

Self- and Parent-Rated Quality of Life in School Aged Children with ADHD: The Impact of Common Comorbid Psychiatric Disorders and Motor Proficiency

Nilay Sahan^a , Halime Tuna Cak Esen^b , Ayhan Parmaksiz^c , Songul Atasavun Uysal^d 

^aYozgat Bozok University, School of Sarikaya Physical Therapy and Rehabilitation, Yozgat; ^bHacettepe University, Faculty of Medicine Department of Child and Adolescent Psychiatry, Ankara; ^cIstanbul Health and Technology University, Faculty of Medicine Department of Biostatistics, Istanbul; ^dHacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara

Abstract

Background: The aim of the study was to investigate the relationship between the clinical key factors, that is, ADHD symptom severity, comorbidity and motor skill level, and the quality of life perceived by the child and parent.

Methods: A total of 81 boys, 6-10 years were evaluated. Five groups of children were compared: ADHD only (n=18); ADHD and specific learning disorder (n=17); ADHD and oppositional defiant disorder (n=16); ADHD and anxiety disorder (n=15); control group (n=15). The Conners' Parent Scale - Revised Short Form and Pediatric Quality of Life Inventory Parent and Child Forms were filled out. Motor skills were evaluated using the 2nd version of the Bruininks-Oseretsky Motor Proficiency Test. Progressive regression analysis was used to determine the extent to which the quality of life of children was predicted by the comorbid status, ADHD symptoms and severity, and motor skill scores.

Results: ADHD diagnosis affects the quality of life according to both child and parent reports whether comorbid psychiatric disorder accompanies it or not. Although the comorbidity of opposition defiant disorder affects the quality of life more according to child reports, it shows that having ADHD diagnosis alone is enough to affect the quality of life of children according to parent reports. Additionally, the presence of comorbidity accompanying ADHD diagnosis, increases in ADHD symptom severity and motor skill deficiencies are important predictors of quality of life according to both child and parent reports.

Conclusions: Considering different aspects of ADHD; a chronic neurodevelopmental disorder with symptoms persisting into adulthood, on the perceptions of both children and families about quality of life will contribute to improving the children's well-being.

ARTICLE HISTORY

Received: Jul 30, 2020

Accepted: Nov 22, 2020

KEYWORDS: quality of life, attention deficit hyperactivity disorder, comorbidity, motor skills, children

INTRODUCTION

Attention deficit hyperactivity disorder (ADHD), the most common neurodevelopmental disorder among children and adolescents, is associated with many developmental, academic, and social difficulties, starting in early childhood and often continuing in adolescence and adulthood [1].

Children diagnosed with ADHD have difficulties not only in achieving the expected academically, but also in establishing healthy social relationships with their peers, parents, and teachers. In addition to the difficulties experienced in ADHD, emotional problems such as lack of self confidence, depressive and anxiety symptoms may also occur [2]. All these problems cause losses in various parameters of the quality of life (QoL), especially in the psychosocial area that directly affects the well-being. Generally, these often untreated difficulties continue in adulthood and decrease self-esteem by disrupting

the daily routine [3]. In their meta-analysis including 36 studies published between 1998 and 2008, Danckaerts et al. [4] supported the above mentioned findings and stated that children with ADHD had more difficulty in achievement and self-confidence compared to those without ADHD but with chronic physical diseases such as cerebral palsy or cancer, and that they had lower levels of quality of life, especially in the psychosocial area. They also mentioned in their study that children with ADHD had more behavioral problems than those with other mental health disorders such as major depressive disorder, and that ADHD diagnosis had a comparable effect on quality of life [4]. In another study, Coghill and Hodgkins compared the children with ADHD, those with Type 1 DM (diabetes mellitus), and their healthy peers in terms of QoL and found that the diagnosis of ADHD affected the children's

Corresponding author: Nilay Sahan, E-Mail: nilay.sahan@yobu.edu.tr

To cite this article: Sahan N, Esen Cak HT, Parmaksiz A, Uysal Atasavun S. Self - and Parent-Rated Quality of Life in School Aged Children with ADHD: The Impact of Common Comorbid Psychiatric Disorders and Motor Proficiency. Psychiatry and Clinical Psychopharmacology 2020;30(4):403-414, DOI:10.5455/PCP.20200818114525

QoL more negatively than the diagnosis of Type 1 DM based on the reports of children and their families [5]. Although it is clear in the literature that ADHD affects the QoL negatively, recent studies have not explored the nature of the relationship between ADHD and QoL and the other possible factors affecting this relationship. In their review of 14 studies conducted between 2008 and 2012, Velö and his friends [6] confirmed the negative effects of ADHD on QoL and stated that there were contradictory results about the effects of age and gender on QoL in ADHD. In a study on the factors affecting the relationship between ADHD and QoL in young adults, it was investigated how ADHD comorbidity, substance use, psychosocial or psychopharmacological treatment mediated the relationship between ADHD and QoL [7].

It is a known fact that ADHD is associated with other psychiatric disorders, and even this comorbidity is said to be a rule rather than an exception [8]. It has been confirmed that two-thirds of the children diagnosed with ADHD have at least one comorbid psychiatric disorder [9,10]. In accordance with the literature, the studies conducted in Turkey have also reported that 60% of the children with ADHD are diagnosed with one or more comorbidities and the most common comorbidities are oppositional defiant disorder (ODD) and specific learning disorder (SLD), followed by anxiety disorder, depression, obsessive-compulsive disorder, and behavioral disorders [11,12]. It is also emphasized that the initial evaluations should be comprehensive, since the presence of these comorbidities may increase the disease severity and decrease the ability to respond to treatment [13,14]. In one of the few studies examining how comorbidity affects the QoL in children diagnosed with ADHD, Klassen et al. [2], relying merely on parents' statements, reported the comorbidity accompanying ADHD was an important predictor of the QoL, and that an effective intervention to improve the QoL in ADHD would be possible only with sensitive measurement results on the severity of symptoms and accompanying comorbidities.

