



Celiac Disease, Consequences and Treatment Remedies

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Abstract

Celiac disease (CD) is a chronic disease of the digestive tract the sufferer has inflammation or ulcers of the small intestine, which causes difficulty getting the nutrients absorbed from the diet. People suffering from CD often have other family members with the similar condition and are therefore vulnerable to this disease. Irritation and inflammation in the intestinal tract occurs when a patient with CD starts food that containing gluten. Gluten is the proteins which is present in wheat, barley, rye and similar grains. Oats are presently proven not to be harmful to patients with CD. As a matter of fact, due to the high possibility of adulteration with other gluten containing grains, oats are usually not recommended for patients with celiac disease. When food containing the gluten protein reaches in the small intestines the immune system reacts against this protein, causing an inflammatory reaction in the walls of the intestinal tract. The small intestine lining is covered by millions of finger-like projections known as villi, which increases the surface area of the intestine resulting in increased absorption of nutrients. These villi are damaged by the inflammation as a result of celiac disease, which in turn leads to a decrease in the nutrient absorption. As a process of therapy if gluten is removed from the food inflammation reduces and the bowel begins to heal. The time it takes for the patient to develop symptoms varies from person to person after their first contact with the gluten protein [1].

Keywords: Celiac Disease; Gluten; Protein

Introduction

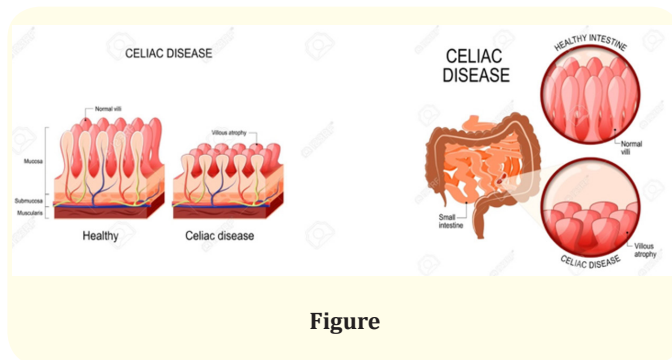
Celiac Disease (CD) is a form of chronic enteropathy affecting the small intestine in genetically predisposed individuals and is precipitated by the ingestion of gluten containing foods. It is also referred as gluten sensitive enteropathy, celiac sprue and non-tropical sprue. Many a times CD was mistaken with tropical sprue for overlapping symptoms but CD can be clearly differentiated from this on the basis of serological tests for the detection of auto antibodies generated in response to gluten ingestion and small bowel biopsy. Moreover, CD is mainly associated with type I diabetes mellitus, auto immune thyroiditis, and chronic liver disease compared to tropical sprue [2]. The disease is characterized by severe immune mediated damage to the small bowel, typically involving chronic diarrhea, abdominal bloating and distention, weight loss, iron deficient anemia, malnutrition and metabolic bone disease [3,4]. Assessment of Indian CD children for clinical, nutritional and pathological characteristics showed the symptoms of vitamin deficiency, abnormal fat excretion, delayed puberty and also altered histology in the small bowel such as partial and subtotal villous atrophy with hyperplastic crypts, increased intra epithelial lymphocytes and mononuclear infiltration in the lamina pro-

pria [5]. Not only typical symptoms but some atypical symptoms like enamel defects in adult celiac have also been reported and was obvious since gliadin and enamel proteins shared common antigenic motifs [6]. Recently several studies agree that, atypical presentation of CD has become more common compared to classical presentation. This may be attributed to the factors such as, onset of symptoms with age, early and late diagnosis which correlates with the dietary practices, geographical distribution and socio-economic aspects [4,6,7].

Earlier, it was thought that prevalence of CD is high in western population. But recent studies showed that CD has become worldwide in its distribution. Though, accurate statistics of CD has not yet been determined since its diagnosis follow iceberg model. However, World Gastroenterology Organization (WGO) data states that the prevalence of CD in a healthy adult population varies between roughly 1 in 100 and 1 in 300 in most parts of the world and female to male ratio was 2:1. Serological diagnosis (anti-gliadin, anti-endomysium and anti-transglutaminase antibody assays) of CD in Middle East, North Africa.

Definition of celiac disease

Celiac disease is a disorder of the digestive tract that destroys the lining of small intestine. The disease is triggered by eating foods containing gluten. The food protein gluten is found naturally in wheat, barley, and rye, and is common in foods made of these grains like bread, pasta, cookies, and cakes. Besides these some other pre-packaged foods, beauty products such as lip balms and lipsticks, hair and skin products, some toothpastes, nutrient supplements, and, even sometimes, medicines, have gluten in them.



