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A COMPARISON OF EXECUTIVE FUNCTIONS IN CHILDREN WITH ADHD AND CHILDREN WITHOUT ADHD

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ABSTRACT

Various studies have shown that productivity impaired executive functions in attention deficit / hyperactivity disorder plays an important role. This study aimed to assess executive functions in children suffering attention deficit disorder / hyperactivity and the children were normal.

In this study of two primary schools in Semnan city among students, 17 girls and 17 boys were selected by available sampling method. Then they perform Raven colored children's intelligence test for measuring intelligence researcher made test go / no go for measuring executive functions of sustained attention, response inhibition, and the working memory researcher made test for measuring executive function of visual-spatial working memory. Data after collection were analyzed using software (spss).

The results show that between the performance of normal children and children with attention deficit / hyperactivity disorder, there are significant differences in the Raven test in the task of sustained attention and visual - spatial working memory.

Keywords: ADHD, Dysfunction, visual - spatial working memory, response inhibition

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is one of the prevalent diagnosted nervous behavioral disorders in childhood. According to Diagnostic and statistical Manual of Mental Disorder (DSM), prevalence of this disorder has been estimated between 3% to 7%, which the frequency of this disorder among boys is more than those in girls and its variable is between 2.1 to 9.1(APA, 2000; barkley, 2006; sadouk & sadouk,2007). The prevalence of this disease has been reported between 3-12% (abdollahian *et al*, 1383; heirani *et al*, 2007; Ardalan *et al*,1381).

This disorder has three main symptoms: inattention, impulsiveness and hyperactivity. Using the results of factor analysis, these three symptoms are classified in two seprated behavioral dimensions as 1) inattentiveness, 2) hyperactivity/ impulsiveness (dis-inhibition) (barkley, 2006).

The behavioral symptoms of this disorder are occurred in the early childhood, mainly before 7 years old that is relatively stable during developmental period (APA, 2000).

Children affected to Attention Deficit Hyperactivity Disorder (ADHD) have more developmental, adaptive, emotional and academic problems than their peers. In addition, they are mostly rejected from their society living in and prone to more snit-social behaviors during their academic year (barkley, 2006). Three different subtypes for this disorder is considered: ADHD predominantly hyperactive/impulsive subtype , ADHD predominantly inattentive subtype and ADHD combined (ADHD-C). In recent years, a large volume of scientific evidence has indicated that the combination of morphological and dominant morphology of hyperactivity / impulsivity are separate disorders (Barkley, 1997; Mylych [1], Balyntyn 2, Lynam 3, 2001). On the other hand, some researchers believe that morphology of overcoming with attention deficit was an isolated problem and was not considered as the morphological disorder attention deficit / hyperactivity (Diamond 4.2005; Mylych et al, 2001; Brown 5.2005; Wilkie, Nyg , Faravnh, Pennington 6.2005; Barkley, 2006).

Many studies have been performed today in this regard due to the nature of this disorder. Research done in the area of behavioral, genetic, neuropsychological, neurological, metabolic, and more recently, Brain imaging studies of the structure and brain function, all are supported the neuropsychological basis of this disorder. The role of frontal lobe, especially pre-frontal lobe and dysfunction disorder are the first instances of indicative

theories of this disorder (welsh & pnington, 1988; barkley,1997,2005,2006; Krain & Castellanos,2005,2006; Sounga, sergeant nigg & wilkat, 2008).

Structure of executive action is a kind of umbrella term that several cognitive processes that serve to take purposeful action or behavior (Lezak, Hvsyn, Lvryng, Hannah 13,2004.) Definitions of the functions of the executive, there are numerous, but many of whom, including the elements and components such as these are: planning and purposeful, organization behavior over time, inhibition of responses, systematic attention and memory that are guiding them, working Memory, processes of self-regulation, self-control, self- supervision, flexibility (Pennington and Ozonoff,1996; Welsh and Pennington, 1988; Barkley, 1997; Gioia & Isquith.2004; Denckla, 2007; Mc Klvzky, Perkins and Vandivner ,2009).

Along with the development created in hyperactive children, some problems are also created in their executive functions, including self-control(barkley,1997; clarck et al,2000), cooperation and movement continuation (martinousen et al.2005; nigg et al,2005), control and inhibition(barkley, 2000). It is supposed that dysfunction is the first neurology problem in this disorder. The evidences indicate that these children have problem in inhibition and have worse functions in the tests of continuous function(corcom and seagel,1993), stoppage-word tests(stivens et al,2003; schcher et al,2000) and Stroop test (nigg et al,2002; sergeant et al,2002). Working-verbal & visual-spatial memory is also one of the executive functions that can be seen in affected hyperactive children(bedle,2007; brown;2000; nigg and Casey,2005). Also, disorder in working memory(hervi et al.2004; Willcutt et al,2005) and planning and organization as executive function that is one of the significant and exellent activities of the brain is seen(penningtonet al, 1993; nigg et al,1998 and sergeant,2002). Capacity planning and the organization as one of the most important functions and administrative activities of the higher brain, have been different either in his role in the performance of activities of daily living and because of its role in coordinating other actions to achieve the goal of researchers (Shalys 9 1982).Since the planning and organizing ability of the prefrontal cortex are excellent actions, It is believed that damage or dysfunction in the prefrontal and some areas of the cerebral cortex with the child's ability to carry out planning and organization is significantly related (Shalys, 1982; Lezak et al, 2004; foster 10,2008).

