Report of Health Care **Original Article**
Volume 5, Issue 3, 2019, p. 33- 42

Examining the Impact of Neurofeedback on Brain Waves and Attention-Deficit Rate in Boys with Attention- Deficit Hyperactivity Disorder (ADHD)

Farnaz Karimpour [1], Seyed Ebrahim Hosseini [2] *
1. Department of Psychology, Marvdasht Branch, Islamic Azad University, Marvdasht, Iran
2. Department of Biology, Shiraz Branch, Islamic Azad University, Shiraz, Iran

Received: 4 April 2019
Accepted: 10 June 2019
Published online: 20 July 2019

***Corresponding author:**
Seyed Ebrahim Hosseini. Department of Biology, Shiraz Branch, Islamic Azad University, Shiraz, Iran

Phone: +989171183917

Fax: +987143311148

Email: ebrahim.hossini@yahoo.com

Competing interests: The authors declare that no competing interests exist.

Citation: Karimpour F, Hosseini SE. Examining the impact of neurofeedback on brain waves and attention- deficit rate in boys with attention- deficit hyperactivity disorder (ADHD). Rep Health Care. 2019; 5 (3): 33- 42.

Abstract
Introduction: Attention-Deficit Hyperactivity Disorder (ADHD) is one of the prevalent disorders amidst children over the world. Due to the side effects of medications used in the treatment of this disorder, this study aimed to survey the impact of neurofeedback on the treatment of children with ADHD.

Methods: This study was a semi-experimental one with pre and post-test design including two groups of control and experiment. It was carried out among 30 students who had been diagnosed as hyperactive by psychiatric experts, performing two questioners of Conner's parent and teacher plus neurofeedback, in two groups of 15 as experiment and 15 as the control. Subjects in the experimental group underwent neurofeedback training for 20 sessions, while the control group did not receive any instruction. Following the completion of 20 sessions, over, two groups of control and experiment were tested, and the outcomes were regarded through a statistical method of covariance analysis ($p \leq 0.05$).

Results: The results revealed that neurofeedback training significantly lessened brain waves, problems of consideration, concentration, hyperactivity and impulsivity, attention deficit, the rate of child behavior in the class, group participation and collaboration, attitude towards power authorities ($p \leq 0.05$).

Conclusion: The results proved that neurofeedback might improve brain waves plus attention deficit hyperactivity decreases in children with ADHD via developing brain excitation.

Keywords: ADHD, Neurofeedback, Brain Waves, Attention Deficit

Introduction
Attention-Deficit Hyperactivity Disorder is one of the most prevalent disorders amongst children, particularly boys, in which the patient fails in social functions such as waiting for a stay, answering nonverbal symptoms, understanding the feelings of others and engaging in social situations needing inhibition and participation, additionally they show aggressive behaviors in their communication with others (1). If ADHD is not diagnosed and treated at the right time, it becomes an adult hyperactivity disorder and results in imprisonment, delinquency, academic failure, divorce and family difficulties (4 and 16). Investigations have attested that deficits in the managing performance of children with ADHD can be maintained at an older age so that they could be confronted with severe difficulties in schoolwork as well as in personal affairs. Accordingly, timely diagnosis and interventions are necessary for these children's dilemmas (2). Brain metabolism, mainly on the forehead, is lower in children with ADHD than in healthy subjects (3). It has been explicated that people with behavioral disorders, notably attention deficit

