MEDIATION OF PHYSICAL EXERCISE ON BRAIN ELECTRICAL ACTIVATION AND HEART RATE VARIABILITY IN CHILDREN WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER

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Abstract This article aims to investigate the impact that physical exercise may or may not have on brain electrical activation in children with attention deficit hyperactivity disorder (ADHD). Following the main research objective, some of the most used treatments in the improvement and cure of children with ADHD are exposed, to show the use of physical exercise as an alternative therapy that can contribute to the disease treatment, which also contributes to search for another effective mechanism that does not cause side effects, a situation that often occurs with medications. On this way, it is intended to show part of the progress made around this topic and contribute to the compilation of sources that help in this line of research.
Keyboards: investigate, research, contribute, disorder

INTRODUCTION

The Attention deficit disorder, or ADHD as it is commonly known, is a mental disorder that usually occurs in childhood, this disorder is characterized by a repetitive pattern in attention and hyperactivity problems that entail different degrees of impulsivity, thus interfering in the optimal day-to-day development (Bustamante et al., 2019). As a result of the above, there may be specific motor difficulties that are related to a high motor complexity, which manifests itself in problems to perform activities that generate a disadvantage in social or individual activities. From what is contemplated in the manual of statistical diagnoses of mental disorders (2015, cited by Castro et al., 2022) ADHD is a neurodevelopmental disorder that is defined by problematic levels of inattention, it seems that whoever has the disorder does not listen and in turn presents behaviors that are incompatible with age or developmental level.

There are clinical trials that make use of drug treatments, these same reveal the effectiveness specifically of methylphenidate or amphetamine, since, respectively, the first is responsible for inhibiting the dopamine transporter in the synaptic space, and the second increases the release of dopamine. In relation to this, there are also studies that focus their emphasis on evaluating the behavioral performance of people with this disorder to know the ability they must develop a physical activity, so that it is not affected if it is executed (Bustamante et al., 2019).

The variation of the genes that make up the genetic pattern generates a deficiency in the regulation of neurotransmitters that are considered necessary for the organism, which, according to Castro et al. (2022) implies the appearance of the symptomatologic manifestations that characterize ADHD. The function of neurotransmitters is to communicate and regulate the information that is manifested in the individual's behavior; therefore, it can be inferred that an erroneous operative functioning in

mental processes leads to the expression of irregular behaviors that prevent the person from performing optimally any physical activity.

As stated by Castro et al, (2022) movement is the product of an intentional act of the human being that constantly with compound objectives results in a positive activity in the organism, thus influencing the emotional state of the individual. Based on these considerations, physical activity can be considered as an entity that generates benefits that are mediated by the effects or physiological responses of the body. It is known that physical activity increases blood flow in the cortical area and the segregation of neurotransmitters; this according to Davey (1992), cited by Bustamante et al., 2019) which is closely related to increases in excitability and improvements in cognitive performance. From the neurological, neurophysiological, and neuroanatomical bases, it is also established in this article the opportunity to evaluate how physical activity influences children suffering from ADHD from the assessment of their heart rate and brain electrical activity. Galianal, (2020) assures that by means of the electroencephalogram a quantitative analysis can be made on the level of activity in different brain areas, understanding that this allows measuring the response of different treatments or physical methods in relation to the disorder, which would be relevant to determine the benefits of this.

In relation to the studies conducted by Hillman (2009 cited by Lomas and Clemente 2017) from tests performed by an electroencephalogram he was able to account that there is a better cognitive control, attention, response accuracy and even, better academic performance after performing 20 minutes of aerobic physical exercise than after 20 minutes of rest. In accordance with this, Castro et al., a (2022) assures that, according to a specific dose of mild and moderate intensity of the practice of physical activity, the organism will respond with significant changes in the symptomatology of ADHD, which may reflect a better performance of the attention process and a decrease in disruptive behaviors such as hyperactivity and impulsivity.