The therapist should be able to describe the behaviors of children affected to Attention Deficit Hyperactivity Disorder (ADHD)as well as understands its cause. Evaluation and assessment of executive functions regarding developmental disorders helps understand better the characteristics of children affected to these disorders including disorganization, lack of planning and poor decision making and control Alizadeh, 1385).

Given the important role of executive dysfunctions in Attention Deficit Hyperactivity Disorder (ADHD) and the results of various studies performed in this field and the ones associated with, the mail problems of this study is that is there a significant difference between executive functions (response inhibition, functional, verbal, visual and spatial memory, planning and organization) in children affected to this disorder and normal children measured with different Neuropsychological tests.

METHODOLOGY

Community, sample and sampling method:

The current research design is retrospective and comparative regarding to the nature of issue and research purposes in which group differences are examined. The current research community includes student of two primary schools in Semnan city which one of these primary schools is the one girls are studying and the other one is boys are studying and available sampling was performed over them. Available sampling has been used in this study in that the sample people were chosen from boys and girls schools and then Raven, Go-No go and visual-spatial tests have been performed over them and finally these tests have been interpreted. Statistical sample of this study include 17 female students and 17 male students.

Measures of research:

Measurement tools used in this study include:1- Raven's Color Intelligence Test to measure children's intelligence aged 5-10 years old,2- researcher-made test of Go-No go test, and 3- researcher made functional, visual and spatial memory for measuring the span of functional-visual and spatial memory.

Researcher-made Go-No go Test: this is a type of cognitive test which is used for measuring stable attention executive functions and response inhibition. In this test, children are asked to respond at the time when they see regarded target by pressing a key or clicking the mouse. In addition, children should not respond on non-target forms. In this researcher-made test which is designed and used based on the theoretical and research background (See Nig, 2005), 21 stimuli were used with a variety of fruits and before the

test is performed, one fruit was introduced as target stimuli. Of the total of 21 stimuli, 7 stimuli are target ones. Therefore, the ratio of target stimuli to non-target stimuli will be 1 to 3. After the test, the examiner should be able to calculate errors of response omission and the total errors of response presentation. The meaning of response omission is that one's stable attention is gotten into trouble. Also, response presentation error means that subject should respond after observing non-target stimuli, which means the subject is gotten into trouble in response inhibition. Meanwhile, the total of both types of errors can be taken into account as an indicator of sustainable development.

Researcher-made functional memory (visual-spatial) test: This researcher-made test is one of the interesting cognitive tests which is used to measure execution action of functional, visual and spatial memory. Required materials include a number of similar color cards which has been located with 70.50 dimensions in different locations. The instruction of this test is that a number of these cards (starting from the two cards) are mentioned by the examiner. The task of the examiner is that mentioned cards are kept in memory and then the examiner points out the same cards in the same way. Using this task, which the number of its items are added up in a progressive way, an indicator of functional, visual and spatial memory will be obtained. However, the subject in the task of inverse spatial-visual memory is asked to show the concerned cards immediately after the examiner, but in order of inversion. In the current study, the recent method is used to determine the span of inverse visual-spatial memory.

Raven Test : This test is also made to assess the intelligence if children aged 5-10 years. The material of this test include 36 forms which a part is omitted and the children should choose the appropriate answer from an option existed in the below page. This test has been divided into three twelve branches started from very easy materials and hard materials.

RESULTS

The number of subjects and their age based on their gender distinction is given in **Table 1**. According to the table above, the number of samples is 28 people among which 17 ones are boys and 11 ones are girls.

In **Table 2**, the results related to independent T test to compare the performance of normal children and the ones affected to Attention Deficit Hyperactivity Disorder (ADHD) in Raven's test are given.

As is shown in Table 2, the degree of significance in Raven test is 0.022 and for this

level is less than 0.50, it can be said that there is a significant difference between normal children and the ones affected to Attention Deficit Hyperactivity Disorder (ADHD) in Raven test.

In table 3, the results related to independent T test for comparison of normal children's performance and the ones affected to Attention Deficit Hyperactivity Disorder (ADHD) in the task of stable attention.

