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Comparison of frontal lobe executive functions in hyperactive children and normal

Akram Hafezi
Farhangian University, Nasibeh Campus, Tehran, Iran
ak.hafezi@gmail.com

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Abstract

Purpose: The study was conducted to compare the frontal lobe's executive functions in hyperactive and normal children.

Research methodology: The study was conducted by a causal-comparative method with applied nature in 2020. The statistical population included all exceptional elementary school students in Tehran. Due to the fact that there are no accurate statistics on children with ADHD in the country and it is not possible to use a random sample for the statistical population,10 inactive students were selected for the experimental group and 10 as a control group. The informed consent form of the research was also taken from the sample. Measurement tools in this research, including four bender Gestalt tests, Stroop computer test, Wisconsin and Wechsler similarity subtests were used. Also, statistical analyzes were performed using SPSS25 software.

Results: Overall, the findings of this study conclude that there is a significant difference between normal children and children with hyperactivity in terms of limb error, selective attention, ability to change attention and abstract thinking. In general, the results of multivariate analysis of variance show that there is a significant difference in test scores between people with ADHD and normal people in terms of frontal lobe executive functions.

Limitation: The limitations of this study are the lack of similar articles in this field and the lack of participation of some patients in completing the questionnaires.

Contribution: Respected educators are suggested to use new therapies to strengthen the abstract thinking of hyperactive children and provide them with the necessary training in this area.

Keywords: *Executive functions, Frontal lobe, Inactive children, Normal children*

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1. Introduction

Attention Deficit Hyperactivity Disorder is one of the most common disorders in school age and is one of the main reasons for seeing a psychiatrist and pediatric psychologist. This disorder is characterized by a persistent pattern of inattention or impulsive and hyperactive behaviors. Affected children have major weaknesses in executive function that lead to many problems in planning and purposeful behavior at school, home and communication with others (Kaplan & Sadock, 2015). This disorder, which is characterized by inattention, hyperactivity and impulsivity, is one of the most controversial childhood and adolescent mental disorders that has been the subject of numerous studies in recent decades. 3 to 5% of school children They suffer from this disorder and its prevalence is higher in boys (Barkley, 2003). Hyperactivity Disorder, or ADHD, is a disorder in which hyperactivity, inattention, and sudden behaviors are more severe than other children. 3 to 5 percent of

children have the disorder and it is more common in boys. Symptoms of the disease begin before the age of 7, but often cause serious problems during school. The main problem for children is their inability to maintain and regulate their behavior, so they often cannot show proper behavior in line with the environment. Their sleep and eating are not regular. They seem to interfere in everything and care. They need it constantly. They are emotionally unstable, laughing or crying suddenly, and their behavior is unpredictable or unpredictable. Children's behavior affects their performance in the family, community, and school, causing negative reactions from those around them, the family. These behaviors cause serious problems in school and society and reduce self-confidence and feelings of inadequacy in these children. If left unchecked, the tendency of children with this drug disorder is more common than normal people and, as a result, can cause more social disorders (Bazi & Bazi, 2016). Studies comparing executive functions (EF) in children with attention deficit hyperactivity disorder with normal children have found that children with impaired performance are poorer than normal children, and the results suggest that The executive of children with disorders compared to normal children has degrees of disorder that this defect is especially evident in the inhibition of responses (Tehrani Doost et al, 2002). Attention Deficit Hyperactivity Disorder is one of the most common behavioral disorders among students in most countries. There are three categories for this disorder, which include mostly inattentive, mostly impulsive and compound. Most children fall into the combined sub-category, meaning that they have both symptoms of inattention and criteria for hyperactivity-impulsivity. Research shows that attention-deficit-hyperactivity disorder affects both children and parents. (Feizollahi, Sadeghi & Rezaei, 2020). At present, the causes, although a common disorder, are unknown.

However, it may be due to a complex set of factors, including heredity, environmental factors, the function of different brain areas, and the level of activity of neurotransmitters. One of the most prominent features of this disorder is extreme restlessness and very poor attention span, which leads to impulsive and disorganized behavior. These types of disabilities affect almost all areas of a child's functioning. A normal child can sit and concentrate if encouraged, but a child cannot do so. Therefore, the distinguishing factor of a child's motor behavior is its accidental quality, not its extreme, because as mentioned before, normal children also have extreme motor activities. Inability to focus and maintain attention has a very destructive effect on academic achievement. Children have major problems in pursuing education and completing homework. They often cannot even remember what to do. These children also have difficulty adjusting socially, refusing to play age-appropriate games, disrupting group games, barking, and arguing. In fact, it has a negative effect on self-care, independence and self-confidence, and affects the areas in which the child needs to become proficient in order to become a social being (Kakavand, 2005).