hyperactivity disorder, tend to use drugs more than ordinary people (4). The therapy plan for attention deficit hyperactivity disorder can be classified into single-intervention direct therapies plus multiple complex interventions. Today, pharmacotherapy with stimulant drugs, behavioral-oriented programs including parental training, class-oriented interventions and summer therapy plans are the most robust interventions that have led to empirical support (5). Neurofeedback is a training method without punishment, negative enhancement or emotional content, through which the patient enhances himself without having to speak also normalize his cortex profile by modifying slow brain waves and boosting the brain's fast waves (6,7,8). In neurofeedback systems, individuals may significantly either improve or suppress the particular rhythm of their brain electroencephalography signals, following the principle of operant conditioning (9). The success rate of neurofeedback treatment has been reported to be 60 to 90% (10), referring to the effects of the investigations. The studies have exhibited that the therapeutic effect of neurofeedback in the treatment of adult hyperactivity patients is as much as medical therapy (11). It has been specified that for the treatment of patients aged 7 to 25 years with a primary diagnosis of ADD and ADHD, with an intelligence level lower than the average, moderate or higher than average, the neurofeedback can be applied (12). The findings of a separate study intimated that neurofeedback treatment touches the change in the pattern of brain waves in children with attention deficit hyperactivity disorder (13). It has been pointed out that neurofeedback training enhances memory and improves the image distinction rate, and also lessens response time in female employees (9). The outcome of extra research indicates that the neurofeedback equilibrium protocol improves the performance balance of children with the reading disorder, although there may be required more sessions to achieve notable brainwave changes (14). Neurofeedback significantly diminishes the cognitive and behavioral symptoms of ADHD, and its effectiveness is equivalent to medication and even a substitute for stimulant drugs (5). The results of the research also designate the effectiveness of neurofeedback as a treatment method in treating the attention problems plus in the decrease of hyperactivity symptoms in female students with ADHD (15). Holding that many techniques, namely, positron emission radiography, nuclear medicine imaging, and functional magnetic resonance imaging, have already been employed for monitoring the function of the brain, yet in addition to high costs, usually, they are accompanied by unpleasant complications of radioactive infusion as well as being exposed to strong magnetic fields. Nevertheless, the brain electroencephalography technique, which records the brain electrical activity, while being cost-effective, does not end in reported disease complications (16). Consequently, since disorders in brain waves are one of the causes of ADHD, the present examination was carried out aiming to evaluate the impact of neurofeedback on brain waves and attention deficit hyperactivity disorder (ADHD) rate in boys with this ailment.

Methods

This research is a semi-experimental with pre-test and post-test design of two groups, the control, and experiment, which was conducted in Islamic Azad University of Marvdasht in 2017. The statistical population of the study comprised male hyperactive students from Shiraz. Out of the referrals to the center in a purposeful sampling method, 60 people who were diagnosed as hyperactive by psychiatric experts were selected; then two questionnaires, namely, Conner's parent and teacher plus the neurofeedback machine itself were administered. The students who obtained higher scores were selected and divided in two groups of control and experimental. Later, they were distributed in two groups of 15 as the experimental and 15 as the control homogeneously, mainly based on the children

age and mother's education level, according to Tables 1 and 2. The reliability of the Conners Teachers' Questionnaire, based on the studies of Conners et al. in 1999, was 0.90 and also, 0.76 according to Shahim et al. in 2007 by a reciprocal test, plus 0.86 of Cronbach's alpha coefficients for the whole questionnaire. Besides, the reliability of the Conners parent's questionnaire was 0.90 based on Conners *et al.* in 1999 and 0.85 according to Alizadeh *et al.* in 2005, done by the Institute of Cognitive Sciences. Furthermore, its reliability has been reported 0.93 by Cronbach alpha method. In this study, following estimation of the statistical population and sampling, two Conners' parents and teachers questionnaire and neurofeedback diagnostic record on some of the patients who referred to the center, was implemented. Following correction of the questionnaires and evaluation of theta to beta scores, 30 subjects with the highest attention deficit hyperactivity disorder, were selected and subsequently, 15 subjects were placed in the experimental and 15 in the control group. Later, the neurofeedback training method was held in 20 sessions as follows. After the end of 20 sessions, repeatedly, two groups of control and experiment were tested. The contents of the sessions are briefly summed in Table 3. To this end, the effectiveness of neurofeedback training on reducing hyperactivity/ attention deficit symptoms as well as brain signal correction have been discussed in this study, In addition the present research is semi-experimental; therefore, the covariance statistical analysis method was employed to eliminate the pre-test consequence and analyze the collected data.