Motor skill problems are very common in ADHD, especially in school-age children even though they are not evaluated and diagnosed according to formal criteria. Motor skill problems, affecting children at different levels of daily lives, are seen in 30-50% of children diagnosed with ADHD, and the gross and fine motor skill development in these children are significantly deficient compared to typical developing peers [15 - 17]. These problems in motor skills in school-age children cause not only problems in social competence and academic achievement, but also problems such as resisting physical activity, obesity, lower self-esteem, low school performance, and problems in social relations [18-20]. In their study with children diagnosed only with ADHD, Goulardians et al. [21] concluded that there was a positive relationship between motor skill development and QoL in children. In another study conducted by Engel-Yeger [22] it was mentioned that motor problems in adulthood affect the QoL, especially in psychosocial and environmental areas. Additionally,

Collizi et al. [23] stated that the motor problems seen in neuropsychiatric disorders have important public health costs and are also a neglected area. They also mentioned that the recognition of motor problems and the effects of these problems on the QoL is important in creating new approaches for early intervention.

Although it is clear that ADHD diagnosis negatively affects the QoL, according to the reports of children and parents; how comorbid disorders and motor problems change the QoL in children with ADHD has not been clearly revealed in the literature. Therefore, the main purpose of this study is, first, to determine whether the QoL perceived by both the child and the parent changes in the case of 3 psychiatric comorbid disorders (ODD, SLD, Anxiety Disorder), which are known to accompany ADHD most frequently, in the school-age children with ADHD by comparing them with control group; and second, to investigate the relationship between the clinically key factors, that is, ADHD symptom severity, comorbidity and motor skill level, and the QoL perceived by the child and parent. Hypotheses of the this study are firstly; the QoL of the whole ADHD group, regardless of existence of a comorbid disorder, will be lower than control group in both parent and child reports. Secondly; In the presence of a comorbid psychiatric disorder in ADHD, the QoL will be further impaired. Thirdly; the increase in ADHD symptom severity will decrease the QoL reported by both the child and the parent and last hypothesis is that the decrease in motor skill level will negatively affect the reports of both child and parent on QoL.

METHODS

Participants

In our study, the sample was selected by screening the files of the boys with only ADHD and with ODD, SLD or Anxiety Disorder accompanying ADHD at the Hacettepe University Department of Child and Adolescent Mental Health, between October 2018 and October 2019. Inclusion criteria were boys between the ages 6 and 10 years, right hand dominant and diagnosed with only ADHD and with either ODD, SLD or Anxiety Disorder accompanying ADHD. The file information of 426 children who met the criteria were reviewed. Exclusion criteria were children with a history of head trauma, known chronic disease, known neurological disease, comorbid tic disorder, obsessive compulsive disorder, psychotic disorder, mood disorder, conduct disorder, mental retardation or autism spectrum disorder, and multiple comorbid psychiatric disorders. As a result, a total of 106 children who met the inclusion and the exclusion criteria and agreed to participate in the study were evaluated.

The control group included 30 children selected from the boys between the ages of 6-10 years, right hand dominant who volunteered to participate in the study and did not have any psychiatric symptoms according to the reports of their teachers or parents. Control group was selected by

convenience sampling method.

Our study was approved by the Non-Interventional Clinical Research Ethics Committee, Hacettepe University, with the decision dated 25.09.2018 and numbered GO 18/694-29, and carried out in accordance with the Helsinki Declaration. All children and their parents were informed about the purpose and content of the study and the signed informed consent was obtained from all children and parents.

Evaluation

The demographic characteristics (age, body mass index, occupation, etc.) of the children and their parents who met the inclusion criteria and agreed to participate in the study were recorded on the prepared evaluation form. Once again, a clinical psychiatric evaluation was made with 106 children and their families constituting the research group within the scope of the study to review and confirm the children's psychiatric diagnoses.

The Conners' Parent Scale-Revised Short Form (CPS-R:SF) and Pediatric Quality of Life Inventory Parent Form were filled by the parents of the children in the research and control groups.

The children's motor skills and QoL were evaluated using the 2nd version of the Bruininsky-Oseretsky Motor Proficiency Test and Pediatric Quality of Life Inventory Child Form, respectively, by a physiotherapist.

Measures

The Conners' Parent Scale - Revised Short Form (CPS-R:SF) is a scale used to screen "Attention Deficit and Destructive Behavior Disorders" [24]. The Turkish adaptation study was carried out by Kaner et al. [25]. It consists of 27 items in total. In CPS-R:SF, questions are answered on a 4-point Likert scale. The higher the scale score, the intenser the symptoms specific to ADHD and destructive disorders.

Motor skills were assessed using the 2nd version of the Bruininsky-Oseretsky Motor Proficiency Test (BOT-2) [26] (Bruininks, 1978). It is a standard test commonly used by physiotherapists to detect the gross and fine motor problems of children between the ages of 4 and 21 years. It has both short and long form. Short form was used in our study. The short form of BOT-2 consists of 8 subtests: fine motor precision, fine motor integration, manual dexterity, bilateral coordination, balance, speed of movement and agility, upper extremity coordination and strength. The score for each subtest can be calculated separately, as well as the scores for fine motor skill, gross motor skill, both fine and gross motor skill, and total motor skill score [26,27].

The Pediatric Quality of Life Inventory (PedsQL) was developed by Varni et al. [28] in 1999, and its Turkish validity and reliability study was carried out by Memik et al. [29]. It aims to measure the overall QoL in the 2-18 age group. The scale has separate parent and child forms for the groups of 5-7 years, 8-12 years, and 13-18 years. The

scale is scored in 3 ways: scale total score (STS), physical health total score (PHTS), and psychosocial health total score (PHTS), which consists of calculating the item scores evaluating emotional, social, and school functionality. The higher the scale total score, the better the perceived QoL related to health. In order to evaluate the reliability of the scale, its internal consistency was tested, and the Cronbach's alpha coefficient was found to be 0.70-0.89 [30].

Statistical Analysis

The data of the study was analyzed using SPSS 21.0 package program. It was calculated to have 15 people in each group to conduct the study with 80% power. The homogeneity of the groups was investigated using Levene Test. In binary comparisons, Student t Test was used to evaluate the difference between groups in the case of normal distribution and homogeneous groups, and Mann Whitney U Test was used in case the groups were not normally distributed. In order to compare multiple groups, if the groups were normally distributed and homogeneous, One Way Variance Analysis was used, and Bonferroni post hoc test was carried out to determine which groups differ. In case the groups were not normally distributed and homogeneous, the groups were compared using the Kruskal Wallis analysis. The Fisher Freeman Halton test was used in categorical evaluations.

