

Diagnostic validity of the brief scale in students with attention deficit disorder

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Abstract

Background: ADHD is one of the neurodevelopmental (NDs) disorders, that can effect on executive functions of the brain, so it is important to have a valid psychodiagnostic to measure this disorder. The Brief Executive Functions Questionnaire (BRIEF) is one of these tools. In the present study, the aim of this research is to investigate the diagnostic validity of this tool in diagnosing students with attention deficit disorder.

Methods: The current research is Cross-sectional applied research and standardization. The target population is students between 9 and 15 years old in Tehran who affected by attention deficit hyperactivity disorder. The sample size was selected based on the formula, which includes 58 people.

Finding: In this study we found emotional control organization of material has not diagnostic validity because confidence interval was less than one and two standard deviations (47/36)(49/50). Sensitivity coefficient were (0.40)(0.36). The amount of experimental and critical difference were (0.75)(0.68).

Conclusion: According to the present research, the scale of executive functions of BRIEF in students with attention deficit disorder in the scales of inhibition, transition, planning, monitoring, working memory and initiation has diagnostic validity according to the distribution diagram of the sensitivity coefficient and confidence interval, as well as the scales of emotion control and organization of materials has not diagnostic validity, thus the current tool in terms of scales that have diagnostic validity can help us in measuring it in people with ADHD.

Keywords: ADHD; BRIEF scale; Student; Diagnostic validity

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is a psychiatric diagnosis for children and adolescents who are in the stages of development (Cherkasova 2013). Among children and adolescents in the United States between the ages of 4-17 years, attention-deficit/hyperactivity disorder affects 11% of people. (Danielson 2018). It's prevalence among high school students is 2 to 12 percent (Nugent 2014). The frequency of this disorder among boys is more than girls and it has been reported in the range of 2:1 to 9:1 (APA 2000) (Bauermeister, J. J 2005) (Senol.V 2017). In Iran, this disorder is reported between 5 and 20 percent (Hassanzade 1398) (khalilinejad 2021). In this disorder, various functions are affected, executive functions are one of the most important. Executive functions are the ability to use cognitive processes to control thoughts and emotions (Miyake A 2012). Executive functions help people to behave according to the goal and to deal with environmental stimuli and stay on the goal path (Alloway TP 2010) (Abdulmohammadi.k 2016). Executive functions have a significant impact on intelligence, educational, success, personality, developmental coordination, and social skills (Brydges, C. R 2012) (Neuenschwander, R 2012) (Razza, R. A 2009) (Cortés Pascual 2019) (Hilton, D. C

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2022). If there is a problem in the executive functions, there will be issues such as aggression, inattention, behavioral and communication problems in front of people (Cruz, A. R 2020) (Schnider, B2020) (Li, C.2023) (Reynolds, B. W 2019). It is difficult to measure executive functions due to the lack of a very precise and broad definition of this function (Graham 2002). It is important to have a tool for a more detailed examination of psychological characteristics due to the impact of executive functions on people (Barkely 2010). There are questionnaires such as the Wisconsin card alignment test and the Tower of Hanoi test, whose validity and reliability are discussed (Miyake, A 2000).

Brief executive function behavioral grading questionnaire (BRIEF) is one of these tools that was made by Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). This questionnaire has two parent and teacher forms and measures two sets of behavior regulation and metacognition in the scale, which include inhibition, attention shifting, and emotion control. , initiation, working memory, strategic planning, organization and supervision (Memisevic, H 2013). The first subscale of emotion control is considered to be the ability to adjust emotional responses, shift attention to change a situation or activity, and the ability to solve problems in a flexible way, inhibition is the ability to control impulses and stop correct behavior. Strategic planning is the ability to predict the future, events, and set appropriate goals. It is before carrying out tasks systematically. Working memory is the ability to store and simultaneously cultivate information in short-term memory. Initiation is the ability to start a task or activity and generate ideas independently. Follow up is individual (Bakar, E 2011).

