

Parents and Teachers Intervention for Children with Attention Deficit Hyperactivity Disorder Abstract

maede Hosseinnia

Isfahan University of Medical Sciences

Maryam Amidi Mazaheri (✉ maryamamidi@hlth.mui.ac.ir)

Isfahan University of Medical Sciences School of Public Health <https://orcid.org/0000-0002-0169-5997>

zahra Heidari

Isfahan University of Medical Sciences

Research

Keywords: Attention Deficit Hyperactivity Disorder, Teachers, Parents, education, Intervention, children, Iran

Posted Date: September 20th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-903260/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Parents and Teachers Intervention for Children with Attention Deficit Hyperactivity Disorder

Abstract:

Background: this study evaluated the effect of parents and teachers educational intervention to decrease the ADHD symptoms in children.

Method: Seventy-two children and their parents and teachers participated in this quasi-experimental study and randomly divided into two groups of test and control. Data collected by CSI4-questionnaire. Parents and teacher in test group participated in training sessions. Student's ADHD symptoms were assessed before and after the educational intervention.

Results: Two months after the intervention, based on parent and teacher report, the ADHD symptoms was decreased significantly only in test group students.

Conclusion: parents and teachers training and developing appropriate strategies can diminish ADHD symptoms in all three aspects including inattention and reduce the side effects of ADHD.

Trial registration: The study was approved by the by the Research Deputy of Isfahan University of Medical Sciences. In addition, The Ethical Committee of Isfahan University of Medical Sciences approved the study proposal. (ID code: IR.MUI.RESEARCH.REC.1398.297). The required permission from Education Department of Isfahan City was attained. Participation in the study was voluntary. Before taking part in the study, selected teachers provided written consent also study goals were described to them.

Key words: Attention Deficit Hyperactivity Disorder, Teachers, Parents, education, Intervention, children, Iran

Background

Defining as a neurodevelopmental disorder, Attention Deficit Disorder with Hyperactivity (ADHD) is the most common developmental age disorder, which affects many children around the world and progresses with hyperactivity, lack of attention, and impulsivity(1).

According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V-TR), there must be at least six of the nine problematic behaviors in a child confirmed by a mental health professional in order to diagnose ADHD. To ensure the diagnosis, it must last for at least 6 months, develop in two environments (e.g. school and home), and cause problems in the child's academic and educational performance(2).

ADHD is highly heritable(3). The evidence all over the world indicate that the prevalence of ADHD is increasing significantly over recent years (4-7).Because of heterogeneity in the methodological approaches to diagnosis and reporting systems, various studies have reported prevalence rates for ADHD in a very wide range (from 0.2 to 34.5%)(1).A recently published population-based survey among 30,532 children and adolescents between 6 and 18 years in Iran reported that the prevalence of ADHD was 4%, with more prevalence among boys (5.2% vs. 2.7%)(8).

The consequences of this complex disorder not only adversely affect the different aspects of the functioning of the individual but also affects the members of the family and society(9, 10). Also, many children with ADHD have at least one comorbid psychiatric disorder such as Learning Disorders, Anxiety Disorder, Behavior Disorder, Oppositional Defiant Disorder, and Depression(11). As a result, ADHD is considered a complicated disorder with a variety of impairments in main life activities particularly in the areas of educational functioning, family, and peers. The disorder is also famous to increase a range of risks for health-related impairments such as accidental and self-inflicted injuries (12-14).

Despite the fact that pharmacotherapy is the frontline of ADHD symptom(15), psychosocial interventions are a key factor to the management of ADHD functional impairment, so the American Academy of Pediatrics strongly recommend considering the combination of medication and behavioral treatments to manage ADHD properly(16). To manage the behavioral problems of children with ADHD a range of interventions are designed. Parent training and school-based interventions are well-established kinds of behavioral treatments for children with ADHD(17).

Because of the consequence of their symptoms and executive functioning deficits or self-regulatory, children with ADHD pose significant management problems for their families. Thus, it is important that parents be involved in any kind of ADHD treatment. When managing children's ADHD symptoms and associated impairments, parents deal with numerous challenges often resulting in high levels of parenting stress compared to the general population(3). High levels of parenting stress among parents of children with ADHD adversely affect the quality of parent– child relationships. They are less able to engage in behaviors that are helpful in addressing their child's psychopathology(18).

A community-based study of children with and without ADHD revealed that even when taking into account the severity of child ADHD symptoms and other comorbid conditions, negative parenting behaviors were associated with poorer child social and emotional functioning(19). To help parents manage child behavior problems, parent training targets dysfunctional parenting practices, such as inconsistent, negative, and punitive behaviors(16).

On the other hand, teachers have a key role to play in identifying, referring, and treating hyperactive students(20).Informing teachers about this disorder is an important issue. Knowing how to properly treat a hyperactive child makes teachers realize that the child's inappropriate behavior is not intentional, therefore they would improve their understanding and acceptance of the child(21) and will have a positive attitude towards them. It also makes the children feel better about themselves and use a more effective way to improve their behavior instead of self-blaming(22) when children with ADHD present in class, their teachers face numerous challenges(17, 23). Therefore, teachers need efficient knowledge about the problems and special needs of children with ADHD and they have to plan effective behavior management strategies in dealing with those children (10, 24).

