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ORIGINAL ARTICLE

The Effect of Treatment for Attention-Deficit/Hyperactivity Disorder on Children's Symptoms and Caregivers' Quality of Life: A Prospective Study

Dikkat Eksikliği/Hiperaktivite Bozukluğu Tedavisinin Çocukların Semptomları ve Bakım Verenlerin Yaşam Kalitesi Üzerindeki Etkisi: Prospektif Bir Çalışma

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ABSTRACT

Aim: Attention-Deficit/Hyperactivity Disorder (ADHD) affects not only children's mental health but also their parents' psychological well-being. This study examined the impact of ADHD treatment on children's symptoms and the quality of life (QoL) of their caregivers.
Materials and Methods: The study involved 100 children aged 6 to 17 who were newly diagnosed with ADHD and starting treatment, along with their 100 primary caregivers. Children were evaluated using the Conners' Parent Rating Scale–Revised: Long Form (CPRS-RL), while caregivers were assessed with the Short-Form 36 (SF-36) Scale, Hamilton Anxiety (HAM-A), and Depression (HAM-D) Scales. Mental status examinations and assessments were conducted at treatment initiation and repeated after three months.
Results: A statistically significant reduction was observed in CPRS-RL scores after three months of treatment ($z = -8.385$, $p < 0.001$). No significant difference was found in symptom reduction between those receiving stimulant versus non-stimulant medications ($p = 0.541$). Caregivers showed statistically significant improvements in all SF-36 subdomains after three months ($p < 0.001$). When SF-36 score changes were compared according to the ADHD subtype of the children, significant differences remained between the inattentive and hyperactive ($p < 0.001$), and inattentive and combined type groups ($p < 0.017$), while no significant difference was observed between the hyperactive and combined type groups ($p > 0.017$). No significant changes were found in caregivers' HAM-A or HAM-D scores over the three months ($p = 0.211$ and $p = 0.562$, respectively).
Conclusions: ADHD treatment—regardless of medication type—significantly reduces children's symptom severity and improves caregivers' QoL. Although anxiety and depression levels in caregivers remained unchanged, QoL improvements are likely due to symptom relief in children. Therefore, the early diagnosis of ADHD and the initiation of treatment as soon as possible are critically important for both reducing the symptoms in children and improving the QoL of their parents.

Keywords: ADHD, caregivers, psychological impact, treatment, quality of life

ÖZ

Amaç: Dikkat Eksikliği/Hiperaktivite Bozukluğu (DEHB) sadece çocuklarda mental sorunlara yol açmakla kalmaz, aynı zamanda ebeveynleri de psikolojik olarak olumsuz etkileyebilir. Bu çalışmanın amacı, DEHB tedavisinin çocukların semptomları ve ebeveynlerinin yaşam kalitesi üzerindeki etkisini incelemektir.
Gereç ve Yöntemler: Çalışmaya, 6-17 yaş aralığında DEHB tanısı almış ve ilk kez tedavi başlanan 100 çocuk ile onlara bakım veren 100 ebeveyni dahil edilmiştir. Çocuklara Conners Ebeveyn Değerlendirme Ölçeği Uzun Formu (CEDÖ-Y); bakım verenlere ise Yaşam Kalitesi Ölçeği (SF-36), Hamilton Anksiyete Derecelendirme Ölçeği (HAM-A) ve Hamilton Depresyon Derecelendirme Ölçeği (HAM-D) uygulanmıştır. Ruhsal durum muayenesi ve ölçekler, DEHB tedavisinin başlangıcında ve üç ay sonrasında çocuklara ve ebeveynlere tekrarlanmıştır.
Bulgular: Üç aylık tedavi sonrasında çocukların CEDÖ-Y puanlarında istatistiksel olarak anlamlı bir düşüş gözlemlendi ($z=-8.385$, $p<0.001$). Uyarıcı veya uyarıcı olmayan ilaç alan gruplar arasında, CEDÖ-Y puanlarındaki değişim açısından fark bulunmadı ($p=0.541$). Bakım verenlerin SF-36 Yaşam Kalitesi ölçeğinin tüm alt alanlarında üç ay sonrasında anlamlı bir iyileşme gözlemlendi ($p<0.001$). Bakımverenlerin 3 aylık süredeki SF-36 puanlarının farkları çocukların DEHB tipine göre karşılaştırıldığında, dikkat eksikliği ile hiperaktivite ($p < 0.001$), dikkat eksikliği ile kombine tip ($p <0.017$) arasında istatistiksel anlamlılığını korurken, hiperaktivite ile kombine tip grupları arasında anlamlı fark saptanmadı ($p>0.017$). Bakım verenlerin HAM-A ve HAM-D ölçek puanlarında üç aylık süre boyunca anlamlı bir değişiklik tespit edilmedi ($p=0.211$, $p=0.562$, sırasıyla).
Sonuçlar: DEHB'li çocukların uyarıcı veya uyarıcı olmayan ilaçlarla tedavisi, çocukların semptomlarında iyileşmenin yanı sıra ebeveynlerin yaşam kalitesinde de anlamlı bir artış sağlamıştır. Ebeveynlerin depresyon ve anksiyete skorlarında belirgin bir değişiklik olmamasına rağmen yaşam kalitesinin iyileşmesi, çocukların DEHB tedavisinin etkisine bağlanmıştır. Bu nedenle, DEHB'nin erken teşhisi ve mümkün olan en kısa sürede tedaviye başlanması, hem çocukların semptomlarını azaltmak hem de ebeveynlerin yaşam kalitesini artırmak açısından kritik öneme sahiptir.