Progressive regression analysis [31] was used to determine the extent to which the children's QoL was predicted by comorbidity, ADHD symptoms and severity, and motor skill scores. Piecewise regression or MARS models, different regression models are obtained for the dependent variable in different intervals / parts of the independent variable and the model was established for 6 different dependent variables in study.

Although the Shapiro-Wilk normality test result was significant only for model 2 for regression model residuals, when the statistics on residuals were examined; mean and median values of residuals for all models were relatively close, histogram graphs, P-P plots, studentized residual graphs against the unstandardized predicted value, skewness/SE ratio (maximum obtained ratio was 1.917). It was seen that the assumptions of variance homogeneity and normality of errors/residuals were not violated. The significance was set at $p < 0.05$.

RESULTS

Of the 106 children (study group) and 30 children (control group), the children who were found to have one of the exclusion criteria during the face-to-face clinical psychiatric evaluation or who did not complete the research scale or tests were excluded from the study. The formation of the study and the control groups is summarized in Figure 1. As a result, a total of 81 children were included in the analysis in order to match the groups in terms of age, body mass index and maternal education level: 18 children with

ADHD, 17 with ADHD and special learning difficulties (ADHD + SLD), 16 with ADHD and oppositional defiant disorder (ADHD + ODD), 15 with ADHD and anxiety disorder (ADHD + Anxiety Disorder) in the study group and 15 children in the control group. The demographic characteristics of the groups are summarized in Table 1. There was no difference

between the ages of the children in the groups; likewise, the groups were similar in terms of socio-demographic characteristics, but the rate of being diagnosed with psychiatric disorders in the siblings of children in the ADHD group was found to be significantly higher.

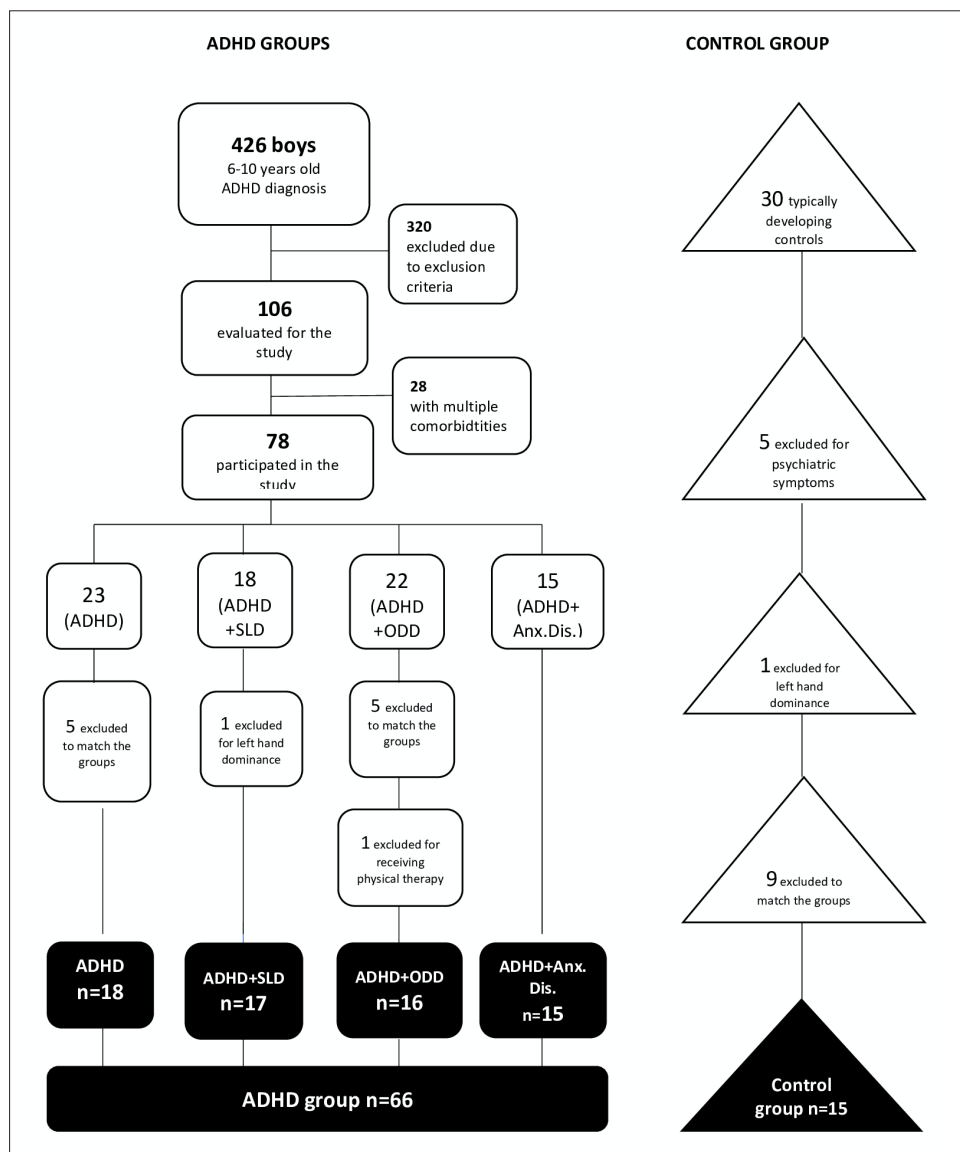


Figure 1. Formation of the Attention Deficit Hyperactivity Disorder (ADHD) and the Control Groups

Symptom Severity of ADHD in the Study Groups

As expected, the CPS-R:SF scores of the control group were significantly lower than those of the ADHD group in all subscale scores (Table 2). ADHD and comorbidity groups were compared using CPS-R:SF scores in terms of ADHD

symptom severity. A statistically significant difference was found only between ADHD group and ADHD + ODD group in terms of CPS-R:SF oppositional behaviour scores. In the ADHD + ODD group, CPS-R:SF oppositional behaviour scores were significantly higher than the group diagnosed with ADHD alone (p = 0.013).

