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Nutrition in Celiac Disease

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Abstract Nutrition plays a key role in patients with celiac disease. Gluten-free diet is main therapeutic option despite of new possibilities keeping the intestinal barrier, modulation of gut microbiome or extraction of gluten from the diet. The prevention of formation the autoimmune reaction against gluten in genetically predisposed patients is the addition of small amount of gluten-rich food during breastfeeding between 4th and 7th months of life. The possible prevention at a later age could include the keeping of gluten-free diet during stress-induced damage of intestinal barrier and/or the influence of gut microbiom using probiotics.Gluten-free diet become to be new phenomenon, new strategy for non-celiac population despite of absency of proven benefits for them. There are defined new clinical entities of gluten intolerance, especially non-celiac gluten sensitivity, but its differentiation from irritable bowel syndrome is very difficult. This issue will require further research.

Keywords: *celiac disease, gluten-free diet, gut microbiome, gluten sensitivity, probiotics, non-celiac gluten sensitivity, intestinal barrier*

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1. Introduction

Celiac disease is an autoimmune disease, in which occurs on the basis of genetic predisposition (predominantly HLA DQ2/DQ8) to autoimmune reaction triggered by the presence of gluten in the intestinal lumen. The autoimmune reaction is directed against enterocytes (epithelial cells of small intestine), leads to their destruction to the action of antibody and cell-mediated immune responses, resulting in damage to the mucosa of the small intestine, which is classified by Marsh (I-III), and Oberhuber (I-IV) according to severity of histological findings [1,2].

2. The Formation of Autoimmune Reaction and Its Prevention

The autoimmune reaction against small bowel mucosa arises, when gluten penetrates intestinal epithelium into the submucosa and triggers cascade of immune reactions.

There are three essential conditions necessary to form celiac disease, namely genetical predisposition, disruption of intestinal barrier and presence of gluten in gut lumen.

Some patients examined more than 10 years after diagnosis of celiac disease, who, despite a recommendation, decided to include gluten in the diet, did not develop intestinal mucosal injury. It was about 50 % patients (4 from 8) with gluten containing diet and 100 % of patients with gluten transgression. 2 patients have no serological and morhological signs typical for celiac disease and developed tolerance on gluten, one of them had HLA non DQ2/non DQ8 genetics [3]. Although it is described in the literature transitory intolerance to gluten [4], it is assumed that if correctly diagnosed celiac disease, there is a permanent intolerance to gluten.

2.1. What Options are Avalaible to Prevent Celiac Disease?

Ingestion of small amount of gluten (cca 2 g) between 4th and 7th month of life (not earlier, not later) during breastfeeding seems to protect development of celiac disease in predisponed children [5]. Recommendation of ESPGHAN (European Society for Paediatric Gastroenterology, Hepatology and Nutrition) 2012 takes account of these experiences [6].

To start the autoimmune response and the development of celiac disease is essential the damage to the intestinal barrier and gut microbiome changes, this occurs for example in repeated infections in early childhood (in first six months of life), especially when consumed greater amounts of gluten after discontinuation of breastfeeding [7]. Increased incidence of celiac disease was found in children who have undergone diarrhea caused by rotavirus [8] or Campylobacter sp., but not other bacteria [9]. Conversely, a lower incidence of celiac disease has been detected in children colonized by Helicobacter pylori [10], an intentional infection by Necator americanus (hookworm) improved tolerance to gluten [11,12]. A theory of the influence damaged intestinal microbiome to a greater incidence of celiac disease is confirmed by the higher incidence of patients with celiac disease in a group of births by elective, but not emergency, caesarean section [13].

In genetically predisposed adults (positive HLA DQ2/DQ8 – prevalence 30% in general population) is an autoimmune reaction against its own enterocytes triggered

by the failure of the intestinal barrier and the presence of gluten in the intestinal lumen. This reaction can be avoided by influencing the tight-junctions using laratozide acetate [14]. The examination of gut permeability is able to show the integrity of intestinal barrier [15]. In patients with untreated celiac disease is gut permeability increased, after gluten-free diet decreases in several months to basic value and its examination served (in time before good and valid serological markers) as screening test for celiac disease [16,17,18].

Conditions that cause an increase in intestinal permeability (which reflects the integrity of the intestinal barrier) are different, it may occur in various diseases, whether they are infectious diarrhea or other severe infections [19,20]. The increase in intestinal permeability occurs during stress situation, whether it is an injury, multiple trauma [21,22,23], burns [24,25,26], surgery, sepsis, acute pancreatitis, trauma or severe physical performance [27]. The possibility of preventing the development of celiac disease, there is a more complicated and in practice difficult to implement. The question is, how should the primary prevention of celiac disease was appropriate to dispose of the individuals in these situations, adhere to a gluten-free diet. Currently, in situations where there is an impairment of the intestinal barrier supposed, doctors usually been prescribed diet based on white bread and tea, that is a concentrated source of gluten. All prerequisites for development of celiac disease (ie, predisposed individual, impaired intestinal barrier and the presence of gluten in the intestinal lumen) are therefore met. Preventive compliance with a gluten-free diet for all holders of genetic predisposition seems to be unrealistic, the second tent compare the number of holders of this code and the number of Americans abiding voluntarily gluten-free diet for other indications than the celiac disease. In both cases, about 30% of the population.