This questionnaire is valid for measuring executive functions and is very important since it evaluates behavior in real life (Memisevic, H 2013). Several studies have investigated the validity and reliability of this scale of different degrees: USA 0.96, Australia 0.77, France 0.72. 0.93 (Nyongesa, M. K 2019). This questionnaire was made for normal people, but it was used to diagnose ADHD, Pervasive Developmental Disorder, Tourette's symptoms, brain damage and intellectual disability (Parhoon, K 2022) (Drechsler, R 2018) (Miranda, A 2015) (Mahone, E. M 2007) (Mahone, E. M 2002) (Gioia, G. A 2000) (Abdulmohammadi.k 2016).

Also, a research was conducted in the year 1396 by Abdulmohammadi and colleagues, which evaluated Tehran, East Azarbaijan, West, Kurdistan provinces in terms of the validity of the brief executive functions scale. Cronbach's alpha calculated for the eight scales of the questionnaire is between 68 and 86, and also alpha Cronbach's calculated for behavioral regulation and cognitive index and the total score of the brief questionnaire are 0.86, 0.89 and 0.93, respectively. (Abdulmohammadi.k 2016)

Due to the influence of executive functions on various aspects of people's lives, it is necessary to have a suitable tool to measure it, and for this reason, the present study tries to examine the diagnostic validity of this questionnaire to help measure executive functions in people with attention deficit hyperactivity disorder in Tehran province, also The diagnostic validity of the executive function scale, which has a high overall validity, has clinical value (Smith, J. N 2020) and also has the ability to diagnose ADHD (Miranda, A 2015).

2. Methods

The current research is Cross-sectional applied research and standardization.

The target population is students between 9 and 15 years old in Tehran who affected by attention deficit hyperactivity disorder.

2.1. Sample

The sample size was selected based on the formula, which includes 58 people, in this formula

$$n = \frac{z^2 p(1-p)}{d^2},$$

$$z=1.96, p=0.02, d=0.0025$$

and to be sure, we used 60 people in this research, 60 students between the ages of 9 and 18 who are suffering from attention deficit hyperactivity disorder from two separate centers that measure and diagnose They are in charge of children with special needs, who were first given a diagnostic interview based on DSM-5, and then they were asked to answer questions.

2.2. Inclusion criteria

- Having a confirmed diagnosis of ADHD based on the psychiatrist's opinion and confirmation of the diagnosis based on the initial interview by the researcher (subtypes of ADHD were not considered)
- Having a normal IQ (above 85) based on the intelligence test included in the child's educational record
- Parent's willingness to participate in the study Questionnaire of executive functions(Brief) parent form

2.3. Tools

BRIEF(Behavior Rating Inventory of Executive Functioning):

This questionnaire has 86 questions, which was made by Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L.in(2000), which has 2 parent and teacher forms that measure 8 scales: inhibition, attention shifting, emotion control, initiation, working memory, strategic planning, organization and supervision. This questionnaire was implemented among Iranian students and has psychometric properties suitable for measuring the executive function of school-aged children and adolescents in research and clinical activities(parhoon2022).This questionnaire It has the ability to measure people's behavior in the natural environment, and the obtained Cronbach's alpha is between 0.82 and 0.98(Abdolmohammadi1396) (Joseph 2020) (Parhoon2022) .It is made for normal people, but it can be used to diagnose ADHD.

The scoring of this questionnaire is (never = zero / sometimes = one / often = two).

To carry out the research, two special centers for the education of children with attention deficit hyperactivity disorder were selected from the city of Tehran, considering that all the children had previous medical records, the previous diagnosis of impulsivity or mixed disorder was not taken into account, 60 cases were randomly selected. The parents of the children were contacted and asked to come to the center on a specific day to fill out the questionnaire in person. Additional information about the research and the importance of confidentiality and not recording personal information was presented to them and they were asked to answer the questionnaire.

