Salahaddin University - Erbil

College of Agriculture Engineering Science

Department Of Food Technology

Gluten Allergy

By

Mamz Samad Ali

Supervised by

Suzan Sabah

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List Content

Abstract

Gluten “Allergy”

Gluten is a protein found in grains, such as wheat, barley and rye. Some people are allergic to wheat, but that is not the same as a gluten allergy. Gluten allergy is a misleading term commonly confused with wheat allergy, or sometimes celiac disease. There is no such thing as a gluten allergy, but there is a condition called Celiac Disease. Celiac Disease is a digestive condition that is potentially serious if not diagnosed or treated. Symptoms of celiac disease include severe diarrhea after eating gluten-containing products, a rash, severe weight loss or failure to properly gain weight, and abdominal pain. In small children, you may only see poor weight gain and no pain, or other symptoms. Diagnosis of celiac disease can only be made by a board-certified gastroenterologist. It must also be made when the person is eating foods with gluten, as gluten avoidance is the active treatment.A gluten intolerance is not an allergy, and there are currently no tests for accurate diagnosis. People with certain symptoms might need to be tested for celiac disease, but few people with gluten intolerance have celiac disease. Gluten intolerance is not an indication for allergy testing and is not a condition where an allergist could offer help. There are many people who label themselves as “allergic” to gluten, and unfortunately limit their diet without having seen a specialist. People with gluten intolerance should be seen by their primary care provider or referred to a gastroenterologist if there is concern about celiac disease.

Introduction

Wheat (Triticum vulgare) is the most important cereal used in baking. The proteins present in the cereal prolamins can be classified into (ethanol soluble) and glutenin (ethanol insoluble). These proteins when hydrated form a protein complex called gluten, responsible for the viscoelastic properties of dough that are essential for the development of all kinds of breads made from wheat flour. Importantly, in addition to wheat, gluten is present in barley, rye and oats.Some people have allergic reactions to gluten; these people develop celiac disease, considered an autoimmune disease. This disease results from the interaction of environmental factors, genetic and immunological, inflammatory lesions in the bowel and it triggers several adverse reactions.The treatment is done through a strict gluten free diet. Researchers have sought new alternatives to facilitate diagnosis and contribute to improve the quality of life of celiac patients. However, options for gluten free foods, especially in baking, are limited. Alternative ingredients used to replace wheat flour or to simulate the effect of gluten in the dough have been studied. Considering these facts, this first chapter will discuss the gluten network formation, its sources, composition and effects on health.

The gluten proteins can be classified into subgroups dependent on key differences including sulfur content and molecular weight and then further classified according to their different primary structures into alpha, beta, gamma, and omega (α, β, γ, and ω) gliadins. Individual gluten proteins are bound by strong covalent and non-covalent forces, which, together with the structure and interaction of these proteins, contribute to the unique properties of gluten (Wieser , 2007)

Non-coeliac gluten sensitivity. While coeliac disease is a well-established entity, much debate remains around whether the gluten proteins can trigger symptoms in patients with no features of coeliac disease, so-called non-coeliac gluten sensitive.Considerable research is needed for confirmation of diagnosis,mechanism, prevalence, and management. However, it is likely that this syndrome encompasses a heterogeneous group of patients, reporting a range of gastrointestinal and extraintestinal symptoms, clinical histories and characteristics, and may only exist in a small number of people. (Biesiekierski , 2015)

The clinical presentation of NCGS includes gastrointestinal symptoms, such as abdominal pain, bloating and altered bowel habit, and systemic symptoms, such as fatigue, headache, bone or joint pain, mood disorders and skin manifestations (e.g. eczema or rash). Symptoms usually closely follow the consumption of gluten and disappear after gluten withdrawal.(Volta U , 2014).