Anahtar Kelimeler: Bakımveren, DEHB, psikolojik etki, tedavi, yaşam kalitesi

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Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a common childhood mental health problem affecting approximately five percent of school-age children worldwide [1]. Children diagnosed with ADHD exhibit a range of symptoms consisting of inattention, hyperactivity, and impulsivity in at least two social contexts (e.g., family and school) that are developmentally inappropriate compared to typically developing age-matched healthy children [2, 3]. According to the Fifth Edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), ADHD has 3 subtypes: attention deficit dominant, hyperactivity/impulsivity dominant, and combined type [1, 4]. Children with ADHD, if not treated appropriately, can develop academic failure, poor emotional regulation, and unsatisfactory relationships with their families, teachers, and peers [5].

ADHD not only causes difficulties in the lives of children but also affects their parents [6]. ADHD can increase stress and fatigue in the family and reduce their extracurricular activities. Difficulties in meeting the financial, academic, and developmental needs of the child with ADHD can also predispose parents to mental disorders and lead to a decrease in their QoL [7]. Caregivers of children with ADHD may be prone to depressive [8] and anxiety disorders [9] due to illness burden, stigmatization, and hopelessness. It has also been reported that parents of children with ADHD experience psychological, social, and environmental difficulties more frequently and severely than parents of children with normal development [10, 11].

In recent years, the concept of quality of life (QoL) has attracted more attention as an important outcome measure in guiding health services [11]. In general terms, QoL may be considered as a multidimensional construct that includes an individual's subjective QoL. QoL is associated with the perception of physical, emotional, and social well-being, including both cognitive and emotional components [3]. Although QoL is influenced by many factors, including family, friendships, socioeconomic status, and cultural factors, the presence of a mental illness in one's family or oneself has been recognized as one of the strongest risk factors for poorer QoL scores [12].

Previous studies have shown that the quality of parents' marital life, parenting stress, and socioeconomic status are associated with behavioral problems in children; in turn, children's mental problems may lead to increased parenting stress, marital problems, role dissatisfaction, and parental mental problems [11]. As such, there appears to be a bidirectional relationship between children's and parents' interactions and mental health. The cumulative burden of raising a child with ADHD poses a significant long-term risk for families, as the negative effects of ADHD on caregivers' QoL are associated with poor treatment outcomes for the child, as well as long-term negative mental and physical health consequences for families [13]. Studies investigating the QoL of caregivers of children with ADHD are mostly cross-sectional. They are aimed at determining the impact of ADHD symptoms on parents' QoL [3]. Most of these relevant studies have found that ADHD negatively affects parental QoL [10, 14] and that parents of children with ADHD have worse QoL compared to parents of healthy children [11]. It has been reported that one of the goals of ADHD treatment should be both to reduce parental stress associated with ADHD and to improve parental QoL [15].

Although ADHD medications, including stimulants (methylphenidate, amphetamines) and nonstimulants (atomoxetine, clonidine, guanfacine), are well-documented in reducing core symptoms [16, 17] and enhancing children's QoL [18], their effects on caregiver well-being remain underexplored. Most existing studies are cross-sectional, limiting causal interpretations [3, 13]. Moreover, the bidirectional relationship between parental stress and child behavioral problems underscores the need to evaluate both child and caregiver outcomes in ADHD treatment. This study prospectively investigates how ADHD treatment affects both children's symptoms and their caregivers' QoL, anxiety, and depression. To the best of our knowledge, no study has prospectively investigated the effect of stimulant and nonstimulant treatments of ADHD on the QoL of parents as caregivers.

Materials and Methods

Approval for the study was obtained from the ethics committee of the Selçuk University Hospital (protocol/decision number: 70632468-050/04.:01. 2015/280). All procedures were performed according to the 1964 World Medical Association (WMA) Declaration of Helsinki ethical principles for medical research involving human subjects, similar ethical standards, and guidelines set by the national research committee. All participants gave written informed consent to participate in the study after reading and understanding the informed consent form. Parents were allowed to participate in the study during regular visits with their children.

