International Journal of Home Science 2022; 8(2): 194-196

International Journal of Home Science

ISSN: 2395-7476
IJHS 2022; 8(2): 194-196

www.homesciencejournal.com
Received: 04-03-2022
Accepted: 09-04-2022

Singh Itisha
Ph.D. Scholar food and Nutrition, Department of Food Nutrition Science, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India

Dr. Verma Anisha
Professor, Department of Food and Nutrition Science, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Singh Itisha
Ph.D. Scholar food and Nutrition, Department of Food Nutrition Science, Ethelind College of Home Science, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India

Celiac disease and gluten-free products

Singh Itisha and Dr. Verma Anisha

Abstract
In celiac patient exposure to even only a small amount of gluten can lead to malabsorption of some important nutrients including calcium, iron, folic acid, and fat-soluble vitamins because of small-intestine inflammation. A strictly followed gluten-free (GF) diet throughout the patient's lifetime is the only effective treatment for celiac disease; however, elimination of gluten from cereal-based product leads to many technological and nutritional problems. This report discusses different substitutes to replace gluten functionality and examines the economic and social impacts of adherence to a GF diet. Better knowledge about the molecular basis of this disorder has encouraged the search for new methods of patient treatment. The new and common GF sources and different challenges encountered in production and consumption of these products and different solutions for improving their properties are discussed in this review.
Celiac disease is the inability of the small intestine to tolerate some cereal prolamin with sequence specific oligopeptide. Wheat gliadin, rye secalins and barley hordenine are the main proteins involved in the disease mechanisms and may provoke an inflammatory process to damage the small intestine. There are different methods to overcome the problems for such patients; one of them is using gluten-free diet. Bread has the main role in the human diet and gluten is its main structure forming component. Gluten-free products are produced by either cereals like wheat, barley and rye with removed prolamin or no prolamin containing ingredients.

Keywords: Celiac disease, gluten-free, habits, calcium, iron, folic acid, and fat-soluble

Introduction
Celiac disease is a disease that affects people of all ages and is characterised by gluten intolerance. It is classified as autoimmune enteritis with positivity of transglutaminase 2 autoantibodies and the destruction of small intestine mucosa, accompanied by a wide spectrum of clinical symptoms. Extra-intestinal symptomatology is not considered unique to celiac disease in clinical practice, with the disease being often diagnosed in older patients.
It is induced by consumption of gluten proteins from commonly prevailing food sources like wheat, rye, barley, and probably oats (Dicke *et al*., 1953; Hardy *et al*., 2015; Londono *et al*., 2013). The intake of gluten provokes an inflammatory process which damages the villous structure of the small intestine (Shan *et al*., 2002). Currently about 1 percent of the world's population are encountered with the celiac disease and the only useful way to its treatment is the strict constant abandonment of gluten containing foods (Feighery, 1999; Ronda and Roos, 2011). It is important not only for bread appearance, but also for its structure formation in dough systems (Gallagher *et al*., 2004). Glutenin and gliadin are two main fractions of gluten (Abbasi *et al*., 2012). Whereas glutenin is necessary to make an elastic and consistent structure in dough, gliadin is responsible for viscosity and extensibility of a dough system (Abbasi *et al*., 2015; Gujral and Rosell, 2004) [1].

Gluten Free-Products
Gluten-free Product are technologically poor with low specific volume (SV); crumb softness and higher staling rate compared to complete product owing to the lack of gluten structure (Arendt *et al*., 2007; Gallagher *et al*., 2003) [4]. Various non-gluten components have been incorporated in gluten-free breads to supply their structure. They are also involved in mimicking gluten network and improve their nutritional quality (Mariotti *et al*., 2009).

Non-gluten components used to improve the quality of gluten-free bread

Gums and thickening agents are mainly used in glutenfree breads for different reasons, including gelling, thickening, and texture expansion (Balaghi *et al*., 2011). They are in the form of polysaccharides and/or protein which are originating from different sources of seeds, fruits, plant extracts, seaweeds and microorganisms (Mollakhalili Meybodi *et al*., 2014). Starches and hydrocolloids are two main groups which are extensively used in bakery products formulation to improve their texture and appearance properties (Anton and Artfield, 2008; Demirkesen *et al*., 2010; Kohajdová *et al*., 2009) [3]. Different studies have investigated the possibility of a wide range of starches with gums/hydrocolloids to make high quality gluten-free breads (Kohajdová *et al*., 2009; Lamacchia *et al*., 2014; Linlaud *et al*., 2009). Comparison wheat starch with non-wheat starches, for gluten-free bread making, showed that the latter is more pleasing since some celiac patients cannot endure even wheat starch (Chartrand *et al*., 1997; Ribotta *et al*., 2004). Rice starches are usually accessible and potentially applicable as replacement in the formulation of gluten-free baked goods (Hoover *et al*., 1996). However, lack of gluten in rice creates problems in bread making. It has been noted that some gums including hydroxyl propyl methyl cellulose (HPMC), locust bean gum (LBG), guar gum, xanthan gum and agar can be used to form rice bread and HPMC create the optimum volume development (Demirkesen *et al*., 2010; Hager and Arendt, 2013). Previous studies revealed that the substitution of rice flour instead of wheat flour in amount as high as 30 percent makes the most acceptable gluten-free bread quality.