Although parent and teacher training programs have beneficial effects for children with ADHD, these approaches often target only one system (for example, at home or at school) at the same time (9, 25, 26). However, the effectiveness of simultaneous intervention with regard to improving ADHD symptoms is limited.

This study focuses on parents, teacher training simultaneously, since involving parents and teachers in treatment are likely to address home, and school problems, all of which contribute to child symptoms. The present study aims to determine the effects of an educational intervention for parents and teachers of students with ADHD in elementary schools in Isfahan, Iran.

The study hypothesizes that parents and teacher participation in the intervention would lead to a decrease in children's ADHD symptoms.

Methods

Participants and procedure

This quasi-experimental study with a randomized control group before and after was conducted in Isfahan province of Iran, in the autumn of 2020. Seventy-two children and their parents and teachers participated in the study. Research Deputy of Isfahan University of Medical Sciences provided ethical approval for the study (397796). Also, the Ethical Committee of Isfahan University of Medical Sciences approved the study proposal. (ID code: IR.MUI.RESEARCH.REC.1398.297).

In addition, the Education Department of Isfahan City provided the required permission.

Initially, among the five Education Offices in Isfahan, one of them was randomly selected (Office 3); then, 12 elementary schools were chosen randomly from the list of the elementary schools in that area (six public primary and six private schools). Selected schools were randomly assigned as the intervention group or the control group.

In the selected schools, all students were identified with a definitive diagnosis of ADHD based on their medical records, and 75 parents and 52 teachers were invited to participate in the study and were assessed against inclusion criteria. Finally, according to the inclusion criteria, qualified parents and teachers participated in the study as intervention or control. A total of 5 parents and 2 teachers were not available and were excluded from the study, including 2 parents, 2 teachers from the experimental group and 3 parents from the control group. Finally, 70 parents and 50 teachers entered the final analysis(Figure1).

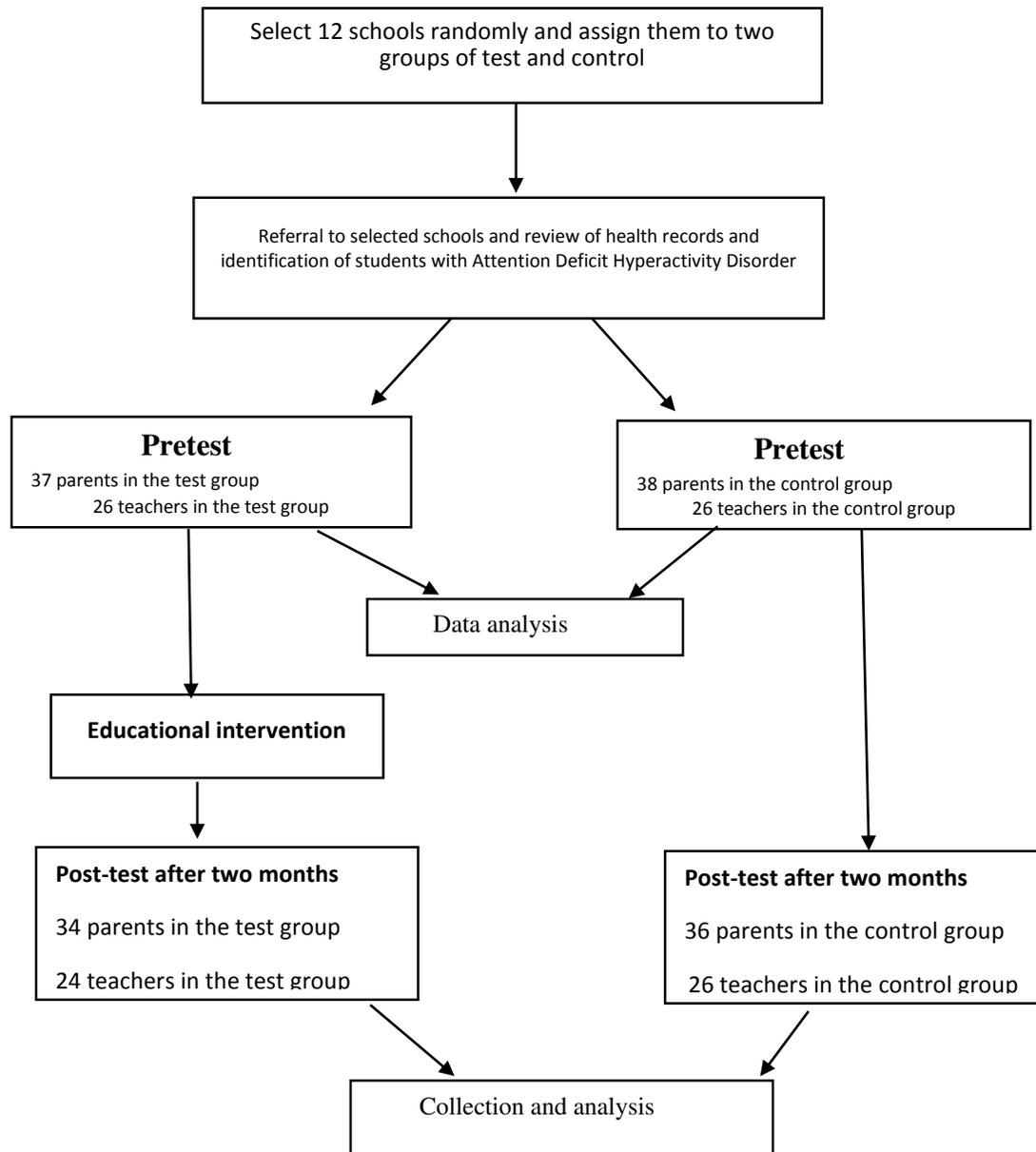
For inclusion in the research, students in both groups were required to (a) be between the ages of 6 and 12 years, (b) have a confirmed diagnosis of ADHD by a specialist, (c)have no history of pervasive developmental disorder, neurological disorder, and traumatic brain injury according to the parent report.

