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ALL ASPECTS OF GLUTEN-FREE DIET AND ITS USE IN CHILDREN

GLUTENSİZ DİYETİN TÜM YÖNLERİ VE ÇOCUKLARDA KULLANIMI

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ABSTRACT

Gluten-free diet is a nutrition model in which gluten-containing products such as wheat, oat, barley, or rye and foods made from these products are not consumed. While it is used as an essential treatment in diseases such as celiac disease, non-celiac gluten/wheat sensitivity, and wheat allergy, it is also used as a nutritional therapy in some inflammatory bowel diseases, type 1 diabetes, neurological disorders, autism, dermatitis, irritable bowel syndrome, rheumatoid arthritis, cardiovascular diseases. Considering that gluten has adverse effects on health, the gluten-free nutrition model is applied at a rate of up to 30% in healthy people. While there is a decrease in the intake of fiber, iron, vitamin B1, and folic acid in the gluten-free nutrition model, the fat and calorie content of the products may increase. As a result of the consumption of gluten-free products, changes may occur in the colon, which may negatively affect the activity of bifidobacteria and cause problems in the immune response. Based on previous studies, this review evaluated the effects of using the gluten-free nutrition model in children by considering current sources.

Keywords: Gluten-free diet, Celiac disease, Nutrition in children, Gluten-free diet in diseases

ÖZET

Glutensiz beslenme buğday, yulaf, arpa, çavdar gibi gluten içeren ürünlerin ve bu ürünlerden yapılan gıdaların tüketilmediği bir beslenme modelidir. Çölyak hastalığı, çölyaksız gluten/buğday duyarlılığı, buğday alerjisi gibi hastalıklarda temel tedavi olarak kullanılırken, bazı iltihaplı bağırsak hastalıkları, tip 1 diyabet, nörolojik bozukluklar, otizm, dermatit, irritabl barsak sendromu, romatoid artrit, kardiyovasküler hastalıklarda da beslenme tedavisi olarak kullanılmıştır. Glutenin sağlık üzerinde olumsuz etkileri olduğu düşünüldüğünde, sağlıklı kişilerde %30'a varan oranlarda glutensiz beslenme modeli uygulanmaktadır. Glutensiz beslenme modelinde lif, demir, B1 vitamini ve folik asit alımında azalma olurken, ürünlerin yağ ve kalori içerikleri artabilir. Glutensiz ürünlerin tüketimi sonucunda kolonda bifidobakterilerin aktivitesini olumsuz etkileyebilecek ve bağışıklık tepkisinde sorunlara neden olabilecek değişiklikler meydana gelebilir. Bu derlemede daha önce yapılan araştırmalara dayalı olarak güncel kaynaklar göz önünde bulundurularak çocuklarda glutensiz beslenme modeli kullanımının etkileri değerlendirilmiştir.

Anahtar Kelimeler: Glutensiz beslenme, Çölyak hastalığı, Çocuklarda beslenme, Hastalıklarda glutensiz beslenme

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INTRODUCTION

GLUTEN-FREE DIET

Gluten is the substance of storage proteins defined as prolamins and glutelins, which means glue and found together with starch in various cereal grains (Melini & Melini, 2019). A gluten-free diet is a diet model in which gluten-containing products such as wheat, oat, barley, rye, and foods made from these products are not consumed. In the gluten-free diet plan, milk, meat, fruits and vegetables, and cereals like rice, corn, buckwheat, and quinoa can be consumed (Serin & Akbulut, 2017; Tunçer & Ayhan, 2021). Since gluten has been included in the list of allergen foods since 2005, foods must be specified in the label contents, and foods such as wheat, rye, barley, and oat should be included. t is stated on nutrient labels that the gluten content must be lower than 20 ppm to be considered reliable (Rostami et al., 2017).