Dietary fiber

Diets which have average amounts of cereal grains, fruits and vegetables are likely to supply enough fiber (Buttriss and Stokes, 2008). Considering the fact that gluten-free breads are usually not fortified, and prepared from refined flour or starch, they will not have the same amounts of nutrients as the gluten containing ones. So, doubt still exists about the nutritionally balanced diet of celiac patients received a gluten-free diet. In a study investigated the intake of nutrients by 49 adults with celiac disease receiving a gluten-free diet, the results indicated that their fiber intake was lower compared to a control group with a normal diet (Grehn *et al*., 2001). The fortification of gluten-free baked goods with dietary fibers has consequently been investigated by different teams of technologists. Inulin, as a non-digestible polysaccharide and prebiotic component, is able to develop loaf volume and slice ability, to increase dough stability and to produce an even and finely grained crumb texture (Korus *et al*., 2006). In a similar work carried out by Gallagher *et al*. (2004) to encompass inulin (at 8 percent level) into a wheat gluten-free formulation, it was revealed that the dietary fiber amount of the bread increased from 1.4 (gluten-free bread) to 7.5 percent (insulin containing gluten-free bread). Results also designated the higher browning colour of insulin containing sample which can be attributed to its hydrolyzing by yeast enzyme, resulting in the creation of fructose that is more prone to crust browning (Gallagher *et al*., 2004). The fortification of gluten-free products with dietary fibers has been verified to be required, regarding the lower intake of fibers ascribed to their gluten-free diet (Korus *et al*., 2006).

Sourdough

Considering the fact that gluten-free breads are highly poor in vitamins, iron, folate as well as dietary fiber (Hallert *et al*., 2002), and the growing demand for producing high quality, natural and affordable gluten-free breads, the addition of sourdough is suggested to be a good solution (Di Cagno *et al*., 2008; Moore *et al*., 2008; Moroni *et al*., 2009). Sourdough is a combination of flour, water, and/or other components which is fermented by naturally occurring starter culture containing lactic acid bacteria (LAB) and yeasts (Gobbetti, 1998). The sourdough supplementation creates different positive effects on appearance, texture, nutritional quality, and shelf life of gluten-free breads which is mainly resulted from the metabolic activity of LAB. Acidification, exopolysaccharide production, proteolytic, lipolytic and phytase enzyme activity are some examples of these organisms performance (Ravyts *et al*., 2012) which are discussed in the next. Gluten network is responsible for slowing down the water transfer and maintaining of gas produced during yeast fermentation and oven-rise (Demirkesen *et al*., 2010). Using sourdough fermentation postpones the starch retrogradation and staling of gluten-free bread (Rojas *et al*., 1999). Biological acidification, amylolytic and proteolytic activities of sourdough starter culture are the main mechanisms involved in retardation of retro-gradation.

Sourdough starter culture addition to gluten-free bread is also able to enhance the immune system of celiac patients by producing prolin/glycin-rich peptide via proteolytic activity (Rollan *et al*., 2005). It is also proved that the addition of sourdough to gluten-free bread make it prone to be a functional food. This function is mainly due to the ability of LAB to produce exopolysaccharide especially fructooligosaccharide (Schwab *et al*., 2008).

Methods

A gluten free bakery products with incorporation of locally available ingredients'' will be carried out with appropriate methodology in the Department of Food, Nutrition and Public Health, Ethelind College of Home Science, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh.

The detail of materials, experimental procedures and techniques adopted during the course of present investigation are as followed.

- Procurement of raw materials.
- Preparation of flours.
- Analysis of Gluten of developed flour mixture.
- Development of Gluten free products.
- Sensory Evaluation.
- Analysis of Nutrient content, antioxidant and storage quality organoleptically best treatment.
- Cost calculation of prepared products.
- Statistical analysis.
- Period of the study.

Increased numbers of people diagnosed with celiac disease has promoted gluten-free market production and raised awareness of this diet in the public. A gluten free diet is currently being implemented in many people's lifestyles both healthy and the sick. This paper intends to review the way gluten-free diet has changed over the years. Here complications in a gluten-free diet are presented. This is shown from scientific references and our experiences.