Results

The outcomes of the study, from the parentsب point of view, revealed that there was no significant difference between the subjects of the control group and the experimental one in the pretest phase separating focus and attention problems, attention deficit, hyperactivity, and impulsivity. While in the post-test stage within indices of focus and attention problems, attention deficit, hyperactivity, and impulsivity in the subjects under treatment through neurofeedback training, there were observed significant decrease at the level of $p < 0.05$, compared to the pretest stage. Additionally, there was no significant difference between the above indicators in the pre- and post-test stages in the subjects of the control group (Table 4). Moreover, the effects of the data analysis, from teachers' viewpoint in this study, explicated that there was no significant difference between the indicators of child behavior in the class, participation and group collaboration, attitude towards the power authorities and the total score of attention deficit in the pre-test phase among the subjects of control and experimental groups. While in the post-test stage in the above indicators among the subjects treated by neurofeedback training, there was a significant reduction at p<o.o5the level of $p < 0.05$ contrasting to the pre-test. Furthermore, there were no significant changes between the indicators of child behavior in class, participation and group collaboration, attitudes towards the authorities and the total score of attention deficit in the pre and posttest steps in the control group subjects (Table 5). Besides, the outcomes of single-variable covariance analysis to determine the impact of neurofeedback on attention deficit degree, from the position of parents, pointed out that in the post-test step, focus and concentration, attention deficit and hyperactivity disorder, have been modified at the level of p<0.001 as opposed to the pre-test stage (Table 8). The data analysis results showed that, from the perspective of parents in the pre-test stage, the mean of hyperactivity and impulsivity, attention and concentration problems, plus, in total, the attention deficit level of the experimental group has been reduced sequentially from 49.53, 38.20 and 87.73 to 38.80, 31.27 and 69.80 in the post-treatment phase. While in the control group, the mean in the pre-test stage, has been raised from 50.80, 37.73 and 88.53 to the rate of 51.62, 38.07 and 89.87, respectively (Table 4).

Further, the data analysis results showed explicated that, from the teacher's standpoint in the pre-test stage, the average of the child behavior in class, the participation and group collaboration, attitude toward the authorities and in total the attention failure score in the experimental group, have been decreased in the post-treatment from 48.80, 18.67, 20 and 87.47 to 37.27, 14.47, 14.53 and 69.27, respectively. While, in the control group, in the pretest phase, the mean has improved from 52.27, 20.07, 17.13 and 89.47 to 51.49, 21.33, 17.33, and 90.80, respectively (Table 5). Besides, the results of this study showed that the mean brain waves of the experimental group in the pre-test stage had been lowered from 3.16 to 1.96, in the post-treatment state. Nonetheless, in the control group, the mean in the pre-test phase, has been raised from 3.27 to 3.29 in the post-test period (Table 6). The results from Multivariate Covariance Analysis (MANCOVA) of data, from parents' aspects, concerning the neurofeedback impact on the attention deficit rate of children with ADHD regarding F and significance level of MANCOVA records, clarified that the linear combination of variables has a significant difference concerning group membership. Moreover, the effect size of the test (ETA squares) confirmed, from the parents and teachers views, that the neurofeedback-based therapy has had an impact on the attention insufficiency rate of children with attention deficit hyperactivity disorder, and the test has the statistical power of (1), (Tables 4 and 5). Additionally, based on the results of the single-variable covariance analysis to determine the effect of neurofeedback on the focus and attention deficit degree, from the viewpoint of parents, it has been attested that neurofeedback ends in a reduction of attention, concentration, and hyperactivity as well as impulsivity and attention insufficiency in children with ADHD at the level of $p \leq 0.001$ (Table 9). In addition, according to the results of the single-variable covariance analysis in determination of the neurofeedback impact on the level of child behavior in class, participation and group collaboration, attitude toward authorities plus attention deficiency, from the teachers' view, it has been revealed that neurofeedback degrades the above difficulties in children with ADHD at the level of $p \leq 0.001$ (Table 10). Further, the results of single-variable covariance analysis of data explicated that the neurofeedback-based therapy leads To a significant decrease in the brain waves in patients with attention deficit hyperactivity disorder at $p \leq 0.001$ (Table 11).