3. Results

To analyze the information, three statistical methods of measurement through sensitivity factor, scatter plot and confidence interval were used.

The subjects include students aged 9 to 15 living in Tehran, receiving services in centers for children with special needs, 30 girls and 30 boys were selected. The average age of the students was 12.4. Seven student 9-year-olds(11.6%) / Eight student 10-year-olds(13.3%) /Twelve ST 11-year-olds(20%)/Ten ST 12-year-olds(16%)/Twelve ST 13-year-olds(20%)/Eight ST 14-year-olds(13.3%)/Three ST 15-year-olds(5%)

Table 1 Investigating the diagnostic validity of 8 scales of the brief test with emphasis on the confidence interval method in students with ADHD

Diagnostic validity	confidence interval	Theoretical average	Experimental average	Executive function
valid	More than two standard deviations	50	29/68	Inhibition
valid	More than two standard deviations	50	30/25	shift
Not valid	less than two standard deviations	50	47/36	Emotional control
valid	More than two standard deviations	50	20/09	initiate
valid	More than two standard deviations	50	22/74	Working memory
valid	More than two standard deviations	50	26/49	Plan/organize
Not valid	less than one standard deviations	50	49/50	Organization of material
valid	More than two standard deviations	50	23/43	monitor

According to the statistical analysis related to the confidence interval method to calculate the diagnostic validity of the executive functions of the brief in students with attention deficit disorder, it can be stated that there is a significant difference in the level ($\alpha=0.01$) between the experimental and theoretical means (50) in the dimensions of inhibition, transfer, planning, monitoring, working memory, and initiation, and the difference between the experimental and theoretical averages in the aforementioned dimensions is more than two standard deviations. Therefore, it can be said that the dimensions mentioned in the brief executive functions scale in a student with attention role disorder have diagnostic validity. is. Also, in the dimensions of emotion control and organization of materials, there is a significant difference in the level ($\alpha=0.05$) between the experimental and theoretical average, and the difference between the experimental and theoretical average is less than one standard deviation, so the dimensions mentioned in the BRIF executive functions scale in students It does not have diagnostic validity with attention deficit disorder.

Table 2 Investigating the diagnostic validity of 8 scales of the brief test with emphasis on the sensitivity coefficient method in students with ADHD

interpretation	Sensitivity coefficient	Number of clinical samples	Executive function	The number of students with attention deficit disorder whose clinical sample was diagnosed by the instrument
valid	0.75	60	inhibit	45
valid	0.86	60	shift	52
Not valid	0.40	60	Emotional control	24
valid	0.65	60	initiate	39
valid	0.97	60	Working memory	58
valid	0.93	60	Plan/organize	56
Not valid	0.36	60	Organization of material	22
valid	0.68	60	monitor	41

According to the above table and the obtained sensitivity coefficient, it can be stated that the dimensions of inhibition, transition, planning, monitoring and working memory have a sensitivity coefficient higher than the standard limit of 60, and these dimensions have diagnostic validity. Also, the dimensions of emotion control and material organization have a sensitivity coefficient lower than the standard limit of 60 and do not have diagnostic validity.

Emphasizing the level of significance obtained from the experimental value and the critical value, it can be stated that there is a significant difference in the dimensions of inhibition, transition, planning, monitoring, working memory and initiation in the scale of executive functions at the level ($\alpha=0.001$) of Since the difference of the experimental level (students with attention deficit disorder) with the critical value in the mentioned dimensions is more than 3, it can be concluded that these dimensions have diagnostic validity, as well as the dimensions of emotion control and material organization, their significant difference in the level ($\alpha = 0.05$) does not exist and the difference between the experimental rate and the critical rate is less than 3. It can be concluded that it does not have diagnostic validity in these dimensions.

In general, by summarizing all three statistical methods, it can be stated that the transitional inhibition scales of working memory monitoring planning have diagnostic validity in students with attention deficit disorder. Also, emotional control and material organization scales do not have diagnostic validity in students with attention deficit disorder.

