

Effectiveness of Rehabilitation Package Based on Executive Performance of Signs (Child Behavior in Class, Participation and Group Cooperation, Attitude towards Authorities) in Children with Attention Deficit / Hyperactivity Disorder: Pilot Randomized Control Trial

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Original Article

Abstract

Introduction: Attention Deficit and Hyperactivity Disorder (ADHD) is caused by dysfunction of the central nervous system and may affect all activities by the individual. The aim of this study was to determine the effectiveness of rehabilitation package based on executive performance of signs (child behavior in class, participation and group cooperation, attitude towards authorities) children with ADHD.

Materials and Methods: The research project was a randomized clinical trial with the control group. 30 children with ADHD were selected from primary schools that were referred to in Isfahan health centers and clinics using convenient sampling and were randomly assigned into experimental and control groups. The experimental group underwent training in 11 2-hour sessions with the intervention of Dawson and Guare training package (target behavior, goal setting according to behavior, goal setting steps, monitoring, process evaluation, and gradual elimination of monitoring). The control group did not receive any parallel treatment process during the study (with the agreement of the child and the parents). Child behavior in the classroom, group participation and cooperation, attitude towards power authorities were assessed by the Connor Attention Deficit Hyperactivity Disorder Questionnaire. Data were analyzed using Mixed Model ANOVA.

Results: The results showed that Dawson and Guare educational package significantly improved the signs of ADHD including child behavior in the classroom, participation and group cooperation, and attitudes towards power authorities ($P \leq 0.001$ for all variables).

Conclusion: It seems that Dawson and Guare educational package may be effective in managing the signs of children suffering from ADHD like child behavior in the classroom, group participation and cooperation, and attitudes toward power authorities.

Keywords: Attention deficit hyperactivity disorder; School children; Child behavior in the classroom; Participation and group cooperation; Attitude towards power authorities

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Introduction

Attention Deficit/Hyperactivity Disorder (ADHD) is a type of central nervous system (CNS) dysfunction (1) characterized by disturbances in levels of attention and disturbance or hyperactivity/impulsivity (1). Among the characteristics of these people is the lack of

attention to detail in educational, occupational, and other activities and the loss of objects that do not match the level of developmental changes and age of the person. Hyperactivity and impulsivity are associated with high activity, restlessness, and inability to wait (2). Depending on the diagnostic criteria used, the

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prevalence of ADHD has been reported to be between 5.9 and 7.1% (1,2). The main problems of this group of children are behavioral inhibition and executive dysfunction. In other words, the child does not have sufficient skills to monitor his behavior and cannot regulate his behavior for a long time (3).

Children with ADHD are vulnerable in two important areas of school performance and peer communication. These children may not have inability to learn, but they have difficulty with school-related activities that may be due to poor organization, inattention, impulsivity, hyperactivity, and distraction (2). Students with ADHD are more likely to fail and be expelled from school if they do not receive adequate treatment, and often experience poor educational achievement and social and emotional adjustment problems (4). If hyperactivity is not properly diagnosed and treated, the result is ADHD in adolescence and adulthood, which puts the person at risk for poor academic performance, job failures, and aggression (3).

So far, no single factor has been identified as the cause of ADHD, and it is thought to occur as a result of complex interactions among different factors (4). Some children, for various reasons, such as overt and covert brain injuries or disorders such as ADHD or pervasive developmental disorders (PDDs), do not go through the normal process of executive function development and need executive interventions to achieve maximum performance and improvement (5). Children with ADHD have poorer executive functions compared to normal children (6). Any defect or impairment in executive function can cause attention deficit, difficulty remembering tasks, hyperactivity, impaired planning for starting and finishing tasks, memory impairment, and learning disabilities (2). This disorder causes significant problems for many students (4,7,8) and affects their cognitive, social, emotional, and family functioning, in addition to impacting their professional and marital performance in adulthood (2). Moreover, suffering from this disorder due to financial costs (7), imposing stress on the family (9), and being in conflict with job (3) and educational issues (2,3,9), puts a heavy burden on society. Therefore, the need to follow up and treat ADHD is especially felt at a younger age. Among the interventions that have had the greatest impact on children with ADHD are medication (6,9,10), executive function training packages (6,8,11), parental management training in child control skills (7,9,12), and methods of correcting the child's behavior at home and school (2,13-15). One of the newest methods introduced in the implementation of executive functions is the Dawson and Guare training package (5), which considers all executive functions (10).