Sánchez et al. (2015) propose that physical activity, in addition to having a direct impact on some factors associated with the disorder itself, is related to aspects such as diet, sleep, body image, heart rate, blood pressure, motor coordination and laterality. That is, in addition to the components that are activated inside the brain during physical activity, this activity contributes to the development of other areas of the human body, especially those that obey executive, psychomotor, cognitive, and even cardiovascular functions. In this sense, in their research they expose the existing relevance that, after reviewing the scientific literature on the relationship between physical activity and the mitigation of ADHD, becomes evident. In this framework, they propose the creation of new innovative non-pharmacological treatments, in which physical activity is the essential element through which it is possible to improve, in addition to those aspects associated with the pathology itself, those related to the physical health of patients.

Similarly, García et al. (2021), indicate that physical activity reflects a positive impact on behavior and neurocognitive function, headings that are strictly related to the dynamics of ADHD functioning, which precisely inhibit many neurocognition-dependent skills. Therefore, they state that physical education can represent a valuable contribution in terms of mitigating the pathology from a psychoeducational perspective where, in addition to achieving improvements in terms of the expressions resulting from the pathology, it is sought to generate a contribution as an alternative means of non-pharmacological treatment.

Thus, in their narrative they configure a broad spectrum of relationship between cognitive functions with respect to physical activity. In this exercise, they expose three key points that arise because of this relationship: the first is inhibition, by means of which some of the predominant responses of the pathology are inhibited or censored, in the same way that it contributes to the control of attention. The second is switching between "mental tasks or sets" (p.6). The third has to do with working memory, which accounts for the retention and processing of information. Similarly, Jarraya et al (2019) interprets that the physical activation of children could lead to an improvement of cognitive and executive functions, which has a positive impact on their academic performance.

However, Suárez et al (2018) agree with the three previous postulates in their research they expose that, after the implementation of a coordinated physical exercise and activity plan, an improvement

could be perceived in all the children studied in terms of attention. In addition, after the physical exercise plan, the children who underwent the treatment experienced positive changes in behavior, physical condition, and motor skills. However, they do point out that this field of study is scarce, and that future research is needed to obtain more empirical information on the subject. Thus, despite the stated limitations, they conclude that "PA programs of at least three weeks can have a positive effect on the attention of children diagnosed with ADHD" (p.1).

The benefits of the practice of physical activity range from the improvement and prevention of chronic diseases, such as obesity or type 2 diabetes, to osteoarticular benefits, as well as psychological, cognitive, social and sleep quality benefits, among others. In summary, the authors understand that the constant practice of physical activity represents an improvement in the general levels of quality of life. Ultimately, they state that: "physical-sports activities could produce improvements in inattention, hyperactivity and impulsivity" (p.2).

Consequently, this article is relevant because it considers the relationship of a dynamic method, such as physical exercise, with the heart rate and in turn with the impacts that this generates in the cognitive aspects of the individual, because as previously mentioned, physical activity presents changes in children suffering from ADHD both in their performance and in the physiological responses that it generates after it.

The aim of this article is to analyze the effects of physical exercise on brain electrical activation and heart rate variability in children with attention deficit hyperactivity disorder. Likewise, and from this main objective, we seek to briefly analyze how physical activity is related to this type of disorders also to briefly study how this disorder operates in children. For this purpose, the aim is to review the literature on the studies carried out to identify the effects of interventions based on physical activity for the treatment of ADHD, and to identify the incidence of physical exercise on the acquisition of motor and cognitive faculties and how this is evidenced by brain electrical activation, as well as to describe the main effects of physical activity on heart rate in children suffering from ADHD.

METHOD

To make a bibliographic review of the existing documentation on the subject. For this purpose, we seek to conceptualize ADHD, the clinical treatments with drugs that are given to it and the relationship that can be found between physical activity and the improvement that can be evidenced in children with ADHD symptoms. Thus, through the review of sources we seek to show part of the relationship between ADHD and physical exercise, where a qualimetric study is proposed through documentary and bibliometric review, data sources and search strategies such as Web of Science, MEDLINE, EMBASE, Google Scholar, Cochrane Central, which aim to show the impact of physical exercise in children with ADHD.

One of the deficiencies found, for example, in Colombia, is the limitation of studies investigating attention deficit hyperactivity disorder, mainly in the Caribbean region. However, within the data found, it is essential to show the incidence of this disorder between 15% and 17% in a study conducted by Leónidas (2019) to children in a school in Barranquilla. The results of this research show a high and worrying panorama regarding mental health diseases, centered on the one mentioned above, since as it is well verified and in relation to the general statistics existing in the country, about 15% of the population in that age range presents such a diagnosis.