Figure

Celiac disease can be very dangerous, the disease can cause chronic digestive problems and keep our body deprived of all the nutrients it needs. Effects of celiac disease can also be seen outside the body other than the intestines [8,9].

Wheat allergy

Is a disease, which belongs to the group of food allergies. Therefore, its path mechanism is completely different than celiac disease and is based on an allergic reaction and not an autoimmune reaction [10]. Products that most often cause food allergies are: cow's milk, eggs, cereals (mainly wheat), soya, fish, crustaceans, nuts and peanuts [11]. The development of the allergic process is complex and occurs in people with a genetic predisposition to allergies. It is worth noting that the food we eat is a foreign substance to the body and naturally stimulates the cells of the immune system. However, in normal conditions, the mechanisms referred to as "food tolerance", the immune response suppresses. In people who develop food allergy this mechanism does not work properly and sensitize to a given food allergen. Sensitization consists in the production of specific antibodies, which upon re-contact with a given antigen can lead to mast cell activation and the release of mediators of the allergic reaction - histamine. Symptoms of food allergy appear within a few minutes or a few hours after consumption of the product and affect the skin (urticaria, atopic eczema, angioedema), digestive system (nausea, vomiting, spasmed abdominal pain) and respiratory IgE system (asthma, allergic rhinitis) [12]. A fatal consequence of food allergy may be the occurrence of life-threatening anaphylactic reaction. In the case of allergy to wheat, the main allergens include α - Amylase/trypsin inhibitors and ω -5 gliadin, which is an element of gluten [13].

Wheat allergy and celiac disease

Wheat allergy, often dismissed with celiac disease, can be differentiated with celiac disease because of the involvement of different immune cells and antibodies. Both of them are conditions whose primary treatment is avoidance of specific dietary components.

Some people are allergic to gluten protein, but that is not the same as a celiac disease. People who have the signs of celiac disease often need to be tested with a test called skin prick test, but usually people with wheat allergy will not necessarily have celiac disease.

There are four main classes of proteins found in wheat namely: albumins, globulins, prolamins and glutenins. Prolamins are known as gliadins and glutenins are called glutenins. So basically, these two protein groups form the classic gluteins which is the prime culprit of celiac disease (CD) [14].

Classification of wheat protein

Wheat proteins are categorized into four fractions on the basis of their solubility in a series of solvents: water (albumins), dilute salt solutions (globulins), aqueous alcohol (gliadins), and dilute alkali or acid (glutenins). The albumins and globulins are mainly structural proteins and metabolically active enzymes. The water/salt-insoluble gliadins and glutenins, together known as prolamins or gluten, are the major storage proteins of the wheat grain.

Alfa-amylase inhibitors are the most important wheat proteins contributing to asthma. Profilins are proteins that are found in all eukaryotic cells and constitute a key component in the cells cytoskeleton. They consist of a large portion of the class 2 allergens (mainly seen in adults and develops as a consequence of an allergic sensitization to inhalant allergens) and frequently show cross-reactivity between pollen and food [15].

The prolamins share a great degree of sequence and structural homology with each other and with the corresponding proteins in rye and barley. They can be divided into two fractions according to their solubility in aqueous alcohols: the soluble gliadins and the insoluble glutenins. Gliadins are monomeric proteins and can be classified according to their primary structures into the α/β - γ - type. Based on primary structure, glutenin subunits have been ω - divided into the high-molecular-weight (HMW) subunits and low- molecular-weight (LMW) subunits [16].

Other wheat proteins

Glycoproteins are proteins that contain oligosaccharide chains (glycans) and are often important integral membrane proteins. Water-soluble glycoproteins that are 10 to 70 kDa in size have been identified as a class 1 allergen (the sensitization process occurs in the gastrointestinal tract; Wheat protein hydrolysates are peptides

derived from wheat through proteolysis. These hydrolysates can create allergens of wheat proteins that previously did not exist. Such hydrolyzed wheat proteins are used as an additive in foods and cosmetics. (15,16)

Symptoms and causes of celiac disease

Most people with celiac disease have one or more symptoms. However, some people with the disease may not have symptoms or feel sick. Often certain health related problems like surgery, a pregnancy, childbirth, diarrhea and vomiting, a viral infection, or emotional and mental stress can enhance symptoms of celiac disease.