This study included 120 children aged 6–17 years who were newly diagnosed with ADHD and their primary caregivers (mothers or fathers). ADHD diagnoses were made by an experienced child psychiatrist based on clinical interviews and the DSM-5 diagnostic criteria. Primary caregivers were evaluated by an experienced adult psychiatrist using mental status examinations and assessments based on the DSM-5.

Of the initial 120 child-caregiver pairs, 20 children were unable to complete the 3-month follow-up due to various reasons (e.g., dropout, non-compliance, or loss to follow-up) and were excluded from the analysis along with their caregivers. Therefore, the final sample consisted of 100 children and their 100 primary caregivers.

All children were evaluated using the Conners' Parent Rating Scale – Revised Long Form (CPRS-RL), while caregivers were assessed using the 36-Item Short Form Health Survey (SF-36), the Hamilton Anxiety Rating Scale (HAM-A), and the Hamilton Depression Rating Scale (HAM-D). Psychiatric evaluations and scale assessments for both children and parents were conducted by psychiatrists at baseline and repeated after three months.

Children were categorized into three ADHD subtypes based on DSM-5 criteria: predominantly inattentive

(n = 23), predominantly hyperactive/impulsive (n = 37), and combined type (n = 40). Pharmacological treatment was initiated by an experienced child psychiatrist and individualized for each child based on clinical presentation, subtype, symptom severity, comorbidities, functional impairment, and parental input. In general, stimulant medications (short-acting or long-acting methylphenidate formulations) were the first-line treatment for children with hyperactive/impulsive or combined type ADHD. Atomoxetine, a non-stimulant selective norepinephrine reuptake inhibitor, was primarily prescribed for children with predominantly inattentive presentation, those with comorbid anxiety symptoms, poor tolerability to stimulants, or based on caregiver concerns about stimulant use. Medication selection also considered factors such as side effect profile, prior treatment history, and caregiver preference. Treatment protocols followed national clinical guidelines and current evidence-based recommendations.

Inclusion Criteria for Children with ADHD:

• Children aged 6-17 years.

• Children diagnosed with ADHD and starting treatment for the first time.

• Children who were not using any psychotropic medication other than stimulant and nonstimulant drugs at the start of ADHD treatment and three months later.

Exclusion criteria for children:

• Children with a serious physical illness or another psychiatric disorder, such as intellectual disability or disruptive behavior disorder, in addition to ADHD, that requires treatment during the 3-month follow-up period, were not included in the study

Inclusion Criteria for Caregivers:

• Being the primary caregiver (mother or father) of a child with ADHD.

• Having only one child with ADHD in the household.

• Living with the child diagnosed with ADHD for at least six months.

• Not currently receiving treatment for a psychiatric disorder.

• Not having a debilitating physical illness.

• Being fluent in Turkish and able to provide written informed consent.

Exclusion Criteria for Caregivers:

• Being the parent of a child with a serious mental illness unrelated to ADHD, such as addiction, schizophrenia, autism spectrum disorders, or depressive disorders.

• Having a mental or physical illness that requires treatment during the 3-month follow-up period

Assessment Scales

The Revised Conners' Parent Rating Scale Long Form (CPRS-RL) was developed by Conners in 1997 [19]. The validity and reliability study of the revised form was conducted by Kaner et al. in 2011 [20]. It consists of 14 subscales. The subscales are listed in the following order of sequence: 'Defiance Subscale' (10 items), 'Cognitive Problems/Inattention Subscale' (12 items), 'Hyperactivity Subscale' (9 items), 'Anxiety-Shyness Subscale' (5 items), 'Psychosomatic Subscale' (6 items), 'ADHD Index Subscale' (12 items), 'Conners' Global Index-Restlessness/Impulsivity Subscale' (7 items), 'Conners' Global Index-Emotional Variability Subscale' (3 items), 'Conners' Global Index Total Subscale' (10 items), 'Hyperactivity-Impulsivity Subscale' (9 items), Inattention Subscale' (9 items). The scale consists of 80 items, rated on a 4-point Likert scale: 0 (Not true at all) to 3 (Very much true). Scoring is based on converting raw scores into T-scores, with a mean of 50 and a standard deviation of 10. T-scores below 60 are considered within the average range. Scores between 60 and 64 are viewed as mildly elevated and may suggest a possible concern. T-scores from 65 to 69 are considered moderately elevated and are typically regarded as clinically significant. Scores of 70 or higher are markedly elevated, indicating a likely clinical problem. A T-score of 65 or above is generally used as a clinical cut-off, suggesting a potential need for further evaluation or intervention.

