comes to nutritional value whole-grain barley is low in fat content and higher in total dietary fibre and therefore has a positive health profile. In addition, the essential amino acid profile of barley protein equals, or exceeds, that of other cereal grains, especially maize and rice.

Many health professionals and government agencies have advised people to eat more whole grain and have lately also put

special focus on health benefits by consumption of barley. Studies have shown that food products with barley  $\beta$ -glucans will lower blood cholesterol (Abu Mweis et al., 2010; Behall et al., 2004; Newman et al., 1989) and glycemic index (Cavallero et al., 2002).

The concentration of salt (NaCl) in food has become a nutritional question (Salovaara et al., 1982). High levels of salt in the diets are linked to high blood pressure, which in turn can lead to stroke and coronary heart disease. The UK population's intakes of salt from cereal and meat products are 38% and 21%, respectively. In Norway the corresponding percentages were 22% and 29%, respectively (Helsedirektoratet, 2011). The World Health Organisation (WHO) has identified the bakery sector as one of the main contributors to the salt intake among the European population and hence, cereal products to be a food product contributing to cardiovascular diseases.

The major functions of salt in bread are summarised (Man, 2007) as 1) sensory effect by imparting flavour, 2) control of yeast growth and fermentation rate, 3) improvement of product texture and 4) reduction of spoilage, particularly mould spoilage.

Commercial breads in Europe vary in content of salt, most often 1.0–1.5% salt/kg flour in the finished product. This range is considered to represent an optimal level with respect to bread flavour. Lynch et al. (2009) describes the current usage level of salt

<sup>\*</sup> Corresponding author.

E-mail address: [per.lea@nofima.no](mailto:per.lea@nofima.no) (P. Lea).

<sup>1</sup> Presently at: Norwegian Knowledge Centre for the Health Services, P.O. Box 7004, St. Olavs plass, N-0130, Oslo, Norway.

<sup>2</sup> Presently at: Design\*Hub Norway, Sagaveien 13, N-1443, Drøbak, Norway.

in white bread in Ireland to be 1.2%. Barley bread (*Byggbrød*) commercially produced in 2012 for the Norwegian market by *Mesterbakeren* contains 19% barley and 1.2% salt.

Food acceptance is based on interactions between sensory properties, context, sensory familiarity and nutritional value of the product. According to studies on food labelling, the same product may be rated differently when information about sensory attributes, content of fat, salt, organic grown ingredients or dietary fibre is given (Solheim, 1992; Kähkönen et al., 1996; Kihlberg et al., 2005; Swahn, 2011; Imm et al., 2012).

There are large cultural and geographical variations in food preference (Ward et al., 1998; Mialon et al., 2002). As a consequence of a more open European food market, finding less variation in food preferences between European citizens than was the case some decades ago would be expected (Risvik et al., 2007). This will probably vary depending on type of food. In this study, we have investigated the sensory quality of wheat-based breads with a high percentage of barley as well as the effect of different salt levels. All recipes included 40% barley flour. An additional 20% barley either as whole grains or as flakes was added to some of the breads, reaching a total barley content of 60%. The salt level added was also adjusted and was 1.3% or 0.6%. Consumer responses to these breads were in 2009 studied in five European countries, first without and then with health information.

## 2. Materials and methods

### 2.1. Barley breads

#### 2.1.1. Flours and baking procedure

The breads were produced using flour, whole grains and flakes from the UK barley variety *Optic*, a commercial two-rowed barley variety with hull and normal starch, grown in the UK. Barley grains were first dehulled and used as whole grains and in the production of barley flakes. The whole grains (dehulled/hulled) were milled to flour on a hammer mill or by Silvery Tweed Cereals, (Berwick-upon-Tweed, UK). Before mixing, the whole barley grains were soaked for 24 h in 800 mL of water at room temperature and the barley flakes were soaked in 800 mL water for 20 min at room temperature. The wheat flour used for baking was a commercial Norwegian baking flour with strong protein quality (*Regal Hvetemel Bakeri*, from Lantmännen Cerealia AS, Oslo). The extraction rate of the wheat flour was 78%, which is the normal extraction rate for white wheat flour in Norway.

