

The role of brain waves in distinction children with intestinal parasite diseases and attention-deficit/hyperactivity disorder in Karaj

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Abstract

Introduction: Intestinal parasites diseases, in addition to causing specific physical problems, also cause cognitive impairments in children similar to children with attention-deficit/hyperactivity disorder (ADHD). This study aimed to investigate the role of brain waves in the differentiation of children with a parasitic intestinal infection and children with ADHD.

Methods: The study was a descriptive cross-sectional study. The statistical population consisted of all children referred to a Rehabilitation Center in winter and spring 2019. Convenient sampling was performed on 120 children in groups of 40 healthy children with ADHD and intestinal parasites. Research tools included a diagnostic interview, Conners Rating Scale, brainwave recording by the two-channel ProCamp biographer in the FCZ area, and parasitic test. Data were analyzed by SPSS software version 23 using logistic regression and diagnostic analysis.

Results: Findings revealed that theta wave logistic coefficients were obtained in children with intestinal parasites disease and active memory and attention retention in children with ADHD. Also, healthy children and children with ADHD of 85% had the highest accuracy in predicting, and children with a parasitic intestinal infection with 52.5% had the second-highest accuracy in predicting and, based on the proposed model, were correctly classified.

Conclusion: As hyperactivity has a pattern of theta surge, diseases associated with intestinal parasites can also have such symptoms. When electroencephalographic waves of a child with a parasitic intestinal disease are similar to that of a child with ADHD, the behavioral symptoms that these two disorders exhibit can overlap and, if left unchecked, can lead to errors in evaluation and diagnosis. Therefore, testing for intestinal parasites disease before starting treatment for a child diagnosed with ADHD can be helpful and vital.

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Extended Abstract

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is among the most common neurobehavioral disorders presenting for treatment in children and adolescents. A review of symptoms and impairment clinically establish

the diagnosis of ADHD. The main symptoms of ADHD are inattentiveness, impulsivity, and hyperactivity; accordingly, these symptoms continue into adulthood in a large proportion of children diagnosed with this disorder.

ADHD is now considered a chronic disorder that is not limited to childhood only. This change in definition has resulted in revising the ADHD diagnostic criteria for older adolescents and adults (i.e., 17 years of age and older) in the recently revised Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5). Although in many cases, the maladaptive symptoms of impulsivity or hyperactivity are reduced in adulthood, it is incorrectly assumed that the main symptoms of ADHD also disappear. In addition, the issues faced by adults having ADHD in different situations are often regarded as a part of their characteristics and not because of their disorder. Therefore, the diagnosis of ADHD is more difficult in adults than in children. On the functional level, a dysfunction of the prefrontal cortex seems to be the leading cause of most of the deficiencies in ADHD, especially the dorsolateral prefrontal cortex and cingulate areas. Electroencephalography (EEG) studies comparing adult individuals with ADHD to healthy controls have suggested various brain activity patterns, including increased theta/beta ratios, theta and alpha activity, and abnormal activity in delta and beta frequencies. However, the patterns of brain activity seem to be related to the ADHD subtypes. Children with ADHD have higher theta wave activity and lower beta wave activity than normal children. A similar pattern can be seen in adults with ADHD. In other words, the EEG pattern of ADHD is typically characterized by a high rate of theta wave activity compared to beta wave activity. Thus, the neurofeedback training for ADHD aims to reduce theta wave activity and increase beta wave activity. Another common disorder in children is parasitic diseases. Infection with intestinal parasites is one of the health problems related to individual behaviors, social relations, and economic levels. Besides, parasitic intestinal infection is one of the significant childhood health problems in developing countries. Intestinal parasites diseases, in addition to causing specific physi-

cal problems, causes cognitive deficits similar to children with ADHD. One of the most common issues in treating children with attention-deficit and cognitive problems is receiving a diagnosis of ADHD without definitive assessments and based solely on behavioral observations and clinical interviews with a psychiatrist or psychologist and their medication. Just as hyperactivity has a pattern of theta surges, intestinal parasite-related diseases can have similar symptoms. In fact, the symptoms of a person with intestinal parasites are very similar to the symptoms of a person with ADHD, which lead to erroneous assessment and diagnosis if not examined more closely. When the electroencephalographic waves of a child with intestinal parasite disease are similar to those of a child with ADHD, the behavioral symptoms of that the two disorders also show can overlap. Thus, this study aimed to investigate the role of brain waves in the differentiation of children with intestinal parasitic diseases and children with ADHD in Karaj.

Methods

The present study was a descriptive cross-sectional study. The statistical population consisted of all children referred to Radmin Comprehensive Rehabilitation Center of Karaj in spring 2020. Convenient sampling was performed on 120 children in 40 healthy children with ADHD and intestinal parasite disease. Initially, all children who were diagnosed with ADHD at a specified time were clinically interviewed. Then, these children underwent parasitic tests, and finally, brainwaves were recorded. Written consent was obtained from the children's parents to conduct the research. The research tools included a diagnostic interview, Conners Rating Scale, brainwaves recorded by the two-channel ProCamp biographer in the FCZ area, and parasitic test. The Conners 3rd Edition-Parent (Conners 3-P) is an assessment tool used to obtain the parent's observations about the youth's behavior.

This instrument is designed to assess ADHD and its most common comorbid problems in children and adolescents aged 6 to 18 years old. When used in combination with other information, results from the Conners 3-P can provide valuable information for guiding assessment decisions. This report provides information about the parent's assessment of the youth, how he compares to other youth, which elevated scales and subscales. The data were analyzed by SPSS-23 software using logistic regression and diagnostic analysis.

Results

The results of logistic regression and diagnostic analysis showed that theta wave logistic coefficients were obtained in children with intestinal parasite disease and active memory and attention retention in children with ADHD. Also, healthy children and children with ADHD of 85% had the highest accuracy in predicting, and children with intestinal parasite disease with 52.5% had the second-highest accuracy in predicting and based on the proposed model were correctly classified.

Conclusion

Findings from children with intestinal parasitic diseases are more focused on children's cognitive function, and brain waves have not been studied separately like children with ADHD. Possible links between parasitic infection and cognitive consequences are reduced school attendance due to illness and loss of concentration. Children with cognitive dysfunction due to intestinal parasites, in addition to the drug needed to eliminate intestinal parasites, need cognitive recovery and enrichment to restore lost cognitive function. The research results showed that as hyperactivity has a pattern of theta surge, diseases associated with intestinal parasites can also have such symptoms. When electroencephalographic waves of a child with a parasitic intestinal disease are similar

to that of a child with ADHD, the behavioral symptoms that these two disorders exhibit can overlap and, if left unchecked, can lead to errors in evaluation and diagnosis. Therefore, testing for intestinal parasite disease before starting treatment for a child diagnosed with ADHD can be valuable and essential.

Ethical Considerations

Compliance with ethical guidelines

In order to maintain ethical considerations, written consent was obtained from the parents and companions of the children before the start of the research, and all names were coded with respect to the principle of confidentiality. This research was approved by the Ethics Committee of the Iran University of Medical Sciences with the ethical ID code of (IR.IUMS.FMD.REC.1397.008).

Authors' contributions

Somayeh Toreyhi (First author): Study concept and design, collecting information and data, analysis and interpretation of data, drafting of the manuscript 35%. Shahram Vahedi (second author and corresponding author): Corresponding and revising the manuscript and study supervision 25%. Seyed Mahmoud Tabatabaei (Third author): Study supervision 20% and Ramtin Hadighi (Fourth author) contributing in performing parasitological tests and data collection 20%.

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Conflict of interest

The authors of the present article declare that there is no conflict of interest in writing this research.