Parents were considered eligible to participate in the study if meet the following inclusion criteria: (a) have children who fulfilled mentioned above inclusion criteria, b) being willing to participate, c) be able to read and write.

To participate in this study, teachers required to meet the following inclusion criteria: (a) being willing to participate, (b) having at least two years' work experience as a schoolteacher. Parents and teachers were excluded from the study if they were unavailable to complete the post-test or dropped more than two sessions of training.

Participation in the study was voluntary. Before taking part in the study, selected parents and teachers were signed written consent, also study goals were described to them. After being informed by a member of the research project, eligible parents and teachers in selected schools (in both groups) attended a single assessment session of 30 minutes to complete the assessment tools before the intervention. The training sessions were provided only for the parents and teachers in the intervention group. After 2 months, participants in both groups completed the questionnaires again. Refreshments were provided during parent and teacher training sessions. Participants in the control group were offered free educational sessions after completion of the study.

Figure 1: Steps of the method of implementing the educational intervention



Measures

Developed by Gadow KD, Sprafkin, the parent and teacher versions of The ADHD Symptom Checklist-4, a DSM-IV-referenced rating scale, were used to measure ADHD symptoms (27).

The 50-item ADHD-SC4 comprises six scales: ADHD: Hyperactive-Impulsive (HI), ADHD: Inattentive (IA), ADHD: Combined, Peer Conflict Scale, Oppositional Defiant Disorder, and Checklist of the Symptom Side-Effects. However, in the current study, only items from the 9-item IA and 9-item HI scales were used. All items on the scales are scored on a Likert-type scale ranging from zero (never) to three (very often). Internal consistency, reliability also convergent and discriminant validity with respective scales for the IA

and HI scales have been examined and supported previously (27-29). The psychometric properties of the IA and HI scales (parent and teacher versions) in Iran have been examined and confirmed by Mohammad Esmaeel (30). The important characteristics of Children, their parents, and teachers as sex, age, school type, pharmacotherapy for ADHD were assessed with the demographic information checklist.

Intervention:

Performing separately for parents and teachers, the intervention was provided as group training sessions offered through a neighborhood public school that was consisted of weekly sessions only for the participants in the intervention group, spread over 3 months.

Parent training:

The research team chose the parent training manual, Defiant Children (Barkley, 1997) (31) as an intervention design framework and adapted it as possible for use with Iranian families.

The skilled and trained educator in the field of ADHD delivered every session. Two experienced and interested teachers helped the educator as facilitators. Every session ran for 60 to 90 minutes (including a 10-min break). Lecture, question and answer, role-playing, and active participation in group discussion were used as main and supportive activities in the intervention.

The participants were encouraged to contribute their comments and questions during the presentation. In each session, two trained facilitators encouraged parents to explore, discuss, and practice learned behavioral techniques. By engaging in-group work, parents had the best opportunity to listen, pay attention to others' experiences, and share similar experiences with each other. They could modify approaches to their situations and achieve confirmation and support, for their individual practices to become more confident and effective to apply the behavioral techniques to their child in challenging to handle daily life situations. Each session is briefly presented below.

Session1: General Information on ADHD

In the beginning, to improve parent's knowledge about ADHD and parental perceptions of the degree of deviance of their child's behavioral problems, the educator provided a brief overview of the nature, prognosis, developmental course, and etiologies of ADHD. Facilitators provided parents with additional reading materials such as pamphlets and books.

Session2: The Causes of Defiant /Oppositional Behavior

In the second session, the educator tried to correct potential misconceptions that parents have about defiance. So major contributors to the development of defiant or oppositional behavior in children such as child and parent characteristics, situational consequences for coercive and oppositional behavior, and stressful family were deeply discussed.