The Short Form-36 (SF-36) scale is the most common generic scale used to measure the QoL. It was developed especially to measure the QoL in patients with physical illness. However, it has also been successfully used in healthy participants and in patients with psychiatric illness. It was developed and applied by John E. Ware et al. (1992) to assess the QoL of the study participants [21]. Turkish validity and reliability studies were conducted by Koçyiğit et al [22]. The SF-36 is a self-report scale that assesses eight dimensions of health in 36 items, including physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role emotional (RE), and mental health (MH). Positive as well as negative aspects of health status are assessed. The scoring of the SF-36 is performed using a detailed directive. The total score is obtained by summing the scores of its eight subscales. The scores of the subscales range from 0 to 100, with higher scores indicating good health status.

The Hamilton Depression Rating Scale (HAM-D) is a popular measurement tool developed for clinicians to assess the severity of depression. Scoring ranges from 0-7 for "no depression", 8-15 for "mild depression", 16-28 for "moderate depression," and 29 and above for "severe depression". The scale was created by M. Hamilton [23], and its validity and reliability studies in Turkey were published by Akdemir et al [24].

Hamilton Anxiety Rating Scale (HAM-A) is one of the oldest scales constructed to assess the intensity of anxiety symptoms and is still frequently used in clinical studies. This 14-item scale measures both somatic (i.e., physical complaints associated with anxiety) and psychic anxiety (i.e., mental agitation and psychological distress). The scale is administered by the clinician. It was created by M. A. X. Hamilton [25]. The validity and reliability studies of the Turkish version were conducted by Yazıcı et al [26]. The total score on the scale ranges from 0 to

56. A score below 17 is considered to indicate mild anxiety. Scores between 18 and 24 suggest mild to moderate anxiety, while scores between 25 and 30 indicate moderate to severe anxiety. Scores above 30 are typically seen as reflecting severe anxiety, for which clinical intervention is often recommended. Although there is no universally agreed-upon cut-off score, a score of 18 or higher is commonly used to indicate clinically significant anxiety. In clinical trials, a score of 25 or above is often used as a threshold for identifying individuals with moderate to severe anxiety.

Statistical Analysis

We performed the statistical analysis of our study results using SPSS 25.0. A p-value less than 0.05 was considered statistically significant. We used the Kolmogorov-Smirnov test to analyze the normality of our data. Normally distributed data were presented with mean and standard deviation values. On the other hand, numerical data that did not fit the normal distribution were shown with median, minimum, and maximum values. Since the numerical data did not fit the normal distribution, we applied nonparametric tests for group comparisons. Wilcoxon test was used for pairwise group comparisons including dependent measures, the Mann-Whitney U test was used for pairwise group comparisons including independent measures, and the Kruskal-Wallis test was employed for group comparisons including three or more groups (e.g. group comparisons according to ADHD type). In addition, the Mann-Whitney U test was applied to test the significance of pairwise differences, with Bonferroni correction (with a p-value of <0.017 for statistical significance) to determine which groups were responsible for the difference in multiple comparisons.

Results

At the outset of the study, 120 children (74 boys and 46 girls) and their respective parents (a total of 120 caregivers) were enrolled. However, 20 children were unable to complete the 3-month treatment period due to various reasons and were therefore excluded from the study, along with their caregivers. Consequently, the final sample consisted of 100 children (62 boys and 38 girls) and their 100 caregivers. The mean age of the children was 9.63 ± 2.32 years (range: 6–15 years). In terms of educational level, 65 were primary school students, 20 were in middle school, and 15 were attending high school. Among the 100 caregivers who completed the study, 76 were mothers and 24 were fathers. The mean age of the caregivers was 32.12 ± 4.25 years (range: 28–44 years).

Children with ADHD were categorized into three subtypes: predominantly inattentive (n = 23), predominantly hyperactive/impulsive (n = 37), and combined type (n = 40). Pharmacological treatment included short-acting methylphenidate (n = 26; Ritalin®, Novartis Pharmaceuticals, Istanbul, Turkey) at a mean daily dose of 24 mg, long-acting methylphenidate (n = 35; Concerta®, Johnson & Johnson, Istanbul, Turkey) at a mean daily dose of 40 mg, extended-release methylphenidate (n = 19; Medikinet®, Medice Arzneimittel Pütter GmbH & Co. KG, Iserlohn, Germany) at a mean daily dose of 30 mg, and the non-stimulant atomoxetine (n = 20; Strattera®, Eli Lilly and Company, Istanbul, Turkey) at a mean daily dose of 82 mg. When the revised Conners' Parent Rating Scale long form (CPRS-RL) score differences of the children at baseline and after three months were compared, it was seen that the symptom severity of the children decreased significantly at the end of 3 months (Table 1).