Use of Gluten-Free Nutrition in Diseases

Gluten relates to the intestinal mucosal layer. Gluten has been determined to modulate zonulin, occludin, and claudin, which appear to affect the enteric permeability of macromolecules. It aims to decrease the effect of symptoms by using a gluten-free diet model in people with gluten-related problems (Karakula-Juchnowicz et al., 2019). The gluten-free diet model is used in diseases such as celiac disease, non-celiac gluten/wheat sensitivity, and wheat allergy. Moreover, this model can be used in some inflammatory bowel diseases. (Yıldırım, 2019; Ülger et al., 2020). A gluten-free diet is a growing nutritional model and can be used in diseases like dermatitis herpetiformis, cognitive diseases, inflammatory bowel disease, and irritable bowel syndrome (Tovoli et al., 2013; Aljada et al., 2021). The popularity of the gluten-free diet has increased in society on the grounds of weight loss and being healthier (Gaesser & Angadi, 2012; El Khoury et al., 2018). It is believed to be effective in weight loss, mainly because it is inhibitive (Rostami et al., 2017).

Celiac Disease

Celiac disease brings about issues with the absorption of foods due to harm to the villi structures in the small intestines of people who are sensitive to gluten due to the intake of foods involved gluten (Drabińska et al., 2019; Tunçer & Ayhan, 2021). Gluten is an autoimmune disease that takes place in people genetically susceptible to having immune acts on it. Existing data linked with the pathophysiology of celiac disease have been determined. Gluten, wealth in glutamine and proline remains, cannot be entirely digested through peptidases in the stomach, pancreas, and enteric. In influenced individuals, the emerging gliadin peptides join the lamina propria of the small intestine, where they deaminate and bind to human leukocyte antigen (HLA)-DQ2- or HLA-DQ8-positive antigen-offering cells. The peptides are transferred to gliadin-reactive differentiation cluster (CD)4+ T cells, bringing about mucosal inflammation, small intestinal villus atrophy, raised intestinal paracellular permeability, and ultimately malabsorption (Lerner et al., 2019). Its symptoms contain diarrhea, constipation, bloating, and sickness (Aljada et al., 2021). The presence of other small bowel symptoms determined in celiac can be associated with nutrient deficiency. In celiac cases, a lack of micronutrients such as iron, folate, and calcium can be detected caused by malabsorption (Tunçer & Ayhan, 2021). Mucosal damage caused by the effect of the disease and infection can cause a decrease in the absorption of nutrients like calcium, vitamin D, iron, vitamin B12, folic acid, and zinc. As a result, these nutrients lack, it may cause problems like osteoporosis, anemia, and stunted growth (Aljada et al., 2021). On the other hand, deficiency may take place due to insufficient consumption of some micronutrients such as riboflavin, niacin, folate, and vitamin B12 in the gluten-free diet (Tunçer & Ayhan, 2021). The indicators of celiac disease may change according to age. Basis symptoms in children; malnutrition, growth retardation, abdominal pain, and boasting. On the other hand, gastrointestinal symptoms and diarrhea can develop in adults. Especially in children, calcium and vitamin D intake are critically effective in growth and development. Many components affect nutrition patterns, bone mineral density, contain chronic disorders, duodenal absorption, and metabolism. In people with celiac, mucosal damage in the small intestine may occur problems in the absorption of calcium and vitamin D, causing important issues in growth and development. Therefore, short stature and structural delay in puberty can be high in children with celiac disease (Aljada et al., 2021). Research determined that 2-8% of children with short stature and no gastrointestinal disorder had celiac disease. However, when endocrine reasons were excluded as the cause of short stature, it was determined that the incidence of celiac rose to 19-59%.