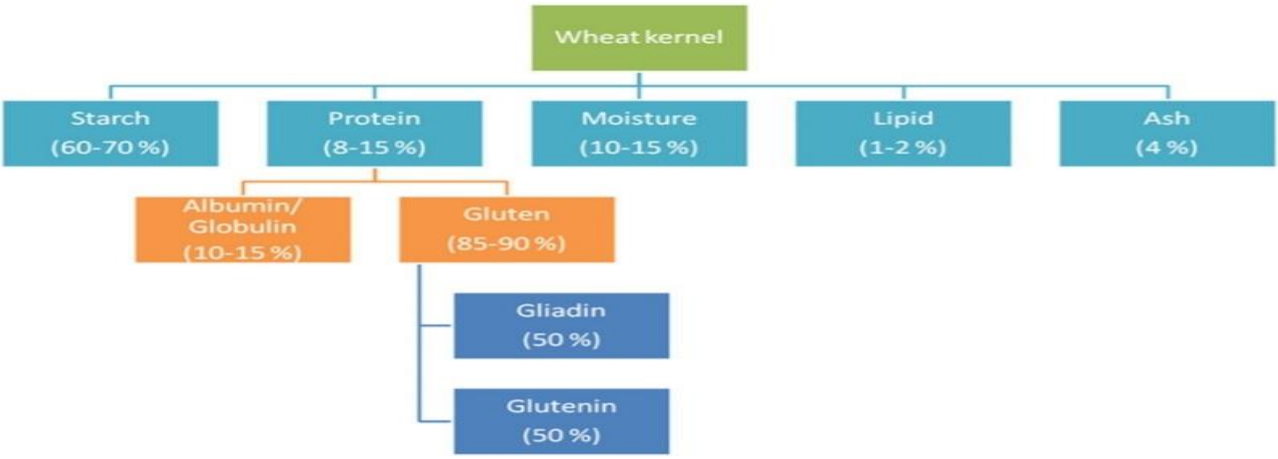
The Objective of this research is to talk about gluten sensitivity those who are sensitive to wheat talk about the types and good and bad means who should eat and who doesn't eat what are the signs How can it be harmful to how its treatments are created at what age and i'm talking about that those who are sensitive should not eat foods that are gluten or in place of those who eat.

Gluten properties and sources

The gluten matrix and its resulting functions are essential to determining the dough quality of bread and other baked products such as pasta, cakes, pastries, and biscuits. Gluten is heat stable and has the capacity to act as a binding and extend-ing agent and is commonly used as an additive in processed foods for improved texture, flavor, and moisture retention.Therefore, less obvious sources of gluten include processed meat, reconstituted seafood, and vegetarian meat substitutes; and as thickeners, emulsifiers, or gelling agents in candies,ice cream, butter, seasonings, stuffings, marinades and dress-ings; and as fillers and coatings used in medications or confectionary. In addition, gluten is increasingly separated from wheat (known as “vital wheat gluten”) or modified for specific uses (known as “isolated wheat proteins”) to improve the structural integrity of industrial bakery products and to fortify low-protein flours.(Kucek LK, et al. 2015)

The unusual rheological and functional properties of gluten are dependent upon the ratio of glutenins to gliadins, and the interac- tions of these structures. Each component has slightly different functions crucial in determining the viscoelastic properties (entrapment of carbon dioxide released during bread leavening) and quality of the end product. For example, purified hydrated gliadins contribute more to the viscosity and extensibility of the dough, whereas hydrated glutenins are cohesive and contribute to dough strength and elasticity.Much work has focused on improving dough strength, for example, increasing the high molecular weight subunit gene copy number to improve glutenin elasticity.(Wieser H. 2007)

Figure 1.Approximate breakdown of wheat components



.Dietary gluten intakes

Wheat is an important staple food because of its high nutritional characteristics, technological properties, and long shelf life. Wheat is a good source of several nutrients and is a fermentable substrate for the human colonic microflora, which conveys substantial benefits to the host. Wheat can form the basis of all daily meals and is eaten in large amounts worldwide. Information regarding gluten intake in the general population is scarce, because there is a lack of detailed information on the gluten content of food products. Calculations of dietary gluten intakes are approximate as they are normally estimated by calculating the amount of cereal protein within gluten-containing cereals and from recipe informa-tion. The average daily gluten intake in a Western diet is thought to range from 5 to 20 g/day, with the most recent data coming from a national Danish survey showing a mean total gluten intake of 10.4 g/day for adults aged 20–75 years.While wheat-containing bread is one of our major sources of gluten (each slice of bread contains approximately 4 g of gluten),there is some evidence that exposure to gluten may be increasing with changes in cereal technology. Modern baking practices have shortened bread leavening, increased the use of chemical/yeast leavening agents, and increased inputs of nitrogen fertilizer and agrochemicals for higher yields of protein content required for bread making. (Hoppe C, et al. 2015)