Executive functions help the child to adjust his/her

behavior in two ways; the first method requires the use of specific intellectual functions to select goals. These functions include "planning, organizing, time management, working memory (WM), and metacognition" and help the child to create an overview of the goal and draw a shortcut to that goal and determine the resources they need along the way. The second method is the functions that he/she needs to guide their behaviors in the path of achieving the goal. These functions include "response inhibition, emotional control, attention retention, task initiation, flexibility, and goal-oriented pursuit" (5). Neuropsychologists believe that executive functions begin to form in early infancy and continue into adolescence and early adulthood (4). If the child does not succeed in acquiring these skills, he/she will have many problems adapting to the outside world (13). Therefore, these skills should be taught to children who are not able to acquire them (11,14,15).

What has the greatest impact on the treatment process of children with ADHD is the timely and early diagnosis of the disorder and the rapid referral of the child to a specialist, which allows to reduce the damage. Teachers in the primary school years have a significant role in the timely diagnosis. In other words, completing the Conners Teacher Rating Scale (CTRS) with the possibility of early detection of this disorder in the early years of school, can play an effective role in timely treatment of children and, consequently, correct behavior at home and school, educational achievement, and increased social and emotional adjustment of these children. It also provides the opportunity to examine the child's behavior in the classroom, participation and group cooperation, and attitudes towards the authorities.

Implementing the Dawson and Guare training package and executive function packages requires experienced instructors to implement it (11,14,15). For example, in order to teach executive skills to children, it is necessary for the instructor to define the target behavior in the first step. In the second step, he must specify the goal according to the type of behavior and in the third step, he must determine the set of steps to achieve the goal and then prepare checklists for the methods to be followed. In the fourth step, the instructor must monitor the way the child uses. In the fifth step, he evaluates the process and, if necessary, makes changes in the training program and in the sixth step, gradually removes the supervision (5).

Recent research on executive function training packages and their satisfactory results is a reason to use it in clinical practice. Empirical evidence for the effect of this treatment on a variety of disorders is increasing, but

very few studies have specifically examined the effect of the Dawson and Guare training package, and it can be said to some extent that there is no study to specifically address school and student functions, in particular, the child behavior in the classroom, participation and group cooperation, and attitude towards the authorities. For example, in their study, Azizian examined the effectiveness of executive function educational interventions for children with cognitive impairment and reported that executive function instruction can be effective on children with cognitive impairment and strengthen their executive skills (8). The results of the study by Madani et al., which was conducted to evaluate the effectiveness of the executive functions training program on reducing the symptoms of children with ADHD, showed that this program has significantly reduced the symptoms of ADHD in children in the experimental group (11).

Materials and Methods

This study was a randomized clinical trial with a control group in which the use of the Dawson and Guare training package was investigated as an independent variable and the ADHD symptom score in CTRS including child behavior in the classroom, group participation and cooperation, and attitude towards authorities as the dependent variable. The therapeutic intervention (the Dawson and Guare training package) was performed as a group for the experimental group. The study population included primary school children living in Isfahan, Iran. Due to the limitations of the statistical population, the samples were selected by the convenience method and random selection by referring to all primary schools in District 6 education department of Isfahan.

The study inclusion criteria included diagnosis of ADHD based on the classification of the Diagnostic and Statistical Manual of Mental Disorders-5th Edition (DSM-V) in the primary school children with a disorder clinically confirmed by a clinical child and adolescent psychologist, parents and children's willingness to participate in the study, and lack of use of psychotherapy and medication at the same time. In addition, lack of cooperation, not doing the homework presented in the sessions, absence of more than 2 sessions, and withdrawal from the study were also considered as the exclusion criteria. The DSM-V is used by psychologists and psychiatrists to diagnose mental illness. This guide was published by the American Psychiatric Association (APA) and covers all different categories of mental disorders in both adults and children (1). This guide is not a theoretical guide and focuses mainly on describing the symptoms

of the disease, statistics on which sex is more exposed to the disease, the common age of onset, the effects of treatment, and common therapeutic approaches (1).

The code of ethics in research was received from the Clinical Council and Vice Chancellor for Research, University of Isfahan. Information about the type of treatment, how people attended the sessions, and the number and timing of the sessions was provided to the children and their parents. Confidentiality as a basic principle in treatment was explained to them, and finally, clients who expressed their consent to participate in the groups were selected. Due to the lack of a similar study in this field, the present study was designed and conducted as a pilot study with 15 people in each group. Finally, among the clients, 30 children with ADHD were randomly selected (the first 15 on the list for the experimental group and the second 15 as the control group). In this way, the two sections of the client list were selected respectively as the experimental group and control group by lottery.

