



Should Everyone Eat Gluten-Free? What does the Scientific Data Say?

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Abstract

Today, changing the dietary habits of the individual to a gluten-free diet during the treatment process of Celiac disease (CD), wheat allergy (WA), non-celiac gluten sensitivity (NCGS), irritable bowel syndrome, autism, and neurological, psychiatric, and rheumatological diseases reduces the symptoms of the diseases. On the other hand, the gluten-free diet is presented as a healthy choice by the popular media. This has led to an increase in gluten-free food alternatives in the market. A long-term gluten-free diet in healthy individuals is associated with problems, such as uncontrolled weight gain, diabetes, and vitamin and mineral deficiencies. This review aims to question the effects of a gluten-free diet on health in healthy individuals. While the beneficial effects of gluten in the treatment of some diseases are supported by the literature, there is not enough evidence to support the positive effects of a gluten-free diet in healthy individuals in line with the relevant objective. Raising awareness of the community about the potential risks of adopting a gluten-free diet in individuals who do not have a gluten-related disease is possible through education emphasizing healthy and sustainable nutrition.

Keywords: Gluten; Gluten-Free Diet; Gluten-Free Diet in Individuals with no Celiac Disease; Diet Education

Abbreviations

CD: Celiac Disease; WA: Wheat Allergy; NCGS: Non-Celiac Gluten Sensitivity; GFD: Gluten-Free Diet; GFP: Gluten-Free Products; GMO: Genetically Modified Organism

Introduction

Today, adjusting to the life cycle in big cities has led to the development of processed/ready-made food production and diversity and an increase in their consumption, which, in turn, has affected the food choices and nutrition styles of societies. Food culture of societies, like their cultural structures, show diversity. According to the World Health Organization, "A healthy diet helps protect against all forms of malnutrition, as well as non-communicable diseases, such as diabetes, heart diseases, stroke, and cancer" [1]. As

stated in many dietary guidelines published throughout the world, a healthy diet should be personalized, balanced, and adequate. According to the World Health Organization, a healthy diet should be rich in low-fat or fat-free milk and dairy products, foods with a high-fiber content (rich in vegetables, fruits, whole grain products, and legumes), and nuts, but it should also be low in fat, saturated fat, sugar, and salt [1]. Personalized medical nutrition therapy, which is applied in diseases, such as diabetes, hypertension, and kidney failure, and some special conditions such as food intolerance and food allergy, is an integral part of the treatment. Some specific diets (ketogenic diets, gluten-free diets) are presented as healthy diets in the popular media, and they become a trend in practice [2]. Today, cereals have a very important place in people's diet because they are easy to access and cheap, and they meet their

daily energy and macro and micronutrient requirements [3,4]. This article aims to raise awareness of people about the health effects of a gluten-free diet, which is not recommended in healthy individuals without a diagnosis of a relevant disease.

Gluten and its properties

Wheat, rice, and corn are widely produced and used cereal grains. Wheat, one of these cereal products, has an important place in the nutrition culture of societies, and it is frequently consumed and traded [5-7]. Gluten, which is found as a storage protein in cereals and in the structure of wheat, means “glue” in Latin [8]. Gluten is available as gliadins and glutenins in wheat, secalins in rye, hordeins in barley, and avenins in oats [6,9]. Gluten makes up 85 - 90% of the wheat kernel [5,6]. Gluten protein has a heat-resistant structure that is insoluble in water [10]. In addition, it has binding, elasticity-enhancing, air-storing, texture-protecting, flavoring, and moisture-retention properties in foods. For this reason, it is used for various purposes (as coating, thickener, emulsifier, or gelling agent) in processed meat types, confectionery, ice cream, seasonings, fillings, sauces, and medicines. In the food industry, it is most commonly used to improve the integrity of bakery products, such as bread, pasta, cakes, pastries, and biscuits, or to strengthen low protein flours [6,11]. It is thought that the average daily gluten intake in the Western diet is 5 - 20 g/day [6].

Who is a gluten-free diet (GFD) suitable for?