If you have celiac disease, every time you eat gluten, the intestine is damaged. This makes it very hard to absorb nutrients and can lead to vitamin and mineral deficiencies. There are many symptoms and other conditions associated with celiac disease. Some symptoms include abdominal pain, bloating, cramping, nausea, vomiting, diarrhea, constipation, fatigue, headaches, joint pain, skin problems, and poor growth in children. Some conditions that can result are depression, osteoporosis, infertility, cancer and anemia. Every time you eat a crumb of gluten, it causes more damage to your intestine and could take weeks to begin absorbing nutrients again. If you have non-celiac gluten sensitivity, you may have the same types of symptoms as celiac disease, but no damage is done to the intestine.

Many people with celiac disease do not have any symptoms when gluten is eaten but the damage is still being done. If you are someone who does have symptoms, they can occur minutes to hours after eating. It is important for those with celiac disease to have another celiac blood test 3 months after going gluten free. This is only way to know for sure if you are getting gluten in the diet.

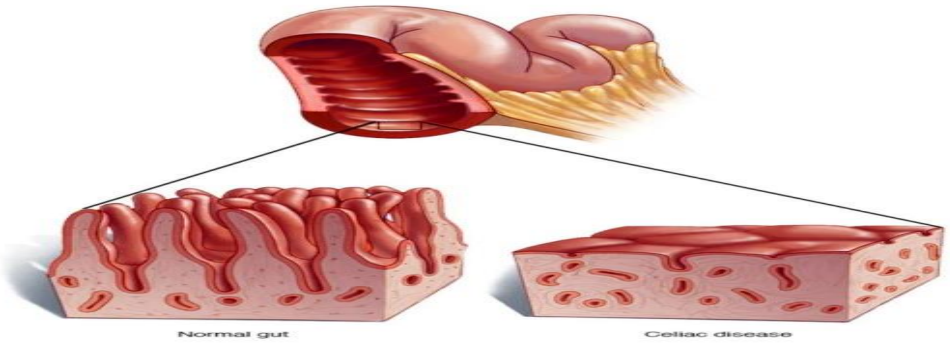
• **Nutrition deficiencies:** CD is an autoimmune condition, where the body's immune system starts attacking normal tissue, such as intestinal tissue, in response to eating gluten. People with CD are at risk for malabsorption of food in the gastrointestinal tract, causing nutrition defi-ciencies, particularly of protein, fat, iron, and the fat-soluble vitamins. This can lead to com-plications such as iron deficiency anemia and osteoporosis. Because a person with wheat allergy or gluten sensitivity usually does not have severe intestinal damage, he or she is not at risk for these nutrition deficiencies. Often, in wheat allergy and gluten sensitivity, only wheat or gluten restriction is needed, and dietary sup-plements and medical screens for nutrition deficiencies (ie, anemia, vitamin levels, bone density) are not warranted. (Smedby KE, et al. 2005).

• **Familial risk: First-** and second-degree relatives of CD patients are at much higher risk than that of the general population to develop CD and also have other autoimmune disorders. Once an index case of CD is identified, screen-ing for CD in first- and second-degree family members should be performed. Screening fam-ily members for wheat allergy or gluten sensitiv-ity is not currently recommended.Thus, although CD, wheat allergy, and gluten sensitivity may be treated with similar diets, they are not the same conditions. It is very important for a patient and his or her healthcare practitioner to know which condition the patient has, as the person with CD needs to be monitored for nutrition deficiencies, other autoimmune diseases, and gastrointestinal cancers.3,18 In general, the symptoms from food allergies and intolerances resolve when the offending foods are removed from the diet and do not cause permanent organ damage. (James, S. P. 2005).

Celiac disease

Celiac disease, sometimes called celiac sprue or gluten-sensitive enteropathy, is an immune reaction to eating gluten, a protein found in wheat, barley and rye.