The counselors and teachers of the target schools were asked to identify students with ADHD symptoms. To ensure the presence of ADHD, the CTRS (recommended in the research) (7,8,15) was presented. To assess the child's behavior in the classroom, group participation and cooperation, and attitudes toward authorities in children with ADHD, the CTRS was utilized. This questionnaire, designed by Brock and Clinton, contains 38 items that are completed by teachers before and after the program. The items were scored using a four-point Likert scale (not at all, somewhat, much, and very much with scores from 0 to 3, respectively). This questionnaire consists of three subscales of child behavior in the classroom (items 1 to 21), group participation and cooperation (items 22 to 29), and the attitude towards authorities (items 30 to 38), with the minimum and maximum total scores of 38 and 114, respectively. This tool is used as the most common scale for measuring the severity of ADHD symptoms. The higher the score, the more severe the disorder in the child, and vice versa. The validity and reliability of the CTRS in Iran were evaluated by the Institute for Cognitive Science Studies and its reliability was reported to be 0.85 (12). In their study of the psychometric properties of the CTRS, Shahim et al. found that the internal consistency (IC) (using Cronbach's alpha coefficient) was 0.76 for the whole scale and 0.87, 0.79, and 0.81 for the three subscales of child behavior in the classroom, group participation and cooperation, and attitudes toward authorities, respectively (15). Therefore, the validity and reliability of this scale were confirmed (12,15).

Table 1. Dawson and Guare training package sessions

Session	Treatment content
1	Response inhibition: Teaching a competing skill that replaces the child’s uninhibited response. For example, in the classroom, a child may always interrupt involuntarily other people’s conversations. Therefore, he/she should be taught to raise his/her hand and ask for permission first before starting to speak.
2	WM: describing the problem as you see it in the child; Teaching a diverse set of signs and clues, practicing the association between clues and WM, creating a monitoring system
3	Emotional control: Explaining the skill to the child, practicing the skill, encouraging the child, guiding the child to apply the skill in real life situations, encouraging the child to use the skill correctly
4	Sustained attention: providing solutions for sustained attention and maintaining focus, internalization of environmental and external solutions
5	Homework initiation: training to do homework immediately, planning training
6	Planning: Planning training through accompaniment tasks and assignment of planning task , teaching reminding methods
7	Organization: Providing a plan for cleaning the room, providing a way to organize school bags, providing a way to organize homework, providing a way to tidy the desk both at school and at home
8	Time management: helping to have a clear understanding of tasks, teaching a realistic understanding of tasks, knowing how obstacles affect the plan and time
9	Goal-oriented pursuit: objectification of temporary and short-term goals
10	Flexibility: Learning to deal with new programs, activities, and situations, individual participation in more structured social experiences
11	Metacognition: preparing error monitoring checklists, identifying errors, teaching problem solving strategy

WM: Working memory

On the other hand, the symptoms of ADHD in children were also evaluated using DSM-V. The intervention consisted of 11 two-hour group sessions using the Dawson and Guare training package once a week. Data were collected and analyzed by a PhD student in Educational Psychology and a professor of Psychology and Educational Sciences. A summary of the content of the treatment plan is presented in table 1.

With the agreement of the child and the parents, the control group did not have a parallel treatment process during the study, but it was decided that after the study, they would also receive the Dawson and Guare training package.

Data were analyzed using the mixed model analysis of variance (ANOVA) method in SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered as the significance level.

Results

The aim of the present study was to investigate the

effect of Dawson and Guare educational package on the ADHD symptoms in children with primary. The study lacked any sample dropout and therefore, no Intention-to-treat (ITT) analysis was performed. In the present study, the Cronbach’s alpha coefficient for the components of child behavior in the classroom, participation and group collaboration, attitude towards authorities, and the whole questionnaire were 0.87, 0.79, 0.81, and 0.89, respectively. The demographic characteristics of the study samples by group are given in table 2.

In both groups, a higher percentage of mothers were less than 30 years old and the level of literacy was less than a diploma, but a higher percentage of fathers in the experimental group were more than 30 years old and the control group was less than 30 years old, and the level of literacy was higher than the diploma. In terms of gender, the higher percentage of both groups were boys. It should be noted that before performing mixed model ANOVA, the hypotheses related to this test were tested.