If you are suffering from celiac disease, you may develop some digestive problems or other symptoms. Irregular bowel symptoms are more common in children and can include bloating, or a feeling of fullness or swelling in the abdomen, chronic diarrhea, constipation, gas, nausea, pale, foul-smelling, or fatty stools that float, stomach pain and vomiting.

For children with celiac disease, being unable to absorb nutrients when they are so important to normal growth and development can lead to damage to the permanent teeth's enamel, delayed puberty, failure to thrive in infants, mood changes or feeling annoyed or impatient, slowed growth and short height as well as weight loss.

Adults are less likely to have digestive symptoms and, instead, may have one or more of the following symptoms like anemia; a red, smooth, shiny tongue; bone or joint pain; depression or anxiety; dermatitis herpetiformis; headaches; infertility or repeated miscarriage; missed menstrual periods; mouth problems such as canker sores or dry mouth; seizures; tingling numbness in the hands and feet; tiredness; weak and brittle bones.

Adults who have digestive symptoms with celiac disease may also have abdominal pain and bloating; intestinal blockages; tiredness that lasts for long periods of time; ulcers, or sores on the stomach or lining of the intestine.

Celiac disease also can produce a reaction in which your immune system, or your body's natural defense system, attacks healthy cells in your body. This reaction can spread outside your digestive tract to other areas of your body, including your bones, joints, nervous system, skin and spleen.

Depending on how old you are when a doctor diagnoses your celiac disease, some symptoms, such as short height and tooth defects, will not improve [17].

There are often individual differences in the symptoms of celiac disease

Your symptoms may depend on how long you were breastfed as an infant; some studies have shown that the longer you were

breastfed, the later celiac disease symptoms appear; how much gluten you eat; how old you were when you started eating gluten; the amount of damage to your small intestine and your age—symptoms can vary between young children and adults.

People with celiac disease who have no symptoms can still develop complications from the disease over time if they do not get treatment [17].

Pathogenesis:

Importance of environmental factors in the pathogenesis of celiac disease.

Recent researches have concluded that the list of causative factors for celiac disease are enormous which could be listed other than gluten. The genetic factors responsible for celiac disease alone cannot explain the symptoms and occurrence of the disease in a person nor the recent increase in the episodes of celiac disease. [18]. It has been shown that the classical intestinal clinical symptoms of malnutrition, chronic diarrhea, and nutritional deficiencies are diminishing while extra intestinal presentations are emerging. This includes the problems of skin, endocrine glands, skeletal system, hematological, female reproductive system, fertility, dental, and behavioral abnormalities are often explained [19,20]. It is often explained that the sudden surge in the incidence of celiac disease are elevated by environmental factors, as genetic changes are too slow to reach to such developments. On one hand, prolamines are known to play a major role in the initiation of celiac disease, often other more prominent environmental factors have been published as inducers of the condition. Retroviral infections in small children and infections like *Campylobacter jejuni* in adults are linked with a rise in the risk of celiac disease [21].

The infectome–autoimmune disease relationship is congruent with the hygiene hypothesis, which states that decreased exposure to microbes may be driving the increase in autoimmune diseases. Other important factors which are reported to have been linked with increased risk of celiac disease could be concluded as very less or no breast feeding, the timing and increased amount of gluten intake, use of some antibiotics and proton pump inhibitors, cesarean delivery, socioeconomic factors, and, most commonly, maternal iron supplementation during pregnancy [22].

Diagnosis

It is difficult to diagnose celiac disease due the fact that some of the symptoms are similar to the symptoms of other diseases, like irritable bowel syndrome (IBS) and lactose intolerance. The physician will diagnose celiac disease by asking the patient's medical and family history, physical and laboratory tests which may include biochemical analysis, genetic tests, and biopsy.

Medical and family history

Your doctor will ask you for information about your family's health—specifically, if anyone in your family has a history of celiac disease.

Your doctor will ask you for information about your family's health.

Physical exam

During a physical exam, a doctor most often checks your body for a rash or malnutrition, a condition that arises when you don't get enough vitamins, minerals, and other nutrients you need to be healthy. Also he/she listens to sounds in your abdomen using a stethoscope, taps on your abdomen to check for pain and fullness or swelling.

Dental exam

For some people, a dental visit can be the first step toward discovering celiac disease. Dental enamel defects, such as white, yellow, or brown spots on the teeth, are a pretty common problem in people with celiac disease, especially children. These defects can help dentists and other health care professionals identify celiac disease.