Gluten-free diet for healthy individuals

As we discussed in the introduction, a surge of newly-diagnosed celiac patients led to increased awareness of

gluten-free diets among the public, and numerous information sources helped this revolution. First of all, celiac patients are dependent on this diet for the rest of their lives, and celebrities with celiac disease. Collin *et al*. [10]

Complications accompanying gluten-free diet

Long-term gluten restriction can induce many health risks, including nutritional deficiency, cardiovascular problems, as well as an accumulation of heavy metals in the organism. Thus, all celiac patients have to be informed about these health risks, which are well known among professional. These are also valid for healthy people following a gluten-free diet, and must be made aware too. Gluten-free diets are rich in lipids, sugars, and salt, providing a higher energy intake in comparison with a normal diet. This can be considered harmful, and is not recommended for healthy consumers by professionals. Gluten-free diets can contribute to even more health problems, including obesity, dyslipoproteinemia, insulin resistance, metabolic syndrome, or atherosclerosis. For this reason, a new solution is required for quality of life of celiac disease patients, but not for celiac disease treatment. Health education on gluten-free diet in the society seems to be the solution. Gluten is extracted from surplus products of the starch industry whose structure and nutritional properties are very valued in human and animal diets. Some studies have shown that gluten increases intestinal permeability, oxidative stress, has anti-inflammatory properties, and decreases the differentiation of intestinal cells. This information is not properly distributed by non-professionals, and claims that gluten is extremely harmful. On the other hand, observations also highlight the importance of gluten in our diet, and should not be missing if people are to remain healthy. There are significant differences in gluten harmfulness between healthy and intolerant people. While in sensitive individuals it induces a cascade of reactions leading to an inflammatory condition in the small intestine, with atrophy of villi and other health complications, healthy individuals can develop dyspeptic complications, which are not associated with gluten intolerance. These people need to be investigated and diagnosed for the cause of the problem. If health problems of these patients are not caused by gluten itself, gluten-free diet is not the therapeutic solution.

Conclusion

Celiac disease is a common intestinal disorder with only treatment the constant adherence to a gluten-free diet. However, gluten is a major component of wheat and rye flours, and its replacement in bakery products remains a significant technological challenge. Using starches, gums, and hydrocolloids are the most prevalent method to imitate gluten structure in the manufacture of gluten-free bakery products. Novel attitudes as well as applying the dietary fibers, other protein sources and additives which enhance the gluten-free breads nutritional value are also promising. However, regarding the current increasing awareness of celiac disease due to superior diagnostic methods, more comprehensive researches in the field of gluten-free cereal-based products are necessary.

References

1. Abbasi H, Seyedain Ardabili SM, Mohammadifar A, EmamDjomeh Z. Comparison of trial and error and genetic algorithm in neural network development for estimating farinograph properties of wheat-flour dough. Nutrition and Food Sciences Research. 2015;2:29-38.
2. Acs E, Kovacs Z, Matuz J. Bread from corn starch for dietetic purposes. I. Structure formation. Cereal Research Communications. 1996;36:441-449.
3. Anton AA, Artfield SD. Hydrocolloids in gluten free breads: a review. International Journal of Food Sciences and Nutrition. 2008;59:11-23.
4. Arendt EK, Ryan LA, Dal Bello F. Impact of sourdough on the texture of bread. Arentz-Hansen H., Fleckenstein B., Molberg O., Scott H., Koning F., Jung G., Roepstorff P., Lundin K.E., Sollid L.M. (2004). The molecular basis for oat intolerance in patients with celiac disease. PLoS Medicine. 2007;1:84-92.
5. Collin P, Thorell L, Kaukinen K, Maki M. The safe threshold for gluten contaminantion in gluten-free product Can trace amounts be accepted in the treatment of coeliac disease? Aliment Pharmacol Ther. 2014;12:1277-83.
6. Azani M, Badfar G, Abangah G, Mahmoudi L. Celiac disease in Iranian irritable bowel syndrome patients; a systematic review and meta-analysis. Gastroenterol Hepatol Bed Bench. 2019;12:85-97.
7. Yoosuf S, Makharia GK. Evolving therapy for Celiac disease. Front Pediatr. 2019;7:193.
8. Catassi C, Ratsch IM, Fabiani E, Rossini M, Bordicchia F, Candela F, *et al*. Coeliac disease in the year 2000: exploring the iceberg. Lancet. 1994;343:200-3.
9. Samasca G, Lerner A, Girbovan A, Sur G, Lupan I, Makovicky P, *et al*. Challenges in gluten-free diet in coeliac disease: Prague consensus. Eur J Clin Invest. 2017;47:394-7.
10. Gee SJ. S. Bartholomews Hospital Reports. 1888;35:321.
11. Dicke WK. Coeliac disease. Investigation of the harmful effects of certain types of cereal on patients with coelaic disease (Thesis) The Netherlands: University of Utrecht, 1950.