Table 2. Demographic characteristics of the subjects

Group	Parents’ age				Gender		Mother’s literacy level		Father’s literacy level	
	Mothers under the age of 30	Mothers over the age of 30	Fathers under the age of 30	Fathers over the age of 30	Girl	Boy	Below diploma	Above diploma	Below diploma	Above diploma
Experimental	9 (60.0)	6 (40.0)	3 (20.0)	12 (80.0)	6 (40.0)	9 (60.0)	8 (53.3)	7 (46.7)	7 (46.7)	8 (53.3)
Control	10 (66.7)	5 (33.3)	9 (60.0)	6 (40.0)	7 (46.7)	8 (53.3)	9 (60.0)	6 (40.0)	6 (40.0)	9 (60.0)
Total	19 (63.3)	11 (36.7)	12(40.0)	18 (60.0)	13 (43.3)	17 (56.7)	17 (56.7)	13 (43.3)	13(43.3)	17 (56.7)

The data distribution for all variables in the two groups followed the normal distribution and the results of Levene’s test indicated that the homogeneity of variances for the variables of child behavior in the classroom ($F = 0.720, P = 0.779$), group cooperation ($F = 0.050, P = 0.605$), and attitude towards authorities ($F = 0.087, P = 0.782$) was established. However, the default assumptions of sphericity were not established ($P = 0.039$) and the relationships between the variables were likely to change the values of the dependent variable, thus increasing the chance of the first kind of error. Accordingly, alternative analysis (Greenhouse-Geisser test) was applied to reduce the chance of the first kind of error by decreasing the degree of freedom (10). A comparison of the changes between the two groups during the study is presented in table 3.

Based on the data reported in table 3, training of the Dawson and Guare package significantly reduced the mean scores of ADHD symptoms in children. Therefore, this educational package had a significant effect on the mean scores of child behavior in the classroom, participation and group cooperation, and attitudes toward authorities in primary school children with ADHD in the post-test stage. Some of the data were of a high sparsity, which caused the standard deviation (SD) to be very large in some cases. Power analysis showed that in all variables studied, the study power of the intergroup and intragroup (experimental group) comparisons was more than 0.8.

The results of the mixed model ANOVA analysis showed that the mean scores of ADHD symptoms in preschool children based on CTRS changed significantly (Table 4).

Training the children using the Dawson and Guare package significantly improved their behavior in the

classroom, group cooperation, and attitudes toward authorities based on the CTRS scores compared to the pretest and also compared to the control group; so that 85% of the variable changes in ADHD symptoms in primary school children were explained by the interaction of variable stages and grouping.

Discussion

The aim of this study was to investigate the effectiveness of a native package of teacher-specific executive function training on the symptoms of ADHD in primary school children. The results revealed that the native Dawson and Guare education package could be effective in reducing the symptoms of ADHD in primary school children compared to the control group who did not receive treatment, which was consistent with the results of previous studies (11-19). Kermanshahi et al. concluded that the evolution of executive functions in preschool and elementary school boys and girls aged 5 to 12 years with ADHD in Isfahan was increasing given age; however, the executive functions of girls and boys were the same (18). Children with ADHD also have difficulty with executive functions such as planning homework, writing, drawing, or other complex activities (11). In the native Dawson and Guare training package, the child is taught to follow them while doing homework and activities. For example, before starting the homework, a short schedule is prepared and the necessary materials and tools are prepared to do the homework, and a timer is placed next to the child while doing the homework, or the child is helped when completing complex homework by structuring questions. Furthermore, learning to use verbal strategies before and after a task or activity can be helpful (7).

Table 3. Scores of the Conners Teacher Rating Scale (CTRS) in children with Attention Deficit/Hyperactivity Disorder (ADHA) in the experimental group (with Dawson and Guare package training) and control group in the pre-test and post-test stages

	Component	Groups	Pre-test	SD	Post-test	SD	Intra-group P
Dimensions of ADHD symptoms	Behavior in the class	Experimental	46.20 ± 5.65	0.33	37.93 ± 5.29	0.34	0.0010
		Control	46.20 ± 5.65	0.34	46.80 ± 7.23	0.34	0.0010
		Inter-group P	0.0001		0.0001		
	Group participation and cooperation	Experimental	17.53 ± 3.26	0.38	9.53 ± 2.22	0.47	0.0010
		Control	16.73 ± 3.15	0.33	17.00 ± 3.17	0.32	0.0010
		Inter-group P	0.0001		0.0001		
	Attitude towards authorities	Experimental	19.60 ± 4.04	0.33	11.66 ± 2.98	0.53	0.0010
		Control	20.00 ± 4.55	0.27	20.66 ± 4.46	0.27	0.0010
		Inter-group P	0.0001		0.0001		
	Total score	Experimental	83.333 ± 76.60	0.74	13.59 ± 33.60	0.28	0.0010
		Control	92.82 ± 71.70	0.65	46.84 ± 11.80	0.19	0.0010
		Inter-group P	0.0001		0.0001		