Figure 2. Celiac disease



If you have celiac disease, eating gluten triggers an immune response in your small intestine. Over time, this reaction damages your small intestine's lining and prevents it from absorbing some nutrients (malabsorption). The intestinal damage often causes diarrhea, fatigue, weight loss, bloating and anemia, and can lead to serious complications.

In children, malabsorption can affect growth and development, besides causing the symptoms seen in adults.

There's no cure for celiac disease — but for most people, following a strict gluten-free diet can help manage symptoms and promote intestinal healing.

Celiac disease is a genetic autoimmune disease. About 1% of the population has celiac disease. People with celiac disease have an abnormal immune reaction to gluten. Gluten is a protein found in wheat, rye and barley. When people with celiac disease eat gluten, their immune system attacks and damages the small intestine. Celiac disease affects people differently. Common symp-toms are:

• cramps

• bloating

• diarrhea

• constipation

• nausea

• vomiting

Other symptoms can include:

• fatigue

• bone and joint pain

• depression

• irritability

• headaches

With time, celiac disease can lead to other health problems if not treated like:

• extreme weight loss

• malnutrition

• bone loss

• anemia

A doctor can run tests to see if a person has celiac disease. People should not stop eating gluten before being tested because it can change the results. There is no cure for celiac disease. The only treatment is to remove gluten from the diet. Once gluten is removed, the intestines will start to heal. People who have celiac disease must follow a gluten-free diet for life to stay healthy.There is a difference between avoiding only wheat and avoiding gluten. Avoiding gluten means in addition to cutting out wheat, you also have to cut out foods that contain barley and rye. Some medicines, supplements and beauty products may contain gluten. Food labels do not always list gluten as an ingredient. Instead, they will often list some form of wheat. Also, check for rye and barley. Malt and malt flavor are made from barley, so look for these are terms.Pure oats do not contain gluten. But oats can be con-taminated with wheat, barley and rye during processing. To avoid this risk, certified gluten-free oats are available.At present, one in five Americans (20%) buy gluten-free foods. This is far more people than need to for health reasons. But it has increased the number of gluten-free foods in stores. (Lebwohl, B., et al. 2015).

Figure 3. comparison of epidemiologycal,pathogenic features between celiac disease,non celiac gluten

	Celiac disease	Non celiac gluten sensitivity	Wheat allergy
Prevalence	0,5-1% of population; it has been duplicated in the last 20 years	There are no population studies. 20-40% of patients with irritable bowel syndrome	0,5-9% in children
Pathogenia	Autoimmune. Acquired immunity. Gastrointestinal and systemic inflammatory reaction.	Innate immune response	Type I and IV hypersensitivity (type I reactions are better characterized)
Most frequent gastrointestinal symptoms	Abdominal pain Constipation or chronic diarrhea. Abdominal distension Vomits	Abdominal pain Chronic diarrhea Abdominal distension	Vomits, diarrhea immediately after wheat ingestion
Extra-digestive symptoms	Ferropenic anemia refractory to supplementation Tiredness Herpetiform dermatitis Weight lost Aftoid ulcers Short stature Delayed puberty Infertility Repetitive spontaneous abortion Increased transaminases Headaches Cerebelar ataxia Idiopathic Epilepsia Periferic neuropathy Depresion, anxiety	Tiredness Eczema Headaches Blurred vision Depression Anemia Paresthesias Arthralgias	Exercise induced anaphylaxis. Atopic dermatitis. Urticaria. Chronic asthma and rinitis.
Serological markers	anti-tTG IgA anti- Endomisium IgA IgG anti-DGP	anti-gliadin IgA/IgG (AGA)	Wheat specific IgE or prick test
Duodenal biopsy	Necessary for confirmation* Villous atrophy can be observed	Necessary for CD exclusion	It is not necessary

Figure 4. Comparison of treatment celiac disease, non celiac gluten sensitivity and wheat allergy.

