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ADHD FROM A NUTRITIONAL PERSPECTIVE

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Abstract: Attention Deficit Hyperactivity Disorder (ADHD) is characterized by distraction, anxiety, impulsive behaviors and excessive motor activity, in addition to the attention deficit itself. The most common is that it is diagnosed in childhood, and the most indicated treatment is a combination of medication and psychotherapy. Although the causes of ADHD are still unclear, studies show that the origin of such disorder is multifactorial, involving allergies to food and chemical additives, genetic issues, eating disorders, among other factors. This work aims to gather information available in the literature regarding the influence of diet and nutrition on the development of ADHD in children. For that, the method used was an integrative literature review, with an exploratory character, through research in scientific articles that deal with the subject. Nutrients are extremely important for the functioning of the brain, and alterations in some regions may interfere with the ability to maintain attention and self-control of behavior. In addition, inadequate nutrition during prenatal care can lead to epigenetic changes that affect the child's brain development during pregnancy. In addition, children with ADHD have dietary deficiencies, such as deficiency in omega-3 polyunsaturated fatty acids, zinc, iron, B complex vitamins and vitamin D. Some ways to reduce symptoms are related to improving diet, with the intake of the mentioned nutrients and the exclusion of foods with potential allergens, such as gluten, milk, oilseeds, chocolate and eggs. This exclusion must not be total: attempts must be made, in which there is a reduction in symptoms as one of these types of food is eliminated. If it is noticed that the symptoms are directly related to any of these foods, they must be removed from the child's diet. You must also avoid eating large amounts of foods high in sugar, dyes and preservatives. Therefore, nutrition can be a great ally in the treatment of individuals with ADHD, through a diet that combines the inclusion of agents that protect and help brain functioning with the exclusion of foods that serve as triggers that contribute to this disorder.
Keywords: ADHD, hyperactivity, attention deficit.

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD) is one of the most common neurobehavioral disorders diagnosed in childhood, and in many cases it can reach adulthood (woo et al., 2014). In addition, ADHD is characterized by distractibility, attention deficit, anxiety, impulsive behaviors and excessive motor activity. Several children affected by this disorder develop emotional illnesses, social and family problems as a consequence of their primary difficulties. These are also associated with school failure, difficulties in social insertion, as well as low self-esteem and even intra-family problems (Faria, 2010). Furthermore, ADHD prevalence rates can vary according to age, sex, and ethnicity. Boys are more likely to be diagnosed with ADHD than girls, and higher rates of this disorder across age groups have been observed in the younger age groups. young people, as shown by studies carried out with children and adolescents. Across the planet, an overall prevalence of 5.9% ADHD was found in pooled analysis (woo et al., 2014).

The etiology of ADHD is complex and is associated with genetic and environmental factors (SINN, 2008). In addition, one of the environmental interferences that can be considered important in the etiology of ADHD is malnutrition, since this condition can lead to loss of cell numbers and modify brain neurochemistry, already in the prenatal period (Paranhos et al., 2013).

Furthermore, the prevalence of ADHD in school children and the teachers' lack of knowledge resulted in inadequate psychopedagogical intervention. And the stigma associated with the disorder is that they are often seen as "lazy" and "dumb".

According to SCHNOLL, Burshteyn and Cea – Aravena (2003), nutritional management, despite its importance, is an aspect that has been relatively neglected until today. Nutritional factors, including: chemical additives, refined sugars, food allergies and fatty acid deficiency have been linked to the disorder. There is increasing evidence that many children with behavioral problems are sensitive to one or more components of food that may negatively impact their behavior. These authors also expose the existence of investigations into the relationship between diet and brain electrical activity in children with ADHD, considering that certain food sensitivities not only influence ADHD symptoms, but can also alter brain electrical activity, emphasizing the need for professionals understand the role of nutrition in ADHD (Schnoll; Bur. Shteyn; Cea-Aravena, 2003).

In view of this, research on the subject is still quite limited and studies with this theme can be useful for the enrichment and updating of multidisciplinary teams.

Therefore, this review work aims to gather information available in the literature regarding the development of ADHD in childhood and the influence of food and nutrition on its symptoms. As well as fostering the need for Nutritional care in multidisciplinary treatment.

THEORETICAL REFERENCE

ATTENTION DEFICIT DISORDER (HYPERACTIVITY (ADHD) is a neurobiological disorder, of genetic causes, which appears in childhood and often accompanies the individual throughout his life. behavior, accompanied by restlessness, inattention and difficulty in respecting limits and rules. (FOCHI, 2013).