Table 1. Comparison of revised Conners' parent rating scale long form score differences in children at baseline and three months later

CPRS-RL (at baseline) Median (min-max)	CPRS-RL (3 months later) Median (min-max)	*Z*	*P*	r^a
157 (79-210)	82 (36-140)	-8.385	**<0.001**	**0.838**

Note: A nonparametric test (Wilcoxon signed-rank test) was used due to the noncompliance of variables with normal distribution and an interdependency between the variables. ra = effect size (r=Z/ √N)

Abbreviations: CPRS-RL: Revised Conners' Parent Rating Scale Long Form

When comparing the changes in CPRS-RL scores from baseline to three months across different treatment types, no statistically significant differences were found. Median score changes were 75 (67–90) for short-acting methylphenidate, 76 (66–91) for long-acting methylphenidate, 74 (63–92) for extended-release methylphenidate, and 77 (64–93) for nonstimulants (p = 0.541). Similarly, there was no significant difference in score changes between stimulant and nonstimulant groups, with medians of 83 (4–125) and 76 (66–91), respectively (p = 0.545) (Table 2). Statistically significant improvement was observed in all subscales of the SF-36 QoL scale of caregivers within 3 months of treatment (Table 3). When the differences in the SF-36 scores of the caregivers at baseline and 3 months later were compared by the Kruskal-Wallis test according to the ADHD type of the children, a statistically significant difference was observed in the domains of Physical Functioning (PF), Role Physical (RP), Vitality (VT), Role Emotional (RE), Bodily Pain (BP), and General Health (GH) (p<0.001) (Table 4). Post-hoc pairwise comparisons were performed using the Mann-Whitney U test to investigate which ADHD subtype was responsible for the difference. Bonferroni correction adjusted the significance level to 0.017 (0.05/3 comparisons) to control for type I error due to multiple comparisons. Pairwise comparisons of the SF-36 score differences of caregivers according to the ADHD type of the children maintained statistical significance between attention deficit and hyperactivity dominant (p< 0.001), and also attention deficit and combined type groups (p < 0.017), while no statistically significant difference was found between hyperactivity dominant and combined type ADHD groups (p>0.017). Thus, during the 3-month ADHD treatment period, the improvement in the QoL of caregivers of children with hyperactivity dominant and combined type ADHD was statistically significantly different from the improvement in the QoL of caregivers of children with attention deficit type dominant ADHD, while the degree of improvement in the QoL of caregivers of children with hyperactivity dominant and combined type ADHD was statistically significantly different from each other.

Table 2. Comparison of revised Conners' parent rating scale long form (CPRS-RL) score differences in children at baseline and three months later by type of treatment they received

Short-acting methylphenidate	**Long-acting methylphenidate**	**Extended-release methylphenidate**	**Non-stimulant**	*P*
n=26	n=35	n=19	n=20	
CPRS-RL	**CPRS-RL**	**CPRS-RL**	**CPRS-RL**	
(baseline-3 months later)	(baseline-3 months later)	(baseline-3 months later)	(baseline-3 months later)	
Median (min-max)	Median (min-max)	Median (min-max)	Median (min-max)	
75 (67-90)	76 (66-91)	74 (63-92)	77 (64-93)	0.541
	Stimulant		**Non-stimulant**	
	n=80		n=20	
	CPRS-RL		**CPRS-RL**	
	(baseline-3 months later)		(baseline-3 months later)	
	Median (min-max)		Median (min-max)	
	83 (4-125)		76 (66-91)	0.545

Note: A nonparametric test (Wilcoxon signed-rank test) was used due to the noncompliance of variables with normal distribution and an interdependency between the variables

Abbreviations: CPRS-RL: Revised Conners' Parent Rating Scale Long Form

Table 3. Caregivers' HAM-A, HAM-D, and SF-36 quality of life scale scores at the beginning of ADHD treatment and 3 months later

	At baseline Median (min-max)	**3 months later** Median (min-max)	*Z*	*P*
HAM-A	6 (2-15)	6 (1-14)	-1.121	0.211
HAM-D	4 (2-11)	4 (1-11)	-2.035	0.562
SF-36 Subscales				
Physical functioning	85 (5-100)	95 (35-100)	-6.178	**<0.001**
Role physical	50 (0-100)	75 (0-100)	-4.00	**<0.001**
Role Emotional	66.67 (0-100)	100 (0-100)	-2.828	**0.005**
Vitality	55 (25-80)	60 (30-100)	-6.916	**<0.001**
Mental Health	52 (16-84)	60 (32-100)	-7.085	**<0.001**
Social Functioning	50 (12.50-100)	75 (37.50-100)	-6.020	**<0.001**
Bodily pain	77.50 (12.50-100)	83.75 (22.50-100)	-4.459	**<0.001**
General Health	55 (25-80)	60 (45-90)	-6.658	**<0.001**

Note: A nonparametric test (Wilcoxon signed-rank test) was used due to the noncompliance of variables to normal distribution and presence of an interdependency between the variables.