Table 1. *Frequency distribution of subjects' age status*

Age	Control		Experiment	
	Frequency	Percentage	Frequency	Percentage
Seven	2	13.3	2	13.3
Eight	3	20	3	20
Nine	3	20	3	20
Ten	4	26.7	4	26.7
Eleven	3	20	3	20
Total	15	100	15	100

Table 2. *Frequency distribution of maternal education level of subjects*

Education	Control		Experiment	
	Frequency	Percentage	Frequency	Percentage
Diploma	5	33.3	6	40
Associate Degree	4	26.7	3	20
Bachelor	4	26.7	5	33.3
Master and higher	2	13.3	1	6.7
Total	15	100	15	100

Table 3. Test implementation phase (in brief)

Phase	Implementation	Description
1	pre-test	conducting two Conners parents/teachers questionnaires
2	evaluation	interview with the referrer and recording the medical history of the patient and those involved in the training process
3	Brain signal evaluation	an electroencephalogram is taken from the patient to achieve brainwaves
4	Neurofeedback training	training how to perform work and implement the treatment protocol (theta repression and beta reinforcement)
5	post-test and evaluation	re-running two questionnaires and re-recording the brain signal

Table 4. Mean and standard deviation of two groups with attention deficit, from the parental standpoint in pre-test and post-test

Groups / Variables	experiment group at pre-test stage	Experiment group at post-test stage	Control group at pre-test stage	Control group at post-test stage
attention and concentration problems	38.74 ± 3.56	31.27±2.14	37.73±1.62	38.07±2.43
hyperactivity and impulsivity problems	49.53±3.44	38.80±2.34	50.80±4.44	51.62±4.72
attention deficit/insufficiency	87.73±4.43	69.80±3.32	88.53±5.11	90.80±5.03

Table 5. Mean and standard deviation in two groups of attention deficit, from teachers' perspective in the pre-test and post-test

Groups / Variable	experiment group at pre-test stage	experiment group at post-test stage	control group at pre-test stage	control group at stage post-test
child behavior in class	48.80±5.24	37.27±4.43	52.27±3.71	51.49±3.78
group partnership and collaboration	18.67±2.94	14.47±2.39	20.07±1.39	21.33±1.60
attitude towards the authorities	20.00±3.52	14.53±1.99	17.13±3.99	17.33±3.77
total score of attention deficit	87.47±9.83	69.27±7.21	89.47±3.25	90.80±2.98

Table 6. Mean and standard deviation of two groups of brainwaves in the pre-test and post-test

Groups / Variable	experiment group at pre-test stage	experiment group at post-test stage	control group at pre-test stage	control group at post-test stage
brain waves	3.16±0.31	1.96±0.31	3.27±0.44	3.29±0.43

Table 7. The effects of multivariate covariance analysis (Parents' Perspective)

Effect	Statistics	Size	F	P	ETA-relative square	Statistical power
Group	Pillai's trace	0.84	207.44	0.001	0.84	1
	Wilks' lambda	0.16	207.44	0.001	0.84	1
	Hottelling's trace	6.59	207.44	0.001	0.84	1
	The Greatest Root	6.59	207.44	0.001	0.84	1

Table 8. Results of Covariance Analysis Effects

Effect	Statistics	Size	F	P	ETA -relative square	Statistical power
Group	Pillai's trace	0.80	65.91	0.001	0.80	1
	Wilks' lambda	0.20	65.91	0.001	0.80	1
	Hottelling's trace	8.60	65.91	0.001	0.80	1
	The Greatest Root	8.60	65.91	0.001	0.80	1

Table 9. Results of single-variable covariance analysis to determine the effect of neurofeedback on attention deficit (parental perspective)

Change resource		Sum of squares	df	squares mean	F	P	Eta square	Statistical power
Group	post-test focus and attention problems	921.11	1	921.1	96.51	0.001	0.78	1
	post-test hyperactivity issues	1138.65	1	1138.65	129.84	0.001	0.82	1
	post-test attention deficit	4108.01	1	4108.01	226.29	0.001	0.89	1

Table 10. Results of single-variable covariance analysis to determine the effect of neurofeedback on attention deficit (teachers' view)