SD: Standard deviation

Table 4. Mixed model analysis of variance (ANOVA) to investigate the intra- and intergroup effects on the symptoms of the Attention Deficit/Hyperactivity Disorder (ADHA) variable

		Total squares	Degree of freedom	Mean squares	F statistic	P	Effect size	Test power
Symptoms of ADHD	Steps	3607.22	1.37	2617.48	195.30	0.0001	0.84	1
	Grouping	7200.27	1.00	7200.27	50.55	0.0001	0.64	1
	Interaction of stages and grouping	3806.29	1.37	2761.93	206.08	0.0001	0.85	1
	Error	517.15	38.58	13.40				

ADHD: Attention Deficit/Hyperactivity Disorder

Improvement in executive functions is also associated with improvement in cognitive and metacognitive processes (8). This approach was found useful in the study by Klassen et al. for subjects with ADHD (19). In this regard, it was found that the training program of response inhibition and sustained attention significantly reduces the symptoms of ADHD in children (11). In the executive function training package, checklist exercises for error monitoring, problem solving strategy, behavioral regulation, planning through reminding, organizing, managing time, strengthening WM by practicing association between clues, inhibiting response by competing skill training, emotional control, sustained attention, internalization, and initiation of cognitive homework and flexibility are considered (5), which has a positive effect on improving the child's behavior in the classroom, group participation and cooperation, and attitudes toward authorities, and improvement in these processes is also associated with the natural reduction of children's ADHD symptoms. The main reason for this effect is that the desired activities in training executive functions are related to cognitive processing (the frontal lobe of the brain); that is, exactly where children with ADHD are harmed (20). Therefore, this training package can be useful in improving the symptoms of children with ADHD and, more effectively, in the child's behavior in the classroom, group participation and cooperation, and attitudes toward authorities. The present study seems to be the first in Iran on children with ADHD that specifically examined the effect of the Dawson and Guare educational package on child performance and interaction in the class.

Limitations

The use of the convenience sampling method, limitation of individuals to one disorder and one city due to financial and time constraints, and lack of studies on the rational and scientific effects of the Dawson and Guare executive function training package on child performance in the class were among the limitations of the present study. Moreover, the impossibility of matching groups in terms of the

severity of symptoms of hyperactivity in children and economic, social, and cultural status were among the limitations of the present study; Because the severity of hyperactivity and the level of family culture affect the rate of parental follow-up and proper exercise at home and school (7).

Recommendations

It is suggested that the effectiveness of Dawson and Guare methods be compared with other treatments, including medication.

Conclusion

Based on the results of the present study, the Dawson and Guare training package had a significant effect on improving ADHD symptoms in children. Therefore, its use may be effective for Iranian children with ADHD, and it is recommended to be used alone or in combination with other treatments or educational packages for primary school children with ADHD.

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Authors' Contribution

Khalil Ghasemi: study design and ideation, study support, executive, and scientific services, providing study equipment and samples, data collection, specialized statistics services, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of

scientific concepts, final manuscript approval to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to the publication, and responding to the referees' comments; Mohammad Bagher Kajbaf: study design and ideation, study support, executive, and scientific services, providing study equipment and samples, specialized statistics services, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, final manuscript approval to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to the publication, and responding to the referees' comments; Amir Ghamarani: study support, executive, and scientific services, providing study equipment and samples, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, final manuscript approval to be submitted to the journal office, responsibility for maintaining the integrity of the study process from the beginning to the publication, and responding to the referees' comments; Hajar Torkan: study support, executive, and scientific services, providing study equipment and samples, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, final manuscript approval to be submitted to the

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Conflict of Interest

The authors declare no conflict of interest. Khalil Ghasemi attracted the budget for the basic studies related to this study. Dr. Mohammad Bagher Kajbaf has been a faculty member of the University of Isfahan since 1991 and Dr. Amir Ghamarani (Supervisor) since 2010 and Dr. Hajar Torkan (Supervisor) has been an Assistant Professor at the Isfahan (Khorasgan) Branch, Islamic Azad University since 2011.

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