Looking at the development charts, children with celiac appear to have a reduction in both weight and height (Van Rijn et al., 2004; Garganta & Bremer, 2014). The basis of celiac is included genetic, environmental, and immunological factors. The incidence of the disease in more than one person in the same family is increasing. Celiac disease has been determined at a ratio of 10-12% in first-degree relatives of celiac patients (Aydoğdu & Tümgör, 2005). In research on celiac, human leukocyte antigens (HLA)-DQ2 and DQ8 are determined in 98.4% of celiac patients and 89.6% in their families, suggesting that the disease has a genetic component (Cecilio et al., 2015). Celiac disease is now easier to diagnose and treat. However, nutrition treatment is very complex, and modification to the nutrition model can be a difficult process, especially cause of the ability to get gluten-free products and the perception of taste. On the other hand, gluten-free Nutrition is an important market now (Tunçer & Ayhan, 2021). As a result, changes in availability and taste have occurred, and finally, it has gained popularity. It is consumed especially concerning weight control and is considered a healthier diet. However, while there is still no important finding on this issue, there are conflicts about a healthy diet. In recent research, it has been stated that it may be risky concerning metabolic syndrome (Tortora et al., 2015). This may be due to gluten-free foods' more fat, sugar, and salt amounts (Mariani et al., 1998). Alternative nutrition therapy to a gluten-free diet has been studied in a few research available on celiac disease, but no conclusive findings have been founded (Håkansson et al., 2019). A gluten-free diet is a basic diet in children with celiac (Mercan & Özel, 2019). In a research on the effect of a gluten-free diet on celiac disease in children, the effect of serum ferritin in diagnosing and observing celiac disease was founded. A notable correlation was found between the decline in tissue transglutaminase-immunoglobulin A and the increase in serum ferritin after a gluten-free diet ($P < 0.0001$), suggesting that resolution of villous damage is necessary to stimulate sufficient iron absorption (Popov et al., 2018). Although gluten-free Nutrition was effective in reducing symptoms when applied to the treatment of celiac patients, positive effects on dysbiosis were not observed within the scope of intestinal microbiota. In a study on this subject, although the number of harmful bacteria such as E.coli and Staphylococcus reduced due to gluten-free Nutrition, it was observed that there was a reduction in bacteria with positive effects such as Bifidobacterium and Lactobacillus. The absence of gluten-containing foods in the diet causes a decrease in prebiotics that contribute to the microbiota (Mercan & Özel, 2019). It has been determined that this type of nutrition pattern, which has low fiber and high-fat content, causes a decline in the synthesis of short-chain fatty acids and the amount of Bifidobacterium kinds, and inflammation is influenced as a result of these changes (Ertaş-Öztürk & Karabudak, 2019). A study on this subject searched on certain sites until January 2019 and found that nutrient lacks generally occur in Celiac patients at diagnosis and during treatment in a GFD. Nutritional lack and declined nutrient absorption can influence these results. As a result of the research, it was determined that while it could not obtain important data on the clinical effectiveness of nutritional supplementation during celiac disease, further studies are needed (Kreutz et al., 2020). Common skin disorders like aphthous stomatitis, psoriasis, atopic dermatitis, urticaria, and rosacea can be observed at a higher ratio in celiac patients than in society. Considering the ratio between psoriasis and celiac disease, it was determined that the rate of celiac increased three times in people diagnosed with psoriasis (Antiga et al., 2019).

Non-Celiac Gluten Sensitivity

This sensitivity; is a clinical syndrome stated by symptom improvement with a gluten-free diet without celiac disease or wheat allergy. It has symptoms such as abdominal pain, swelling, diarrhea, and dyspepsia. Fatigue, headache, lethargy, and extraintestinal symptoms like cognitive impairment or "brain fog" are among the critical symptoms. Although a study has identified serological indicators of immune reactions and evidence of intestinal epithelial damage in patients with celiac disease or healthy non-celiac gluten sensitivity, there is no founded biological principle for describing either specific histological evidence or serological indicators of non-celiac gluten sensitivity (Lerner et al., 2019). A gluten-free diet is applied to a person without celiac disease but with gluten sensitivity (Ulusoy & Rakıcıoğlu, 2019). In research on 34 patients with gluten-sensitive irritable bowel syndrome, two groups were formed: gluten-free and non-gluten-free. Moreover, other research found that the effect of gluten exposure in people with this phenotype decreased with a low-FODMAP diet (fermentable oligosaccharides, disaccharides, monosaccharides, and polyols) (Biesiekierski et al., 2013). Describing non-celiac gluten sensitivity can be difficult. Therefore, professionals recommend the double-blind, placebo-controlled cross-gluten test as the "gold standard" for identifying a disorder (Vazquez-Roque