Table 1. Clinical Characteristics of the Participants

		ADHD (n=18)	ADHD+SLD (n=17)	ADHD+ODD (n=16)	ADHD+Anx. Dis. (n=15)	CG (n=15)	ADHD (n=66) -CG (n=15) p	ADHD Groups p
Participants	Age (month) (X±SS)	91(81-120)	103 (77-125)	95,5 (79-107)	102 (74-128)	99 (95-112)	0,081	0,293a
	BMI	16,41(12,6-23,6)	17,1(14,4-30,2)	15,95(13,9-23)	17,75(13,1-26,5)	17,7(14,3-20,8)	0,315	0,440b
Mother	Age (X±SS)(year)	33,5±6,04	36,8±5,8	35±5,6	38±5,19	33,6±3,9	0,088	0,118a
	Education (year)	10,44	11,76	8,06	11,66	10,20	0,064	0,145
Father	Age (X±SS)(year)	36±7,07	40±5,4	41±7,1	40±5,2	35±4,9	0,053	0,140b
	Education (year)	11,77	11,05	9,12	10,93	12,2	0,248	0,287
Parents	Married	16(88,9)	13(76,5)	16(100)	12(80)	15(100)	0,231	0,204
	Divorce	2(11,1)	4(23,5)	0	3(20)	0		
Consanguineous Marriage	Yes	1(5,6)	2(11,8)	5(31,2)	1(6,7)	1(6,7)	0,339	0,175
	No	17(94,4)	15(88,2)	11(68,8)	14(93,3)	14(93,3)		
Psychiatric Diagnosis in siblings	Yes	2(11,2)	4(25)	3(18,75)	4(26,7)	0	0,01	0,754
	No	16(88,8)	12(75)	13(81,25)	11(73,3)	15(100)		
Psychiatric diagnosis in family	Yes	2(11,2)	4(23,6)	4(25)	4(26,7)	0	0,03	0,645
	No	16(88,8)	13(76,4)	12(75)	11(73,3)	15(100)		
Smoking during pregnancy	Yes	5(27,8)	4(23,5)	1(6,3)	2(13,4)	2(13,4)	0,5	0,364
	No	13(72,2)	13(76,5)	15(93,7)	13(86,6)	13(86,6)		
Birth Type	Normal	8(44,4)	8(47,1)	4(25)	4(26,7)	6(40)	0,388	0,424
	Caesarean	10(55,6)	9(52,9)	12(75)	11(73,3)	9(60)		
Time of Birth	Term	16(88,9)	16(94,1)	15(93,8)	15(100)	14(93,3)	0,5	0,898
	Preterm	2(11,1)	1(5,9)	1(6,2)	0	1(6,7)		
Complications at Birth	Yes	2(11,1)	3(17,6)	5(31,2)	3(20)	2(13,3)	0,362	0,565
	No	16(88,9)	14(82,4)	11(68,8)	12(80)	13(86,7)		

ADHD: Attention deficit hyperactivity disorder, ADHD+SLD: attention deficit hyperactivity disorder and Specific learning disorder, ADHD+ODD: attention deficit hyperactivity disorder and oppositional deficit disorder, ADHD+Anx Dis.: attention deficit hyperactivity disorder and anxiety disorder, CG: Control Group, a: One Way Analysis of Varians, b: Kruskal Wallis Analysis, p< 0,005.

Table 2. Conners' Parent Scale- Revised Short Form Scores by Groups

Conners' Parent Scale- Revised Short Form Score	Groups	X±SS	Min	Max.	ADHD (n=66) -CG (n=15)		ADHD Groups		
					Z	p	X'	p	Bonferroni
Oppositional Behaviour	ADHD	6±4,1	0	16	-3,747	0,0005	10,849	0,013	ADHD+ODD>ADHD
	ADHD+SLD	8±3,9	2	16					
	ADHD+ODD	12±4,4	1	17					
	ADHD+Anx. Dis.	7,5±5,36	1	16					
	CG	2±2,9	0	12					
Cognitive Problems- Inattention	ADHD	8±4,9	2	18	-4,850	0,0005	1,812	0,612	
	ADHD+SLD	10±4,19	1	17					
	ADHD+ODD	10,5±2,7	5	16					
	ADHD+Anx. Dis.	11±4,7	2	16					
	CG	0±3,8	0	12					
Hyperactivity	ADHD	6±3,04	0	11	-3,801	0,0005	7,602	0,55	
	ADHD+SLD	6±4,5	0	14					
	ADHD+ODD	11±4,7	3	18					
	ADHD+Anx. Dis.	7,5±4,9	0	16					
	CG	2±2,9	0	10					
ADHD Index	ADHD	20±8,3	5	35	-5,206	0,0005	3,051	0,384	
	ADHD+SLD	19±7,08	9	32					
	ADHD+ODD	23,5±5,7	10	31					
	ADHD+Anx. Dis.	23±8,3	8	35					
	CG	4±6,2	0	19					

ADHD: Attention deficit hyperactivity disorder, ADHD+SLD: Attention deficit hyperactivity disorder and Specific learning disorder, ADHD+ODD: Attention deficit hyperactivity disorder and Oppositional deficit disorder, ADHD+Anx Dis.: Attention deficit hyperactivity disorder and Anxiety disorder, CG: Control Group, Z: Mann-Whitney U Test, X2 :Kruskal Wallis Varyans Analysis, p< 0,05.

Motor Skill Levels in the Study Groups

When we compared the children in terms of their motor skills using the scores for the sub-scales of the BOT-2 Test; it was observed that all children in the ADHD group scored significantly lower in each subscale and each category (fine motor skill, gross motor skill, both fine and gross motor skill, and total motor skill) compared to control group (Table 3). It was also found that there were differences between ADHD and comorbidity groups in terms of motor skills. It was observed that the ADHD + SLD group scored significantly lower in both fine and gross motor skill subscales compared to the ADHD only group ($p = 0.015$) and scored significantly lower in gross motor skill subscale than the ADHD and ADHD + ODD group ($p = 0.004$).

Relationship between Quality of Life and ADHD

In all subscales of the Pediatric Quality of Life Inventory, based on the reports of both parents and children, the QoL scores of children in the ADHD group were found to be

significantly lower than control group (Table 4). In addition, when the correlation between the QoL reported by children and the QoL reported by their parents was analyzed, it was found that there was a statistically significant correlation between the child-reported and parent-reported scores of QoL ($p < 0.05$ $r = 0.24-0.445$).

