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A Comparison of Effectiveness of Attention Process Training (APT) with Parenting Management Training (PMT) in Reducing Symptoms of Attention Deficit Hyperactivity Disorder

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Abstract

Objective: Child-oriented psychotherapies, such as Attention Process Training (APT), target ADHD symptoms directly, whereas family-oriented interventions, like Parent Management Training (PMT), address its functional impairments. The aim of this study was to compare the effectiveness of APT and PMT in treating ADHD symptoms.
Method: This research was a randomized controlled trial in which 45 children (26 females and 19 males, with a mean age of 8.47 ± 1.66 years) with ADHD were selected conveniently and assigned randomly to one of three groups (PMT = 15, APT = 15, and CTRL = 15). The groups had no significant differences in ADHD severity. The PMT children were managed with parenting techniques. Children in the APT group practiced attention techniques, while children in the control group did not receive any intervention. Ritalin was prescribed to all the children in the three groups. The score on the Conners Parenting Rating Scale-Revised: Short form was the outcome variable.
Results: Both interventions decreased ADHD symptoms severity more than the control group. Howver, the reduction in the APT group was more than in the PMT group (P-value < 0.001). The scores of 40% of the APT group and 80% of the PMT group did not fall below the cut-off point. In the APT group after the intervention, the inattention subscale was significantly lower than the hyperactivity subscale, while in the PMT group, the hyperactivity subscale was lower. The effect sizes of APT and PMT were 2.18 and 2.09, respectively.
Conclusion: For ADHD, psychological interventions are crucial in addition to medication. According to the results of this study, APT is more effective for inattention symptoms, while PMT is more effective for hyperactivity symptoms. When selecting psychotherapy, the subtype of ADHD should be taken into account. Treatment sessions must also be completed according to intervention protocols.

Key words: *Attention Deficit Hyperactivity Disorders; Cognitive Psychotherapy; Parent-Child Relationship; Parenting; Visual Auditory Spatial Processing*

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Attention Deficit/Hyperactivity Disorder (ADHD) is the most prevalent psychiatric disorder among school-age children (1-3). Different studies revealed the prevalence of ADHD among Iranian children and adolescents was 4% (4, 5). It is often comorbid with other disorders such as conduct disorder and oppositional defiant disorder (6, 7). ADHD frequently produces persistent difficulties, including school failure (8, 9), interpersonal problems (10), low social function (11, 12), and delinquency (13, 14). The study by Tarver and colleagues showed that untreated ADHD has a poor prognosis and significant impairment in functioning (15).

Various pharmacological and psychological treatments have been generated for ADHD (16, 17). The age to start treatment for ADHD is usually school-age (18, 19). Medication is one of the most effective interventions and plays an essential role in reducing the symptoms of ADHD (20, 21). The most commonly used medications for ADHD are stimulants such as methylphenidate, dexamphetamine, etc. (21-23). These are considered the gold standard of ADHD treatment (24). However, studies have shown that the use of methylphenidate has little therapeutic effect and many side effects in some children (25, 26). These side effects have caused some parents and clinicians to be very cautious about medications (27-29). Many families and therapists often prefer mixed therapeutic strategies involving both medical and psychological interventions (30). Different short-term psychological interventions are available for treating ADHD such as game-based training, neurofeedback training, cognitive training, and some review studies have confirmed their effectiveness (16, 31-33). Family-based interventions are one of the most widely used treatment methods (34). The destructive behaviors of children with ADHD often harm parent-child relationships (35). Their hurtful behaviors increase stress among parents, and in turn, their reactions increase children's anxiety, thereby intensifying ADHD symptoms (36, 37). One therapeutic strategy therefore is to work directly with parents in order to improve parenting skills, with the aim of achieving positive results for their kids. Parent Management Training (PMT) is one of the most famous parent-oriented approaches (38, 39). In this method, parents learn to modify their children's behavior at home (36). Mockford and Barlow previously explained the impact of the interaction between parents and children on the signs and symptoms of children with ADHD (40). Danforth's study indicated that PMT improved parenting skills, decreased parents' stress, and lowered destructive behaviors in children (41). Many studies have shown the positive effects of parenting programs on children and their parents. Despite these findings, other studies have not demonstrated high effectiveness of PMT (26% - 64%) in the treatment of ADHD. (38, 42, 43). Therefore, the empirical evidence suggests a divergence in the outcomes of several investigations assessing the efficacy of PMT (44).