Within these results they also present some of the most frequent comorbidities in these minors, which are:

- Oppositionist disorder, characterized by disobedience, defiance, and hostility towards adult authority figures.
- Mood disorders, where the causative factors may be related to violent family environments, which results in difficulty in relating to peers and other people close to them (Leónidas, 2019, p. 7).

Regarding the mediation of physical exercise on brain activation in children with ADHD, one of the articles found talks about how physical activity leads to an increase in catecholamine, since these "both from the point of view of neurotransmitters and hormones are involved in the control of a large

number of physiological and metabolic actions related to the maintenance of homeostasis" (Muñoz, 2020).

The proposed relationship between physical activity as an aid in the improvement of patients with ADHD, involves looking for options to replace or complement the medication that is given to patients with this diagnosis. Considering, on many occasions the medications used may have some side effects, so it is also necessary to consider other ways to contribute to the improvement of people. To that extent, it is also highlighted the need to have a proper diet that goes hand in hand with physical exercise, as this allows adequate values of catecholamine in the body.

Among the side effects that have been found in ADHD medication, there are some such as changes in sleep schedules, dizziness, depression, psychosis and even what is called the so-called rebound effect that can worsen the symptoms of the original disease and also brings changes in mood (Muñoz, 2020).

In view of this scenario, in addition to the costs of treatments and medications, the search for alternatives that are affordable to the entire population that may have this disease is proposed.

It also highlights how anaerobic exercise:

Reduces the risk of non-communicable diseases such as coronary heart disease, stroke, type II diabetes, hypertension, colon cancer, breast cancer, etc., but from a neuropsychological point of view it has been shown that aerobic exercise has a positive impact on the brain. In fact, physical activity as we present in this work has cognitive benefits which may have an impact on learning abilities and sociability (Muñoz, 2020).

Therefore, it is precisely in this aspect where the importance and necessity of physical exercise is highlighted to reduce these negative effects, since, among other things, the fact of:

Increasing blood flow in the brain, achieves beneficial and lasting effects on cognitive function by activating some areas of the prefrontal cortex and the amygdala, improving plasticity, attention and processing of the information received; and in the long term has a positive effect on executive and motor functions" (Vidal de Valicourt, 2020).

In this way, the proposal of mediation of physical activity in relation to brain activation and heart rate, is relevant to the extent that it shows the effective relationship between the elements raised, since it not only corroborates, through research, the way in which physical exercise helps in the improvement of this diagnosis, but it is also a way to contribute in the search for alternatives to which all people can have access, regardless of their economic solvency. In addition, it is also an important issue that can be taken as a guideline in educational institutions that often do not know how to properly handle children with ADHD diagnoses (Creswell, 2018).

RESULTS

Regarding In accordance with the objectives of the article, it is therefore necessary to make a sweep on the results that have been made around the existing treatments for children suffering from ADHD. The focus is on physical exercise as a possible method to cope with this disease. In the first part, it is fundamental to talk about heart rate variability, since it is one of the central axes in this paper. In this way, we find that cardiac variability is used as a method to evaluate cardiac activity, where it is defined "as the variation of the frequency of the heartbeat during a previously defined time interval (never more than 24 hours) in an analysis of consecutive circadian periods" (Rhodes, 2007, p. 1).

The main way to measure the frequency is by means of an electrocardiogram, where the different times of the consecutive R waves or RR interval are calculated, as shown in the following figure:

There are two main parameters to analyze Heart Rate Variability (HRV), which are:

1. Time domain parameters: result from the electrocardiographic measurement of normal RR intervals, where the easiest to calculate are RRSD: the standard deviation of all RR intervals of the measured period; RMSSD: the square root of the mean value of the sum of the squared differences of all successive RR intervals; pNN50: the percentage of consecutive RR intervals that differ by more than 50 ms. SDANN: Standard deviation of the NN (or RR) periods with a mean measurement of 5 min; and ASDNNN (index): Index of the standard deviations of all measurements of the 5-min RR intervals over 24 hours (Rhodes, 2007).