Relationship between Quality of Life and ADHD and Comorbidity

When the parent reports and children's self-reports on the QoL were compared in terms of the difference between ADHD and comorbid groups; no statistically significant difference was found. However, it was found that while the ADHD + ODD group had the lowest score in children's self-reports on QoL; according to parent-rated reports of the QoL, the only ADHD group had the lowest scores in the categories of total score and physical health score; on the other hand, the ADHD + Anxiety Disorder group had the lowest score in the category of psychosocial score (Table 4).

Table 3. BOT-2 Scores by Groups

	Groups	X±SS	Min.	Max.	ADHD (n=66) -CG (n=15)		ADHD Groups				
					t	Z	p	F	X2	p	Bonferroni
Fine Motor Skills	ADHD	15±4,4	7	24	-	-4,356	0,0005	-	5,065	0,167	
	ADHD+SLD	19±6,08	6	24							
	ADHD+ODD	20±4,5	10	24							
	ADHD+Anx. Dis.	19±5,4	7	28							
	CG	23±2,8	20	29							
Fine and Gross Motor Skill	ADHD	6,5±2,09	2	10	-	-3,097	0,001	-	10,429	0,015	ADHD>ADHD+SLD
	ADHD+SLD	3±2,5	2	10							
	ADHD+ODD	6±2,2	0	8							
	ADHD+Anx. Dis.	6±2,3	1	8							
	CG	7±1,01	6	9							
Gross Motor Skills	ADHD	20,6±5,2	8	28	-5,797	-	0,0005	9,830	-	0,004	ADHD>ADHD+SLD ADHD+ODD>ADHD+SLD
	ADHD+SLD	15,4±5,7	4	24							
	ADHD+ODD	20,9±5,4	9	28							
	ADHD+Anx. Dis.	15,9±5,6	7	27							
	CG	27,4±2,1	24	31							
BOT Total	ADHD	45±8,2	29	53	-	-5,718	0,0005	-	5,593	0,133	
	ADHD+SLD	37±11,46	11	53							
	ADHD+ODD	50±10,8	21	57							
	ADHD+Anx. Dis.	41±11,1	22	58							
	CG	57±4,3	53	68							

ADHD: Attention deficit hyperactivity disorder, ADHD+SLD: Attention deficit hyperactivity disorder and Specific learning disorder, ADHD+ODD: Attention deficit hyperactivity disorder and Oppositional deficit disorder, ADHD+Anx Dis.: Attention deficit hyperactivity disorder and Anxiety disorder, CG: Control Group, t: Student t Test, Z: Mann-Whitney U Test, X2 :Kruskal Wallis Varyans Analysis, F: Mann-Whitney U Test, $p < 0,05$.

Table 4. Pediatric Quality of Life Inventory Scores by Groups

	Groups	X±SS	Min.	x.	ADHD (n=66) -CG(n=15)			ADHD Groups		
					t	Z	p	F	X2	p
Child Reported Total Score	ADHD	71,57±16,06	36,9	97,8	4,117	-	0,001	1,077	-	0,366
	ADHD+SLD	64,5±16,1	30,43	91,30						
	ADHD+ODD	63,37±16,1	30,43	86,95						
	ADHD+Anx. Dis.	64,27±11,7	45,65	84,78						
	CG	79,06±8,8	65,21	91,30						
Child Reported Physical Health Total Score	ADHD	81,25±18,2	40,62	100	-	2,493	0,006	-	7,385	0,061
	ADHD+SLD	75±23,5	12,50	90						
	ADHD+ODD	68,75±14,3	50	100						
	ADHD+Anx. Dis.	68,75±17,02	31,25	87,5						
	CG	81,25±8,6	71,87	100						
Child Reported Psychosocial Health Total Score	ADHD	67,4±17,3	26,6	96,6	1,805	-	0,003	0,780	-	0,510
	ADHD+SLD	64,01±14,8	40	93,3						
	ADHD+ODD	58,64±20,7	13,3	86,6						
	ADHD+Anx. Dis.	63,46±12,6	43,33	83,33						
	CG	76,33±11,1	60	96,66						
Parent Reported Total Score	ADHD	56,52±16,35	36,95	95,65	-	4,649	0,0005	-	0,820	0,845
	ADHD+SLD	62,49±15,2	38,86	85,86						
	ADHD+ODD	66,84±14,08	30,43	81,52						
	ADHD+Anx. Dis.	59,78±14,9	41,3	86,95						
	CG	88,04±10,5	65	100						
Parent Reported Physical Health Total Score	ADHD	57,81±21,4	25	100	-	4,056	0,0005	-	3,668	0,300
	ADHD+SLD	71,81±11,2	50	93,75						
	ADHD+ODD	62,5±16,8	40,62	87,5						
	ADHD+Anx. Dis.	75±15,5	46,87	90,62						
	CG	90,62±12,7	56,25	100						
Parent Reported Psychosocial Health Total Score	ADHD	59,16±16,9	33,33	93,33	7,611	-	0,0005	0,919	-	0,437
	ADHD+SLD	59,99±20,09	26,66	83,33						
	ADHD+ODD	64,99±16,9	25	87,5						
	ADHD+Anx. Dis.	56,66±16,4	38,33	90						
	CG	86,6±10,2	61,66	100						

ADHD: Attention deficit hyperactivity disorder, ADHD+SLD: Attention deficit hyperactivity disorder and Specific learning disorder, ADHD+ODD: Attention deficit hyperactivity disorder and Oppositional deficit disorder, ADHD+Anx Dis.: Attention deficit hyperactivity disorder and Anxiety disorder, CG: Control Group, t: Student t Test, Z: Mann-Whitney U Test, X2 :Kruiskal Wallis Varyans Analysis, F: Mann-Whitney U Test, p < 0,05.

Predictors of Quality of Life

Multiple linear regression analysis, which is applied with backward stepwise method, was carried out with the following independent variables: motor skill scores (BOT-2 fine motor skill and gross motor skill scores), ADHD symptom severity (CPS-R:SF subscale scores; oppositional behaviour, cognitive problems/inattention and carelessness, hyperactivity scores), and the comorbidity (Table 5).