In addition to family interventions, other psychological methods have been developed to improve attention deficit (16). These treatments, such as Attention Process Training (APT), directly focus on ADHD symptoms. Sohlberg and Mateer designed APT to rehabilitate attention difficulties in people with brain damage (45, 46). APT is one of the specific processing approaches in cognitive rehabilitation and is a structural and individualized intervention in neuropsychology (47, 48). APT has been shown to be effective in improving attention deficits in various disorders, including ADHD. (49-54). Also, the study results of Shalev *et al*. indicated that training children with ADHD through the computerized progressive attentional training method (C-APT) improved continuous, selective, directional, and executive attention (55). The results from some studies on APT for managing ADHD have been unsatisfactory. Kerns *et al*. did not report significant APT results in treating ADHD (54).

Due to the lack of studies on the treatment of ADHD subtypes, this study compares two treatment methods, namely PMT and APT, which may be suitable for the hyperactive and inattentive subtypes. The findings of this research can help select more cost-effective interventions and enhance the treatment of specific ADHD subtypes. Since there have been insufficient and inconsistent studies comparing the effectiveness of APT and PMT in the treatment of ADHD, the purpose of this study was to answer the following question: Which of the interventions – APT or PMT – does significantly reduce the severity of ADHD symptoms compared to the control group?

Materials and Methods

This research was a randomized controlled trial with a time series and control group design. It was registered in the Iranian clinical trial registration center (IRCTID: IRCT20171104037215N2).

Participants

The research population consisted of children with ADHD referred to a psychiatric clinic in a general hospital in Ardabil. Sampling took place from April 1, 2021 up to November 10. The sample comprised 45 conveniently selected children assigned to three groups using block randomization (APT = 15, PMT = 15, CTRL = 15). In block randomization, replacements are made by using cards with different combinations of group names (ABC, ACB, BAC, etc.). Randomly choosing one card determines in which groups each child will be placed. It ensures an equal distribution of individuals across the groups. The sample size was estimated by considering similar intervention studies (56-58). The diagnosis of ADHD was made by a psychiatrist using K-SADS and DSM5 criteria. Inclusion criteria for children included having ADHD and being 6 to 12 years old. The study encompassed participants receiving methylphenidate

treatment in order to prevent bias in the results. Exclusion criteria for children included having concomitant mental retardation and severe psychiatric disorders and participation in less than six sessions (absence ≥ 3). Seven individuals in two groups (APT = 4 PMT = 3) had participated in less than six sessions and were excluded from the study and replaced by someone else.

They were the mothers who received PMT training because mothers typically have the most contact with their children. The inclusion criteria for mothers were being 18 to 40 years old and having at least a high school diploma. The exclusion criteria included being diagnosed with a severe mental disorder or being divorced. If a mother did not agree to participate or did not perform the PMT techniques correctly, someone else was substituted. Two mothers were excluded from the study due to poor implementation of the techniques and were replaced by other subjects. Figure 1 illustrates the process of admission of samples.