Children with ADHD are agitated, have difficulty concentrating, are easily distracted, do not efficiently solve or organize their problems, have difficulties in social relationships and low self-esteem. Children affected by this disorder are often unable to inhibit inappropriate behavior and pay attention to details, which leads them to make careless mistakes in two routine activities (Segura, 2002).

Rodhe et al. (2004) point out several characteristics according to the chronological evolution: when they are insatiably irritated, they reveal difficulties in Feeding and sleeping; in the preschool stage They are stubborn, very satisfying, activity increased to usual; at school age They are unable to stay focused, they are easily distracted and in adolescence, in addition to the Classic symptoms, they can easily adhere to substance use and get involved in accidents.

Naparstek (2004) describes that people diagnosed with ADHD are often labeled "problematic", "unmotivated", "avoid", "undisciplined" and "Irresponsible", which for Segura (2007), leads to a rejection of society in the conviviality with these children, it makes them prone only to bullying and prejudice, leading them to feel sadness, anxiety, frustration and low self-esteem.

According to Woo et al. (2014) ADHD affects about 5.29% of children and adolescents worldwide. In addition, Ximenes (2008) infers that in Brazil, ADHD affects 3 to 6% of school-age children and, among adolescents aged 12 to 14 years, a prevalence of 5.8% was found before the age of 6, in addition, the diagnosis is avoided, because in this age group the family context excessively influences the child's behavior and the child has not reached an adequate degree

of stability/motor maturity. In this context, the proportion between females and males is different according to the type of ADHD. Among girls, symptoms such as: attention deficit and comorbidities related to mood and anxiety disorders are more common, with few reports of aggressiveness and impulsivity. of behavior generates less social impact and, as a result, girls are generally underdiagnosed. Unlike boys who have more symptoms of hyperactivity/impulsivity and higher prevalence of case registration (Coelho et al;2010). From 30 to 70% of people diagnosed with ADHD have persistent symptoms in adulthood, with a prevalence estimate of 0.3 to 3.5% among young adults, thus being identified as a chronic disorder (Ximenes, 2008).

In this sense, scientific investigations to determine the etiology of this syndrome permeate biochemical, genetic, neurobiological, psychological and socio-environmental aspects (Couto. MELOJUNIOR; GOMES, 2010).

PARANHOS (2013), also adds nutritional factors, thus configuring it as a disorder of multifactorial etiology.

Furthermore, evidence suggests that the disorder derives from a dysfunction of the prefrontal cortex, due to a deficiency in dopamine transmission, and that, in addition, there is a reduction in both the metabolism and the volume of the cerebellar and frontal regions. (Couto; Melo-Junior GOMES, 2010).

Pellow, Solomon and Barnard (2011), report that the biochemical etiology of ADHD is related to low levels or underutilization of catecholamines (epinephrine, norepinephrine and dopamine and serotonin in certain brain areas. These neurotransmitters are responsible for activating regions of the brain in the lobe frontal, necessary for the execution of the focus is concentration. Since, with damages in this area, that normally sends inhibitory signals to the other parts of the brain making the region responsible for the concentration become active, failures are generated in the inhibitory mechanism, the which will generate too much excitatory stimuli, giving way to distraction. and hyperactive behaviors in adolescence (OHINMAA; VE UGELERS, 2016).

Other studies have analyzed the association between dietary patterns and ADHD. A common finding is that unhealthy dietary patterns (high in saturated fats and vegetables) are associated with ADHD (AzADBAKHT, 2012; PARK, 2012)., However, there is disagreement about the magnitude of the effect caused by diet on ADHD (Lok et al., 2013).

Furthermore, the neurobiological mechanisms involved in the disorder are complex and do not depend on a single neurotransmitter, therefore, even though it is one of the most studied neuropsychiatric disorders today; it does not yet have a completely concluded etiology (Coelho et al 2010).

The diagnosis of ADHD is a process that must consider several aspects, bearing in mind that it is carried out considering behavioral clinical criteria. For its realization, it is necessary to take into consideration, the clinical history of the individual, a thorough anamnesis, a comprehensive physical examination, examinations, reports from the country and teachers and criteria adopted by the formal classification systems (ANDRADE; LOHR, 2007). Because it involves multiple symptoms, the diagnosis requires the evaluation of several professionals, including: physicians, educational psychologists, psychologists and neuropsychologists (Couto; Melo-Júnior Gomes 2010). Considering that, according to Coelho et al. (2010).