A major role in the development of celiac disease but also plays an intestinal microbiome, which affects the toxicity of gluten in the early stages of celiac disease [28]. Therefore, other preventive measures in predisposed individuals may be affecting the intestinal barrier by the improvement of gut microbiome using probiotics. Bifidobacterium Lactis is able to inhibit the toxic effect of wheat gliadin to epithelial cell line [29]. Consuming probiotics as an emergent treatment in violation of a gluten-free diet seems to be in patients with celiac disease one of the effective option [30], to stabilize the intestinal barrier by using probiotics is also available eg for athletes undergoing major physical performances [31].

3. Gluten Free Diet and Its Consequences, Celiac Disease and Gluten Sensitivity

Gluten-free diet is currently the only treatment of patients with proven celiac disease leads to improvement of clinical symptoms, normalization of the damaged intestinal mucosa and prevention of complications, although they studied a new treatment strategies celiac disease without adherence to a strict gluten-free diet [32]. Compliance to the diet correlates with intelligence, patients´ age, but also with clinical symptomatology, level of education physician regarding celiac disease and the way to explain this information to the patient [35]. There is very difficult to motivate patients without clinical symptoms, the gluten-free diet in this case cannot improve clinical status. Patients with mild celiac disease, with increased number of IELS in submucosa (Marsh I) have no clinical symptoms. Although not yet proven effect on reducing the risk of developing lymphoma, a gluten-free diet prevents the development of iron deficiency anemia, bone demineralization [36]. The benefit of a gluten-free diet have all patients with celiac disease, regardless of degree of enteropathy [37]. Adherence to a gluten-free diet may be measured using a special questionnaire [35] or by measuring 33-mer gliadin epitope in the stool [33,34]. Clinical symptoms may persist even after the deployment of a gluten-free diet [38], the first measure is necessary to carefully examine adherence to diet.

In patients with untreated celiac disease occur malnutrition, the mild forms may show malabsorption of iron, sideropenia and sideropenic anemia, not shown in non-Caucasians [39], metabolic bone disease due to malabsorption of calcium and vitamin D. [40] Parts is also lactose intolerance and deficiencies of other disaccharidases, even in patients with Marsh I histology [41], hypovitaminosis of vitamin B complex and vitamin C. Therefore, these symptoms should us lead to exclusion of celiac disease [40]. Severe forms of celiac disease with the destruction of the intestinal mucosa lead to severe proteinoenergetic malnutrition.

Treatment with gluten-free diet leads to a gradual adjustment of malabsorption, but there could be also an increase in BMI, therefore, part of the dietary consultation should be the issue of weight control [42,43]. Conversely, gluten-free diet is a hit for weight loss in patients without a diagnosis of celiac disease. Gluten-free diet is nutritionally full-fledged and can be safely consumed by relatives of patients with celiac disease [44]. Patients with celiac disease must follow a strict diet, safe consumption is only 10 mg of gliadin (gluten 20 mg) daily, higher levels lead to changes in the intestinal mucosa [45].

The issue of gluten intolerance is much broader. The avoidance of wheat- and gluten-containing products is a worldwide phenomenon [46], completely healthy people with no risk of celiac disease eliminate gluten from the diet and defend this behavior actual or purported health benefits. About 30% of the US population voluntarily adheres to a gluten-free diet, the most famous are former US president Bill Clinton and his daughter Chelsea Clinton, tennis player Novak Djokovic, Anne Hathaway, Gwyneth Paltrow, Rachel Weisz and Victoria Beckham

Gluten intolerance can be caused by autoimmune reactions (celiac disease, dermatitis herpetiformis Duhring, gluten ataxia), allergies (gluten or wheat allergy, wheat exercise induced anafylaxis), psychological intolerance, which is intertwined with irritable bowel syndrome (IBS). In 2009 was defined Non-celiac gluten sensitivity (NCGS) as gastrointestinal symptoms associated with the consumption of gluten without evidence of celiac disease [47].

4.Conclusion

Nutritional aspects of celiac disease and gluten-free diet in non celiacs and in prevention of formation the autoimmune reaction as well as its relationship to gut microbiom are important parts of research and treatment of patients with celiac disease and nutritional impact on whole population.

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