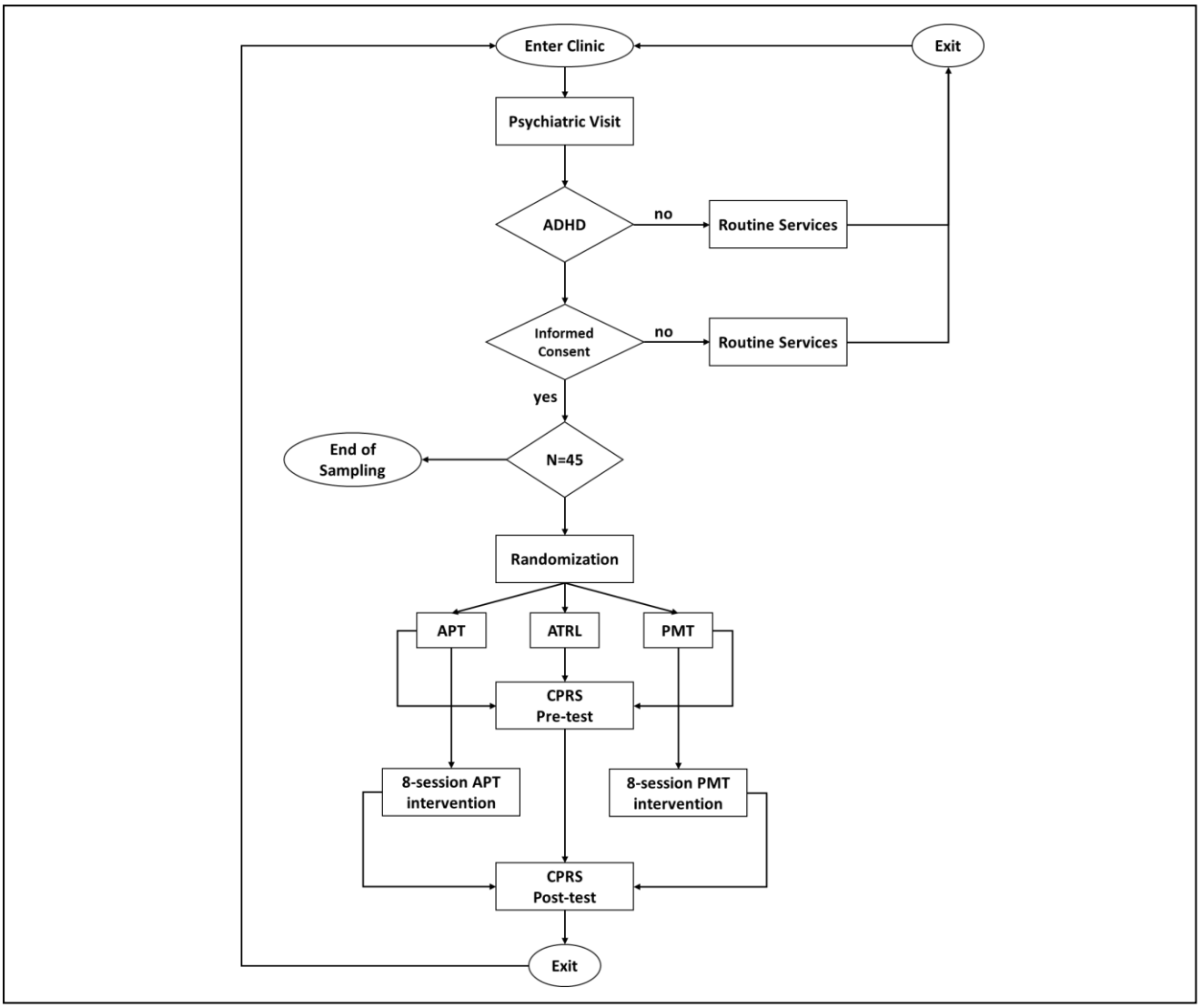

Figure 1. Flowchart of Admission of ADHD Patients and Random Assignment to Parent Management Training (PMT) and Attention Training Process (APT) Groups.

Interventions

In addition to receiving medication, the members of the APT and PMT groups received the interventions in eight sessions individually (45-60 minutes). Unaware of the research process, two trained clinical psychologists performed therapeutic interventions. The children in the control group received only medication.

The children in all three groups consumed Ritalin (the average dose was 50 mg, TDS). Children who were not under medical treatment were not included in the study. The researchers evaluated the dose of medication admission, manner of consumption, and compliance with the treatment diet before entering the study.