Session3: Improving Parental Attention

In this session, to increase the value of parents' attention to their children, more effective ways of attending to child behavior were trained. In this technique, occasional positive statements and verbal narration are provided to the child only when he/she displays appropriate behaviors. Parents were trained to increase their attention to compliant child behaviors while greatly reducing the amount of attention to unsuitable behaviors, as well as ignoring as much negative behavior as possible.

In addition, techniques of giving effective commands, eliminating or reducing setting activities that compete with child task performance, increasing imperatives, reducing task complexity were educated.

The facilitators encouraged parents to increase the frequency with which they give brief and effective commands to their children and to reinforce each command obeyed.

Session4: Creating a Home Token Economy

In this session first, the concept of the token economy was taught to parents. The educator emphasized that to maintain suitable behavior and compliance, children with ADHD require more immediate, frequent, and noticeable consequences for their behaviors. Therefore establishing a home token economy is critical to managing behavioral problems of children with ADHD. Parents were asked to list most of the children's home responsibilities and privileges and then allocate point or chip values such as points recorded in a notebook to each. To maintain the motivating properties of the program, they were encouraged to have a variety of incentives reinforces on their menu.

In the first week of establishing a home token economy, parents were asked to be generous in awarding points to children for even minor instances of correct behavior. Participants were encouraged to create and retain a home token economy for at least six to eight weeks to allow the newly developed contact patterns to convert to habitual patterns.

Session5: Creating a Home Token Economy (continued)

Since the token economy is an unfamiliar concept in the culture of Iranian families, most of the parents reported much difficulty implementing the home token economy. Hence, the fifth session extended the home token economy developed in session 4. Participants were encouraged to express their challenges and concerns. The educator and facilitators patiently answered the parent's questions.

Session6: Applying Time Out Technique for Noncompliance Behaviors

To enable families to use response cost (removal of points or chips) contingent on non-compliance, an effective time-out-from-reinforcement technique was taught to parents.

First, the time-out procedure was introduced and its conditions and rules were expressed. Then parents practiced how to use this technique by role-playing.

Session7: Applying Time Out Technique for Noncompliance Behaviors (continued)

Similar to the token economy concept of the time-out procedure is unfamiliar in the culture of Iranian families; therefore, they reported much difficulty to implement it in their home. Parents in this session learned no new material; instead, any prior problems and challenges with applying this technique were reviewed and improved. Parents shared their experiences with each other and extended their abilities to use time out to noncompliant behaviors.

Session8: Managing Noncompliance Behaviors in Public Places

Participants were trained to generalize their home behavioral management procedures to troublesome public places. They learned just before entering public places, stop and review two or three rules with their child, which the child may have formerly disobeyed and explain to he/she what reinforces are obtainable for obedience in the place, then explain what punishment may occur for disobedience, and finally give the child an activity to do during the outing.

Session9: Refining Child School Behavior from Home

To help parents appropriately support their child's teacher with the management of behavior problems in the classroom, the educator focused on the use of a home-based reward program. The daily school behavior report card was introduced to parents. In addition, they were taught how to use this report card as the means by which consequences later in the day will be dispensed at home for classroom behavior.

Session10: Review and Summary

In the last session, the concepts and techniques taught in previous sessions were concisely reviewed, problems and difficulties, which have arisen in the last days, were discussed, and correction plans suggested to them.

Teacher training:

Based on review of relevant literature, the Classroom Accommodations for Children with ADHD (32) was chosen by researchers as an intervention design framework. The trained and skilled educator in the field of ADHD delivered every session. Every session ran for 45 minutes to 1 hour (including a 10-min break) and it was presented in lecture format. In addition, role-playing, and active participation in-group discussion were used as supportive activities in the intervention.

The participants were encouraged to contribute their comments and questions during the presentation. In each session, two trained facilitators encouraged teachers to explore, discuss, and practice learned managing strategies. By engaging in-group work, teachers had the best opportunity to listen, pay attention to others' experiences, and share similar teaching and managing experiences with each other. They could modify approaches to their class situations and achieve confirmation and support, for their individual practices to become more confident and effective. The content of the sessions was as follows:

Session 1: The definition of ADHD, its symptoms and diagnosis, ADHD etiology and epidemiology, short term and long term consequences of ADHD, manifestations in the classroom, common treatment strategies.

Session 2: the main principles that must be considered for the planning and management of programs for affected students with ADHD

Session 3: the main behavior strategies that must be taken by the teacher to increase incentives, for example, increase praise, approval, and appreciation of student's good behavior and work performance.

Session 4: self-awareness training, to display student work productivity on a daily chart or graph on the public

Session 5: fundamental methods and measures to make rules and time clearer for affected students with ADHD

Session 6: The possible punishment methods in case of necessity. Also in the last session, a summary of medications used for treatment of ADHD was provided to point out the effect of probably side effects such as stomachaches, insomnia, decreased appetite, growth problems, and irritability.

Statistical Analysis;

Even though we randomly assigned the parents and teachers to the two groups, possible differences could exist between them. The main demographic characteristics such as parents and teacher's age and level of education, student's sex, school type (private or public), attending any training workshop about ADHD were compared between the parents and teachers in intervention and control groups using descriptive statistics, Chi-square test and independent-sample t-test.