Although stimulant medications are the main focus in the treatment of this

disorder, multidisciplinary interventions contemplating training with parents in order to clarify the disorder and define strategies that alleviate the undesirable behavior of their children, reducing the frequency of family conflicts, as well as a problem adequate pedagogy and individual psychotherapy, lead to a more favorable result of the treatment (Naparstek,2009).

From the perspective of multidisciplinary interventions, nutrition can act as an adjuvant in treatment. The need for nutritional monitoring is evidenced in a study that identified a compromised nutritional status in one third of children at the time of diagnosis of the disorder. The continuous drug treatment for 30 months still had a negative influence on the height of these children (DURA TRAVE YOLDI; ZARDOYA-SANTS, 2011).

Some diet therapy approaches have been proposed, such as diets to eliminate food additives, gluten and casein, micronutrient supplementation and encouraging the consumption of specific foods that are sources of micronutrients (Milic Hap e Yee. 2012; Montgomery Omery et sl., 2013; woo et al.2014).

ANALYSIS AND DISCUSSION OF RESULTS

Currently, a large body of research suggests that the manifestation of ADHD is related to nutritional deficiencies. In addition, investigations suggest that changes in the American diet, rich in sugars and poor in essential fatty acids, may have been one of the main causes for the manifestation of this disorder (OTTO BONI; OTTOBONI, 20031). of micronutrients can adversely affect brain function. This relationship would have great benefits for public health (BENER; Karnal, 2013).

According to Otellana-ayala (2010), nutritional deficiencies have a significant impact on brain development and functioning, especially when these failures occur early in life or during pregnancy. Ximenes (2008) reveals that exposure to environmental factors and nutritional deficiencies can clearly interfere with gestational neurogenesis. According to, Paranhos et al. (2013).

One of the environmental interferences that can be considered an important factor in the etiology of ADHD is malnutrition, as this condition can lead to loss of the number of cells and modify brain neurochemistry; already in the prenatal period.

Given this, the effects of diet and dietary supplements are still unclear, but considerable evidence suggests an association between dietary factors and behavioral disorders such as ADHD in childhood. Low levels of nutrients such as iron, zinc and polyunsaturated fatty acids have been reported in children with ADHD, as well as the association between sugars and artificial additives and an increased risk of ADHD (WOO et al., 2014).

ZINC:

Some studies suggest that the ADHD population may have a higher prevalence of zinc deficiency and even suggest that this deficiency is involved with ADHD symptoms. IN ADDITION, interactions with the brain and other functions of the central nervous system are also suggested by the effects of zinc deficiency. Furthermore, SOME evidence from studies suggests that zinc deficiency may affect cognitive development, although the mechanisms remain inconclusive (ARNOLD; DI SILVESTRO, 2005).

Zinc is an important nutrient for the body. For growth, immune function and neurological development. In addition, it is also a fundamental co-factor for the metabolism of neurotransmitters, in the conversion of vitamin B6 to its active form,

being therefore necessary for the conversion of tryptophan into serotonin participates in the metabolism of prostaglandins and melatonin indirectly affects the metabolism of dopamine (Rucklidge; Johnstone; Kaplan,2009). Furthermore, some research shows that a dysfunction in dopaminergic transporters may be involved with zinc deficiency. This neurotransmitter, essential for brain functioning, has a reduced action in patients with ADHD who have reduced levels of zinc (WOO et al., 2014).

IRON:

Iron deficiency is one of the most common nutritional deficiencies on the planet. In addition, the greatest risk of iron deficiency occurs during periods of rapid growth and nutritional demand, especially age 6-24 months, adolescence and pregnancy. Furthermore, iron is essential for the synthesis of hemoglobin. Therefore, iron deficiency leads to reduced ability to transport oxygen and can affect immunity, growth and development (Black, 2003). Furthermore, iron plays fundamental roles in neurological functions, such as the synthesis and degradation of dopamine, its relationship with dopaminergic neurons, in addition to a decrease in dopamine transporters and receptors when this nutrient is found at low levels in the brain. This evidence suggests that iron metabolism may play a fundamental role in the pathophysiology of ADHD, however this relationship is not yet completely proven (Menegassi, 2009).

Furthermore, iron deficiency may be associated with ADHD, as iron stores in the brain may influence dopamine-dependent function. A case-control study in India found that the serum ferritin level was lower in children with ADHD, while an autumn study found that ADHD symptoms in children with low serum ferritin levels were alleviated after iron supplementation (WOO et al.,2014).

Symptoms of iron deficiency can include decreased attention span, difficulty arousing responsiveness. In a controlled study in which there was a comparison of groups,53 children diagnosed with inattentive ADHD (but not hyperactivity) measured by the Conners Parent Rating Scale (Ruckidge, Johnstone,2009).