Change resource		Sum of squares	df	squares mean	F	P	Eta square	Statistical power
Group	post-test of child behavior	1411.72	1	1411.72	95.94	0.001	0.78	1
	post-test of participation	204.44	1	204.44	69.26	0.001	0.73	1
	post-test of authorities	153.49	1	153.49	43.20	0.001	0.66	1
	post-test of attention deficit	412940.	1	4129.40	113.02	0.001	0.81	1

Table 11. Results of covariance analysis test to examine the effect of neurofeedback on brain waves of children with attention deficit hyperactivity disorder

Change resource	Sum of squares	df	squares mean	F	p	Eta square
pre-test	3.52	1	3.52	184.01	0.001	0.87
group	10.93	1	10.93	271.98	0.001	**0.88**

Discussion

The present survey outcomes revealed neurofeedback training progresses brainwaves and according to parents, adjusts the difficulties of focus and attention, hyperactivity and impulsivity as well as attention deficit. Additionally, referring to teachers, it ends in an amendment of the child's behavior in the classroom, participation and team collaboration plus a reduction in overall attention failure rate. The results of a different investigation showed the effectiveness of neurofeedback as a therapeutic strategy in the treatment of attention problems as well as the reduction of hyperactivity in female students with attention deficit hyperactivity disorder (15). In addition to the higher frequency of alpha waves in the electroencephalogram of patients with ADHD, the record of lower beta waves inside brainwaves of these patients is also notable, indicating low Cerebral Cortex arousal (17). In another study, it was attested that neurofeedback training is as practical as Ritalin in the treatment of involved children, and may be applied as an alternative treatment in the circumstances, where either the patient does not respond to the medications or suffer from side effects (18). In a further study, referring to parents' report, it was recorded that neurofeedback training, is as effective as Methylphenidate on hyperactivity and focus parameters of patients with attention deficit hyperactivity disorder (19). In line with the results of this study, a separate study more determined neurofeedback training improves the symptoms of hyperactivity and attention deficit disorder (20). According to the findings of a different notable study, it was revealed that neurofeedback is a suitable treatment for diminishing the level of attention deficit hyperactivity disorder in children (21). Considering the high theta waves in ADHD patients and the neurofeedback capabilities in lessening these waves, which are associated with distraction, inattention, fantasy and anxiety, the neurofeedback, hence, improves the symptoms of ADHD (22). In children with ADHD, neurofeedback may normalize the brainwaves of these children plus improve the children's selective attention (23). One examination found out that the efficiency of combination therapy of neurofeedback and Ritalin in raising the scores of children with ADHD in the Wechsler's revised IQ test was more than any other method (24). Further, other studies indicate the effectiveness of neurofeedback as a therapeutic method for brainwave modification and treatment of attention problems in female students with attention deficit hyperactivity disorder (25). Meyer et al. investigated the impact of neurofeedback on the practice of attention deficit hyperactivity disorder in adults and decided neurofeedback has a beneficial impact in diminishing the symptoms of ADHD, though its adverse effects expect further thoughts (26). Lee et al. questioned the influence of neurofeedback on the treatment of children with ADHD and noted neurofeedback has a positive impact on brainwave and hyperactivity/deficiency symptoms (27). Referring to the other research and according to the parents' report of children with ADHD, comparing perceptual attention training with neurofeedback one, it was affirmed that neurofeedback develops the attention and managing performance of involved children (28). In a study, it was discovered that neurofeedback has an advantageous effect in

decreasing the symptoms of ADHD; still, its adverse effects require more studies (29). Similarly, in line with the results of this study, a different one explicated that neurofeedback, by a positive effect on brainwaves, is helpful in the treatment of children with ADHD (30). One of the findings of this investigation is that neurofeedback technique training decrease the attention deficit level, which is consistent with the effects of some other studies (31, 32, 33). In support of this finding, it may be asserted that in children with attention deficit hyperactivity disorder, the brainwaves mass profile record a decrease in beta-wave, and neurofeedback training for these children grows the bata activity as the neurofeedback training process is based on the operant conditioning principal, which has been in turn rooted from two reinforcement and reinforcementer notations. Furthermore, the completion of studies by Rajabi *et al.* intimates the effectiveness of neurofeedback training as a therapeutic approach to brainwave modification and attention problems treatment in female students with attention deficit hyperactivity disorder (34).