The Total QoL Score Reported by the Child: The model explained approximately 17.4% of the variance (variability) in the dependent variable “quality of life child reported

total score” (F = 5.164, p = 0.001). The variables found to have a significant effect on the QoL child reported total scores were the fine motor skill scores and the presence of comorbid diagnoses (SLD, ODD and Anxiety Disorder) accompanying ADHD. It was found that a 1-point increase in fine motor skill caused a 0.842-point increase in the child assessment total score. Furthermore, compared to, the total score of the evaluations of the ADHD + SLD, ADHD + ODD, and ADHD + Anxiety Disorder groups were found to be 8.355, 10.897, and 9.431 points lower than the control group, respectively.

Table 5. Multiple Regression Analysis Results

Model	Unstandardized Coefficients		Standardized Coefficients			Correlations			
	B	SE	Beta	t	p	Zero-order	Partial	Part	VIF
Child Reported QoL Total Score									
(Constant)	58,700	5,956		9,856	<0.001				
Fine Motor Skill	0,842	0,282	0,310	2,981	0,004	0,339	0,326	0,305	1,033
group=ADHD+SLD	-8,355	4,143	-0,229	-2,017	0,047	-0,148	-0,227	-0,206	1,229
group=ADHD+ODD	-10,897	4,172	-0,292	-2,612	0,011	-0,180	-0,289	-0,267	1,192
group=ADHD+Anx. Dis.	-9,431	4,361	-0,240	-2,163	0,034	-0,102	-0,242	-0,221	1,175
R=0.465, R-sqr=0.216, Adj. R-sqr=0.174, se=13.673, (F=5.164, p=0.001)									
Child Reported QoL Physical Health Total Score									
(Constant)	74,069	7,581		9,771	<0.001				
Fine Motor Skill	0,607	0,334	0,188	1,816	0,073	0,270	0,205	0,182	1,065
Oppositional Behaviour	-1,092	0,376	-0,300	-2,905	0,005	-0,378	-0,318	-0,291	1,062
group=ADHD+SLD	-9,029	4,570	-0,208	-1,976	0,052	-0,221	-0,222	-0,198	1,101
group=ADHD+Anx. Dis.	-9,876	4,868	-0,211	-2,029	0,046	-0,180	-0,228	-0,203	1,078
R=0.498, Rsqr=0.248, Adj.R-sqr=0.208, se=15.933, (F=6.179, p<0.001)									
Child Reported QoL Psychosocial Health Total Score									
(Constant)	52,847	7,743		6,825	<0.001				
Gross Motor Skill	0,722	0,285	0,284	2,535	0,013	0,310	0,279	0,263	1,163
Cognitive Problem-Inattention	0,836	0,443	0,259	1,888	0,063	-0,080	0,212	0,196	1,747
Hyperactivity	-1,334	0,479	-0,376	-2,784	0,007	-0,301	-0,304	-0,289	1,693
R=0.425, Rsqr=0.181, Adj.R-sqr=0.148, se=15.329, (F=5.581, p=0.002)									
Parents Reported QoL Total Score									
(Constant)	68,683	6,126		11,211	<0.001				
Fine Motor Skill	0,801	0,261	0,269	3,070	0,003	0,406	0,334	0,260	1,066
Cognitive Problem-Inattention	-1,053	0,354	-0,329	-2,970	0,004	-0,570	-0,324	-0,252	1,703
Hyperactivity	-1,022	0,393	-0,290	-2,599	0,011	-0,564	-0,287	-0,221	1,726
R=0.678, Rsqr=0.460, Adj.R-sqr=0.439, se=12.411, (F=21.311, p<0.001)									
Parents Reported QoL Physical Health Total Score									
(Constant)	86,137	3,257		26,445	<0.001				
Hyperactivity	-1,870	0,374	-0,490	-5,003	<0.001	-0,446	-0,498	-0,484	1,022
group=ADHD	-12,796	4,158	-0,301	-3,077	0,003	-0,230	-0,333	-0,298	1,022
R=0.536, Rsqr=0.288, Adj.R-sqr=0.269, se=15.337, (F=15.333, p<0.001)									
Parents Reported QoL Psychosocial Health Total Score									
(Constant)	89,679	3,380		26,535	<0.001				
Hyperactivity	-2,213	0,348	-0,548	-6,366	<0.001	-0,544	-0,595	-0,537	1,041
group=ADHD	-16,822	4,204	-0,375	-4,001	<0.001	-0,131	-0,422	-0,338	1,230
group=ADHD+SLD	-17,800	4,353	-0,380	-4,089	<0.001	-0,239	-0,429	-0,345	1,211
group=ADHD+Anx. Dis.	-11,739	4,593	-0,238	-2,556	0,013	-0,144	-0,285	-0,216	1,217
R=0.687, Rsqr=0.473, Adj.R-sqr=0.444, se=14.130, (F=16.578, p<0.001)									

ADHD: Attention deficit hyperactivity disorder, ADHD+SLD: Attention deficit hyperactivity disorder and Specific learning disorder, ADHD+ODD: Attention deficit hyperactivity disorder and Oppositional deficit disorder, ADHD+Anx Dis.: Attention deficit hyperactivity disorder and Anxiety disorder, CG: Control Group.

The QoL Physical Health Score Reported by the Child

Variables having statistically significant effect on the QoL physical health scores reported by the child were the oppositional behaviour score and the diagnosis of *Anxiety Disorder* accompanying the diagnosis of ADHD ($p = 0.005$ and $p = 0.046$, respectively). A 1-point increase in the opposition behaviour score caused a 0.607-point decrease in the QoL physical functionality score reported by the child. Also, the QoL child-reported physical functionality score of ADHD + Anxiety Disorder group was found to be 9,876 points lower than the control group. The model explained approximately 20.8% of the variance (variability) in the dependent variable “quality of life child-reported physical functionality score” ($F = 6.179$, $p < 0.001$).

The QoL Psychosocial Health Score Reported by the Child

In the QoL psychosocial health scores, the last dependent variable of child reports; the model explained about 14.8% of the variance (variability) ($F = 5.581$, $p = 0.002$). The variables found to have statistically significant effects on QoL child-reported psychosocial scores were the gross motor skill scores and hyperactivity scores ($p = 0.013$ and $p = 0.007$, respectively). It was found that a 1-point increase in gross motor skill score caused a 0.722-point increase in the psychosocial field of QoL of children, and a 1-point increase in the hyperactivity symptom score caused a 1.334-point decrease in the psychosocial field of QoL of children.