There are multifaceted therapies that can be divided into five groups: 1. Parent training 2. Teacher training 3. Use of special classes, social and individual skills groups 4. Psychological therapies (psychotherapy, nutrition therapy, etc.) 5. Drug therapy. The frontal lobe is located in front of the central groove (Rolando), located behind this groove, the parietal lobe. It is a part of the cerebral hemisphere which is located in It is located in front of the central groove and above the lateral groove. The frontal lobe is in the shape of an al-Qaeda triangle pyramid with the apex at the front and is called the frontal lobe pole. The frontal lobe has three levels: inner, outer and lower. They are divided into four sub-parts: the first three parts are the movement bar, the complementary movement area, and the broca area, and the fourth part, which is mainly anterior, is the prefrontal cortex (Mohammadi 2012a). The human prefrontal cortex integrates, processes, processes, executes, controls, modifies, and judges all the nervous system's activities. The frontal lobe is an important area of movement. The pyramidal system, which includes the cortico-spinal pathways (cortical-spinal pathway or pyramidal pathway (and corticobulbar)), originates from the forehead's motor areas in the cerebral cortex and any damage to the cerebral cortex or along the cortical fibers. Spinal and cortical-medulla oblongata lead to skeletal muscle movement disorders, especially cognitive disorders. Cognitive functions are the product of brain processing processes and include two subsets; one is law-based functions that regulate thinking and performance; Controls and is known as executive functions and other illegal functions that are based on emotions, desires, social cognition and situational factors (O. Santiago et al., 2007). In other words, executive function, including cognitive flexibility and the ability to manage

interfering components. In goal-oriented behaviors and predicting the consequences of an action. A group of researchers group these functions into different cognitive domains to explain the executive functions of the concept of how and why human behavior and another group organizes these functions into different cognitive domains, including planning and organizing. Behavior, inhibition and response inhibition, uncle persistence Leakage is a decrease in mastery and the ability to start performance (Kamphaus & et al., 2000). Provide evidence for the division of executive functions into three cognitive components, including containment, transfer, and updating, which, although separable, all play a role in the process of regulating and controlling many functions. Other components that these researchers introduced are planning, decision making and problem solving. Another division of executive functions into core domains includes the five components of immediate response inhibition, planning, cognitive flexibility, attention transfer, and working memory (Ghamari, 2009).

Executive function refers to a set of mental activities that are coordinated in the frontal lobe. The function of abilities such as time and attendance management, shift focus, plan and organize, recall details, limit behavior, and apply previous experiences, including current performance. When there is a problem in executive tasks, behavior control is reduced, affecting a person's performance. Executive functions include: Organizing and organizing: Organizing involves gathering information and organizing it for evaluation. Adjustment involves storing environmental stimuli and changing behavior in response to them. A person can be born with poor executive function. Executive function can also be impaired by damage to the prefrontal cortex of the brain. Problems with executive function associated with the developmental-mental disorder; Such as depression, hyperactivity, learning disabilities, as well as mild trauma or head injury, can lead to problems with executive function. Problems with executive function can be inherited, and this problem can occur during a child's school age, when they School assignments appear to be involved. Since the brain continues to grow into adulthood, a person's executive performance is shaped by physical changes as well as by evolving experiences. Timely attention to functional problems an executive can help a person compensate for weaknesses. Attention Deficit/Hyperactivity Disorder (DSM-5) is more than just an attention deficit disorder but covers a wide range of cognitive impairments. Cognitive deficits include distraction, hyperactivity, lack of planning for activities, attention to detail, not following instructions, difficulty completing activities, and completing activities that require constant brain concentration. They also have lost items and forgetfulness over-mentioned. This disorder is, in a way, a disorder of executive function and working memory. According to previous research, we now know that children with Attention Deficit/Hyperactivity Disorder are impulsive and high-risk children who often act without organized thinking or scrutiny, or do something fundamentally aimless and impulsive. They begin. These children also have limited flexibility in social relationships (Mereugliana, 2003)