Attention Process Training (APT)

The children in APT individually participated in eight sessions. They practiced attention-processing techniques according to the protocol (Table1). The APT therapist

used auditory and visual stimulations to improve the attention process.

Table 1. Summary of Attention Process Training (APT) Sessions for Children with Attention Deficit Hyperactivity Disorder

Sessions	Aim of the Program	Sessions Main Content
First session	Establishing the suitable connection, Knowing the process of sessions, Improving visual sustained attention (level 1). Improving auditory sustained attention (level 1).	Warm-up, simple auditory and visual questions, for example: Show me things that are red? for example: Say a name that starts with L?
Second session	Therapeutic communication, Improving auditory sustained attention (level 2) Improving visual sustained attention (level 2)	Hop-hop game: 1, 2, 3, 4, Hop, 6, 7, 8, 9, Hop, 11etc. Make a sentence, for example: Say the name of the city that starts with M, Connect the dots in order to draw a shape,
Third session	Maintain the results of sessions 1 and 2	Repeat previous exercises
Fourth session	Improving auditory sustained attention (level 3) Improving auditory selective attention (level 1) Improving auditory divided attention (level 1)	Presenting a story(auditory) and asking questions Answer the simple question with irrelevant sounds Answer the simple question along with throwing and catching the ball.
Fifth session	Improving visual sustained attention (level 3) Improving visual selective attention (level 1) Improving visual divided attention (level 1)	Presenting a story(visual) and asking questions Shape / Title game, Hidden shapes, Find a shape Catch the ball while moving the pieces
Sixth session	Maintain the results of sessions 4 and 5	Repeat previous exercises
Seventh session	Improving auditory selective attention (level 2) Improving auditory divided attention (level 2)	Presenting the story (auditory) with irrelevant stimuli Asking questions along with drawing
Eighth session	Improving visual selective attention (level 2) Improving visual divided attention (level 2)	Presenting the story (visual) with irrelevant stimuli Asking questions along with connecting the dots

Adapted from Sohlberg and Mateer 2008

Parent Management Training (PMT)

The behavior of 15 children in the PMT group was managed through parenting techniques. Their mothers individually participated in eight sessions of parent management training according to the protocol (Table 2). These mothers practiced these techniques with their children at home. The quality of implementation of PMT techniques was evaluated in each session. Mothers who could not perform the techniques correctly were excluded from the study.

Table 2. Summary of Parent Management Training (PMT) Sessions for Children with Attention Deficit Hyperactivity Disorder

Sessions	Aim of the Program	Sessions Content
First session	Reduce attention-seeking behaviors	Teaching how to pay attention to the child (descriptive techniques, gaming)
Second session	Reduce Interrupt behaviors	Training to prevent the accidental encouragements
Third session	Reduce inappropriate behaviors	Training the Ignorance techniques
Fourth session	Increasing obedience behaviors	Training the Commanding techniques
Fifth session	Increasing purposeful behaviors Increasing calm behavior	Using the encouragement technique
Sixth session	Reduce high-risk behaviors Reduce hyperativity behaviors	Using the deprivation technique

Seventh session	Increasing the legitimacy and compliance of the order	Training the programming for doing activities
Eighth session	Increasing parents' desirable behavior as a model for their children	Training parents to modify their own undesirable behaviors

Adapted from Alan Kazdin 2008

Control Group

The children in the control group only received medication and were evaluated twice.

Measurements

K-SADS

The KSADS is a semi-structured interview-based diagnostic tool used to identify mental health issues in kids and teenagers (59). This tool uses DSM-5 criteria to evaluate 22 common psychiatric disorders and its psychometric properties are considered acceptable (60). A psychiatrist diagnosed ADHD using the K-SADS.