et al., 2013). Due to the inconvenience in its determination, future studies should be rigorously investigated. In a research of 231 people with non-celiac gluten sensitivity, only 38 (16%) were determined to have gluten-specific findings (Molina-Infante & Carroccio, 2017). Thanks to these factual findings, it is determined that many people with non-celiac gluten sensitivity are not actually gluten sensitive. Some of these persons may occur symptoms in response to FODMAPs or other wheat components like amylase-trypsin inhibitors. Most patients not determined by professional institutions but defined as non-celiac gluten sensitivity was diagnosed with lactose and fructose intolerance, excessive bacterial growth in the small intestine, and microscopic colitis (Tavakkoli et al., 2014). Especially in children, Data on non-celiac gluten sensitivity is very limited. It is recommended for adults in this regard. A table in the form of gluten loading after eight weeks of a gluten-free diet seems appropriate. Nevertheless, due to the scarcity of factual data, there is no existing guideline yet (Elli et al., 2015).

Gluten Ataxia

It is an immune-related disease caused by gluten consumption in genetically predisposed individuals. (Akhondi & Ross, 2019). Gluten ataxia is an autoimmune disease in which gluten ingestion causes the body's immune system to attack nervous system tissue, especially the cerebellum. Transglutaminase 6 (TG6) autoantibodies are greater in persons with gluten ataxia. These antibodies are believed to be the fundamental mechanism by which neurological indications are seen in people with gluten sensitivity. A decrease in TG6 autoantibodies has been found in patients on a gluten-free diet and a continuous normalization in those who maintain a gluten-free diet. In these results, it has been shown that a gluten-free diet can be applied for ataxia, but though it has been determined that gluten is effective for ataxia and celiac disease, there are no exact findings on the effects of other diseases (Aljada et al.,2021; Akhondi & Ross, 2019).

Wheat Allergy

It is a widespread allergy among food allergies, especially in Western countries. The rate of wheat allergy among infants is 10%, while this rate increases even more in developing countries. Wheat may be responsible for different diseases with regards to its effect in a specific way due to immunity and exposure to allergen foods. For this reason, wheat allergy can be observed often, especially in children (Mellini & Mellini, 2019; Ricci et al., 2019). Its prevalence in children is 0.4% (Zuidmeer et al., 2008). Guidelines published by the American National Institute of Allergy and Infectious Diseases state that food allergies, like wheat allergies, should be rigorously investigated in children with a combination of clinical symptoms that occur after anaphylaxis or food consumption (Elli et al., 2015). Patients with wheat allergies may evolve indications within 2 hours of eating wheat, and wheat is responsible for typical IgE-mediated reactions. Symptoms include urticaria, angioedema, bronchial obstruction, and nausea. The pathophysiology of the disease is not yet completely known. However, the genetic structure of the person can be effective in allergies.For this reason, similar to atopic dermatitis and asthma, food allergies are more common in infants with a family history of atopic disease (Ricci et al., 2019). In research examining the determinants of wheat allergy, 83 children with wheat allergy were involved in the study, and children were tracked up to the age of 6. Tolerance formation rates at ages 3, 5, and 6 were found to be 20.5%, 54.2%, and 66.3%, respectively. Children with a higher rate of persistent wheat allergy: It has been determined that some children experience anaphylactic reactions in response to whole foods and wheat before the age of 3, and children with high grades of wheat or ω-5 gliadin-specific IgE antibodies (Koike et al., 2018).

Dermatitis Herpetiformis

Dermatitis herpetiformis (DH) is a particular skin symptom of celiac disease (Antiga et al., 2019). It is a situation associated with gluten sensitivity that occurs with itchy cell sacs in different parts of the body, and a gluten-free diet model can also be applied (Akhondi & Ross, 2019). These patients have intestinal findings alike to celiac disease. It has been found that their genetic characteristics are similar to celiac disease. It has also been determined that a gluten-free diet changes skin-related symptoms of dermatitis herpetiformis, just like in celiac disease. Dermatitis herpetiformis occurs in patients with gluten sensitivity, like celiac disease, and has the same Human Leukocyte Antigen (HLA) and haplotypes (DQ2 and DQ8). On bowel examination in patients with dermatitis herpetiformis, they have similar findings