Independent t-tests were applied in both groups to examine the effects of the intervention on parent and teacher-rated symptoms of ADHD before and after the intervention. To examine the effect of the educational intervention analysis of covariance (ANCOVA) was applied. The post-intervention scores were set as the dependent variables and the group (two levels: intervention and control group) was set as a fixed factor as well as pre-intervention scores were set as covariates and controlled for.

Statistical analyses were done by the 20th version of the Statistical Package for the Social Sciences (SPSS) for Windows, with $p = 0.05$ as the significance level.

Results:

Independent t-test showed that there was no significant difference between the mean and standard deviation of age of students in the experimental and control groups. In addition, the average work experience of teachers in the experimental and control groups was not significantly different and the groups were in the same situation.

Table 1 shows the characteristics of the study population in the experimental and control groups. The number of students who take the medicine was about 20% and 25% in the experimental and the control group respectively. The majority of students in both groups lived with their parents (about 75% and 78% in the experimental and the control group respectively).

According to the demographic characteristics analysis, no significant differences were found (all $p \geq .05$) between the parents and teachers in intervention and control groups.

In the experimental group, the results showed a significant improvement on parent-reported inattention, hyperactivity symptoms. In the control group, there was no significant pre-to-post improvement on parent measures.

On teacher measures, there were significant changes in either inattention, hyperactivity symptoms in the experimental group but there were no significant changes in the control group.

Table 1- Child and family characteristics for the Two Groups (Intervention vs. Control).

Variable	Experimental		Control		Test P	
	Num.	%	Num.	%		
Sex	female	18	50	18	50	0.059
	Male	18	50	18	50	
School type	Public	24	66/7	27	66/7	0.59
	Private	12	33/3	12	33/3	
Medicine consumption	Yes	7	19/4	9	25/0	0.38
	No	29	80/6	27	75/0	
legal custody	Parents	27	75	28	77/8	0.43
	One parent (mother)	4	11/1	5	13/9	
	One parent (father)	4	11/1	4	11/1	
Father's education	A.D	6	16/7	6	16/7	0.26
	B.S	8	22/2	9	25	
	M.A or M.S	20	55/6	17	47/2	
Mother's education	Higher	5	5/6	4	11/1	0.50
	A.D	6	16/7	8	22/2	
	B.S	8	22/2	5	13/9	
	M.A or M.S	19	52/8	17	47/2	
Father's job	Higher	3	8/3	6	16/7	0.42
	employee	23	63/9	20	55/6	
	Freelancer	9	25	12	33/3	
Mother's job	Worker	4	11/1	4	11/1	0.59
	employee	16	44/4	13	36/1	
	housewife	20	55/6	23	63/9	

Table 2: Mean and Standard Deviations of ADHD Scores According to Teacher Report over Time for the Two Groups (Intervention vs. Control).

Variable	Intervention group (n=24)				Control group (n=26)				P-value ^b
	Baseline M (SD)	End M (SD)	Change M (SD)	P-value ^a	Baseline M (SD)	End M (SD)	Change M (SD)	P-value ^a	
Inattentive (IA)	26.91 (6.84)	22.23 (6.55)	-4.67 (3.49)	< 0.001	28.25 (6.43)	28.02 (6.48)	-.22 (1.14)	0.245	<0.001
Hyperactive-Impulsive (HI)	28.41 (5.28)	23.32 (5.78)	-5.08 (3.81)	<0.001	27.33 (6.72)	26.94 (6.74)	-.38 (1.07)	0.057	<0.001

Combined	55.32 (9.39)	45.55 (10.72)	-9.76 (5.69)	<0.001	55.58 (10.22)	54.97 (10.43	-.61 (1.66)	0.064	<0.001
----------	-----------------	------------------	-----------------	--------	------------------	-----------------	----------------	-------	--------

P-value <0.05 was significant

Data reported based on Mean (SD)

^a P-value was obtained from paired t-test

^b P-value was obtained from ANCOVA adjusted for baseline

Table 3: Mean and Standard Deviations of ADHD Scores According to Parent Report over Time for the Two Groups (Intervention vs. Control).

Variable	Intervention group (n=۳۴)				Control group (n=۳۶)				
	Baseline M (SD)	End M (SD)	Change M (SD)	P-value ^a	Baseline M (SD)	End M (SD)	Change M (SD)	P- value ^a	P- value ^b
Inattentive (IA)	25.78 (6.76)	21.05 (6.01)	-4.74 (3.97)	< 0.001	25.38 (7.58)	25.55 (7.53)	.16 (1.84)	.591	<0.001
Hyperactive- Impulsive (HI)	27.02 (5.74)	21.7 (6.34)	-5.32 (5.2)	<0.001	24.25 (6.95)	23.98 (6.83)	-.27 (1.72)	.056	<0.001
Combined	52.82 (8.02)	42.76 (10.49)	-10.05 (6.55)	<0.001	49.63 (8.26)	49.13 (8.36)	-.5 (2.46)	0.232	<0.001

P-value <0.05 was significant

Data reported based on Mean (SD)

^a P-value was obtained from paired t-test

^b P-value was obtained from ANCOVA adjusted for baseline

Discussion:

The aim of the present study was to determine the effect of an educational intervention on students' ADHD symptoms in primary school in Isfahan according to teacher and parent reports.