Tests used to diagnose celiac disease

Blood tests

A health care professional may take a blood sample from you and send the sample to a lab to test for antibodies common in celiac disease. If blood test results are negative and your doctor still suspects celiac disease, he or she may order more blood tests.

Genetic tests

If a biopsy and other blood tests do not clearly confirm celiac disease, your doctor may order genetic blood tests to check for certain gene changes, or variants. You are very unlikely to have celiac disease if these gene variants are not present. Having these variants alone is not enough to diagnose celiac disease because they also are common in people without the disease. In fact, most people with these genes will never get celiac disease.

Intestinal biopsy

If blood tests suggest you have celiac disease, your doctor will perform a biopsy to be sure. During a biopsy, the doctor takes a small piece of tissue from your small intestine during a procedure called an upper GI endoscopy.

Skin biopsy

If you are suspected to have dermatitis herpetiformis, your doctor will perform a skin biopsy. This test, the doctor removes tiny pieces of skin tissue to examine with a microscope.

A doctor examines the skin tissue and checks the tissue for antibodies common in celiac disease. If the skin tissue has the antibodies, a doctor will perform blood tests to confirm celiac disease. If the skin biopsy and blood tests both suggest celiac disease, you may not need an intestinal biopsy [23,24].

Treatment

The only treatment for celiac disease is to follow a gluten-free diet—that is, to avoid all foods that contain gluten. For most people, following this diet will stop symptoms, heal existing intestinal damage, and prevent further damage. We will observe improvements within a week of starting the diet therapy. Although most of the children get full recovery of their intestinal lining, research has suggested that the healing may remain unsatisfactory in many adults, even though symptoms may subside.

The gluten-free diet may be required throughout the life of the patient. Ingesting any amount of gluten, no matter how small, can inflame the bowel. This could be true for any patient, including those who do not have clear symptoms. It may take a long time for the antibodies (often more than a year) to come to normal after a person has stopped eating gluten. Your physician will suggest if your intestinal damage is improving at a satisfactory rate, based on the reduction of antibody levels in blood. Although depending on a patient's age at diagnosis, some problems, such as stunted growth and discoloration of teeth, may not be benefited.

A gluten-free diet means to restrict all foods containing wheat, rye, and barley. Although patients with celiac disease can enjoy a well-balanced diet with a variety of choices, including gluten-free bread and pasta. For instance, replacing wheat flour with potato, rice, soy, or bean flour [25].

On the other hand foods like meat, fish, fruits, and vegetables don't have gluten at all, so people with celiac disease can include these foods in their diet as much as they like. People with celiac disease have to be very cautious about what they get for lunch at school or work, eating at get together parties, or getting for a midnight snack. If choosing to dine out the person with celiac disease have to be very careful and critical. They should learn about the menu for foods with gluten and ask the waiter or chef about possible ingredients in the meal. Although with the passage of time, recognizing sources of gluten becomes a habit and people will learn to identify the safe foods among the variety of choices.

A dietitian, who is a healthcare professional specializing in food and nutrition, can help people learn about their new diet. Gradually, it becomes easy to choose. But still if you feel you are in a dilemma, take help of your doctor or dietitian, and your support group. It is often possible that you are eating gluten unconsciously and need to identify foods that are keeping you from resuming your health [26].

A need to detect celiac disease

For symptomatic celiac disease patients, a gluten-free diet (GFD) can lead to significant improvement in symptoms and severity of celiac disease, abnormal lab tests, and spoiled quality of life. Long-term treatment also diminishes the risk of tumors and cancers. However, researches still show concern about the long-term effects on patients with asymptomatic celiac disease and whether maintaining a GFD throughout life is necessary for all of them. Recent studies have suggested that patients who are detected during screening, most of whom can be regarded as asymptomatic, can improve their quality of life in the longer term with a GFD [27,28]. Patients with (long-term untreated) CD have an elevated risk for benign and malignant complications [29,30] and Cancer (overall

risk increment 1.35, infertility (12%), Osteoporosis (30–40%), Bone fractures (increased risk for classically symptomatic CD patients) (35% increased risk) [31,32]

Diet

The gluten-free diet

The following list is intended as a general guide only.

If you have celiac disease you should consult with a dietitian with expertise in celiac disease for personal dietary planning and knowledge about reading food labels.

Gluten-free breads, biscuits, pastas, cereals and other foods are available from marts and health food stores.