as celiac, such as the increased presence of intraepithelial lymphocytes from villus atrophy and the development of circulating autoantibodies against tissue transglutaminase (tTG). Although the onset period of the disease can be at any age, it can generally occur during adulthood. A study involving 477 patients diagnosed with DH over a 40-year period showed that the age of patients diagnosed with DH increased important over time.In addition, although dermatitis herpetiformis can be seen in children, its exact date has not been founded. In a study made in 2013, 159 dermatitides herpetiform were found to be 36% under the age of 20 (Antiga et al., 2013). It has been determined that dermatitis herpetiformis may be associated with various autoimmune diseases, containing type I diabetes mellitus, autoimmune thyroid diseases, and diseases such as Sjögren's syndrome. A gluten-free diet, as a lifelong diet in dermatitis herpetiformis persons, is essential to prevent skin symptoms and prohibit complications. However, since a gluten-free diet needs control of all the nutrients consumed, it can limit the person in terms of time and socially. Nutritional monitoring is an essential point in gluten-free foods due to contamination. In addition, some people who follow the gluten-free diet may be resistant despite long-term adherence to the diet (Antiga et al., 2019).

Gluten-Free Nutrition in Other Diseases

The gluten-free diet model can be applied to various diseases. FODMAP diet is also used in inflammatory bowel diseases, and it has been determined that a gluten-free diet can also be used in treatment as a nutrition model. There is no concrete data on using a gluten-free diet for irritable bowel syndrome (IBS). Recent studies have stated that a gluten-free diet may have essential effects in diarrhea IBS cases with HLA-DQ2 or HLA-DQ-8 genotype. However, positive effects could not be determined in other studies. (Paduano et al., 2019). Recent studies have shown that gluten and other wheat proteins can affect symptoms in some non-celiac people. There has been a quick increase in dietary interest in its use as a treatment method for treating irritable bowel syndrome (IBS) and functional bowel disorders. While there has been no actual increase in the number of people diagnosed with celiac disease, the number of people applying the gluten-free diet model has risen. While the rate of searching for the term gluten-free diet was 1.9% on specific sites in 2004, this rate rose to 83% in 2014. In a survey conducted in 2017, it was seen that the gluten-free diet grades second in reputation after low-carb diets (Lerner et al., 2019). Between 2009 and 2014, the rate of celiac in the United States remained almost unchanged (0.7%), while the rate of people who did not consume gluten increased from 0.5% to 1.7% (Aljada et al., 2021). Gluten-containing grains have the potential for antigenicity not only with the gluten itself but also with other proteins and additives. İndicate those α-amylase / trypsin inhibitors in wheat represent potent activators of innate immune responses in monocytes, macrophages, and dendritic cells. For this reason, most of the population does not eat gluten-including grains for various causes, such as sensitivities, intolerances, and allergic reactions. Some research showed that gluten may affect the formation of diabetes by influencing specific changes in immune cell populations or changing the cytokine/chemokine pattern towards an inflammatory profile. Gluten-induced intestinal inflammation may indeed play an essential role in the pathogenesis of type 1 diabetes by islet-infiltrating T cells that express gut-associated target receptors. For this reason, untreated celiac increases the risk of other autoimmune disorders and long-term complications (Rostami et al., 2017). It has also been tried as a nutritional treatment for type 1 diabetes, cardiovascular diseases, neurological disorders, autism, dermatitis, and rheumatoid arthritis. The gluten-free diet model is applied here because similar symptoms, such as abdominal pain, constipation, diarrhea, headache, and fatigue, are observed (Ülger et al., 2020).Now, a gluten-free diet is applied primarily in neurological disorders, and it has been found to have effects like recovery in behavioral problems and a decline in seizures (Aktitiz et al., 2019; Gürsoy & Öztürk, 2019). Recent studies have determined that there may be a link between gluten sensitivity and neurological problems. It has been stated that TG6 autoantibodies interact with the immune system after gluten consumption and attack the nervous system (Aljada et al., 2021). As a result of these data, gluten-free Nutrition has become a nutrition model that can also be used in autism. The opinion is that intestinal permeability is increased and improved by removing components like casein and gluten from the diet. For this purpose, in general, 21-66% of people with autism follow a gluten- and casein-free diet model. However, when we look at the studies on this subject, little low-level scientific evidence has been found (Kutlu, 2019). In a study conducted by Gahalichi et al., 80 children with autism were divided into two groups; one group was given a gluten-free diet and the other a standard diet for six weeks. In the study, it was observed that due to a gluten-free diet, there was a