Before the intervention, according to parent report, ADHD symptoms were not different in the two groups, but two months later in the experimental group, the disorder was significantly reduced in all aspects. The mean score of students' impulsive hyperactivity was 25.7 before the intervention and reached 21 after the intervention. The findings are similar to previous studies(33, 34) . Also, the mean score of students' inattention was 27 before the intervention and reached 21.7 afterward. Contrary to this finding, no significant changes in students' inattention score has been seen in previous studies(35, 36).The mean score of the students' combined type (inattention and hyperactivity) was 52.8 before and reached 42.7 after the intervention. These findings are similar to previous studies(37).

Some studies have revealed the effect of behavioral parent training on reducing attention-deficit / hyperactivity disorder in this age group (38, 39) . The parents who do not have enough knowledge about dealing with a hyperactive child, use negative behaviors towards children, which make them ineffective in controlling the child's hyperactivity (36).

Inadequate knowledge of parents would lead to a decrease in the quality of the parent-child relationship (40) . In addition, parents' knowledge about ADHD makes them behave accurately towards the child and adjust their behavior according to the specific circumstances of the ADHD child with a positive attitude

towards them, resulting in a reduction of impulsive and aggressive behaviors and improving the child's attention(41).

According to teachers' reports, before the intervention, ADHD symptoms were not different in the two groups, but two months later in the experimental group, a significant decrease was seen in all subscales. The finding was similar to a previous study(37).

In the present study, according to the parents and teachers, the mean score of students' inattention after intervention significantly was decreased. This finding was similar to a previous study(37) . Contrary to our study, numerous studies indicated that after educational interventions, the mean score of the inattention has decreased less than the rest of the parameters. (35, 41) For example a study in Iran which compared the effectiveness of the use of parental and teacher behavior modification methods in reducing the symptoms of ADD and attention deficit disorder in elementary school students, revealed that after behavioral parent and teacher training there was no significant improvement in students' inattention scores (42).

Researchers believe that inattention is more resistant to change because it has a stronger biological basis than other behavioral problems in children(41,37,35) however, in our study, students' inattention was significantly reduced. It seems that focus on parents and teacher training simultaneously could lead to a decrease in students' inattention. In another word, because the child's attention-related behaviors were controlled in a coordinated method, both at school and at home, which leads to reinforcing the child's attention and reduces the inattention scores in students.

In our study, the intervention was found to be successful in reducing ADHD symptoms in the school setting based on the ratings of parents and teachers. Contrary to our results, in a previous study by Tamkeen in Pakistan after a behavioral parent, training there was a significant improvement in parent-reported ADHD symptoms, but teacher reports of symptoms and impairments generally did not show any improvement(43).

Although in Iran schools are first-line providers of mental healthcare for students, most students with ADHD don't take any formal school-based services to address their problems and complications. In addition, most of the services provided by school mental health providers commonly comprise of child-centered interventions that emphasize individual or small group counseling, without or with a limited engagement of parents and teachers.

The present study support the effectiveness and feasibility of behavioral parent and teacher training educations for children with ADHD applied in school settings as they significantly improve ADHD symptoms.

There are some limitations of this study. First, we measured only short-term effects of educational intervention, thus, sustainability of education effects requires further study with a long time follow-up. Second, this study did not measure academic performance. For a more accurate assessment of education effects, it is advisable to evaluate academic performance. Third, in the current research due to limited resources, this study could not measure other related items such as oppositional defiant disorder, peer conflict scale, and checklist of the symptom side effects parent variables (e.g., stress), and education acceptability. Future studies should include an expanded number of outcome measures.

Conclusion:

In the present study, educational intervention of parents and teachers regarding ADHD disorder caused an improvement in the disorder symptoms in children. Therefore, it is necessary for parents and teachers to be trained simultaneously in order to see a better and more constant impact on children's behavior and to reduce ADHD symptoms in all three aspects including inattention, impulsive-hyperactivity and combination of both.

The results of the present study show that special training of parents and teachers and developing appropriate strategies in order to improve the disorder can diminish the symptoms and reduce the side effects of ADHD.

Abbreviations:

ADHD (Attention Deficit Disorder with Hyperactivity)

DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, 5th edition)

Declarations:

Ethics approval and consent to participate: The study was approved by the by the Research Deputy of Isfahan University of Medical Sciences. In addition, The Ethical Committee of Isfahan University of Medical Sciences approved the study proposal. (ID code: IR.MUI.RESEARCH.REC.1398.297). The required permission from Education Department of Isfahan City was attained. Participation in the study was voluntary. Before taking part in the study, selected teachers provided written consent also study goals were described to them.