	Celiac Disease	Non celiac gluten sensitivity	Wheat allergy
Treatment	Gluten free diet (wheat, barley and rye)	Gluten free diet (wheat, barley and rye)	To avoid all contact only with wheat
Level of adherence required for remission	Strict exclusion diet	Transgressions are permited according to symptoms presentation	Strict avoidance to wheat contact through digestive, respiratory and cutaneous pathway
Duration of treatment	For life	It is still not completely elucidated. Se Yearly challenge is rocommended	In children a wheat challenge under medical supervision is recommended after 6-12 months of exclusion In adults, exclusion is recommended for life
Complications without treatment	Autoimmunity, nutritional deficit, intestinal malignancies	Not described	Anaphylactic reaction

Non-Celiac Gluten Sensitivity

Non-celiac gluten sensitivity is a non-specific immune response. About 5% of the population has non-celiac gluten sensitivity.We are still learning about non-celiac gluten sensitivity. It is unclear whether gluten or other compounds in wheat cause the problem. In fact, a new term, “non-celiac wheat sensitivity,” is often used to describe this condition. People who have non-celiac gluten sensitivity have symp-toms somewhat similar to celiac disease, which improve when gluten is removed from the diet. However, they do not test positive for celiac disease or wheat allergy. Until lately, it was thought people with non-celiac gluten sensitivity did not have damage to the intestine. But new findings have shown damage may occur, although it is not as noticeable as in celiac disease. At present,a gluten-free diet is the main treatment for non-celiac gluten sensitivity. However, unlike celiac disease, new findings suggest people with non-celiac gluten sensitivity may not have to follow a gluten-free diet for life. (Leonard, M.M., et al. 2017).

Sometimes it is not clear if ingredients are gluten free. This list does not include all ingredients that are gluten free, but just a few that may be confusing. Remember, if any ingredient comes from wheat, this will be identified in the ingredient label.

Figure 4. Gluten Ingredient.

Gluten-Free Ingredients		
Artificial colors (i.e. citrus red No. 2)	Distilled vinegars	MSG (Monosodium Glutamate)
Autolyzed yeast	Fructose	Natural colors (i.e. annatto, carotene)
Baker’s yeast	Glucose syrup	Pectin
Baking soda	Guar gum	Starch
BHA/BHT	Hydrolyzed Corn or Soy Protein	Sucrose
Buckwheat	Lactose	Rice syrup
Caramel color	Lecithin	Vanilla extract and flavoring
Dextrose	Maltodextrin	Wine vinegars
	Mono and diglycerides	Xanthan gum

Ingredients That May Contain Gluten	
Modified Food Starch Most often made from corn, potato, tapioca or maize but sometimes made from wheat	Dextrin Most often made from corn or tapioca but sometimes made from wheat

What are the symptoms of gluten intolerance?

People may experience the following symptoms for several hours or days after they consume gluten:

Abdominal pain, Anemia, Anxiety, Bloating or gas, Brain fog, or trouble concentrating, Depression, Diarrhea or constipation, Fatigue, Headache, Joint pain, Nausea and vomiting, Skin rash.

What is a gluten-free diet?

A gluten-free diet completely avoids the grains below:

- wheat
- rye
- barley
- triticale
- spelt
- kamut

These grains contain a protein called gluten. Gluten can damage the lining of the small intestine in people who have celiac disease. When the lining is damaged, nutrients (like vitamins and minerals) are not absorbed. This may lead to health problems such as low iron, weak and brittle bones, itchy skin rash, and infertility. If you have celiac disease, you should follow a gluten-free diet for the rest of your life. It is recommended that you meet with a registered dietitian with expertise in celiac disease. They can help you to adapt to the gluten-free diet and ensure you are including nutrients that are found in gluten-containing foods (fibre, iron and B vitamins). A gluten-free diet is the only way to keep the intestine healthy and reduce the risk of health problems.A gluten-free diet can be tasty and nutritious. You can find many gluten-free food choices at grocery and specialty stores. Gluten-free foods can also be made easily at home.

Gluten-free baking and cooking

When cooking or baking at home, it's important to keep your foods gluten-free. Even a crumb from gluten-containing bread can affect your small intestine. Baking and cooking surfaces should be clean and gluten-free. Use these tips to keep your foods from coming in contact with gluten, which causes cross-contamination. To avoid cross-contamination:

 Choose flours labelled gluten-free. Flours without the gluten-free claim may be cross-contaminated during production.

 Store all gluten-free products separately. Have a separate cupboard and containers for gluten-free products.