2. Frequency domain parameters (frequency spectrum): results from a mathematical transformation that allows decomposing the energy (power) of the RR signal into different frequency components (Rodas, 2007). For this, it is then important to characterize some of the central aspects that revolve around the symptoms and pathologies of ADHD, along with some of the consequences that this leaves in the lives of children who suffer from it. Likewise, it is also central to talk about the various treatments given to it, as it serves as a contrast to the main objective, which is to study the impacts of physical exercise in relation to ADHD.

It is found that around this disease there are several ways to try to give a management and/or cure to the attention deficit hyperactivity disorder. Thus, some of the existing treatments are the following:

● Pharmacological treatment: within this aspect, there are two aspects, which are divided into stimulants, being methylphenidate the most used; the other is non-stimulants, where atomoxetine is the most used medication. Regarding the use of drugs, it is important to mention that these "are dopaminergic and/or noradrenergic agonists that influence the transmission of catecholamines" (Garcia, 2017).

● Psychosocial treatment: this procedure seeks to develop certain skills with the patient's closest circle, for which the most used method is cognitive conceptual therapy, which emphasizes the improvement of children in factors such as organization, planning and school performance. It is important to clarify that the effectiveness of such therapy does not yet have a clear evidence base to prove its effectiveness.

● Physical therapy: this type of treatment has begun to be studied as a mechanism that contributes to find options that not only provide better results, but also do not leave side effects as many medications do. Physical exercises have begun to be investigated in greater depth, as it has been shown that they contribute to the improvement of some behaviors produced with ADHD.

● Aerobic physical exercise: among the benefits found when performing this type of exercise is, for example, the decrease in the risk of contracting diseases such as diabetes, hypertension, cancer, weight control and others. If we consider that children with this disease tend to have a higher body mass index, the performance of physical activities would result in a double benefit. Similarly, it is found to decrease and control symptoms such as attention deficit, hyperactivity, impulsivity, anxiety and social disorders (Garcia, 2017).

It is important to emphasize that the search for other treatments, other than the exclusive use of medication, and that contribute to the improvement of children with ADHD, is based on those adverse effects that have been found in patients who require medication. Among these effects, it is worth mentioning some of them, such as, for example, the most frequent ones like loss of appetite, weight loss and increased heart rate and, to a lesser extent, motor disorders and psychosis. (García, 2017).

Following this path, it is also important to highlight those symptoms and behavioral problems presented by children with ADHD, thus hyperactivity, impulsivity, attention deficit, sudden changes in behavior and cognitive level are the main symptomatology. Therefore, relational aspects and social skills should also be evaluated, as these are elements that are generally affected. This leads to behaviors such as those related to social integration in appropriate ways, disturbing peers, being impulsive, constantly moving from their established places and others (Fernandez, 2020).

