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The role of diet and supplementation in the prevention and treatment of autism spectrum disorders

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Summary

The role of diet and supplementation in the prevention and treatment of autism spectrum disorders There is evidence indicating the positive effects of dietary intervention in the prevention and treatment of autism spectrum disorders. There are studies linking maternal vitamin D deficiency with ASD in offspring. Children and adolescents on the autism spectrum are also supposed to have significantly lower concentrations of vitamin D than healthy children and adolescents. This indicates the role of vitamin D supplementation in the prevention and treatment of ASD(5). Diets most commonly used in the therapy of autism spectrum disorders are: dairy-free and gluten-free, specific carbohydrate diet, low phenol, low oxalate and ketogenic diet(4). The most popular of them are dairy-free and gluten-free. However, studies conducted by Dr. James Adams attribute the highest effectiveness to a diet of specific carbohydrates(7). After applying the ketogenic diet, improvements in concentration, learning ability and social behavior were observed(1,26). However,

it should be remembered that the scientific literature contains a small number of reliably conducted studies confirming the effectiveness of individual diets and supplementation in the prevention and treatment of ASD. Therefore, the positive impact of dietary intervention is still referred to as "potential". In addition, the use of certain diets may be associated with side effects, such as vomiting and hypoglycemia in the case of a ketogenic diet(1,28) and underweight in the case of elimination diets(16). Therefore, the introduction of dietary changes for therapeutic purposes should be carried out under the constant supervision of doctors and dieticians.

Key words: Diet, autism, supplementation, ASD, nutrition

Introduction and Purpose

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by impaired social interaction, verbal and non-verbal communication, and limited interest in the surrounding environment(1,2). There is evidence in the scientific literature linking ASD to gastrointestinal symptoms, nutrient deficiencies, and metabolic diseases. Scientists have also noticed clear differences in the composition of the intestinal microbiome between healthy individuals and patients with autism(1,3). In addition, pathological conditions related to the gastrointestinal tract are considered to be a factor in the pathogenesis of ASD. These pathologies include, for example, leaky gut syndrome (characterized by increased intestinal permeability for toxins, bacteria and other macromolecules)(4). Therefore, the introduction of an appropriate nutritional plan should significantly support therapy and be an important element of prevention. The aim of the work is to present the role of diet and appropriate supplementation in the prevention and treatment of ASD based on current knowledge and scientific research.

Description of the state of knowledge

Vitamin D is a steroid hormone that plays an important role in the development of the nervous system, such as nerve cell proliferation and neurotransmission. It is also important in the context of immune function and oxidative stress. Scientific research shows that children and adolescents with autism spectrum have significantly lower levels of vitamin D than healthy children and adolescents. Also noteworthy are the results showing that children conceived in the winter months (when sun exposure is limited and thus vitamin D synthesis is reduced) were more likely to be diagnosed with ASD than children conceived in the summer months. In contrast, pregnant women with vitamin D deficiency in mid-pregnancy had more than twice the risk of ASD in their offspring than the group of pregnant women with normal serum levels of this vitamin. Past animal and in vitro studies have shown that vitamin D deficiency may be related to the abnormalities of the nervous system that occur in ASD patients. Importantly, several studies reported significant improvement in people with these disorders who supplemented with vitamin D. This is an important fact in the context of using vitamin D supplementation as an alternative treatment method(5). It is the incorrect level of vitamins that is, apart from malnutrition and maternal disorders such as obesity and diabetes, a frequent cause of permanent structural changes in the brain and pathological changes in the activity of key enzymes and metabolic pathways, which may result in developmental disorders in children(6). Diets used in ASD therapy include: dairy-free and gluten-free diets, specific carbohydrate diets, low phenol, low oxalate and ketogenic diets(4). The most popular diets are dairy-free and gluten-free. According to research by Dr. James Adams, these diets are 69% effective. Even greater results were observed after the use of a diet of specific carbohydrates, the effectiveness of which was 71% (7). However, it should be remembered that although many non-reviewed