 Use clean equipment for gluten-free food preparation. Make sure all pots, pans, utensils, utensil drawers and counter spaces are clean before using. Use a separate strainer for gluten-free foods.

 Prepare and cook gluten-free foods separately from regular foods. Glass or metal dishes are best. Shared wooden utensils and wooden cutting boards may contribute to cross contamination. Have a separate cutting board and wooden utensils that are just for gluten-free foods.

 Have your own toaster. It's best to buy a new toaster and use it only for gluten-free bread. A shared toaster will have crumbs from gluten-containing breads. Another option is to use toaster bags. These re-useable bags cover your bread so it can be placed in any toaster.

 Use separate condiment containers. Have separate containers for items such as margarine, jam, peanut butter, honey, mayonnaise, relish, or mustard. A shared dish or jar may have crumbs from gluten-containing food

Conclusion

Wheat (Triticum vulgare) is the most important cereal used in baking. The proteins present in the cereal prolamins can be classified into (ethanol soluble) and glutenin (ethanol insoluble). These proteins when hydrated form a protein complex called gluten.

The gluten matrix and its resulting functions are essential to determining the dough quality of bread and other baked products such as pasta, cakes, pastries, and biscuits. Gluten is heat stable and has the capacity to act as a binding and extend-ing agent and is commonly used as an additive in processed foods for improved texture, flavor, and moisture retention.

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Non-celiac gluten sensitivity is a non-specific immune response. About 5% of the population has non-celiac gluten sensitivity.We are still learning about non-celiac gluten sensitivity.

People may experience the following symptoms for several hours or days after they consume gluten: Abdominal pain, Anemia, Anxiety, Bloating or gas, Brain fog, or trouble concentrating, Depression, Diarrhea or constipation, Fatigue, Headache, Joint pain, Nausea and vomiting, Skin rash.

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References

1. Alvim, ID; Sgarbieri, VC; Chang, YK. 2002.Desenvolvimento de farinhas mistas extrusadas à base de farinha de milho, derivados de levedura e caseína. Ciências e Tecnologia dos Alimentos. *Campinas*.22, p. 170-176.
2. Biesiekierski JR, Iven J . 2015. Non-coeliac gluten sensitivity: piecing the puzzle together. *United European Gastroenterol* ; 3: 160–5.
3. Guandalini S, Assiri A. 2014; Celiac Disease: A Review. *JAMA Pediatr*. 168(3):272
4. Hoppe C, Gøbel R, Kristensen, 2015.Intake and sources of gluten in 20-to 75-year-old Danish adults: a national dietary survey. Eur. J. *Nutrietes.*; doi:10.1007/s00394-015-1062-3.
5. James, S. P. 2005. National Institutes of Health consensus development conference statement on celiac disease, June 28–30, 2004. *Gastroenterology*, 128(4), S1-S9.
6. Kucek LK, Veenstra LD, Amnuaycheewa P,. .2015. A grounded guide to gluten: how modern genotypes and processing impact wheat sensitivity. Compr. Rev. *Food Sci. Food Saf.*; 14: 285–302
7. Lebwohl B, Green P. 2014. Risk of celiac disease according to HLA haplotype and country. *N Engl J Med*.;371(11):1073-4
8. Lebwohl, B., Ludvigsson, J.F. & Green, P.H.R. (2015). Celiac disease and non-celiac gluten sensitivity. *British Medical Journal*, 18(19).p.351.
9. Leonard, M.M., Sapone, A., Catassi, C., & Fasano, A. (2017). Celiac Disease and nonceliac gluten sensitivity: A review. Journal of the *American Medical Association*, 318(7), 657-656
10. Smedby KE, Åkerman M, Hildebrand H, Glimelius B, Ekbom A, Askling J., 2005. Malignant lymphomas in coeliac disease: evident of increased risks for lymphoma types other than enteropathy-type T cell lymphoma. Gut. *American Medical Association.* 54:54-59.
11. Volta U, Bardella MT, Calabrò A, Troncone R, Corazza GR. 2014. An Italian prospective multicenter survey on patients suspected of having non-celiac gluten sensitivity. *BMC Med;* 12: 85 [PMID: 24885375]
12. Wieser , H . 2007. Chemistry of gluten proteins. *Food Microbiol* ; 24: 115–19.