decline in digestive system problem disorders and recovery in behavior. However, it has been shown that there may be a decline in the immune system with a long-term application (Ghalichi et al., 2016). Type 1 diabetes mellitus (T1DM) and celiac disease are autoimmune disorders resulting from genetic and environmental ingredients. Both conditions have genetic structures associated with HLA-DQ2 and HLA-DQ8, resulting in a prevalence of celiac in T1DM that is five to seven times higher than in the community (Nunes-Silva et al., 2017). As a result of available findings, some ideas of type 1 diabetes and gluten consumption may be linked. In a research conducted on this subject, 21 children with type 1 diabetes were grouped as those who followed a gluten-free diet and followed a standard diet. The HbA1c value was significantly lower in children fed gluten-free than in children fed typically (Söderström et al., 2022). In a study conducted with 950 children with type 1 diabetes, it was observed that celiac disease is much higher in children with type 1 diabetes compared to healthy children. When patients with celiac disease and diabetic patients, and patients with only diabetes were compared, it was observed that the average HgbA1c and body mass indexes were similar between the groups in the study (Goh et al., 2010). In addition, it has been stated that diet may be necessary for kidney diseases seen in children. Restrictions in gluten products have been shown to reduce proteinuria (Pérez-Sáez et al., 2021). Especially, restrictions in gluten and dairy products were seen to produce an effective reduction in proteinuria in both SSNS (steroid-sensitive nephrotic syndrome)/SDNS (steroid-dependent nephrotic syndrome) and SRNS (steroid-resistant nephrotic syndrome). Despite the positive results here, what kind of function has not been found yet? Nevertheless, there are different hypotheses about this subject. Food sensitivity is a complex situation to determine because of the reduction of reliability of tests on circulating antibodies or on the skin compared to food allergies, where food sensitivity is linked with dysfunction in immune cells. The consumption of sensitive foods can affect the release of inflammatory factors/cytokines that can directly damage podocytes. As a result of this effect, it can also affect the microbiota. It has been determined that there is an increase in the secretion of a molecule defined as zonulin, which is the primary modulator of tight intercellular junctions in people with gluten sensitivity. This molecule can then open strict junctions in the intestinal epithelium and, accordingly, increase the permeability of the intestinal epithelium to potentially toxic proteins produced by the microbiota (Leon et al., 2018). Steroid-resistant nephrotic syndrome (SRNS) is the leading cause of end-stage renal disease in children. In a study conducted to see the effect of a gluten-free and casein-free diet on immunity in children with SRNS, this type of Nutrition was determined to have an anti-inflammatory effect. (Pérez-Sáez et al., 2021). Current researches indicate a link between food sensitivity and gut microbiota in children with nephrotic syndrome. It is believed that the reduction in proteinuria is due to the absence of cow's milk and gluten in the diet of people with immune-related disorders, especially celiac disease, and nephrotic syndrome. Dietary patterns and epigenetic and environmental factors can affect the gut microbiota. (Uy et al., 2015). In a study conducted with eight children with idiopathic nephrotic syndrome, a reduction in the recurrence of the disease was observed in all patients due to the application of gluten-free Nutrition. As a result of the study, this also contributed to lower doses or discontinuation of steroids or immunosuppressive drugs (Lemley et al., 2016).