CPRS-R: S

The score on the Conners Parenting Rating Scale-Revised: Short (CPRS-R: S) was the primary variable that also showed the effectiveness of the treatment. To assess the symptoms' severity, the CPRS-R: S was administered at the start of every session. The first and last assessments were considered the pre-test and post-test scores. The Persian version of the CPRS-R: S was employed. This scale consists of 27 four-choice questions (never = 0, sometimes = 1, often = 2, very often = 3). The maximum and minimum scores of this questionnaire are 81 and 0. The raw score ≥ 45 (T score ≥ 60) are considered clinically significant (61, 62**).** A higher score indicates the severity of ADHD. Canners *et al*. reported the reliability of this scale to be about 0.90. The Institute of Cognitive Sciences reported its validity of 0.85 (63). A psychologist supervised the completion of the Conners Parenting Rating Scale-Revised: Short (CPRS-R: S) at the beginning of each session.

Statistical Analysis

The pre-test and post-test scores of the three groups were compared using ANOVA, and the results of eight sessions were assessed using paired t-test and repeated measures ANOVA. By non-parametric tests, demographic variables were analyzed. All the statistical analyses were performed using the SPSS 22 software.

Ethical Consideration

Parents of all children were aware of the goals and process of the research and signed a consent participation form. The ethics committee of Ardabil University of Medical Sciences approved this study (IR.ARUMS.REC.1396.108).

Results

General Characteristics

The average and standard deviation of the age were APT: 8.4 ± 1.77, PMT: 8.42 ± 2.02, control: 8.92 ± 1.56, and total: 8.47 ± 1.66. Table 3 shows no significant differences between the three groups regarding gender, education, family status, duration of drug consumption, and parents' marital status (P-value > 0.05).

Table 3. Demographic Characteristics of the Children with Attention Deficit Hyperactivity Disorder

Variable		APT †	PMT ‡	Ctl §	Ch-Square (P-value)
Gender	Girl	9	10	7	1.27 (0.529)
	Boy	6	5	8	
Education	not started	3	5	0	7.1 (0.130)
	First to third	10	6	11	
	Fourth to sixth	2	4	4	
Family status	Normal	7	9	12	5.15 (0.272)
	Disturbed	7	6	2	
	Divorced	1	0	1	
Consumption duration	3-6 months	8	8	9	2.88 (0.578)
	7-9 months	1	1	3	
	10-12 months	6	6	3	

†: Attention Process Training, ‡: Parent Management Training, §: control.

Pre-Test Results

The mean and standard deviation of the groups in pre-test scores are presented in Table 4. There were no significant differences among the means of the three groups in the pre-test (P > 0.285).

Table 4. Analysis of Variance of Pre-Test and Post-Test For CPRS-R:S¶ Scores

Groups	Evaluation stage Mean (SD)		post-test subscales scores Mean (SD)		Post-test CPRS-R:S ≥ 45**
	Pre-test	Post-test	Inattentive	Hyperactive	N (%)
APT †	75.4 (13.8)	39.73 (8.25)	17 (4.6)	21.4 (5.7)	6 (40)
PMT‡	76.41 (12.9)	51.00 (8.24)	29.13 (6.17)	21.86 (3.68)	12 (80)
Ctl §	69.66 (10.95)	70.00 (10.72)	35.26 (5.57)	34.73 (5.63)	15 (100)

ANOVA			LSD post hoc test for Post-test: Mean difference (P-value)		
			APT	PMT	Ctl
Pre-test F = 1.29 P-value > 0.285	Post-test F = 41.94 P-value < 0.001*	APT		-11.26 (0.00)*	-30.26 (0.00)*
		PMT			-19.00 (0.00)*

†: Attention Process Training, ‡: Parent Management Training, §: control, ¶: Conners Parenting Rating Scale- Revised: Short form,
* Statistical significance, All comparisons, ** clinically significant.

Post-Test Results

Before performing ANOVA, homogeneity of the variances of the CPRS scores was confirmed with Levine's test (P = 0.499). ANOVA demonstrated that the differences among the groups in the post-test were significant (P < 0.01). The LSD post hoc test revealed a significant difference between APT and PMT. Table 4 indicates that APT was the most effective intervention because it caused a further decrease in the post-test scores. It was determined that the effect sizes for APT and PMT were 2.18 and 2.09, respectively.