Table 3 Investigating the diagnostic validity of 8 scales of the brief test with emphasis on the scatterplot method in students with ADHD

Diagnostic validity	Significance level	The amount of experimental and critical difference	Critical difference rate	Extent of experimental difference	Executive function
valid	0.001	4.02	1.23	5.25	Inhibition
valid	0.001	3.75	1.26	4.83	shift
Not valid	Not have	0.75	1.34	2.12	Emotional control
valid	0.001	4.65	1.28	4.50	initiate
valid	0.001	3.75	1.14	4.89	Working memory
valid	0.001	3.10	1.40	4.50	Plan/organize
Not valid	Not have	0.68	1.28	1.96	Organization of material
valid	0.001	5.49	4.62	5.81	monitor

4. Discussion

According to the present research, the scale of executive functions of BRIEF in students with attention deficit disorder in the scales of inhibition, transition, planning, monitoring, working memory and initiation has diagnostic validity according to the distribution diagram of the sensitivity coefficient and confidence interval, as well as the scales of emotion control and organization of materials has not diagnostic validity, thus the current tool in terms of scales that have diagnostic validity can help us in measuring it in people with ADHD.

Children and adolescents with ADHD often show difficulty with time management and do not develop an internal sense of pace in planning tasks. Neuropsychological testing has found that individuals with ADHD demonstrate impaired executive functioning including abnormal response inhibition. On any given measure of executive function, less than half of children with ADHD have been found to be impaired. ADHD is often associated with problems in emotion regulation, resulting in temper outbursts, mood lability, and reactivity. Moods can change dramatically with no obvious connection with what is going on in the environment. Social skills are often significantly impaired in children with ADHD compared to controls. Individuals with ADHD may have problems accurately interpreting nonverbal social cues and have trouble cooperating with other children and following rules in games. Peers identify these individuals as intrusive, bossy, and insensitive to the needs of others. Children with ADHD often overreact and respond to frustration in social situations which can lead to verbal or physical aggression. This is a strong stimulus for peer rejection, which has been shown to be a reliable long-term negative predictor of development, particularly in adolescence. (Kaplan & Sadock 2021).

In line with the research results, they reported that the scales have internal consistency (Cronbach's alpha) as follows: inhibition (alpha 0.87), displacement (alpha 0.87), emotion control (alpha 0.89), initiation (alpha 0.90), memory Work (alpha 0.91), strategic planning (alpha 0.88), organization (alpha 0.89) (Gioia, G. A2000) showed that brief executive function scale has the ability to diagnose attention deficit disorder. It was suitable for the diagnosis of attention deficit disorder. (Mahone, E. M.2002) They came to the conclusion that the brief tool has diagnostic validity, (McCandless, S.2007) they reported it is more suitable for measuring clinical cases referred to the clinic. (Jarratt, K. P2005) give us more comprehensive information due to its focus in specific centers, this is a suitable tool for measuring attention deficit disorder. (Zarrabi, M.2015) The BRIEF considers behavioral patterns, which are compatible with ADHD symptoms, so it can be used to find the symptoms of basic behavioral dysregulation such as sustained attention and inhibition of responses.

(Parhoon, K.2022) in Iran, they confirm the internal consistency (Cronbach) in the two subscales of emotional control and material organization, which is in contrast with the findings of the present research and needs further investigation in Tehran and other cities. Also, the present study used two centers for children with special needs, which can be

expanded in future studies, and including children under 9 years old in the study will give us more information about its validity in children.

5. Conclusion

According to the present research, the scale of executive functions of BRIEF in students with attention deficit disorder in the scales of inhibition, transition, planning, monitoring, working memory and initiation has diagnostic validity according to the distribution diagram of the sensitivity coefficient and confidence interval, as well as the scales of emotion control and organization of materials has not diagnostic validity, thus the current tool in terms of scales that have diagnostic validity can help us in measuring it in people with ADHD.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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