articles, books and websites support and encourage the use of the GFCF (gluten-free, casein-free) diet, the introduction of a gluten-free diet in patients with ASD has very rarely been associated with methodologically correct scientific observation (with comparison group, determination of endpoints and ways to assess their achievement, e.g. through video documentation) (8,9,10,11,12). Key information could be provided by the analysis conducted by Mulloy et al. in 2009 [9, 12], which concerned the effects of dietary intervention in 188 patients in 14 studies, of which only one used a gluten-free diet, and the others combined with a casein-free and various supplements. In 7 studies (among which the only intervention was the elimination of gluten) [9, 13], a positive effect of the diet was found, but in none of them there was a comparison group that would allow excluding the effects of such factors as natural maturation of patients and simultaneous therapy behavioral. One of the people involved in research on the impact of dietary interventions in the treatment of autism was the Norwegian doctor-Karl Reichelt. Working with educator Dr. Ann-Mari Knivsberg, he proved that eliminating gluten and casein from the diet brings many benefits, including relieves behavioral and physical symptoms in children with autism, increases concentration and learning ability . What's more, a small provocation quickly deteriorates their mental health, while the improvement is brought by a strict gluten-free diet for at least several weeks(9). The positive effects of a gluten-free diet on patients include improvement in vocal and non-v communication, attention and concentration, episodes of aggressiveness, affection, motor skills, sleep patterns, routines and rituals, anxiety, empathy and learning response(8). However, it should be remembered that the findings regarding the effect of the GFCF diet on ASD are ambiguous, and what is more, several studies suggest no effect of the GFCF diet on ASD [8,14]. Reviews and meta-analyses of the peer-reviewed evidence to date on the effectiveness of such dietary intervention have mostly found that the research base in this area is limited and has not yet indicated any population-wide impact that such dietary changes may have. Often in these analyzes, due to the potential benefits that may result from a possible modification of the diet, there is a call for the presentation of further, more methodologically reliable evidence of any influence of the diet on the symptoms of ASD [8, 15]. In the scientific work,, NUTRITIONAL VALUE OF DIET OF CHILDREN WITH AUTISM SPECTRUM DISORDERS. PRELIMINARY RESEARCH ", whose authors are Katarzyna Tarnowska, Ewa Lange, Eliza Gruczyńska, Dorota Kowalska and Mariola Kozłowska, it was decided to assess the nutritional value of the food rations of children with ASD using or not using elimination diets. It was shown that among children not using dietary modifications, overweight and obesity were observed more often. On the other hand, being underweight was much more common in children with ASD using elimination diets (30 vs. 9%). In addition, it was noted that the food ration of children without additional dietary restrictions provided more saturated (SFA) and less polyunsaturated fatty acids (PUFA) than the food ration of children on elimination diets. In addition, it was found that children with ASD using the elimination diet more often implemented the recommendations for the consumption of polyunsaturated fatty acids from the n-3 family. What is more, among children remaining on an elimination diet, there is a lower percentage of non-compliance with the recommended intake of dietary fiber compared to children not using this type of dietary modifications. Finally, the authors of the above-mentioned study concluded that the introduction of additional dietary modifications may alter the nutritional value of food rations of children with autism spectrum disorders, and that the diet and dietary modifications in these children should be planned and controlled as part of organized specialist dietary counseling(16). . Research conducted by Dr. Sidney Haas and his son Dr. Merrill Hass. They became the precursors of the Specific Carbohydrate Diet (SCD), which involves limiting the consumption of carbohydrates to monosaccharides. The task of this diet is to control the bacterial flora of the intestines. Its use has a significant impact on improving the functioning of children with autism, who have problems with digestion and diseases of the gastrointestinal tract. The impact of diet on the development of the cognitive and socio-emotional spheres was also demonstrated in a study of a single case of a child with autism. The study used the method of individual cases and the following techniques were used: observation, interview, development scale, behavior scale and analysis of documents and films. A research tool has been appropriately adapted or developed for each