Barley breads from five different recipes were studied in this project (Table 1). All of the recipes contained 40% barley flour and four of these contained additional 20% barley either added as whole barley grains or as barley flakes. These breads also had different salt levels (0.6 or 1.3% of flour weight). The reference sample contained only 40% barley flour and no barley grains or flakes, and had a normal salt content (1.3% of flour weight).

A pan bread baking procedure was used, and the doughs were mixed using a spiral mixer (Diosna SP 12, Osnabruck, Germany), 2 min slow (100 rpm) plus 4 min fast (200 rpm). Water addition was optimized according to the Farinograph. The dough was

divided into 750 g portions by hand and placed to rest at room temperature for 20 min, before moulded and shaped by hand and put in a pan. The moulded dough was proved in a proving cabinet (Lillinord A/S, Odder, Denmark) at 37.5 °C and 70% RH for 45 min and baked in a rotating hearth oven (Revent type 626 G EL IAC, Revent international, Upplands Väsby, Sweden) for 30 min. During the first 10 s steam (1.5 L water) was injected and the temperature was reduced from 250 °C to 220 °C. In Norway the breads were made by Nofima, and in the other countries by a baker associated with the IAG trade association. The breads were served to consumers in each of the five countries and also submitted to a descriptive sensory test in Norway. The breads will in this paper be referred to according to the naming and coding in Table 1.

### 2.2. Sensory profiling

Sensory evaluation was carried out by a panel of 11 well trained panellists employed at Nofima, Norwegian Institute of Food, Fisheries and Agriculture Research, at Ås, Norway. Appropriate ISO-standards were adhered to in performing the sensory tests. The assessments were recorded using Compusense Five, Version 4.8 (Compusense Inc., Guelph, Canada). Prior to the assessment the panel was trained on various samples of bread with and without barley. The assessors developed a list of attributes and agreed on a list of 27 attributes with definitions (Table 2).

The breads were cut in 10 mm slices and served on plates coded with 3-digit numbers. The first and the last cut of the loaves were discarded. Both crust and crumb were analysed together for the flavour and texture attributes, whereas appearance attributes were analysed on the crumb only.

Samples were analysed in duplicates in randomized order according to sample, replicate and assessor to avoid carry-over effects (MacFie et al., 1989). For neutralization of the palate, the panellists were required to rinse the mouth with lukewarm water and unsalted crackers between each sample. The panellists recorded their results at individual speed on a 15-cm non-structured continuous scale with the left side of the scale corresponding to the lowest intensity (1.0) and the right side corresponding to the highest intensity (9.0).

### 2.3. Consumer tests

The consumer tests were carried out in two steps:

- 1) Screening test of consumer response to barley bread in qualitative focus group studies in Norway and England.
- 2) Quantitative consumer tests in all five countries where consumers were presented with the five different barley breads described in Table 1.

#### 2.3.1. Focus groups

The specific objectives of the qualitative tests were to investigate how consumers.

**Table 1**

Naming of the barley breads and amount of barley added (added in three different ways (flour, whole grains or flakes)) and levels of salt (two levels).

Bread coding	% Barley flour	% Whole barley grains	% Barley flakes	% Total barley added	% Wheat flour	% Salt (of total flour)
W-1.3	40	20		60	40	1.3
W-0.6	40	20		60	40	0.6
F-1.3	40		20	60	40	1.3
F-0.6	40		20	60	40	0.6
Control	40			40	60	1.3

W-1.3 = Bread containing whole barley grains and with 1.3% salt, F-1.3 = Bread with barley flakes and with 1.3% salt, etc.

Download English Version:

<https://daneshyari.com/en/article/4515640>

Download Persian Version:

<https://daneshyari.com/article/4515640>

[Daneshyari.com](https://daneshyari.com)