As can be seen in Table 3, level of significance in the task of stable attention is 0.019 and for this amount is less than 0.05, it can be said that there is a significant difference between normal children and the ones affected to Attention Deficit Hyperactivity Disorder (ADHD) in the task of stable attention.

Also, the results related to independent T test to compare the performance of normal children and the one with Attention Deficit Hyperactivity Disorder (ADHD) in the functional and visual-spatial memory has been given in Table 4.

As can be seen in Table 4, level of significance in Raven's test is 0.029 and because this amount is less than 0.05, it can be said that there is a significant difference between children's normal performance and the ones with Attention Deficit Hyperactivity Disorder (ADHD) in the functional and visual-spatial memory (Spin-range Test).

Table 1: The frequency of subjects based on their gender

Gender	Number	Percentage
Boys	17	60
Girls	11	40

Table 2: independent T test for children performance in Raven's test

Indicator/Test	T	Degree of freedom	Degree of significance	Mean difference	Standard error
Raven	2.84	26	0.022	12.286	4.94

Table 3: Independent T test for children's performance in the task of stable attention

Indicator/Test	T	Degree of freedom	Degree of significance	Mean difference	Standard error
The task of stable attention	-7.018	26	0.019	11.57	1.61

Table 4: Independent T test for children's performance in the functional and visual-spatial memory

Indicator/Test	T	Degree of freedom	Degree of significance	Mean difference	Standard error
The task of stable attention	2.07	26	0.029	1.08	0.504

DISCUSSION & CONCLUSION

As mentioned, the aim of this study was to determine whether there is a significant difference between the executive actions (response inhibition, functional and visual-verbal memory, planning and organizing) in children with Attention Deficit Hyperactivity Disorder (ADHD) and the normal children who are measured by different Neuropsychological tests.

The findings of the present study showed that there is a significant difference between children with Attention Deficit Hyperactivity Disorder (ADHD) and normal children in Raven's intelligence test which is significant at 0.05 level. This finding is inconsistent with the research results regarding the comparison between children with ADHD and normal children in Intelligence Test. Some studies performed reported the similarities of the performance of normal children and some others the different performance of this group with normal children (Goldberg et al, 2005; fotga, 2006; monley et al, 2001; Willcuttet al, 2005). This difference can be due to the difference in statistical sample or the hidden variables affecting this research.

Also been west(2002) and scharz(2004) mention that boys with ADHD showed some deficiencies in the interference control, response inhibition and mental designing and planning in their own response. This is while none of the functional deficiencies were remained in the affected children after controlling age and IQ and the sizes not related to executive functions.

Also, findings obtained in the present study indicate that there is a significant difference between children with ADHD and normal children in the task of stable attention that is consistent with the results obtained in other studies.

Some meta-analyzing studies (corcom & segeal,1993) show poorer performance meta-analysis of children with this disorder in comparison with normal peer children with the measurement of the level of omitted errors and presented errors and also the time of reaction receve et al,2001,2002).

In addition, there are strong evidences indicating the poor performance of children with this disorder in attention disorder/inhibition(berlin et al, 2003,2004; Shallice et al,2002).

Gold et.al (2001) compared in a study 53 children with ADHD with 44 normal children over the task of 21 seconds emphasis and showed that children with ADHD had more visual focus movement compared with normal

children which causes that they have less focus in their tasks.

Also, Monroe, Armstrong, Hampton and More (2003) showed in their study that people with ADHD are faced with problems in comparison with normal people in the pursuit of moving goals that are away from the center. As mentioned before, one of the most important executive functions damaged in Attention Deficit Hyperactivity Disorder (ADHD) is deficiency in functional memory (barkley, 2006; brown,2006; nigg and Casey,2005). This study showed that there is a significant difference between children with ADHD and normal children in functional and visual-spatial memory. The results obtained in this study are generally consistent with the researches and theories existed in this regard (bedle,2007; brown,2006; rapport et al, 2008; dige et al, 2008; martinson et al,2005; Willcutt et al, 2005).

Two different theoretical approaches explain the relationship between functional memory and disorder. Berkeley (2006) maintains that deficiency in response inhibition is the main cause of this disorder and response inhibition will result in damaging to functional memory and other executive actions. On the other hand, Rapport et.al (2008, 2009) maintains that this disorder is caused by initial deficiency in functional memory which is led to damaging to executive actions. Although these two approaches approach this deficiency from two different perspectives, it is believed in both attitudes that deficiency in functional memory exists in people with this disorder.

Berkley(2006) mentions out of various follow-up studies that how attention focuses training associated with feedback and monitoring can have long-term and short-term impacts over attention focus and behavior control by the children.

Ryff (2008) maintains that doing any exercise which results in child's more control on his/her own arbitrary actions can have positive impacts on other psychological functions in both short run and long run.

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