ESSENTIAL FATTY ACIDS

The brain needs an adequate interaction between macro and micronutrients so that it can perform its functions. Even though this organ constitutes a small part of the body. It lacks 25% of the body's supply of glucose, and because it has a limited capacity to store it, it is essential to supply nutrients from the blood to this important organ. There are several nutrients involved in the maintenance of blood-brain flow, including omega 3 polyunsaturated fatty acids (pufa) that act as important neurotransmitters in the body (Sinn, 2008).

In addition, about 60% of the dry weight of the brain is made up of fats and the highest concentration is of long-chain fatty acids omega 3 and docosahexaenoic acid (DHA), found in the retina, brain and nervous system. There is evidence that DHA is critical for the minimization of neurons and is therefore essential for nerve transmission. It is important to point out that DHA levels in neural membranes may vary according to the dietary intake of polyunsaturated fatty acids (Sinn, 2008).

Furthermore, Pufa play essential roles in the normal development of the brain and in its functioning, as well as in the health of the cardiovascular and immune system, and are therefore fundamental in the diet. developed in relation to Omega 6 (Puff). Growing evidence indicates that this imbalance may be contributing to a wide range of physical

and mental health problems. Low blood concentrations of Omega 3 have been reported in children with ADHD and related behavior or learning difficulties (Montgomery et al., 2013).

ADDITIVES, SUGARS AND ALLERGENS:

Firstly, it is worth noting that the role of diet in children's behavior has been discussed and controversial, however the association between various nutritional factors and the behavior of children with ADHD has been continually suggested. In addition, food additives, sugar and aspartame are considered negative factors in the development of ADHD, and thus, studies of dietary intervention with special diets, including Diets without additives and elimination of sugar, have been carried out (WOO et al., 2014).

According to Curtis and Patel (2008), dye-free diets, food preservatives and natural salicylates have been used for the treatment of children with ADHD, since they were introduced in the 1970s by Dr. Benjamim Feingold. elimination Developed to alleviate allergic reactions to aspirin and salicylates and was later tested in children with this Disorder, resulting in relief from symptoms such as hyperactivity, learning difficulties and sleep problems. In this case, colorants, flavorings, sweeteners and some foods containing salicylate were restricted (almonds, apples, apricots, cherries, strawberries, coffee, cucumbers, grapes, peaches, peppers, preserves, plums, raisins, tangerines, tea and tomatoes), eliminating "trigger" foods (Curtis; Patel,2008).

Pellow, Solomon and Bernard (2011) relate symptoms of the disorder to hypersensitivity to food or food additives. Furthermore, others point out that exposure to sensitizing foods appears to increase inflammatory meters and neuropeptides in the blood. Hypersensitive children are prone to atopy, irritability, sleep and behavior disorders, as well as impulsivity. Millichap and Yee (2011) confirm when they conclude that atopic children with ADHD have a significantly higher response rate regarding the reduction of symptoms with the elimination of artificial dyes and preservatives from the diet, and may therefore be an important therapy for children with sensitivity to food antigens or allergens.

MCCANN (2007) shows in a study carried out by the University of Southampton, in the United Kingdom, an analysis in which researchers evaluated the effects of mixtures of additives in a group consisting of 297 children (age group 3 to 9 years). it is concluded that food additives had a slight but significant correlation with children's hyperactivity. In 2010, the study was repeated with the same children and showed adverse effects of food additives on ADHD symptoms. In addition, the author also reports that the exacerbation of symptoms provoked by additives is related to an induction of a polymorphism in the genes that control histamine degradation.

Consumption of artificial colors or preservatives may have implications for the etiology of ADHD. As it is a genetically related disorder, it is possible that artificial dyes interact with underlying genetic factors and play a role in the development of the disorder. Therefore, the author considers it important to carry out more studies to identify the risk group that can benefit from a modified diet, as is done for phenylketonuria and other diseases. (Kleinman et al., 2011).

Children from 2 to 12 years old are the most susceptible because they have a physiological deficit of IgA, an immunoglobulin that protects the intestine. So, the more poorly digested foods like proteins, the greater the chance of passing intact into the blood, causing what some authors call "brain allergies", excitement and impulsivity (Debatin,2006).

In addition to additives, excessive consumption of carbohydrates and refined sugar can negatively affect learning ability and aggressive and agitated behavior in "normal" children and more intensely in children with ADHD. In addition, parents of children with this Disorder often report a worsening of hyperactivity after excessive intake of sucrose or aspartame sweets and soft drinks. A study carried out with hyperactive preschoolers aged between 2 and 6 years, submitted to the consumption of aspartame and meals rich in carbohydrates, revealed that the increased load of sugar and aspartame did not increase the level of activity or aggression, however the attention deficit was correlated with sugar intake (Millichap; Yee, 2011).