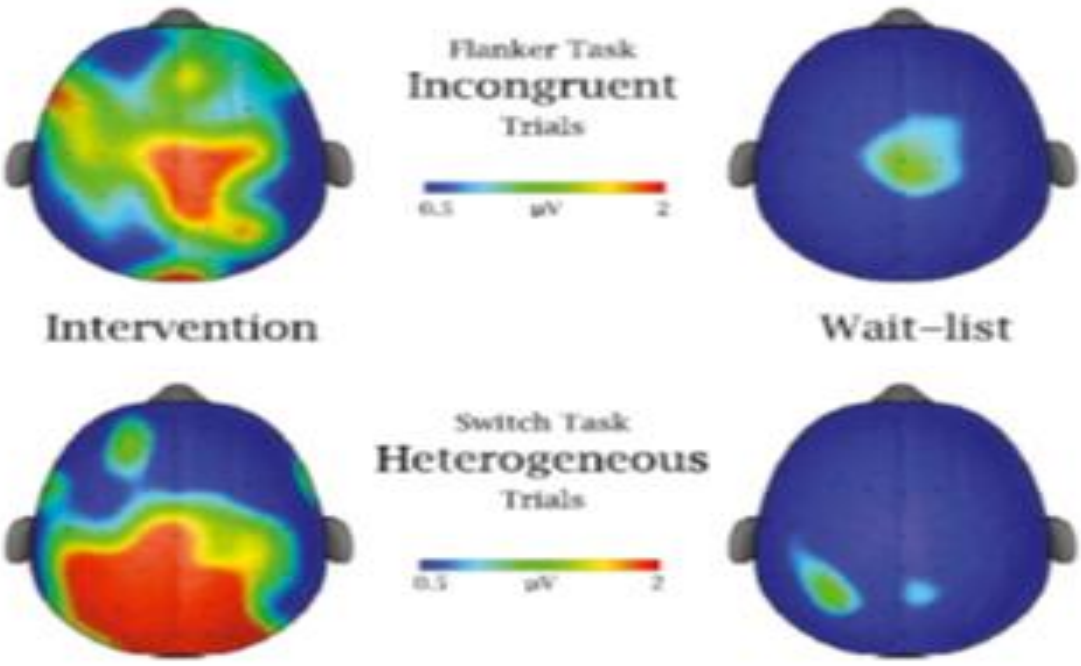
It is found that the brain component of a child with ADHD is made up of two areas of the brain that are particularly compromised is not characterized by following a uniform or specific line. The prognosis involves impulsivity, school failure, antisocial behavior and even delinquency. About 25% of hyperactive children evolve positively, with remarkable behavioral changes and no special difficulties during adolescence and adulthood. The DSM-III-R indicates that approximately one third of individuals diagnosed with hyperactivity in childhood show signs of the disorder in adulthood (Vélez, 2012). In relation to the above, it is important to identify those behaviors that are associated with the hyperactivity factor, as it can be predictive and, to that extent, contribute to finding solutions that move away from the mere fact of isolating and singling out children suffering from ADHD.

Impulsivity, another of the crucial vectors in ADHD, is characterized by behaviors such as impatience and lack of understanding of the basic rules of relationships and behavior. It should also include the fact of lack of concern in risk situations, social disinhibition, situations that lead them to have many more relationship problems with their peers. (Vélez, 2012). Around attention deficit, this can become manifest through attitudes such as not paying attention, being easily distracted, leaving things unfinished and avoiding some kind of task that requires a lot of mental effort. In this sense, "repeated failure in the execution of tasks leads to unpleasant consequences for individuals, who associate the task with an aversive situation that they try to avoid" (Vélez, 2012).

Now, focusing on the benefits that physical activity and exercise have on cognitive improvements and performance, a study published in 1983 tested the hypothesis that cognitive improvements and performance can be optimized by the development of some physical activity (Bustamante et al., 2019). According to the CADAH foundation, it assures that the optimal time to improve or increase attention is around 50 minutes; since in shorter or longer sessions the physical activity will not have noticeable effects and even, will have adverse effects to those expected.

Some studies point out that the benefits of physical activity or exercise are reflected in: Improved self-control of behavior and emotions, sociability, as people improve their communication skills. Increased self-esteem and feelings towards themselves improve. Reduction of impulsivity and frustration by conflict resolution skills, motor skills, among others. The image below shows, based on a case study, how the application of a 30-minute aerobic exercise program in a population sample of children shows an improvement in the performance of tasks that required great attention:

Figure 1. Brain electrical activation



Source: https://escuelaconcerebro.wordpress.com/2015/03/15/puede-el-ejercicio-fisico-mejorar-el-rendimiento-academico/

The improvements in learning and sociability skills are due to the fact that exercise stimulates the BDNF protein, which in turn increases the size of the hippocampus and with it the improvement of memory (Erickson et al., 2011, cited by Muñoz et al., 2020). To that extent, the article "improvement of attention in children with ADHD after a targeted physical sports intervention", suggests that these practices in school environments would help to counteract ADHD in most of the students, besides being beneficial as these exercises are of an inclusive nature, where children with or without attention deficit disorder relate under the same conditions. Therefore, the insertion of this type of

exercises, as mentioned by Lomas & Clemente (2009), contributes to the "students with ADHD reaching the objectives inside the classroom".