The number of people who had a CPRS-R: S raw score greater than 45 in the post-test is presented in Table 4. The scores of 40 % of APT, 80 % of PMT and 100 % of the control groups were not below the cut-off point (CPRS-R: S ≥ 45). That is, even if there was a significant decrease in severity, the residual symptoms of patients were clinically important.

According to the post-test subscale scores (Table 4), in the APT group, the mean score for inattention was significantly lower than that of hyperactivity. However, in the PMT group, the mean score for hyperactivity was lower (Figure 2).

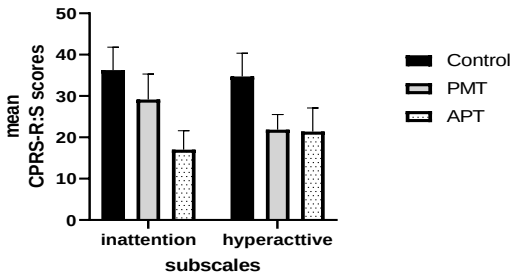

Figure 2. Comparison of Inattention and Hyperactivity Subscales of Parent Management Training (PMT), Attention Training Process (APT) and Control Groups

The results, as shown in Table 5 and Figure 3, indicate that ADHD symptoms decreased over time in both groups. A paired t-test was performed between consecutive sessions. The results showed that the average of each session has a significant difference compared to the previous session (Table 5).

Table 5. Average Scores of Eight Treatment Sessions of APT† and PMT ‡ Interventions

Session Group	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth
APT	75.4	72.13	65.26	58.73	52.66	48	44.86	39.73
PMT	76.4	71.60	67.60	63.46	59.46	56	52.13	51

†: Attention Process Training, ‡: Parent Management Training

The trend of the eight-sessions scores of both groups was analyzed by repeated measure ANOVA. The results in Table 6 indicate the significant differences between the eight sessions (Wilks' Lambda = 0.035, F (7,22) = 87.39, P-value = 0.001). This means that in both APT and PMT, the scores of each session were significantly different from those of the other sessions. Therefore, none of the sessions were ineffective.

Table 6. General Linear Model with Repeated Measure ANOVA on Eight-Sessions Scores of APT and PMT

Effect		Value	F	Hypothesis df	Error df	P-value	Partial Eta Squared
session	Wilks' Lambda	0.035	87.39	7.000	22	0.000*	0.965
Session*group	Wilks' Lambda	0.425	4.26	7.000	22	0.004	0.575

*: statistically significant, APT: Attention Process Training, PMT: Parent Management Training

There were significant differences between the two groups in the rate of change across eight sessions (Wilks' Lambda = 0.425, F (7,22) = 4.26, P-value < 0.004). In other words, all sessions of APT were more effective in reducing the signs and symptoms than all sessions of PMT. The results showed that the changes in mean scores of different sessions were linear in both groups (F (1, 28) = 16.94, P-value < 0 001).

As shown in Figure 3, the scores of both groups decreased with a mild slope, and there was no abrupt change or sharp reduction in symptoms. The trend in reducing ADHD symptoms in the two groups was linear.

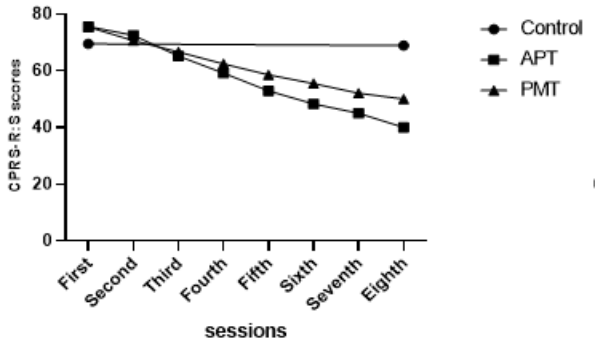

Figure 3. The Eight Sessions Scores Trend of Attention Process Training and Parent Management Training

Discussion

Due to limited references in the field of this research, the explanations are confined to the studies that have addressed the characteristics of PMT and APT separately. The results of this study indicated that both PMT and APT had a positive impact on the reduction of the symptoms in children with ADHD and were more effective than drug treatment alone. The main finding of the research was that APT had a more positive impact than PMT. In other words, the signs and symptoms of ADHD, particularly the symptoms of inattention, were better treated with APT. This finding is consistent with the results of other studies (54, 64) which could be demonstrated by the way that APT offers opportunities for structured practice of different cognitive functions.