Second, Debatin (2006) points out that by having direct access to the brain, sucrose increases ATP molecules generating energy, but these energy molecules increase the production of serotonin, in response to insulin peaks induced by the sudden increase in blood glucose. Serotonin, in turn, generates a feeling of well-being, but takes away the focus of attention., However Millichap and Yee (2011) clarified that sugar-induced cognitive inattention may be a reactive hypoglycemia, considering that low levels of sugar are associated with a decrease in the normal electrical activity of the cerebral cortex and increased activation of the frontal cortex, which is involved with attention control.

NUTRITIONAL INTERACTIONS:

Faria (2010) points out that the various studies carried out covering nutritional interventions in children with ADHD and their different divergent results have generated great controversy around this theme. In addition, Duca (2010) points out that adding nutritional therapy to multimodal treatment certainly contributes to more favorable results, since he reports studies that confirm the effect of dietary influences on behavior and learning in children with ADHD. In addition, the author points out that it is free of allergens (corn, milk, peanuts, soy and wheat), food additives and refined sugars, justifying that children who have allergies or sensitivity to these components become more irritated and agitated with their consumption. Food allergy is a possible ADHD mechanism and research involving the influence of "trigger foods" may add viable alternatives to treatment or immunotherapies (MILLICHAP; Yee, 2011).

In this sense, Pelsser, Buitelaar and Savelkoul (2008), they emphasize that the use of probiotics can also be useful in the treatment of children with ADHD, with atopic symptoms and dysbiosis, benefiting them in the balance of the intestinal flora.

Pellow, Solomon and Bernard (2011), state that parents who are bothered by the frequent use of the drug are more interested in adhering to dietary interventions. They recommend that meals and snacks consist of low-glycemic index carbohydrates, proteins and acids essential fatty. Refined carbohydrates, sugars and processed foods that contain additives must be completely eliminated from the diet.

When possible, organic fruits and vegetables must be consumed. In addition, vegetable proteins, including: soy, quinoa and beans are beneficial, since they help control blood sugar and reduce chemical and hormonal additives found in meat of animal origin. It is essential to introduce foods rich in Epas, especially fats, omega 3, these include fish from Águas Vacations for example (salmon and sardines), walnuts, almonds, pumpkin seeds and flaxseed (Pellow, Solomon and Bernard 2011).

Pradas and Veras (2008) confirm, emphasizing that more natural diets AND rich in polyunsaturated fatty acids present excellent results in learning and socialization, in clinical practice.

In addition, according to Faria (2010) highlights that supplementation of zinc, iron and magnesium in children with deficiencies in these nutrients, results in the reduction of symptoms of attention deficit and hyperactivity. In this context, Lake (2010) states that zinc supplementation is an alternative treatment widely used in ADHD, however few studies have been carried out. The same author, in a 12-week study, concluded that children and adolescents who were supplemented with high doses of zinc (150mg/d) experienced a significant improvement in hyperactivity and impulsivity, however not in attention deficit.

As stated by Rucklidge, Johnstone Kaplan (2010), the number of studies analyzing the effects of micronutrients and nutritional supplements on ADHD symptoms is increasing. The author also states that there are records of significant improvement in symptoms when nutritional deficiencies are treated, since a child's brain is always developing and needs adequate nutrition for its optimal functioning.

FARIA (2010) states the importance of nutrition in the therapeutic approach, however there is a clear need for more research to clarify the real role of supplementation and dietary interventions in the multimodal treatment of ADHD.

FINAL CONSIDERATIONS

Therefore, through the bibliographic review, the considerable role of nutrition in multimodal therapy (or multidisciplinary therapeutic intervention) is verified, however, the need for more studies is clear to determine the relevance of dietary changes and supplementation in the treatment of children with ADHD. In addition, in the absence of a uniform nutritional therapeutic protocol, it is necessary to promote a healthy, balanced and varied diet for the families of children with this disorder, in order to overcome or avoid possible nutritional deficiencies, at the same time there must be a discouragement of the consumption of industrialized foods rich in synthetic food additives, given that there is evidence that these interact negatively with ADHD symptoms.

As you know, this is still a controversial topic. Therefore, it is suggested that more studies be carried out for its definitive clarification, allowing the development of preventive and therapeutic strategies that are completer and more effective.

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