	Foods to Avoid	Foods to Include
Flour:	Wheat, rye, barley, triticale and oat flour; and flour made from wheat varieties including spelt, dinkie and kamut. Wheaten cornflour.	Rice, potato, lentil and soy flour; pure maize cornflour, cornmeal/polenta, arrowroot, buckwheat, sorghum, millet, sago, tapioca, baby rice cereal, amaranth, lupin, and quinoa.
Bread and baked goods	All wheat, rye and sourdough bread; biscuits, pastries, buns, muffins, pikelets, crumpets, croissants and breadcrumbs (unless labelled gluten-free).	Rice cakes, corn cakes and some rice crackers*; gluten free bread; biscuits, pastries, rolls, breadcrumbs, cakes and desserts made from allowed flours; gluten-free bread, biscuit and cake mixes.
Cereals	Breakfast cereals containing wheat, oats, semolina, barley, rye, malt extract, wheat bran, and oat bran.	Rice, corn and soy breakfast cereals*, gluten-free muesli, home-made muesli using allowed ingredients.
Pasta and grains	Wheaten noodles, pasta, spaghetti, vermicelli and instant pasta meals; triticale, couscous, bulgur and semolina.	Rice, corn, cornmeal, tapioca, buckwheat, polenta, quinoa and millet; buckwheat and gluten-free pastas; rice noodles and rice vermicelli.
Fruit	Commercial thickened fruit pie filling*.	Fruit juices and fresh, frozen, canned or dried fruit.
Vegetables	Canned or frozen vegetables in sauce, commercially prepared vegetable and potato salad*.	Fresh, frozen, dehydrated, or canned vegetables without sauces; vegetable juices.
Meat, fish and poultry	Sausages, most processed meats and fish, corned beef, meat pies, frozen dinners; foods prepared or thickened with flour, batter or crumbs.	Canned meat or fish without sauce or cereal, ham off the bone*, bacon, gluten-free sausages; fresh, smoked, cured or frozen products without sauces, crumbs or batters.
Dairy products	Cheese mixtures pastes and spreads*, malted milks, ice cream with cone or crumbs, soy drinks containing malt*.	Block, processed, cream, cottage or ricotta cheese; fresh, UHT, evaporated, powdered or condensed milk; yoghurt*, buttermilk, fresh or canned cream, plain or flavored ice cream*.
Legumes, nuts and seeds	Coated and seasoned nuts*, textured vegetable protein products.	Dried or fresh beans, nuts and seeds, gluten-free canned baked beans, canned beans or legumes*.
Takeaway food	Hamburgers, pizza, souvlaki, sausages, battered food (e.g. fried fish), crumbed food (e.g. crumbed chicken), stuffed roast chickens, pies and sausage rolls.	Steamed rice, grilled fish (check no flour), chicken (no stuffing), steak, Asian dishes without flour or soy sauce, steamed vegetables, baked potato, some chips*, most sushi (check fillings).
Snacks	Packet savory snacks, and filled chocolates, licorice, many frozen desserts, flavored potato crisps and corn chips*.	Fruit juices and fresh, frozen, canned or dried fruit.
Beverages	Cereal based coffee substitutes malted cocoa beverages (e.g. Milo®, Ovaltine®, Aktavite®), barley waters, milk flavorings*, beer, ale, stout and lager, alcoholic soft drinks containing malt extract.	Water, tea, coffee, cocoa, milk, cordials, soft drinks, soda water, mineral water, fruit and vegetable juices, wine (including sparkling and fortified wines), most spirits and liqueurs, cider, gluten free beer.
Misc.	Malt vinegar, soy sauce containing wheat, mixed seasonings, yeast extract spreads (e.g. Vegemite®, Marmite®, Promite®), sauces, pickles, relish, chutney, thickened salad dressings, stock cubes, custard powder containing wheat starch, chicken salt*, baking powder*.	Tomato sauce, gluten-free soy sauce, most vinegars*, sugar, honey, golden syrup, jam, peanut butter, salad dressings *, gluten-free stock cubes, gelatin, gluten-free baking powder and custard powder, herbs, spices, salt, pepper. (33)

Table

Conclusion

Sticking on to a gluten-free diet is the only way of therapy for celiac disease.

However, a gluten-free diet may seem simple on paper, it could be difficult for some patients to follow. The most prevalent reason for lack of response is poor willingness and unconscious gluten intake.

All patients with celiac disease should be often evaluated. This should include analysis of growth, assessment of bowel and other similar symptoms related to celiac disease, and the patient's knowledge about and adherence to the gluten free-diet.

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