The cognitive functions of the frontal lobe are nonverbal communication knowledge; Which helps the individual to be able to send, receive, read and interpret non-verbal messages that play an important role in building intimacy and trust in establishing mutual understanding and social adjustment. Lack of knowledge of non-verbal communication makes it impossible for a person to receive messages from others and send a suitable and desirable message to others. Awareness of non-verbal communication knowledge leads to better social performance and successful social relationships with others and can best understand the wants, needs, emotions, and expectations of others and their own needs, needs, emotions, and expectations. Transmit to others (Miotto & Morris,1998). Fieldman, Philip, and Castini (1991) showed that the ability to interpret and understand others' nonverbal behaviors facilitates both the understanding of others' emotional state and the cluster of common changes associated with forehead injury, including limited, impulsive perceptual self-awareness. Orientation and weakness in social consciousness (Groth Marnat, 2003).

Studies in the field of moral emotions have also shown that patients with forehead cortex injury compared to the healthy group are deficient in emotions such as regret, pride and embarrassment (Camille & et al, 2004). Studies by Koenigs, et al (2007) also show that patients with a forehead injury respond to personal moral judgments more profitably than normal individuals. In other words, these people accept violence against the individual and others in these riddles, and in the hypothetical situation, their response to this act is more positive. According to researchers, because the prefrontal

cortex, especially the middle abdominal forehead, plays a role in the perception of moral and social excitement, this group cannot consider the social consequences due to the defect in this area and accept the moral violence of these riddles. Studies by Young et al (2006) in patients with middle abdominal anterior cruciate ligament injury have shown that these patients tend to evaluate negative (conscious) moral behavior more negatively, but when it is morally good, it does not. Shooshtari et al (2011) in their study showed that early interventions based on attention games effectively affect the level of attention of children with attention deficit hyperactivity disorder/preschool impulsivity. The results indicate that attention to early diagnosis and intervention can be an effective approach in the treatment of attention deficit/hyperactivity disorder. In meteorological research (Shahabi.2011), the results showed that girls are superior to boys in all functions except emotional control. There is also a significant negative relationship between most executive functions and the disorders in the study. It seems that in terms of the forehead's participatory activity with cortical and subcortical areas of the brain, as well as the existence of anatomical infrastructures and heterogeneous growth trends in both sexes, executive functions have different functions in girls and boys and also in terms of wide scope.

Functions in cognitive, emotional and behavioral dimensions are related to some disorders. In the study of Mashhadi et al (2009), the findings showed that: The performance of children with in the reaction time component in consonant and inconsistent stimuli is significantly different compared to normal children. Regarding the control of interference, the results show that despite the difference between normal children and normal children, but this difference is not statistically significant. Also, in the Stroop test component, despite the difference between children with subtypes of this disorder, this difference was not statistically significant. The results indicate that: The performance of children with this disorder was poorer than the normal children in the Stroop task. In the study of Narimani et al (2009), the results indicate that children who suffer from learning disabilities, compared with normal children and children with attention deficit hyperactivity disorder, have more dysfunction in executive functions. Activity and increased attention to the control group. Therefore, music therapy has probably improved the symptoms of aggression, attention deficit and hyperactivity in children with attention deficit-hyperactivity disorder by improving brain function. The frontal cortex's function is complex and multifactorial, and pre-existing defects mainly characterize it. They are described in patients with large lesions of this cortex. In fact, forehead lip injuries usually destroy executive functions such as movement, speech, motivation, inhibition, social judgment, and ordering (Mohammadi 2012b).

In addition, the prefrontal cortex plays an important role in abstraction, problem-solving, planning, execution, and behavioral evaluation (Mahmoud & Kabirnejad, 2011). Enables the brain to perform targeted activities. The forehead cortex plays an important role in the processing and integration of internal and external information. The forehead cortex can be conceptualized as an attempt to limit or sublimate the influence of the default style and its stimulus-dependent style in response to the environment (Stuss & Knight, 2000)

Optional linkage and reversibility, emotional value to the secondary amplifier, ability to inhibit strong tendencies, and parallel processing capacity of multiple variables were noted. In addition, it can be said that the forehead cortex plays an important role in problem-solving abstraction, performance planning and behavior evaluation (Mohammadi, 2012b). Attention Deficit/Hyperactivity Disorder, as one of the most common childhood disorders can have detrimental consequences in social life and Have a person with the disease; Therefore, its treatment is considered. In addition to pharmacological interventions, psychological interventions have been proposed to improve the disorder (Ghayrin,E.Emadi Chashami, 2019),

Children with ADHD have Attention Deficit Hyperactivity Disorder or a combination of both. Inactive children have been shown to have problems with the executive functions responsible for the frontal lobe (Scheres, 2004) During the development of the brain, the frontal lobe forms the newest part and has the largest structure (Mehri, 2010). Cortical function The forehead is complex and multifactorial. In fact, forehead lobe problems usually destroy executive functions such as motor, speech, motivation, inhibition, social judgment, and ordering (Mohammadi, 2012a). In addition, it can

be said that the forehead cortex in abstraction, problem solving. Planning, execution, and evaluation of behavior play an important role (Mahmoud & Kabirnejad, 2011).