Conclusion

To sum, this study proved that neurofeedback training increases the brainwaves of children with ADHD and, according to parents and their teachers' reports, the neurofeedback leads to modification of difficulties with attention and concentration, hyperactivity and impulsivity plus attention deficit. Further, it develops the child behavior in class, participation and group collaboration, and degrades the total score of the deficit disorder.

Ethical issues

Not applicable.

Authors' contributions

All authors equally contributed to the writing and revision of this paper.

References

1. Humphreys KL, Galán CA, Tottenham N, Lee SS. Impaired social decision- making mediates the association between ADHD and social problems. J Abnorm Child Psychol. 2016; 44 (5): 1023- 1032.
2. Seidman LJ. Neuropsychological functioning in people with ADHD across the lifespan. Clin Psychol Rev. 2006; 26 (4): 466- 485.
3. Lubar JF. Neurofeedback for the management of attention deficit disorders. Biofeedback: A practitioner's guide. 2003; 3: 409- 437.
4. Alizadeh GJ, Bayrami M, Hashemi T. Predicting substance abuse from attention deficit/ hyperactivity disorder symptoms in adult. J Res Addict. 2013; 7 (27): 93- 106.
5. Ahmadlou M, Rostami R, Sadeghi V. Which attention-deficit/hyperactivity disorder children will be improved neurofeedback therapy? A graph theoretical approach to neocortex through a neuronal network of ADHD. Neuroscience Lettera. 2012; 516: 156- 160.
6. Fernández T, Prado Alcalá R, Santiago E, FernándezBouzas A, Harmony T, Belmont H. Positive vs. negative reinforcement in neurofeedback applied to teach disabled children. Clin Neurophysiol. 2008; 119 (9): e163- 171.
7. Fuchs T, Birbaumer N, LutzenbergerW, Gruzelier JH, Kaiser J. Neurofeedback treatment for attention-deficit/hyperactivity disorder in children: a comparison with methylphenidate. Appl Psychophysiol Biofeed. 2003; 28 (1): 1- 12.
8. Breteler MH, Arns M, Peters S, GiepmansI, Verhoeven L. Improvements in spelling after QEEG-based neurofeedback in dyslexia: A randomized controlled treatment study. Appl Psychophysiol Biofeed. 2010; 35 (1): 5- 11.