Table 1. Literature review on brain electrical activation

Research	Authors	Results
Physical activity and ADHD: developmental evidence, short- and long-term neurocognitive effects and their applications.	Bustamante, E. Santiago, M., Ramer, J., Balbim, G., Metha, T., Frazier, S. (2019).	Taken together, this evidence based on laboratory experiments suggests that short-term aerobic exercise [relative to sedentary activities] improves inhibition, prolonged attention, and neurological processes in infants with ADHD for transient periods of time after short-term exercise.
Physical activity as an optimization in the quality of life of young people with attention disorders.	Castro, V., Moreira, D., Aleivar, M. and Vera, B. (2022)	The strategies implemented by the coach do help them to control their ADHD, with only 20% of the minority emphasizing that the strategies they apply do not help them to control their ADHD. Everything indicates that the physical activity coach is applying strategies for this type of behavior.
Quantitative electroencephalography as a tool for the diagnosis and follow-up of patients with attention-deficit/hyperactivity disorder.	Galianal, A., Vecina, P., Sánchez, P., and Vela, M. (2020).	The usefulness is currently limited to complementing other subjective diagnostic methods and not replacing them, as the published data are preliminary and larger and more in-depth studies are needed.
Benefits of physical-sports activity in children with adhd.	Lomas, A., and Clemente, A. (2017).	Tests performed by an electroencephalogram showed that there is better cognitive control, attention, response accuracy and even better academic performance after 20 minutes of aerobic physical exercise than after 20 minutes of rest.
Improvement of attention in children with adhd after intervention	Suazo, D. M., Muñoz, J. N., Lazarraga, P. C., Rodríguez, A. R., Alcayde, M. I., Roman, A. D., & García, R. C. (2019).	The results suggest a positive effect of physical exercise on the quality of attention. It is recommended to use a physical-sports intervention as a complementary therapy in the treatment of ADHD and to improve the symptoms of the disorder.

Source: Own elaboration (2022)

Electroencephalography (EEG) is used to observe inhibitory control in children during the Flanker task test. They found that there was an immediate improvement in response conflict and stimulus classification speed in children who received exercise intervention. However, the degree of improvement was greater in children with lower inhibitory control ability, and these children benefited more from a single set of exercises. These benefits are more significant in ADHD children with inhibitory dysregulation, which means that ADHD has a generalized and extreme characteristic.

Therefore, a single series of exercises has greater immediate effects on cognitive functions. This effect can be attributed to the fact that a single series of moderate-intensity exercises induces regulatory and attentional resources and allocates them effectively, as well as decreases the load on neural activities associated with conflict detection. These effects may be amplified in children with lower cognitive functions.

In comparison, it was found that, among children with ADHD with lower inhibitory control ability, those with higher aerobic fitness or higher activity level demonstrated better inhibitory control. In one study, children with ADHD were asked to wear an accelerometer for 1 week to assess their daily physical activity level. The results indicated that children with moderate-high physical activity had better executive function performance, which was the most significant aspect in the results of the Tower of London planning task. This finding suggested that children with higher physical activity have better executive function performance in working memory, inhibitory control, and information processing speed. However, these correlations change with age. Brassell et al (2017) found that cardiopulmonary endurance correlates positively with inhibitory control in children at high risk for ADHD. Such children have better aerobic capacity and inhibitory function, and this phenomenon is more significant in younger preschool children. However, aerobic endurance, fitness and inhibitory function improve with age. Therefore, aerobic exercise intervention is also an important prevention strategy for children at risk for ADHD.

In addition, the duration of exercise-generated benefits is also important for lifestyle and learning strategies in children with ADHD. These children were given a single series of moderate-intensity aerobic exercise and inhibitory control tests. The data showed that response accuracy and conflict detection improved significantly within 60 minutes after moderate-intensity exercise, regardless of task difficulty. This result means that the benefits of a single-session aerobic exercise intervention on inhibitory control can last for 60 minutes in children with ADHD.

An analysis of exercise models found that both aerobic and anaerobic exercises have potential short- and long-term benefits on cognition, social behavior, emotions, and physical/mental outcomes in patients with ADHD. Aerobic exercise appears to have greater potential for immediate and long-lasting cognitive and behavioral effects in children with ADHD. In a study of attention and executive function in children with ADHD and normal children and adolescents, the type of exercise involved was primarily moderate intensity cycling or treadmill exercise, and the results showed that both cycling, and treadmill exercise had immediate ADHD benefits. There are many types of aerobic exercise training, and intensity is key. Because of the characteristics, impulsivity, amotivation, impatience, and persistence of children with ADHD, interval training is the most recommended form of exercise. Therefore, the following sections are divided into aerobic interval training and anaerobic exercise. There are various types of anaerobic exercise, and the effects of perceptual motor training and mediation training in children with ADHD are discussed in the following sections.