Abbreviations: HAM-A: Hamilton Anxiety Rating Scale; HAM-D: Hamilton Depression Rating Scale; SF-36: Short-Form 36

Table 4. Comparison of caregivers' SF-36 score differences at baseline and 3 months later according to children's ADHD type

SF-36 Subscale	**Attention deficient dominant type** Median (min-max)	**Hyperactivity dominant type** Median (min-max)	**Combined type** Median (min-max)	*P*
Physical functioning	0 (0-30)	30 (0-50)	0 (0-50)	**<0.001**
Role Physical	0 (0-0)	0 (0-75)	0 (0-75)	**<0.001**
Role Emotional	36 (-16-52)	22 (-16-48)	20 (1-48)	0.146
Vitality	0 (0-30)	20 (0-40)	5 (0-30)	**<0.001**
Mental Health	8 (0-28)	16 (0-40)	0 (0-20)	**<0.001**
Social Functioning	12.5 (0-50)	25 (0-37.50)	25 (0-50)	0.568
Bodily pain	0 (-10-12.50)	10 (0-22.5)	0 (0-22.5)	**<0.001**
General Health	0 (0-25)	20 (0-30)	5 (0-20)	**<0.001**

Note: A nonparametric test (Wilcoxon signed-rank test) was used due to the noncompliance of variables with normal distribution and an interdependency between the variables

Abbreviations: SF-36: Short-Form 36

When we compared the change in the SF-36 scores of caregivers over 3 months by grouping them according to the treatment type of the children, the improvement in SF-36 QoL scores in the parents of children receiving stimulant (n=80) and non-stimulant treatment (n=20) did not show a statistically significant difference between the groups (Table 5).

SF-36 Subscale	Stimulant n=80 Median (min-max)	Non-stimulant n=20 Median (min-max)	*P*
Physical functioning	0 (0–50)	0 (0–5)	0.056
Role Physical	0 (0–75)	0 (0–5)	0.218
Role Emotional	10 (0- 50)	12.5 (0–66)	0.317
Vitality	0 (0–40)	0 (0–5)	0.423
Mental Health	12 (0–40)	10 (0–28)	0.723
SSocial Functioning	12.5 (0–50)	12 (0–50)	0.327
Bodily pain	0 (0–22.5)	0 (0–10)	0.534
General Health	5 (0–30)	0 (0–10)	0.076

Note: A nonparametric test (Wilcoxon signed-rank test) was used due to the noncompliance of variables with normal distribution and an interdependency between the variables

Abbreviations: SF-36: Short-Form 36

The median QoL scores of mothers and fathers as caregivers of children with ADHD both at baseline and 3 months later were not statistically significantly different in terms of SF-36 subscale scores (physical functioning, role physical, role emotional, vitality, mental health, bodily pain, general health) (z=-2.222,p=0.117; z=-0.765,p=0.444;z=-1.139,p=0.265; z=-0.270,p=0.787; z=- 0.540,p=0.589;z=-0.892,p=0.372; z=-2.686,p=0.107, respectively).

Caregivers' HAM-A and HAM-D scores decreased -but not statistically significantly- three months after the onset of treatment (p=0.211; p=0.562, respectively) (Table 3). The HAM-A and HAM-D scores of the caregivers at baseline and 3 months later were not statistically significantly different when compared according to the ADHD type of the children (Table 6).

	Hyperactivity dominant n=37 Median (min-max)	Attention deficit dominant n=23 Median (min-max)	Combined type n=40 Median (min-max)	*P*
HAM-A (At baseline)	5 (2-11)	4 (2-11)	4 (1-11)	0.536
HAM-A (3 months later)	5 (3-11)	4 (2-11)	4 (1-10)	0.442
HAM-A (Difference)	0 (1-1)	0 (1-2)	0 (2-3)	0.613
HAM-D (At baseline)	6 (2-13)	6 (3-10)	7 (2-15)	0.555
HAM-D (3 months later)	7 (1-11)	6 (3-9)	6 (3-15)	0.292
HAM-D (Difference)	0 (3-5)	0 (2-4)	1 (3-5)	0.477

Note: Since the variables did not comply with normal distribution, a nonparametric test (Kruskal -Wallis test) was used.

Abbreviations: HAM-A: Hamilton Anxiety Rating Scale; HAM-D: Hamilton Depression Rating Scale

Discussion

This study demonstrated that pharmacological treatment for children with ADHD significantly reduced symptom severity over three months, regardless of medication type. Caregivers also reported improved QoL, especially those of children with hyperactivity-dominant and combined-type ADHD. However, no significant changes were observed in caregivers' anxiety and depression levels, nor were there differences between mothers and fathers in QoL outcomes. These findings suggest that ADHD treatment positively affects both children and their caregivers, particularly in terms of QoL.

It has been reported that having a child with ADHD is associated with high levels of guilt, vulnerability, susceptibility to depression, and poor QoL among caregivers [3]. A small number of cross-sectional studies examining the QoL of parents of individuals with ADHD have found that ADHD worsens the QoL scores of parents as caregivers of their children with ADHD [10, 14]. However, follow-up studies in this field are limited in number, and to our knowledge, our survey is the first study to examine the effects of different ADHD treatment options on the QoL and symptoms of anxiety and depression of parents at follow-up.