While the prevalence of the celiac disease has remained stable over the past few years, interest in GFDs is increasing every other day. GFD is the main method employed in the treatment of Celiac disease, which is an autoimmune disorder [12]. When we do Google searches using the keyword “GFD” with 10-year intervals, we get 7.090.000 results for 2001, 25.600.000 results for 2011, and 370.000.000 results for 2021 [13]. This shows that despite the stability in the prevalence of celiac disease in recent years, GFD has been presented as a healthy diet in the popular media and has spread rapidly [12,14]. According to a study, up to 5% of the population in Western societies has adopted a gluten-free diet voluntarily, while the rate of individuals who self-reported gluten sensitivity is 13% [15]. According to a similar study, 13% of young adults place a higher value on gluten-free diets and gluten-free products. Also, individuals are 4 to 7 times more likely to value organic, non-

GMO, unprocessed, and local products [16]. The three major conditions that cause gastrointestinal symptoms in response to gluten ingestion and require gluten removal from the diet are Celiac Disease (CD), Wheat Allergy (WA), and Non-Celiac Gluten Sensitivity (NCGS). In addition, during the treatment of irritable bowel syndrome, autism, and neurological, psychiatric, rheumatological, and dermatological diseases, the removal of gluten from the individual's diet has been found to reduce the symptoms of the diseases [2,9,17].

Celiac disease (CD): It is an immune-mediated systemic disorder caused by environmental factors in individuals genetically sensitive to gluten. While the incidence of the disease varies from country to country, the age of incidence is stated as childhood. Clinical features in celiac disease differ according to the age of onset. It usually occurs in late childhood. Bowel symptoms and delayed growth are common in children diagnosed with CD. The clinical signs of the disease include gastrointestinal symptoms, such as abdominal pain, vomiting, chronic diarrhea, and/or constipation, which can be accompanied by headaches and joint pain. This disease is a permanent condition, and the main point in medical nutrition therapy is a gluten-free diet [5,18-20].

Wheat Allergy (WA): It is defined as an immuno-allergic reaction. It is a hypersensitivity reaction to wheat protein, namely gluten, as a result of increased IgE and histamine release. It occurs through ingestion, inhalation, and skin exposure. The most common symptoms are vomiting and diarrhea. However, in some cases, symptoms can be anaphylaxis, atopic dermatitis, urticaria, and asthma/rhinitis [5,9,21].

Non-celiac gluten sensitivity (NCGS): It is a newly identified condition that is 10 times more common than celiac disease. NCGS is characterized by the presence of gastrointestinal and extraintestinal symptoms. It is a condition in which allergic symptoms increase in gluten intake in the absence of celiac and enteropathy. Its clinical features and diagnostic methods are very similar to those of Celiac Disease. Commonly described symptoms include abdominal pain, chronic diarrhea, abdominal distention, anemia, fatigue, eczema, headache, blurred vision, and depression. In some complex situations, a differential diagnosis criterion is needed to discriminate it from celiac disease [5,8,18].

A gluten-free diet and nutrient content

The basic principle of a gluten-free diet is to remove wheat, barley, rye, oats, and products made from these grains (starch, flour, bread, pasta, cake, etc.) from individuals' diets, known as gluten elimination [2]. Foods, such as fresh vegetables and fruits, meat and poultry, seafood, legumes, nuts, and most dairy products, are naturally in the gluten-free group [22]. Gluten-free products (GFP) cannot be enriched as they are made from refined flour or starch. Therefore, they do not have the same amount of nutrients as their gluten-containing equivalents [2]. According to the "Standard for Foods for Special Dietary Use for Persons Intolerant to Gluten" published by Codex Alimentarius in 2015, gluten-free products defined are foods with a gluten content of less than 20 mg/kg [23]. Refined grains contain less fiber compared to unrefined grains, and they also have a higher glycemic index, carbohydrate, and fat content [24,25]. Considering that bread is the basic food of the table, the nutritional composition of gluten-free bread types sold on the market contains 40 - 62% carbohydrates, 0 - 8% proteins, and 1 - 11% fat in GFD. Dairy products, eggs, rice starch, potato starch, tapioca starch, soy protein, and hydrocolloids are used to enrich the content of gluten-free products in the market and to preserve their structure [4,26]. Processing wheat grains and separating gluten will cause changes in the macro and micronutrient composition and quality of the food. The outer part of whole-grain kernels is rich in the vitamin B group, iron, folate, and fiber. In the case of a gluten-free diet, the intake of some vitamins and minerals (iron, calcium, zinc, magnesium, vitamin B12, and vitamin D) will be restricted, and at the same time, carbohydrate contents, glycemic indexes, and fat contents will increase as a result of processing [9,11,27]. The amount of fiber that a healthy individual should take daily is 25 - 38 grams, but it is about 6 grams per day in GFD. For individuals on a gluten-free diet to complete the prescribed micronutrients and fiber content, it will be enough to consume 4-5 servings of vegetables and fruits per day for optimal nutrition [9,26].