GLUTEN-FREE DIET IN CHILDREN

Examining the nutritional status of children, especially in people who apply the gluten-free nutrition model, is critical in monitoring growth and development. As a result of gluten-free Nutrition, there is a change in eating habits (Yıldırım, 2019). Particular food is restricted in gluten-free Nutrition, so it is significant to form an adequate and balanced nutrition program that contains both macronutrients and micronutrients in this type of nutrition model. In addition, this type of nutrition model may require significant lifestyle changes. Therefore, repeated and accurate counseling by specialist/specialist dietitians to patients and their families is an integral part of the treatment. (Makharia et al., 2022). In this type of Nutrition, there is a decrease in fiber, iron, vitamin B1, and folic acid intake (Yıldırım, 2019). While the fat content and calorie rate are much higher in such products, the protein rate is low (Gaillard, 2016). Gluten-free diets have much higher proportions of toxic metals like mercury and arsenic. In a gluten-free diet, especially in rice and rice products, which are sources of carbohydrates, the amount of mercury, lead, and arsenic is higher than in other grains such as wheat, oat, and barley (Punshon & Jackson, 2018). In this nutrition model, foods like milk, meat, vegetables, and fruits can be used easily, but foods like gluten are not. In such foods, the value of protein, fiber, iron, and vitamins such as folic acid, niacin, thiamine, and riboflavin is much lower, but the carbohydrate content is high. For this

purpose, a gluten-free diet should not be applied for weight loss or health unless there is a gluten-related problem (Kutlu, 2019). In a study conducted on this subject, 68 celiac patients and 43 healthy children were studied and it was determined that the diets of children with celiac disease were more unbalanced than healthy children. It was determined that the celiac group had lower iron intake than the controls, and the control group had more folate, iron, magnesium, selenium, and meat group intake (Nestares et al., 2020). A study on this subject determined that fiber, vitamin K, and polyunsaturated fatty acids were higher, and saturated fatty acid and sodium consumption were lower in children with the gluten-free diet compared to the group that followed the standard nutrition model (Aktitiz et al., 2019). A decrease in gluten consumption can lead to a reduction in the consumption of whole grains, and a decrease in their intake can lead to cardiovascular problems. In addition, a decrease in whole grain consumption may adversely affect the activity of bifidobacteria in the intestines (Karakula-Juchnowicz et al., 2019). As a result of this variation in the colon, changes in the immune response may occur (Håkansson et al., 2019). Besides, a high intake of processed gluten-free foods and not consuming whole grains may adversely influence children's health who follow a gluten-free diet. Studies have found that obesity is more common in people on a gluten-free diet (Cornicelli et al., 2018; Suárez-González et al., 2021). Recently, obesity in children and adults with celiac can be seen more than in the past. There are concrete data on the contribution of a gluten-free diet to obesity. Because a gluten-free diet increases absorption in the intestines, there is an increase in the intake of fats and proteins. In addition, products with higher calories can be consumed to increase the flavor of gluten-free foods (Anania et al., 2017). In a study on this subject, 149 young people with celiac disease were studied and it was founded that the prevalence of overweight and obesity at the time of diagnosis was 11% and 3%, respectively. After one year, a significant increase in body mass index (BMI) was observed due to a gluten-free diet, and the percentage of z-score and overweight children almost doubled (Valletta et al., 2010). However, there are studies in contrast to these studies. A study conducted with 142 pediatric celiac patients determined that 19% had a high body mass index (12.6% overweight and 6% obese), and 74.5% had an average body mass index. Seventy-five percent of pediatric patients with a high body mass index at diagnosis had a significant reduction in BMI z-scores as a result of a strict gluten-free diet. (Reilly et al., 2011). Not consuming gluten-containing grains and consumption of processed gluten-free foods may predispose children with celiac disease to chronic constipation (Suárez-González et al., 2021; Cornicelli et al., 2018). In a study, when celiac patients were compared with the control group, it was observed that celiac patients had a significantly higher intake of added sugar and total fat (Babio et al., 2017). Nutritional lacks can be the risks of a gluten-free diet in pediatric patients. Folate, magnesium, zinc, and selenium consumption may reduce in a gluten-free diet (Sue et al., 2018). It is considered that the positive aspects of this nutritional model are the elimination of many food groups (fermentable oligosaccharides, disaccharides, monosaccharides and polyols, fast food, processed packaged products, bakery products, high-energy-fat-containing foods) (Biesiekierski et al., 2013). However, this subject has no exact findings (Ülger et al., 2020). Today, there is an increase in the number of people who practice a gluten-free diet model except for diseases. Considering that gluten has adverse effects on health in the modern era, applying a gluten-free nutrition model has emerged at a rate of up to 30% in healthy people (Yıldırım, 2019). Sales of gluten-free products in the food market are estimated to reach $ 8 billion by 2024, which is at a growth rate of 34% in 2014 compared to the last five-year period (Igbinedion et al., 2017). Today, a gluten-free nutrition model is being applied for purposes such as weight loss and healthy Nutrition. In a study conducted among children, it was observed that there were more adolescents following a gluten-free diet than celiac cases. A study conducted at the University of Chicago evaluated the body growth and development values of children with celiac. It has been observed that there is an increase in body mass index after diagnosis in adolescent celiac patients. For this purpose, choosing healthy food should be prioritized during these periods, and care should be taken in this regard (Amirikian et al., 2019). In a study conducted in New Zealand, it was seen that there are children who follow a gluten-free diet at a much higher rate compared to the incidence of celiac. In general, three different conditions were determined here. These are Nonspecific symptoms (e.g. behavioral changes, intestinal movement alterations, subjective or uncertain abdominal complaints), suspected/diagnosed situations (e.g. wheat "allergy" or "intolerance", irritable bowel syndrome, pervasive developmental disorder [PDD or autistic spectrum] disorder]) or suspected positive celiac disease serology is gluten avoidance, sometimes without investigation for celiac disease. However, very little research shows that a gluten-restricted diet may benefit children with nonspecific symptoms and conditions (Tanpowpong et al., 2012). In addition,