These disorders cause a person to have difficulty in their actions. According to the above, this study aims to compare the executive functions of the frontal lobe in hyperactive children and normal children. Therefore, we seek to answer the following questions:
1- Is there a significant difference between people with ADHD and normal people in terms of posture error?
2- Is there a significant difference between people with ADHD and normal people in terms of selective attention?
3- Is there a significant difference between people with ADHD and normal people in terms of the ability to change attention?
4. Is there a significant difference between people with ADHD and normal people in terms of abstract thinking?

2. Materials and methods

The present study is a causal-comparative method with an applied nature and taken from a part of a research project with the code of ethics 50800/1609/100 Farhangian University, Nasibeh Campus, Tehran, registered in the National Ethics Committee. The statistical population of the study consists of exceptional primary school students in Tehran. Due to the fact that there are no accurate statistics on hyperactive children in the country and it is not possible to use a random sample for the statistical population, 10 inactive students were selected from the available sample method for the experimental group and 10 as a control group. With the diagnosis of the specialists of the Exceptional Education Department of Tehran, they were identified as hyperactive and enrolled in schools, and after a diagnostic interview, they were selected to confirm the diagnosis of the disorder. Thus, if there was at least one diagnostic criterion for the disorder, the individual was selected as the experimental group.

The measurement tool in this study is a questionnaire that includes: 1. Gestalt test: In the present study, this test is used to assess the condition of children. This test was invented in 1938 by Lortab Ander (Groth & Gray, 2003). Schemes 1-2 and 6 of this test can be used to measure behavioral inhibition and determine whether the subject is able to inhibit performance or not. This test's reliability has been reported by Pooor Sharifi et al (1996) 89%, 2. Stroop test: Stroop test was first developed Stroop (1935) to measure selective attention and cognitive inflexibility. Different types in different clinical groups have been used to measure response inhibition, selective attention, cognitive variability, and cognitive flexibility. Research on this test indicates its reliability and appropriate validity in measuring inhibition in adults and children. The validity of this test has been reported through retesting in the range of 80% to 91%. 3. Wisconsin Test: Grant and Berg first developed this test in 1948. In the study of abstract behavior and cognitive flexibility, this test has been widely used. This test's reliability based on the agreement coefficient of evaluators is 83% and in the Iranian sample with the retest method is 85% (Mohammadi, 2012a). 4. Wechsler test: Wechsler IQ scale for children (Whisker (developed by Wechsler (1949) to measure children's intelligence), in 1974 Wechsler IQ scale for children (Whiskey) This scale has 12 sub-tests, 2 of which are reserve tests, 6 are verbal tests and 6 are practical non-verbal tests. Wechsler reported that the validity of the two half-tests for general intelligence is 97% for verbal intelligence 97% and for IQ is a practical scale of 93%. The test used in this study is a subscale of children's Wechsler similarities. This test includes 14 questions that measure abstract thinking and is also used to measure the function of the frontal cortex.
The present study, according to the subject and hypotheses tested on children who had referred directly or through school referrals to (private/public) medical centers. While evaluating and conducting a diagnostic interview with a psychiatrist, more diagnosis The activity was considered definite for them and in addition to drug treatment, non-drug treatments were referred to the psychologist (researcher student). The dependent variable is actually the answer and the result. The dependent variable is observed or measured to affect the variable. This variable is predicted through the independent variable. In this study, the dependent variable is ADHD. The independent variable, which is a default for the dependent variable, is manipulated by the experimenter to affect its changes. Another variable that is assumed to be dependent is observed and measured. In this study, the

independent variable is the executive function of the frontal lobe. After conducting a diagnostic interview and identifying the patient group, children individually take all tests, including the Wechsler similarity test and test Picking Wisconsin Bender Gestalt Test and Stroop Test Cards P was performed individually for all of them.