Consent for publication: "Not applicable"

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: "The authors declare that they have no competing interests"

Funding: The Research Deputy of Isfahan University of Medical Sciences provided the sources for this study.

Authors' contributions: Maede Hosseinnia and Maryam Amidi Mazaheri performed designing the work. Maede Hosseinnia did acquire the data. Interpreting the data was done by Maede Hosseinnia, Maryam Amidi Mazaheri, Zahra Heidari. Drafting the work/ revising the work critically for intellectual content was performed by Maede Hosseinnia and Maryam Amidi Mazaheri.

Acknowledgment:

The authors like to express their appreciativeness to all parents and teachers participated in this study.

Reference:

1. Reale L, Bonati M. ADHD prevalence estimates in Italian children and adolescents: a methodological issue. *Italian journal of pediatrics*. 2018;44(1):108.
2. Epstein JN, Loren RE. Changes in the definition of ADHD in DSM-5: subtle but important. *Neuropsychiatry*. 2013;3(5):455.
3. Evans S, Ling M, Hill B, Rinehart N, Austin D, Sciberras E. Systematic review of meditation-based interventions for children with ADHD. *European child & adolescent psychiatry*. 2018;27(1):9-27.
4. Safavi P, Ganji F, Bidad A. Prevalence of attention-deficit hyperactivity disorder in students and needs modification of mental health services in Shahrekord, Iran in 2013. *Journal of clinical and diagnostic research: JCDR*. 2016;10(4):LC25.
5. Yadegari N, Sayehmiri K, Azodi MZ, Sayehmiri F, Modara F. The prevalence of attention deficient hyperactivity disorder among Iranian children: A meta-analysis. *Iranian Journal of Psychiatry and Behavioral Sciences*. 2018;12(4).
6. Mahmoodi N, Mousavi R. The effectiveness of Group Interventions based on Parent-child Relationship on Promoting Child-rearing in parents of Children with Attention-Deficit Hyperactivity Disorder, aged 6-11 years. *MEDICAL SCIENCE*. 2019;23(95):12-8.
7. Adeboye M, Akande T, Osagbemi G, Buhari O, Abdulkadir M, Ojuawo A. Attention Deficit Hyperactivity Disorder in Ilorin: Screening with the Conner's Teachers' Rating Scale. *Sierra Leone Journal of Biomedical Research*. 2018;10(1):33-41.
8. Mohammadi M-R, Zarafshan H, Khaleghi A, Ahmadi N, Hooshyari Z, Mostafavi S-A, et al. Prevalence of ADHD and Its Comorbidities in a Population-Based Sample. *Journal of Attention Disorders*. 2019:1087054719886372.
9. Espases US. Analysis of the effectiveness of a training program for parents of children with ADHD in a hospital environment. *Actas Esp Psiquiatr*. 2018;46(1):21-8.
10. Hosseinnia M, Mazaheri MA, Heidari Z. Knowledge, attitude, and behavior of elementary teachers regarding attention deficit hyperactivity disorder. *Journal of Education and Health Promotion*. 2020;9(1):120.
11. Garreta E, Jimeno T, Servera M. Analysis of the effectiveness of a training program for parents of children with ADHD in a hospital environment. *Actas espanolas de psiquiatria*. 2018;46(1):21-8.
12. Khodabakhshi Koolaee A, Shahi A, Navidian A, Mosalanejad L. The effect of positive parenting program training in mothers of children with attention deficit hyperactivity on reducing children's externalizing behavior problems. *Journal of Fundamentals of Mental Health*. 2015;17(3).
13. Khademi M, Rajezi-fahani S, Noorbakhsh S, Panaghi L, Davari-Ashtiani R, Razjouyan K, et al. Knowledge and attitude of primary school teachers in Tehran/Iran towards ADHD and SLD. *Global Journal of Health Science*. 2016;8(12):141-9.
14. Barkley RA. ADHD and injuries: Accidental and self-inflicted. *The ADHD Report*. 2014;22(2):1-8.
15. Kollins SH. Moving beyond symptom remission to optimize long-term treatment of attention-deficit/hyperactivity disorder. *JAMA pediatrics*. 2018;172(10):901-2.
16. Schechter JC, Kollins SH. Adaptations to Behavioral Parent Training for Children with ADHD: Promoting Access, Engagement, and Treatment Effectiveness. *The ADHD Report*. 2019;27(1):1-6, 10, 1, 2.
17. Latouche AP, Gascoigne M. In-service training for increasing teachers' ADHD knowledge and self-efficacy. *Journal of attention disorders*. 2019;23(3):270-81.
18. Hutchison L, Feder M, Abar B, Winsler A. Relations between parenting stress, parenting style, and child executive functioning for children with ADHD or autism. *Journal of Child and Family Studies*. 2016;25(12):3644-56.