a study conducted in the USA determined that 43 children avoided gluten in a study on 579 children. Reasons for gluten avoidance were usually found to be irritability or moodiness, diarrhea, weight problems, pervasive developmental disease, and a family history of celiac disease. As a result, gluten avoidance is quite common among children without a diagnosis of celiac disease. The predictors identified are related to nonspecific behavioral and gastrointestinal complaints of gluten avoidance and perhaps to perceived dietary responses in another family member thought to have celiac disease (Tanpowpong et al., 2012). Gluten is an essential component in general dietary patterns. For this purpose, applying a gluten-free diet can create problems in terms of habits and diet. Contamination is a crucial issue regarding the environments where food is prepared and the tools used. Contamination is a serious threat, especially for people following the gluten nutrition model due to a particular disease. In addition, the availability of gluten-free foods during consumption is one of the main challenges, and hidden sources of gluten include certain soups, processed meat, french fries, spices, and beer. Gluten-free foods can also force people in terms of cost. Finally, sticking to a GFD can be costly (Aljada et al., 2021). In one study, gluten-free products were found to be 242% more expensive than their gluten-containing counterparts in the same food group (Stevens & Rashid, 2008).

CONCLUSION

Gluten is a nutrient that is often taking place in nutrition programs. While gluten-free Nutrition is strictly used in diseases such as celiac disease, non-celiac gluten/wheat sensitivity, and wheat allergy, it can also be used in diseases such as some inflammatory diseases, type 1 diabetes, neurological disorders, and autism. Although a gluten-free diet is a model with difficulties in terms of eating habits and diet, it is available as a primary nutritional therapy for certain diseases. However, today, there is an increase in the number of people who apply the gluten-free diet model except for a diagnosed disease. However, this type of Nutrition can create problems regarding growth and development, especially in healthy children. Especially in a gluten-free diet, the value of vitamins such as protein, fiber, iron, folic acid, niacin, thiamine, and riboflavin is much lower. However, the carbohydrate, calorie, and fat ratio is high. Therefore, deficiencies can occur in children regarding macro and micronutrient intake. In addition, it has been determined that a gluten-free diet may negatively affect the activity of bifidobacteria in the intestines due to a decrease in whole-grain consumption. As a result of these changes in the colon, changes in the immune response may occur. A gluten-free diet should not be applied unless a gluten-related disease is diagnosed. In diseases that require an application, attention should be paid in terms of nutrients and growth and development.

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