Table 1. Mean and standard deviation of Gestalt, Stroop, Wechsler and Wisconsin port test scores in two groups of hyperactive and normal children

Group	Test	Mean	standard deviation
Children with hyperactivity	bender Gestalt	21/7	2/6
	Stroop	24/1	6/6
	Wechsler	30/3	6/1
	Wisconsin	32/2	4/3
Normal children	bender Gestalt	18/9	4/04
	Stroop	37/06	5/7
	Wechsler	40/2	9/7
	Wisconsin	41/1	4/08

Hypothesis 1: There is a difference between normal children and children with hyperactivity disorder.

Table 2. The results of correlation and regression tests

group	Number	mean	Standard deviation	Levin test for equal variance		Score t	Significance level
Normal Hyperactive	10 10	21/7 18/9	2/6 4/04	F Score 13/8	Significance level 0/000	3/2	0/002

Due to the fact that the significance level of the test or test error is less than the standard ($p < 0.05$), so the test is significant, that's mean there is a difference between normal children and children with hyperactivity in terms of retention error. The standard deviation and mean scores in individuals show that the survival error in hyperactive children with a mean of 21.7 is higher than normal children with an average of 18.9. The t-test score is 3.2 and in Levin test the Fisher score is 13.8.

Hypothesis 2: There is a difference between normal children and children with hyperactivity in terms of selective attention.

Table 3. Student's T for two independent groups of normal children and children with hyperactivity in terms of selective attention

group	Number	mean	Standard deviation	Levin test for equal variance		Score t	Significance level
Normal Hyperactive	10 10	24/1 36/06	6/6 5/7	F Score 0/078	Significance level 0/78	-8/07	0/000

The test's level of significance or test error is less than the standard ($p < 0.05$), so the test is significant. That means there is a difference between normal children and children with hyperactivity in terms of selective attention. Selective attention deficit has been obtained in normal children with 37.06 higher than hyperactive children with an average of 24.1.

Hypothesis 3: There is a difference between normal children and hyperactive children in terms of the ability to change attention.

Table 4. Student's T for two independent groups between normal children and children with ADHD in terms of attention ability

group	Number	mean	Standard deviation	Levin test for equal variance		Score t	Significance level
Normal Hyperactive	10 10	34/2 41/1	34/2 4/08	F Score 0/42	Significance level 0/516	-6/3	0/000

Due to the fact that the level of significance of the test or test error is less than the standard ($p < 0.05$), so the test is significant, that means there is a difference between normal children and children with hyperactivity in terms of the ability to change attention. Individuals show an error in the ability to change attention in normal children with an average of 41.1 higher than hyperactive children with an average of 34.2.

Hypothesis 4: There is a difference between normal children and children with hyperactivity in terms of abstract thinking.

Table 5. Student's T for two independent groups of normal children and children with hyperactivity in terms of abstract thinking

group	Number	mean	Standard deviation	Levin test for equal variance		Score t	Significance level
Normal Hyperactive	10 10	30/3 40/2	6/1 9/7	F Score 3/7	Significance level 0/05	-4/7	0/000

Due to the fact that the level of significance of the test or test error is less than the standard ($p < 0.05$), so the test is significant, meaning there is a difference between normal children and children with hyperactive thinking in terms of abstract thinking. The abstract thinking of changing attention in normal children with an average of 40.2 is higher than hyperactive children with an average of 30.3.

Table 6. The results of the same test of variance to determine the significance of the mean difference

	Name of exam	the amount of	Fisher score	Degrees of freedom	Significance level	Eta Squared
Model	Pillais Trace	0/99	2656/1	4	0/000	0/99
	Wilks Lambda	0/005	2656/1	4	0/000	0/99
	Hotelling's Trace	193/1	2656/1	4	0/000	0/99
	The biggest root of the error	193/1	2656/1	4	0/000	0/99
group	Pillais Trace	0/69	31/1	4	0/000	0/69
	Wilks Lambda	0/30	31/1	4	0/000	0/69
	Hotelling's Trace	2/2	31/1	4	0/000	0/69
	error 's Largest Root	2/2	31/1	4	0/000	0/69

As can be seen in Table 6, the results of multivariate analysis of variance (MANOVA) on the executive functions of the frontal lobe in children with hyperactivity and normal children show that the significant levels of all tests allow the use of multivariate analysis of variance. The results show that there is a significant difference between test scores between people with ADHD and normal people. Eta squared shows that the difference between the two groups due to the dependent variables is significant in general and The amount of this difference is 99%. That is, 69% of the variance is related to the difference between the two groups in the interaction of dependent variables.

