



Scientific paper

# A comparison of sensory properties of artisanal style and industrially processed gluten free breads

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## Abstract

The consumption of gluten free foods is increasing in today's society and consumers are demanding more from their gluten free products. Consumers are also looking for local alternatives to conventionally produced foods. This study compares the sensory aspects of industrially processed gluten free bread and locally produced, artisanal gluten free bread. Three breads were purchased from grocery stores and three from local bakeries. Global Napping<sup>®</sup> and ultra flash profiling were used to identify the overall differences between the two different categories of gluten free breads. Partial Napping<sup>®</sup> and ultra flash profiling were also used to determine if there were any differences between flavor and texture of the breads. Twelve panelists, who regularly consume bread, evaluated all six of the bread samples. Both methods indicated that there are many differences between the industrially processed and artisanal gluten free breads. The main differences being artisanal breads were associated with a wide array of flavors and a dry texture, while the industrially processed breads were found to be bland in flavor and moist. Overall, the artisanal gluten free breads were associated with more negative characteristics than that of industrially processed breads.

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## Introduction

Wheat and other glutinous grains are a staple food in the diet for many of the global population (Mansueto et al., 2014). Humans have been long aware of the unique properties of wheat flours, particularly the viscoelastic characteristics of wheat dough that enables the entrapment of carbon dioxide in the process of leavening. These viscoelastic characteristics can be attributed predominantly to the gluten protein complex (Shewry, 2009). Gluten is found in products and flours containing wheat, kamut, spelt, rye and barley. It is formed from the hydrated protein fractions of gliadin and glutenin. This gluten protein complex is an essential factor in forming the crumb and texture of wheat breads that consumers are familiar with (Hüttner and Arendt, 2010). A

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Celiac disease (CD) is an immune-mediated systemic disorder elicited by gluten and related prolamines in genetically susceptible individuals and characterized by the presence of a variable combination of gluten-dependent clinical manifestations (Husby et al., 2012). The disease has a wide variety of manifestations, which can make it difficult to diagnose the condition. Some with the disease may not present gastrointestinal symptoms despite damage to the enterocytes of the small intestine (Cranney et al., 2007). The symptoms of CD can be described as a spectrum that varies from severe mal-absorption symptoms to the absence of symptoms (Mustalahti et al., 2002). The only confirmed treatment of CD is life-long adherence to a gluten-free diet. Celiac disease is the only chronic condition where diet is the exclusive treatment for the disease (Shepherd and Gibson, 2013).

Bread is considered to be a staple food to all of humanity. However, wheat bread consumption has been declining possibly due to changing eating patterns and availability of alternative grain

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products such as breakfast cereals (Gellynck et al., 2009). Due to the growing number of people diagnosed with celiac disease, combined with consumer demand for novel products that are perceived as “healthful”, the consumer market for products made from alternative grains is growing (Hüttner and Arendt, 2010).

There has been a recent rise in the market size for gluten-free foods, exceeding the demand from celiac consumers alone. Although, there has been an increase in the prevalence and awareness of CD; this increase in demand for gluten free products could be largely attributed to the recent claims communicated through media and advertising that a gluten-free diet provides health benefits to the general population. The gluten-free market has increased over the past decade climbing from \$100 million in 2003 to \$1.31 billion in 2011. The gluten-free market is projected to reach \$1.68 billion by 2015 (Mansueto et al., 2014).

To satisfy the demand of GF consumers for high quality bread products companies must produce GF bread that has characteristics similar to that of wheat flour bread (Moore et al., 2004). Making bread that is similar to the familiar wheat bread formulations without gluten presents a technological challenge. Gluten-free bread (GFB) is associated with low quality products that have poor crumb and mouth feel. Gluten-free breads and other gluten-free products are also associated with fast staling. Gluten-free doughs are not able to develop a protein network with characteristics like that of gluten. Therefore, the replacement of gluten network in GFB has become a primary goal in the development of new products. GFB formulations have improved in recent years through the addition of various ingredients such as hydrocolloids to the formulation (Hüttner and Arendt, 2010).

In recent years, following a gluten free diet has become easier because of increases in the number and quality of GF products available. A 2013 report by Zarkadas et al. surveyed Canadians living with CD found that, compared to a 2006 survey, consumers have experienced an increase in the ease of finding GF foods, including yeast breads. A study by Laureati et al. (2012) suggested that consumers' preference for GFB is positively affected by softness, crumb, porosity, uniformity and sweet taste. The researchers suggest that these key attributes should be considered in the development of GBF to further improve consumer acceptability.

Most food purchased by consumers is still produced conventionally maintaining the industrial food system (Koury-Hanna, 2014). However, local venues such as farmers' markets have provided outlets for entrepreneurship in local food markets. The goal of these producers tends to coincide with those of the community, to support local economic growth. Local markets are creating a renewed respect for small-scale artisan producers who meet the desires of consumers for good quality food products (Guthrie et al., 2006). Business strategies that rely on niche markets, such as local food are currently experiencing rapid growth (Henryks and Pearson, 2011).

In recent years there has been growth in the U.S. market for unpackaged and artisanal breads, which accounted for 33% of the market share in 2010. These breads are becoming more popular with consumers, as artisanal varieties of breads are perceived as being of premium quality and having more health benefits than the

industrially processed bread (Agriculture and Agri-Food Canada, 2012). Artisan bread, for the purpose of this study, will be defined as produced by small bakeries and sold locally (within 100 km of the location of the study). Like the industrially processed companies, small scale bakeries are beginning to cater to the needs of the consumers that adhere to a gluten free diet. This has led to the production artisanal versions of GFB. Unlike standard wheat bread, each GFB has an individual formulation with a different approach to solving the technological challenge of making high quality bread without the gluten protein complex. This can lead to a wide variation in the sensory characteristics within the gluten free bread category. Sensory research conducted on the niche market of artisan GFB could help small businesses to improve their formulations of GFB. Artisanal GBF is fairly new to the market therefore creating a product description of these products will provide insight into the quality of these breads to help guide future development of such products.

Napping<sup>®</sup> is a relatively new sensory technique that provides a description of a product and insight into the sensory characteristics of the tested products. Napping<sup>®</sup> is perceptual mapping technique where the evaluated products are represented in a bi-dimensional (2-D) plane (Lawless and Heymann, 2010). In this test participants are instructed to try the presented samples and position and mark them on a large piece of paper (60 cm by 40 cm), resembling a tablecloth (nappé map), according to the similarity of the products (Valentin et al., 2012). No instruction is given on how to evaluate the products the assessor decides their own criteria. Napping<sup>®</sup> is often combined with a method called Ultra Flash Profiling, in which case assessors are asked to write a few words describing each sample next to where they positioned them on the map.

This study will examine the differences in the sensory properties of industrially processed GFB and locally sourced artisanal GFB and will identify the descriptive differences between the two sub-types of products.

## Materials and methods

The study was conducted at the Acadia Centre for the Sensory Research of Food, Acadia University. Ethics approval for the study was received from the Acadia University Ethic's Board (REB 13-72).

### Products

Six gluten-free bread products identified on the package as whole grain or multi-grain were selected to be used as samples for the Napping<sup>®</sup> trial. Three of the GFB products were industrially processed and were sourced from local chain grocery stores in Atlantic Canada. All of these breads were produced by national companies and are sold across Canada. The other three samples were artisan varieties of whole grain GFB sourced from local bakeries. The sensory center is located in rural area approximately 100 km from the nearest urban area. Because of this a radius of approximately 100 km was used to source the local artisan varieties. The main ingredients found in each bread are shown in

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