Finally, despite the above, there is still "no study that really shows how a child with ADHD has improved through an intervention program based on physical exercise" (Lomas & Clemente, 2009); the only evidence we have are the benefits that through specific tests or tests have been reflected in their behaviors but not in their grades. However, it is necessary to mention that the following bibliographic material was compiled during the documentary review process. Table 1 shows the names of the research that make up the most important theoretical approaches considered, followed by their respective results.

IMPLICATIONS AND CONCLUSION

Bearing in mind that the aim of the present study was to analyze the effects of physical exercise on brain electrical activation and heart rate variability in children with attention deficit hyperactivity disorder, it was found that:

Attention-Deficit/Hyperactivity Disorder is among the many syndromes in psychiatric nosology for which the etiological signal and clinical prediction are weak. Reducing phenotypic and mechanistic heterogeneity should be helpful in arriving at more robust clinical and etiological predictive signals. For example, ADHD is a single dimension in some dimensional psychopathology models but is two-

dimensional (based on factor analytic studies) in DSM V. Hybrid dimensional and categorical models of nosology.

Appropriate exercise intervention can not only increase sensorimotor skills, but also increase self-confidence and improve communication and social interaction skills in children. Exercise is an important tool for children with ADHD in the developmental phase. Aerobic exercise or perceptual motor training is beneficial for children with ADHD. Both single-session and long-term exercises can improve blood flow to the brain, improve information processing ability and attention, decrease impulsivity, and increase inhibitory control, thus improving interpersonal relationships. Regarding, exercise prescription, planned and combined exercise courses should be selected, and the contents should emphasize exercise intensity and motor perception exercises combined with cognitive tasks (such as motor planning skills) [51]. The teaching plan should include game content. This approach can effectively improve the perceptual and cognitive functions of children with ADHD.

It is hoped current studies intend to bring more scientific attention to the subject and provide important directions for future research by establishing a positive effect of exercise. If the effects of precise exercise for ADHD are better corroborated in the future, we may be looking at a powerful complementary or alternative treatment. Finally, it is recommended that for children suspected to be at high risk for ADHD, appropriate physical training can be integrated into the overall ADHD intervention plan. There are several types of exercises or practices that treat this disorder; however, in the case of children, physical activity may be one of the most recommended since it allows them to relate in a calmer and more appropriate way with their peers and may even be a better treatment than pharmacological ones.

Physical activity, apart from contributing to the development and improvement of the cognitive abilities of children with ADHD, helps to mitigate other problems that can be triggered by ADHD, such as obesity. Bearing in mind that physical activity helps to counteract the problems that children with ADHD face daily, it would be of great importance to implement physical activity programs in schools that contribute to improving the quality of life of these people. The physical activities to develop with children with ADHD may be subject to the age ranges in which they are so that these seek to respond to the needs and obstacles that each one presents.

The central symptom of ADHD is a neuropsychological deficit, when responding to external stimuli, abnormalities occur in the selection or maintenance of attention, resulting in response inhibition/delay. ADHD is also accompanied by neurophysiological deficits. Research on the mechanisms of brain functioning found that ADHD is caused by physiological, structural, and functional abnormalities in the central nervous system. Currently, treatment methods for ADHD include mainly medication, psychological counseling, and behavioral therapy. Many recent studies found that appropriate physical training can effectively reduce these symptoms. Studies found that acute exercise and regular physical activities can induce physiological and psychological mechanisms that not only promote physical and psychological health, but also improve physiological and cognitive functions, including memory and executive function

It is necessary to investigate more rigorously about other mechanisms that allow moving towards an improvement and cure of this disease, such mechanisms should seek to go beyond only pharmacological treatments that often have generated side effects, which end up aggravating the disease presented. At the local level -Colombia- there is a lack of studies and research that document and analyze this disorder in the population of minors in the country, with which we can contribute to present effective solutions in the classrooms of the institutions, avoiding that, as commonly happens, minors with this type of disorder continue to be isolated and stigmatized.

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