Table 7. Test subscales in normal and hyperactive people

	The dependent variable	SS	df	MS	F	p	Eta coefficient
Model	Bender Gestalt	120/4	1	120/4	10/3	0/002	0/15
	Stroop	2509/06	1	2509/06	65/2	0/000	0/53

	Wechsler	1480/06	1	1480/06	22/1	0/000	/27
	Wisconsin	721/06	1	721/06	40/7	0/000	0/041
group	Bender Gestalt	120/4	1	120/4	2140/6	0/000	0/15
	Stroop	2509/06	1	2509/06	1461/6	0/000	0/53
	Wechsler	1480/06	1	1480/06	1120/9	0/000	/27
	Wisconsin	721/06	1	721/06	4813/5	0/000	0/041
Error	Bender Gestalt		58	11/6	10/3		
	Stroop		58	38/4	65/2		
	Wechsler		58	66/6	22/1		
	Wisconsin		58	17/7	40/7		

As shown in Table 7, the multivariate analysis of variance shows that the mean F scores of the subscales of the above tests among normal and hyperactive children and the Gestalt port scale scores in hyperactive children and the scores of the Stroop and Wechsler scales. And Wisconsin was reported to be high among normal individuals ($P < 0.005$).

3. Discussion

In examining the difference between normal children and children with hyperactivity in terms of chord error, there was a difference between normal children and children with hyperactivity in terms of chromosome error. The average in individuals shows that the chronological error in hyperactive children with a mean higher than normal children. In Javanmard et al (2008) study, the Wisconsin card classification test's performance was evaluated. The results showed that: The four common errors for schizophrenic patients with positive symptoms were in residual, rotation, distortion and isolation, respectively. The results of means comparison tests for independent groups showed that there is a significant difference between the two groups only in the two criteria of rotation and brevity. Also, the results of significant tests between Gestalt port and Wisconsin scores showed that only the scale correlation in survival in Gestalt port and Wisconsin showed that only the scale correlation in survival in Gestalt port and the sum of survival in Wisconsin and the correlation of objectification scales in bender Gestalt. The time required to reach the first rule in Wisconsin was significant. This correlation indicates that these two tests probably measure the same abilities and parts of the brain. The results of this study are consistent with his research. In examining the difference between normal children and children with hyperactivity in terms of selective attention was obtained. There is a difference between these children in terms of selective attention. Tehrani et al (2002) In the study of executive function defects in children with attention deficit hyperactivity disorder, similar results have been obtained with this study. In examining the difference between normal children and children with hyperactivity in terms of the ability to change attention was obtained. There is a difference between these children in terms of ability to change attention. Standard and mean deviation scores in individuals show error in the ability to change attention in normal children Active is obtained (Ghamari et al, 2009).

In the effectiveness of cognitive advancement software on executive functions, response inhibition and working memory of children with dyslexia and attention deficit/hyperactivity disorder, similar results have been obtained with this study. There is a difference between these children in terms of abstract thinking in terms of abstract thinking. The scores of standard deviation and average in individuals show that abstract thinking has changed normal children's attention higher than

hyperactive children. Narimani et al (2009) In children with attention deficit hyperactivity disorder, learning disabilities and normal children, similar findings have been obtained with this study, which is consistent with this study. Meteorological study Shahabi (2011). In a comparative study of brain executive functions in primary school girls and boys and determining the relationship between executive functions and areas of mental disorders (depressive disorder, attention deficit hyperactivity disorder, learning disability, conduct disorder, obsessive-compulsive disorder) Optional (in both sexes, the results are consistent with this study. Rezaei et al (2000) in a study entitled Cognitive functions of the frontal lobe in adolescents with conduct disorder has obtained similar results to this study.

4. Conclusion

Overall, this study's findings conclude that there is a significant difference between normal children and children with hyperactivity in terms of limb error, selective attention, ability to change attention, and abstract thinking. In general, the results of multivariate analysis of variance show that there is a significant difference in test scores between people with ADHD and normal people in terms of frontal lobe executive functions. In this study, two multivariate analysis methods of variance and Student's t test were used, both of which confirmed a significant relationship. Based on this study's results, it is suggested that respected educators use new therapies to strengthen the abstract thinking of hyperactive children and provide them with the necessary training in this area. One of the limitations of this study is the lack of similar articles in this field and the lack of participation of some patients in completing the questionnaires.

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Conflict of interest

The authors had no conflict of interest.

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