In our study, we observed a statistically significant improvement in the physical, emotional, social, and general health domains of the QoL of parents as primary caregivers in the 3-month ADHD treatment period of children who, for the first time, received the diagnosis of ADHD and were treated accordingly. There are a limited number of follow-up studies in this field with which we can compare our study's results. In a follow-up study, the parents of children with ADHD receiving methylphenidate treatment were evaluated over 8 weeks using the WHOQOL-BREF (World Health Organization Quality of Life Scale, Brief Version). The results showed a statistically significant improvement in parents' QoL scores in the physical, environmental, and psychological domains, while no significant change was observed in the social domain. Additionally, the decrease in parents' scores on the Beck Depression Inventory was associated with improvements in their QoL [27]. Although the longer follow-up period of our study and the different scales we used to evaluate the depression and QoL of the parents make it difficult to make one-to-one comparisons with the results of this aforementioned study, the findings of our study indicating that ADHD treatment improves the QoL of caregivers in physical and emotional domains are consistent with the data of this study. In another recent cross-sectional study conducted with parents of children receiving ADHD treatment, side effects of stimulant medications, such as insomnia and weight loss in children were found to be associated with deterioration in domains that may affect QoL such as mental health and work/activity of parents [28]. In our study, we did not evaluate the side effects of the medications used on parental QoL and mental health. However, the fact that parental QoL improved significantly during the 3-month treatment period compared to baseline

allows us to comment that the negative effects of ADHD treatment due to side effects of the drugs used can be ignored compared to the positive effects of ADHD treatment on parental QoL.

In our study, it was concluded that during the 3-month ADHD treatment period, the degree of improvement in the QoL of caregivers of children with predominantly impulsive/hyperactive and combined type ADHD was statistically significantly different from the improvement in the QoL of caregivers of children with attention deficit type ADHD, while a statistically significant difference was not detected between caregivers of children with hyperactivity and combined type ADHD in terms of symptomatic improvement. Since a similarly designed prospective study using the SF-36 scale has not been reported in the literature so far, it is not possible to make one-to-one comparisons using our study results. However, it is at least possible to partially compare these results with those of cross-sectional studies evaluating the QoL of participants using different assessment scales. Similar to our findings, most of the studies suggest that impulsive/hyperactive and combined subtypes of ADHD are associated with severe impairment in parents' family functioning and worse QoL [29]. In a cross-sectional study, contrary to the authors' expectations, an increase in symptom severity in ADHD, attention deficit, and combined subtype scores was found to be negatively associated with parents' QoL scores [10]. However, based on studies reporting that children diagnosed with the attention deficit subtype may tend to be evaluated, diagnosed, and treated later than children diagnosed with the hyperactivity/impulsivity subtype [30], and it has been suggested that the delay in the treatment of children with the attention deficit subtype may be related to family burden, poorer family functioning, and psychological distress levels of parents [10].

In addition to our findings regarding QoL differences among caregivers based on ADHD presentation types, further elaboration is warranted on the specific challenges posed by hyperactive/impulsive symptoms. Children with the hyperactive/impulsive and combined presentations of ADHD often display disruptive behaviors such as excessive talking, difficulty remaining seated, interrupting others, and impulsive decision-making [31]. These behaviors frequently lead to conflictual interactions with peers, teachers, and family members, contributing to strained family dynamics and increased caregiver burden [32]. Studies have shown that such behavioral manifestations are more likely to be noticed early by caregivers and teachers, often resulting in earlier diagnosis and intervention compared to the inattentive subtype [33]. However, despite early treatment initiation, the persistent behavioral management required for these children can disrupt family routines, increase parenting stress, and limit social participation, thereby negatively impacting caregivers' emotional and physical well-being [32]. Therefore, the statistically significant improvement in caregiver QoL observed in our study may reflect not only the benefits of symptom reduction in the children but also relief from the day-to-day burden of managing disruptive behaviors, ultimately improving functioning in physical, emotional, and social domains [33, 34].

While a statistically significant improvement was observed in the SF-36 quality of life subscale scores of mothers and fathers as caregivers at baseline and 3 months later in parallel with the treatment process of the children, no significant difference was observed in the QoL subscale scores between mothers and fathers at baseline and 3 months later. In studies conducted with caregivers, as expectedly, compared to fathers, mothers of the children with ADHD mostly assumed the caregiver role [13, 35]. This situation often curtails the possibility of making statistical comparisons between mothers and fathers as caregivers. However, in most of the studies, the QoL of mothers as caregivers is worse than that of fathers; however, it is also noteworthy that in most of these studies, mothers and fathers were living together and partially sharing caregiving responsibilities [35, 36]. In our study, 20 of the 24 fathers who assumed the role of primary caregivers were separated from their spouses or their wives were deceased, and fathers fulfilled their caregiving responsibilities without support. Thus, fathers were primarily in the position to satisfy all the needs and solve all the problems of their children with ADHD. This fact may have eliminated the gender role difference between the caregivers as mothers and fathers in our study and may explain why we found no difference in disease-related QoL in both parents at baseline and 3 months later.