19. Bhide S, Sciberras E, Anderson V, Hazell P, Nicholson JM. Association between parenting style and socio-emotional and academic functioning in children with and without ADHD: a community-based study. *Journal of attention disorders*. 2019;23(5):463-74.
20. Menikdiwela KR, Vojtova VJJoE, Practice. Attention-Deficit/Hyperactivity Disorder through Sri Lankan Primary School Teachers' Eyes. 2017;8(2):4-10.
21. Lasisi D, Ani C, Lasebikan V, Sheikh L, Omigbodun OJC, psychiatry a, et al. Effect of attention-deficit–hyperactivity-disorder training program on the knowledge and attitudes of primary school teachers in Kaduna, North West Nigeria. 2017;11(1):1-8.
22. Lewis E. Including a Pupil with Attention Deficit Hyperactivity Disorder: Exploring Teachers Perspectives. 2018.
23. Hosseinnia M, Mazaheri MA, Heidari ZJJoE, Promotion H. Knowledge, attitude, and behavior of elementary teachers regarding attention deficit hyperactivity disorder. 2020;9.
24. Amiri S, Noorazar SG, Fakhari A, Daroukolaee AG, Gharehgoz AB. Knowledge and attitudes of preschool teachers regarding attention deficit hyperactivity disorder. *Iranian Journal of Pediatrics*. 2017;27(1).
25. Malik TA, Rooney M, Chronis-Tuscano A, Tariq N. Preliminary efficacy of a behavioral parent training program for children with ADHD in Pakistan. *Journal of attention disorders*. 2017;21(5):390-404.
26. Nobel E, Hoekstra PJ, Brunnekreef JA, Messink-de Vries DE, Fischer B, Emmelkamp PM, et al. Home-based parent training for school-aged children with attention-deficit/hyperactivity disorder and behavior problems with remaining impairing disruptive behaviors after routine treatment: a randomized controlled trial. *European child & adolescent psychiatry*. 2020;29(3):395-408.
27. Sprafkin J, Gadow KD, Nolan EE. The utility of a DSM-IV-referenced screening instrument for attention-deficit/hyperactivity disorder. *Journal of Emotional and Behavioral Disorders*. 2001;9(3):182-91.
28. Mattison RE, Gadow KD, Sprafkin J, Nolan EE, Schneider J. A DSM-IV- referenced teacher rating scale for use in clinical management. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2003;42(4):442-9.
29. Gadow KD, Sprafkin J, Salisbury H, Schneider J, Loney J. Further Validity Evidence for the Teacher Version of the Child Symptom Inventory-4. *School Psychology Quarterly*. 2004;19(1):50-71.
30. Mohammad Esmaeel E. Adaptation and standardization of child symptom inventory-4 (CSI-4). *Journal of Exceptional Children*. 2007;7(1):79-96.
31. Barkley RA. ADHD and the nature of self-control: Guilford press; 1997.
32. Barkley RA. Classroom accommodations for children with ADHD. *The ADHD Report*. 2008;16(4):7-10.
33. Loren RE, Vaughn AJ, Langberg JM, Cyran JE, Proano-Raps T, Smolyansky BH, et al. Effects of an 8-session behavioral parent training group for parents of children with ADHD on child impairment and parenting confidence. 2015;19(2):158-66.
34. Booster GD, Mautone JA, Nissley-Tsiopinis J, Van Dyke D, Power TJSPR. Reductions in negative parenting practices mediate the effect of a family–school intervention for children with Attention Deficit Hyperactivity Disorder. 2016;45(2):192-208.
35. Zwi M, Jones H, Thorgaard C, York A, Dennis JAJCDoSR. Parent training interventions for Attention Deficit Hyperactivity Disorder (ADHD) in children aged 5 to 18 years. 2011(12).
36. Pordel H, Mahmood Lilo M, Tajvar A, Hejazipor MJT, Psychology BiC. Effectiveness of Children’s Management Skills Training in Decrease of Attention Deficit Hyperactivity Disorder. 2012;7(26):67-76.
37. Zargarinezhad G, YEKEH YR. Efficacy of parent's training on problem behaviors in ADHD children. 2007.

38. Khanduri V. Effectiveness of Educating Parents of Children with Attention Deficit Hyperactivity Disorder (ADHD) on Children's Behavioral Issues and the Stress Experienced by Parents: An Integrative Review. 2017.
39. Raghibi M, Fouladi S, Bakhshani NM. Parent training and behavior therapy on behaviors of children with attention deficit-hyperactivity disorder. 2014.
40. Nejati A, MOSAVI R, ROSHAN R, MAHMUDI GJ. The effectiveness of Child-Parent Relationship Therapy (CPRT) on severity of symptom of Attention deficit/Hyperactivity Disorder (ADHD). 2016.
41. Pasha RJK, Psychology RiA. The Effectiveness of Parents' Behavior Modification on the Degree of Hyperactive Children's Unpleasant Behavior. 2017;17(1):90-8.
42. Shaban S, Baba M, Noah SM, Jaafar WMW. School-based multi-component intervention. Symptoms of Iranian ADHD children. Asian Social Science. 2015;11(10):212.
43. Malik TA, Rooney M, Chronis-Tuscano A, Tariq NJJoad. Preliminary efficacy of a behavioral parent training program for children with ADHD in Pakistan. 2017;21(5):390-404.