Advantages of using gluten in the diet

Gluten should not be consumed in patients with celiac disease, wheat allergy, and non-celiac gluten sensitivity. No concession should be made on gluten-free diets that are recommended in the treatment of the symptoms of some diseases diagnosed by the physician. On the other hand, health professionals do not find it appropriate to exclude gluten from the diet unconsciously following the popular diet culture [11]. Resistant starches such as oligo-

fructose and inulin, which are naturally found in the structure of wheat grains, play a role in the composition of beneficial intestinal bacteria. This shows a protective effect against some types of cancer, inflammatory bowel diseases, and cardiovascular diseases. At the same time, indigestible carbohydrates in the structure of wheat reduce postprandial glycemia, fasting triglyceride level, and thus body weight [26,28,29]. It is known that diets using whole grains improve bowel movements and have a prebiotic effect [30]. In a study, it was stated that a gluten-free diet applied for one month resulted in a statistically significant decrease in bacteria, such as *Bifidobacterium*, *Clostridium lituseburensense* and *Faecalibacterium prausnitzii* ($p < 0.05$) [31]. In contrast, a double-blind, placebo-controlled, crossover study showed that consumption of whole-grain wheat products caused an increase in bacteria such as fecal bifidobacteria and lactobacilli and had a prebiotic effect [32]. In another study, it was stated that gluten in whole grains increased ACE inhibitor activity and had a positive effect on blood pressure [33]. According to another study, the consumption of whole grains in a healthy diet, that is, the high fiber ratio, reduced the blood triglyceride level [34]. It was also reported that gluten had a positive effect on the immune system by increasing the activity of T-Killer cells [30].

Harms of a gluten-free diet

Health risks of GFD

A gluten-free diet (GFD) can lead to a deficiency of macro and micronutrients. When compared to wheat-based equivalents, gluten-free products available on the market are high in carbohydrates, simple sugars, fats (especially saturated fat), and salt and low in protein. Likewise, it is poor in Vitamin B12, folate, vitamin B group, and minerals, such as calcium, zinc, iron, and magnesium [11]. In studies comparing gluten-containing products and their gluten-free equivalents on the market, it has been determined that the protein content of gluten-containing products is higher than that of the gluten-free products but that the content of carbohydrates, saturated fat, and salt is lower [35,36]. In a prospective study examining long-term gluten consumption and risk of coronary heart disease, it was stated that long-term gluten consumption was not associated with the risk of coronary heart disease, while it was reported that the consumption of a GFD could affect the risk of cardiovascular diseases [37]. Despite the increasing popularity of a gluten-free diet and therefore GFP in the media, there is not enough evidence that individuals following this diet

lose weight [26,38,39]. Studies have shown that this diet causes more weight gain, especially in overweight or obese individuals, who were diagnosed with celiac disease and started a gluten-free diet a while ago [38,40,41].

Financial burdens of GFD

In many studies comparing the prices of gluten-containing products and the gluten-free equivalent of these products, it has been found that the former are 2-3 times more expensive than the latter [42-45]. According to the report of Global Market Insights, it is estimated that the size of the gluten-free food market will exceed 15 billion dollars in 2026, considering that it will continue growing without losing popularity [46]. According to the Gluten-Free Market review report of Facts and Factors, the global gluten-free products market was estimated to be US\$22 billion in 2019, and this figure is expected to reach US\$36 billion by 2026. The global Gluten-Free Products market is expected to grow at a compound annual growth rate of 8.5% from 2020 to 2027 [47].

Conclusion

For diagnosed diseases, such as celiac disease, wheat allergy, or non-celiac gluten sensitivity, individuals should remove gluten from their daily diets and should make no concessions on this diet throughout their lives. Although it is thought that a gluten-free diet may have positive effects on some digestive system diseases (irritable bowel syndrome), some neurological diseases (schizophrenia, autism), some dermatological diseases (atopy, dermatitis), fibromyalgia, or endometriosis, there is no clear evidence that gluten-free diets should be used in the treatment of these diseases. A gluten-free diet is thought to support the alleviation of symptoms of these diseases. It should not be forgotten that there is no sustainability of the implementation of many popular diets shared in the media and shown as a healthy nutrition trend and that these unconsciously implemented diets can do more harm than good to the human body. There is enough evidence that long-term consumption of a gluten-free diet may cause deficiencies in many macro and micronutrients in the body.

In addition, the gluten-free products used in a gluten-free diet offered under the name of healthy nutrition are rich in energy, fat, carbohydrates, salt, and sugar; therefore, they pave the way for weight gain, cardiovascular diseases, insulin resistance due to high glycemic index and thus the development of many chronic diseases such as Type II Diabetes. For this reason, healthy individuals should

not prefer a gluten-free diet without the diagnosis of a relevant disease and justification.

Conflict of Interest

The authors declare that there is no conflict of interest.

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