Child’s QoL Total Score Reported by the Parent: According to the result of multiple linear regression analysis of the children’s QoL total scores rated by their parents, the model explained approximately 43.9% of the variance (variability) in the dependent variable “parental assessment total scores” ($F = 21.311$, $p < 0.001$). The variables that have a statistically significant effect on parental evaluation total scores were the fine motor skill scores, cognitive problems/inattention scores, and hyperactivity scores ($p = 0.003$, $p = 0.004$, and $p = 0.011$, respectively). A 1-point increase in the fine motor skill score caused a 0.801-point increase in the parental evaluation total score. A 1-point increase in the cognitive problem and carelessness symptom score caused a 1.053-point decrease in the parental evaluation total score, and a 1-point increase in hyperactivity symptom score caused a 1.022-point decrease in the parental evaluation total score.

Child’s QoL Physical Health Score Reported by the Parent: The variables having a statistically significant effect on the parent-rated child physical functionality scores were the hyperactivity scores and the diagnosis of ADHD independent of comorbidity ($p < 0.001$ and $p = 0.003$, respectively). An 1-point increase in the hyperactivity symptom score caused a 1.870-point decrease in the child physical functionality score. In addition, the parent-rated child physical functionality scores of the ADHD group were 12,796 points lower than the control group. The model explained about 26.9% of the variance ($F = 15.333$, $p < 0.001$) for parent-rated child physical functionality

scores (dependent variable).

Child’s QoL Psychosocial Health Score Reported by the Parent: According to multiple linear regression analysis of the children’s psychosocial scores reported by their parents, the model explained about 44.4% of the variance (variability) in the child psychosocial scores (dependent variable) ($F = 16.578$, $p < 0.001$). The variables having a statistically significant effect on the parent-rated child psychosocial scores were the hyperactivity score, the diagnosis of ADHD, and the diagnosis of SLD and Anxiety Disorder in addition to ADHD ($p < 0.001$, $p < 0.001$, $p < 0.001$, and $p = 0.013$, respectively). A 1-point increase in the hyperactivity symptom score caused a 2,213-point decrease in the parent-rated child psychosocial scores. It was confirmed that the parent-rated child psychosocial scores of the ADHD group, ADHD + SLD group, and ADHD + Anxiety Disorder Group were found to be 16,822, 17,800, and 11,739 points lower than the control group, respectively.

DISCUSSION

This study was carried out to examine whether the QoL differs according to both parental reports and children’s self-reports in the school-age boys diagnosed with ADHD in the presence of ADHD and comorbid psychiatric conditions by comparing them with their control group, and also to investigate the relationship between QoL with ADHD symptom severity, comorbidity and motor skills. As a result, in accordance with the literature, the present study showed that ADHD diagnosis affected the young children’s self-reported and parent-reported QoL scores, regardless of the existence of comorbid psychiatric disorders. In case of comorbidity; although the comorbidity of ODD affected the child reported QoL score more, having the ADHD diagnosis alone was enough to affect the children’s parent-reported QoL scores. Additionally, it was concluded that the presence of comorbidity accompanying ADHD, the increases in ADHD symptom severity and motor skill deficiencies were important predictors of both child - and parent-reported QoL. The strengths of the present study lie in that, first, it evaluated the school-aged children’s QoL based on both the children’s and parents’ reports in the presence of comorbidities that most frequently accompany ADHD diagnosis; and second, there was no difference between the study groups in terms of sociodemographic and ADHD symptom severity, which could affect the QoL, that is, the groups were homogeneous in this regard. However, it can be said that the weaknesses of the study are the small sample size, the evaluation of only boys, the absence of teacher reports and not considering treatment effects.

As planned at the beginning of the study, the sociodemographic features such as age, education of the mother, age of the mother, family structure, and perinatal features were found to be similar in the research groups. As expected, only the ADHD groups differed from the control group in terms of having a psychiatric diagnosis in the sibling [32]. When we compared the groups according

to CPS-R:SF, there was no difference between ADHD and comorbid groups in ADHD symptom severity; indicating that the groups were homogeneous in terms of ADHD symptom severity, although this was not planned at the beginning of the study. Furthermore, the fact that the oppositional behaviour scores were significantly higher in ADHD + ODD comorbidity group than the ADHD only group also showed that psychiatric diagnoses and scale scores were consistent. Besides academic, social, and emotional aspects, the children with ADHD exhibit significantly different motor skills compared to control group. It is believed that the main reason for motor skill problems in children with ADHD is associated with the problems in planning and is revealed in motor motion [15,17,21]. Again, in accordance with the literature, the results of this study showed that children with ADHD exhibited lower motor skill scores than control group, regardless of common comorbid psychiatric diagnoses. When we looked at the case of comorbidity, it was observed that in the presence of SLD accompanying ADHD, the motor skill scores decreased further and the comorbid motor skill problems became more severe.

Although the scales evaluating the QoL are filled by both the child and the parent [30], there are discussions about the consideration of the information given by the child or the family in the assessment of the QoL [33]. In their study, Galloway and Newman [34] examined the studies related to the QoL of children diagnosed with ADHD and stated that the answers they gave to the questions related to the QoL of children may sometimes be different, and in some studies, children who were diagnosed with ADHD did not see their QoL different from their control group. The researchers even stated that the reason for this may be that children minimize the problems they face or they answer the questions in an impulsive response style. In addition, they thought that the responses given by the families may be affected by the burden of ADHD symptoms in children. They also asserted that there was a negative interaction between the emotional stress in parents and the children's QoL. In the meta-analysis study conducted by Lee and her colleagues [35], it was found that the answers given by the families of both children with control group and children with ADHD were especially low in the psychosocial area and they stated that the characteristics of the children and families and the answers of both the families and the children should be taken into consideration in the QoL assessments.

In the present study, in which we questioned the QoL of the children with control group and the children with ADHD according to child's self reports and parent-rated reports, the QoL of the children with ADHD was lower than control group in both parents' and children's reports so, the first hypothesis of the study was confirmed. Also, it was seen that children's self-reports were more optimistic than the parents' reports, and that there was a significant positive correlation between the children's and parents' reports on the QoL. This suggested that considering both children's and parents' reports together in the QoL evaluations would be a guide for achieving healthier results.