technique. In this study, the following were used: Child Behavior Observation Sheet by B. Markowska, Questionnaire of the interview with the mother regarding the child's diet, Psychoeducational Profile by E. Schopler, Psychological and pedagogical opinion of the examined child, Statement of the need for special education. A 6-year-old girl with early childhood autism participated in the study. The research was conducted from March 1, 2014 to May 10, 2014 in the girl's home. After a period of searching for and using various methods in therapy, the parents decided to change their daughter's diet. Initially, they eliminated gluten, casein, sugar and artificial colors from their diet. Then, they gradually began to introduce the following products: cooked vegetables, raw vegetable juices, meat (mainly chicken, rabbit, veal), broths. Then raw vegetables were introduced, and finally some fruits: lemon, kiwi, bananas, apricots, pineapples, papaya. An important element of the diet was the use of enzymes that were supposed to break down sugars and aid digestion. They used a diet that was closest to the specific carbohydrate diet (but more restrictive) and introduced elements of the Gerson, Feingold, Body Ecology and Wild Fermentation diets. It was noticed that the girl had less problems with focusing attention as a result of changing her diet. The social and emotional sphere of the child also improved significantly, the girl began to cuddle with her parents and follow their orders. In addition, she began to willingly cooperate and make contact with other adults, and, supported by an adult, tried to play with other children. She read emotions in other people more and more accurately, but she also learned to talk about her own emotional states(17). The use in supportive therapy is also attributed to the ketogenic diet. It consists of a high fat content with adequate amounts of protein and a minimum level of carbohydrates for metabolic needs [1]. The body is then forced to use primarily fat as a source of energy by producing ketone bodies. The level of ketone bodies depends on the rate of their production and the degree of their utilization. Acetoacetate and 3-hydroxybutyrate are the two main ketone bodies produced and used as fuel in low carbohydrate conditions(1,18,19). There are hypotheses in the scientific literature linking the possible effects of the ketogenic diet with a positive effect on patients with autism spectrum disorders. They mainly refer to the effect on disorders of glucose metabolism and mitochondrial dysfunction(1,20). It has been shown that the ketogenic diet increases the concentration of γ-aminobutyric acid affecting the action of glutamate in the central nervous system (in patients with autism, increased concentration of glutamate and increased expression of genes related to glutamatergic pathways) and also affects the function of mitochondria. It is assumed that this may play a beneficial role in patients with the autism spectrum(1,21-25). There is only one study in the scientific literature addressing the impact of the ketogenic diet on the clinical aspects of autism. The study involved 30 children diagnosed with autism (), who were on a ketogenic diet for 6 months. Among the children who followed the diet (18 participants), those with mild autistic symptoms showed significant improvements in aspects such as concentration, learning ability and social behavior. The rest of the participants showed mild to moderate improvement(1.26). In the scientific literature, you can also find a case report where a modified ketogenic gluten-free/casein diet was used for 14 months. There was a reduction in seizure activity, improvement in cognitive and social skills, language functions, and stereotypical behavior. However, it should be remembered that the beneficial effect in this patient cannot be attributed solely to the ketogenic diet, as it was not the only dietary intervention used(1,27). In the context of the ketogenic diet, the possibility of complications should be mentioned because, according to recent retrospective studies, vomiting, refusal to eat, hypoglycemia, hypertriglyceridemia, hyperuricemia, hepatitis, acute pancreatitis, and persistent metabolic acidosis were noted after starting the ketogenic diet(1,28).

Conclusions

1. Proper vitamin D supplementation during pregnancy may reduce the risk of ASD in offspring.
2. There is not much scientific evidence for the effectiveness of dietary intervention as an alternative treatment for ASD.

3. The potential benefits of specific dietary interventions for people with ASD create the need for reliable scientific research on the effectiveness of individual diets in the future.
4. The use of a specific diet may be associated with health complications, therefore the use of a diet for therapeutic purposes should be carried out under the supervision of specialists in the field of medicine and nutrition.

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