9. Jahanseir M, FiroozAbadi SM, Ghoshouni M, MotieNasrabadi A. The effect of individual upper alpha band enhancing neurofeedback on reaction-time as an indicator of short-term memory in women employees. Iran South Med J. 2014; 17 (5): 834- 846.
10. Gunkelman JD, Johnstone J. Neurofeedback and the Brain. J Adult Develop. 2005; 12 (2): 93- 98.
11. Butnik SM. Neurofeedback in adolescents and adults with attention deficit hyperactivity disorder. J Clin Psychol. 2005; 61 (5): 621- 625.
12. Hammond C. Investigations in neuromodulation, neurofeedback and applied neuroscience. J Neurother. 2011; 15: 305- 336.
13. Besharat MA, Hamidi S, Rostami R, Farahani H. The effectiveness of neurofeedback training on EEG among children with attention-deficit/hyperactivity disorder. Contemporary Psychol. 2012; 7 (1): 3- 16.
14. Sadeghi N, Nazari MA, Alizadeh M, Kamali M. The effect of neurofeedback training on EEG and balance performance in children with reading disorder. MRJ. 2013; 7 (3): 32- 39.
15. Narimani M, Rajabi S, Delavar S. Effects of neurofeedback training on female students with attention deficit and hyperactivity disorder. AMUJ. 2013; 16 (2): 91- 103.
16. Masterpasqua F, Healey KN. Neurofeedback in psychological practice. Prof Psychol Res Pract. 2003; 34: 652- 656.
17. Loo SK, Barkley RA. Clinical utility of EEG in attention deficit hyperactivity disorder. Appl Neuropsychol. 2005; 12 (2): 64- 76.
18. Yaghoubi H, Jazayeri AR, KhoushabiK, Dolatshahi B, Niknam Z. Compare of effectiveness neurofeedback, Ritalin and mix treatment in the reduction of ADHD symptoms. Raftar Daneshvar J. 2008; 15 (31): 71- 84.
19. Mohammadi MR, Malmir N, Khaleghi A, Aminiorani M. Comparison of sensorimotor rhythm (SMR) and beta training on selective attention and symptoms in children with attention deficit/ hyperactivity disorder (ADHD): A trend report. Iranian J Psychiatry. 2015; 10 (3): 165- 174.
20. Deilami M, Jahandideh A, Kazemnejad Y, Fakour Y, Alipoor S, Rabiee F, et al. The effect of neurofeedback therapy on reducing symptoms associated with attention deficit hyperactivity disorder: A case series study. Basic Clin Neurosci. 2016; 7 (2): 167- 171.
21. Seilsepour M, Hamounpeyma E, Pirkhaefi A. The effect of neurofeedback therapy sessions on female elementary students with attention deficit and Hyperactivity in Varamin city, in 2013. J Navid. 2015; 18 (60): 24- 33.
22. Nouri Zadeh N, Mikaeili Mani F, Rostami R, Sadeghi V. The effectiveness of neurofeedback training on comorbid LD and ADHD. J Learn Disabil. 2013; 2 (2): 123- 158.
23. L□vesque J, Beauregard M, Mensour B. Effect of neurofeedback training on the neural substrates of selective attention in children with attention-deficit/hyperactivity disorder: a functional magnetic resonance imaging study. Neurosci Lett. 2006; 394 (3): 216- 221.
24. Yaghoubi H, Jazayeri AR, Khoushabi K, Dolatshahi B, Niknam Z. Neurofeedback specification efficacy on intelligent performance of attention deficit/ hyperactivity disorder children. Arch Rehabil. 2007; 8: 40- 52.
25. Rajabi S. Efficacy of neurofeedback in the correct brain's wave's amplitude and the visual-motor continuous performance with ADHD. J Psychol. 2015; 19 (1): 53- 70.
26. Mayer K, Blume F, Wyckoff N, Wyckoff SN, Strehl U. Neurofeedback of slow cortical potentials as a treatment for adults with attention deficit-/ hyperactivity

disorder. Clin Neurophysiol. 2016; 127 (2): 1374- 1386.
27. Lee EJ, Jung CH. Additive effects of neurofeedback on the treatment of ADHD: A randomized controlled study. Asian J Psychiatr. 2017; 25: 16- 21.
28. Steiner NJ, Frenette EC, Rene KM, Brennan RT, Perrin EC. Neurofeedback and cognitive attention training for children with attention-deficit hyperactivity disorder in schools. J Dev Behav Pediatr. 2014; 35 (1): 18- 27.
29. Kerstin M, Friederike B, Nicole W, Luisa Leonie B, Ute S. Neurofeedback of slow cortical potentials as a treatment for adults with attention deficit-/ hyperactivity disorder. Clin Neurophysiol. 2016; 127 (2): 1374- 1386.
30. Lee EJ, Jung CH. Additive effects of neurofeedback on the treatment of ADHD: A randomized controlled study. Adv Asian J Psychiatr. 2017; 25: 16- 21.
31. Steiner NJ, Frenette EC, Rene KM, Brennan RT, Perrin EC. Neurofeedback and cognitive attention training for children with attention-deficit hyperactivity disorder in schools. J Dev Behav Pediatr. 2014; 35 (1): 18- 27.
32. Narimani M, Rajabi S, Delavar S. Effects of neurofeedback training on female students with attention deficit and hyperactivity disorder. AMUJ. 2013; 16 (2): 91- 103.
33. Seilsepour M, Hamounpeyma E, Pirkhaefi A. The effect of neurofeedback therapy sessions on female elementary students with attention deficit and Hyperactivity in varamincity. J Navid. 2015; 18 (60): 24- 33.
34. Rajabi S. Efficacy of neurofeedback in the correct brain's wave's amplitude and the visual-motor continuous performance with ADHD. J Psychol. 2015; 19 (1): 53- 70.