Children learn to inhibit irrelevant responses by trying to answer correctly to visual and auditory attractive stimuli, and these acquisitions then transfer to real life and other situations. Improvements in the attention system may enhance children's executive function. This explanation is in line with Brown's observations (65). Additionally, with the help of Barkley's opinion, children with ADHD show reduced activity in the forehead areas of the brain. The forehead contributes to the inhibition of behavior, resistance to responsiveness, control of activity levels, and resistance to distraction (66). It may be that APT, as a cognitive intervention, activates these neural centers more than PMT. However, further research is needed to confirm this.

PMT was also effective in reducing symptoms of ADHD, particularly symptoms of hyperactivity. This result is consistent with numerous studies (31, 67-69). A possible explanation for this reduction might be that training efficacious parenting techniques and expanding the quality of parent-child communication help children learn how to control their behavior (58). Another potential explanation is that PMT techniques expand the parent's sensitivity to satisfy their child's psychological needs (40). This explanation is consistent with a study by Barkley *et al*. (70), which also showed that when parents participate in the treatment process, this process is accelerated more than child-centered treatments.

Although each intervention was effective on its own, PMT was less effective than APT in reducing ADHD symptoms. The low effectiveness of PMT is consistent with some studies (40, 42, 71-74). In appraising the lower results of PMT, MacFord and Barlow (40) concluded that while parents' training has been reported effective for many families, it was not successful for all of them. Moreover, during several studies, McMahon and Forehand mentioned that one-third of families did not reflect quick improvements, and one-third failed to maintain the upgrades after one year (75). Family interventions as indirect methods can be influenced by different variables such as the knowledge and attitude of parents, the behavior of other family members such as siblings, and the socio-economic level of the family. It is possible that APT activates the inhibitory system more than PMT because it allows for multiple exercises. Additionally, there are fewer negative variables (confounding variables) in the APT implementation. However, the effectiveness of PMT techniques can be reduced by many variables in the family atmosphere. PMT techniques activate the inhibitory system through positive and negative reinforcement of the child's behaviors.

Eventually based on the obtained results, the research question can be answered that APT was clearly more

effective than PMT. Trend analysis demonstrated that all eight sessions of PMT and APT were necessary. This finding is in line with the opinion of Lopes *et al*. on the need for completing psychotherapy sessions (76). The reduction in scores of both groups continued with a mild slope, and there was no abrupt change or sharp decline in symptoms. For that reason, no session is preferable to others. The trend in decreasing ADHD symptoms in the two groups was linear. However, the reduction trend was not the same in the two groups. Gradually, the differences in the rate of change between the two groups increase along with the number of sessions. This symptom-reduction process is inconsistent with Kadera *et al*.'s observations (77). Their observations showed that the early sessions have more therapeutic effects. It may be related to the type of disorder and the age of the patients. However, Stiles suggests that the quality of psychotherapy sessions is more critical (78).

Limitation

A few limitations of this study should be acknowledged. The sample size was small. There was also no follow-up plan. It was only mothers who conducted PMT interventions. Additionally, PMT was implemented without controlling for a number of confounding variables.

Conclusion

From the results obtained, it can be concluded that both APT and PMT interventions were effective in reducing the symptoms of ADHD, although APT was more effective. Depending on the different techniques used in each intervention, APT was more effective in reducing inattention symptoms and PMT was more effective in reducing hyperactivity symptoms. Therefore, it is better to choose the type of treatment based on the ADHD subtype. The trend of symptom reduction during different sessions indicate the need for completing all treatment sessions.

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Conflict of Interest

None.

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