We could not find a statistically significant difference between the depression and anxiety scores of the parents during the three-month follow-up period compared to baseline. Since our study lacked a control group, we missed the chance to compare our results with those of parents whose children exhibit normal psychological development. Similarly, in our previous study examining the impact of ADHD treatment on caregiver burden, we did not observe any change in caregivers' anxiety and depression scores during the three-month follow-up period [37]. In this context, while the findings of our two studies are similar, some studies in the literature report different results in this field. It has been reported that ADHD symptoms may impose stress on parents, which may make child care more difficult and lead to the development of mental distress, such as anxiety and depression in caregivers [38]. In a cross-sectional study conducted with caregivers of individuals with ADHD and healthy children, parents of children with ADHD reportedly experienced higher levels of depression and anxiety [39]. Similarly, in a cross-sectional study conducted with 62 children with ADHD and 62 age-matched healthy children, the level of trait anxiety experienced by mothers was found to be higher than in the control group [40]. Some previous follow-up studies have shown that treatment of ADHD in children may lead to improvement in symptoms of depression experienced by caregivers [8, 27]. In a follow-up study involving 40 caregivers, Gökçen et al. concluded that treatment of children with ADHD may have a positive effect on symptoms

of depression and burnout levels of mothers [38]. Another follow-up study has disclosed that Beck Depression Inventory (BDI) scores of parents of children with ADHD decreased significantly 8 weeks after the initiation of methylphenidate treatment, and BDI scores have been negatively correlated with ADHD symptom severity [27]. However, the follow-up period in the indicated study was shorter than that of our study, and the BDI scale used to assess depression severity is a self-assessment scale. The relatively longer follow-up period of our study and the fact that the HAM-D scale, which we used to monitor depression scores in our study, was administered by a clinician, may explain- contrary to the results of the abovementioned study- lack of any statistically significant difference in the parents' depression scores during the 3-month study period. Moreover, the lack of significant change in caregivers' anxiety and depression in our study also suggests that improving children's symptoms alone may not be sufficient to enhance parental mental health. Other factors, such as caregiver stress management, social support, and economic challenges, should be considered in future interventions.

Depression [41] and anxiety levels [36] of caregivers are important factors influencing their QoL. In our study, anxiety and depression scores of caregivers did not change during the three-month treatment period. This suggests that the observed improvement in caregivers' QoL can be confidently attributed to the ADHD treatment, and appears to be independent of the presence and severity of anxiety and depressive symptoms.

Limitations and Strengths of Our Study

Our study has some limitations. One of the most important limitations is that children with ADHD were monitored for only 3 months, which can be considered a short period for detecting changes in symptoms and QoL. Besides, other factors that may affect the QoL, such as caregivers' coping skills, were not evaluated, and we did not conduct structured psychiatric interviews with the parents regarding the lifelong psychopathological state of the patients and their habits of substance use.

Despite the short follow-up period of the study, its prospective design, the inclusion of children with ADHD diagnosed and received treatment for the first time, the clear demarcation of the primary caregiving positions of parents, the detailed exclusion of additional psychiatric diseases through a structured psychiatric interview based on DSM-5 criteria, and the inclusion of different ADHD treatment options in the study are the most important strengths of our study.

Conclusion

In our study, treatment of ADHD with stimulant or nonstimulant drugs was associated with positive changes in the QoL of parents as well as alleviating the symptoms of children with ADHD. These results suggest that the effects of ADHD treatment may provide symptomatic improvement in children with ADHD and improvements in the QoL of parents. Therefore, parents caring for their children with ADHD should be integrated into the overall planning of treatment goals for ADHD. Early diagnosis of ADHD and prompt initiation of treatment are crucial for reducing children's symptoms and improving parents' QoL.

Future studies should be designed using larger sample sizes and longer follow-up periods. The inclusion of a control group would also increase the power to attribute observed changes directly to treatment. Additionally, future studies should include a greater number of fathers in the caregiver role to examine outcomes based on parental gender, as most of the primary caregiver parents in our study were mothers.

Highlights

• Children's ADHD symptoms showed similar improvement during the 3-month follow-up, regardless of the type of treatment (stimulant vs. non-stimulant).

• Along with alleviating children's symptoms, ADHD treatment has enhanced parents' QoL.

• Although the anxiety and depression scores of the parents did not change significantly, significant improvement in QoL was attributed to the outcome of ADHD treatment.

• The improvement in the QoL of mothers and fathers at 3 months did not differ statistically.

Conflict of interest

The authors declare no conflicts of interest.

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