When we look at the literature on how QoL changes with the comorbidity in the children with ADHD, it is seen that there are different results. In a study conducted in Turkey by Yıldız et al. [36], the QoL in ADHD was compared in terms of presence or absence of comorbidity and it was found that the feeling of QoL was affected more in the children with comorbidity than those with no comorbidity, especially in the areas of psychosocial and emotional functionality, and that this difference was also observed in the parent reports. In the study by Klassen et al. [2], which is one of the few studies that question how the most frequent diagnoses that accompany ADHD affect the QoL, it was reported that the QoL decreased with the increase of symptoms accompanying ADHD diagnosis, and the children's QoL further decreased especially with two or more comorbidities. In this study, where the QoL was questioned according to only the parental reports, they also reported that the QoL of the children with ODD comorbidity was significantly lower than other comorbidities. In another study, Dallos et al. [1] questioned whether the QoL differentiated with the comorbid diagnoses other than SLD and found that while the self-reported QoL of children in the oppositional group was lower; based on the answers given by the families; the children in the mood, anxiety disorder and ODD groups had a lower QoL. Considering the results of our study regarding the QoL in the most common comorbidities, which was the second hypothesis of the study; despite the fact that the QoL did not differ significantly in child reports, it was found that the children in the ODD comorbid group had low QoL scores in all evaluated areas of QoL, which was in accordance with the literature. On the other hand, in the parent reports, it was found that ADHD diagnosis alone without any comorbidities was sufficient for the families to perceive their children's QoL as low; and the parents in the group "ADHD and anxiety disorder" rated their children's QoL lower in the field of psychosocial health. The difference between ADHD and comorbid groups was compatible with the literature, but not significant. This might have resulted by the fact that there was no difference between groups in terms of ADHD symptom severity, that is, they were homogeneous in this regard, which was not planned at the beginning of the study. In addition, it is seen that, according to the QoL child reports, all comorbidities added to ADHD diagnosis are an important predictor for child reported total scores, and that the presence of SLD and Anxiety Disorder comorbidities also seem to be important for the child reported physical health scores of QoL. As to the parental reports, it is noteworthy that having only ADHD diagnosis is an important reason for decreasing the QoL scores, as well as SLD and Anxiety Disorder comorbidities added to ADHD diagnosis being important factors leading to a low QoL child psychosocial score.

ADHD symptom severity has different effects on social outcomes. For example, social dysfunction in children with severe hyperactivity symptoms characterized by destructive and aggressive behavior causes interpersonal difficulties such as family problems and peer rejection [37,38]. The

third hypothesis of the present study was confirmed in that as ADHD symptom severity increased, QoL decreased. It was seen that the increase in ADHD symptom severity is an important predictor of QoL according to the QoL reports of both children and parents. In their study, Klassen et al. [2] concluded that there was a positive relationship between the increased ADHD symptom severity and the decreased QoL, and ADHD symptom severity was important in predicting psychosocial health.

There is strong evidence that psychosocial and emotional functioning is impaired and prognosis worsens when ADHD is accompanied by motor problems [39]. In their study, Engel - Yeger reported that there was a relationship between poor motor skills and lower self-esteem and lower preference to participate in after school activities [22]. In another study, confirming the relationship between gross motor skills and emotional problems, Smith and Anderson [40] concluded that motor coordination problems in children increased isolation and loneliness as well as decreasing participation in social games. It is seen that a decrease in motor skill negatively affects the QoL, which is the fourth and the final hypothesis of the study. According to children's reports on QoL, it was observed that gross and fine motor skills were an important predictor of the children's QoL. According to the parental reports on QoL, on the other hand, it can be asserted that fine motor skills are an important predictor of the children's QoL in the eyes of the parents. According to the regression analysis, we are aware that the results cannot be generalized due to the large number of variables and small sample size. But according to these results, it is thought that gross and fine motor skills are important in school-age boys who spend most of the day playing games, but it can be concluded that parents care more about the problems in fine motor skills in children. So we think that families and all health specialists should be aware of the high frequency of co-occurring motor problems with ADHD.

When we look at the results of our study in general, it is clear that the diagnosis of ADHD affects the QoL of children in the eyes of both children and their families, whether or not accompanied by a comorbidity. However, accompanying comorbidity of ADHD is also an important predictor of QoL in both child's self-reports and parent-rated reports. It was found that the increase in ADHD symptom severity and motor skill problems also lower the QoL scores of children in both self-reports and parent-rated reports as well as being an important predictor of QoL. We are of the opinion that, considering different aspects of ADHD, namely severity, comorbid psychiatric disorders and comorbid motor problems, is very important to understand the feeling of QoL and contribute to improving the children's well-being.

REFERENCES

- [1] Dallos G, Miklósi M, Keresztény Á, Velő S, Szentiványi D, Gáboros J, et.al. Self-and parent-rated quality of life of a treatment naïve sample of children with ADHD: the impact of age, gender, type of ADHD, and comorbid psychiatric conditions according to both a categorical and a dimensional approach. *J Atten Disord.* 2017;21(9):721-730. doi: 10.1177/108.705.4714542003.
- [2] Klassen AF, Miller A, Fine S. Health-related quality of life in children and adolescents who have a diagnosis of attention-deficit/hyperactivity disorder. *Pediatrics* 2004;114(1):1322-1322. doi: 10.1542/peds.2004-0844.
- [3] Marques JC, Oliveira JA, Goulardins JB, Nascimento RO, Lima AM, Casella EB. Comparison of child self-reports and parent proxy-reports on quality of life of children with attention deficit hyperactivity disorder. *Health Qual Life Outcomes* 2013;11(1):186. doi: 10.1186/1477-7525-11-186.
- [4] Danckaerts M, Sonuga-Barke EJ, Banaschewski T, Buitelaar J, Dopfner M, Hollis C, et al. The quality of life of children with attention deficit/hyperactivity disorder: a systematic review. *Eur Child Adolesc Psychiatry* 2010;19:83-105.
- [5] Coghill D, Hodgkins P. Health-related quality of life of children with attention-deficit/hyperactivity disorder versus children with diabetes and healthy controls. *Eur Child Adolesc Psychiatry* 2016;25(3): 261-271. doi: 10.1007/s00787.015.0728-y.
- [6] Velő S, Keresztény Á, Szentiványi D, Balázs J. Quality of life of patients with attention-deficit/hyperactivity disorder: systematic review of the past 5 years. *Neuropsychopharmacol Hung* 2013;15(2):19-26.
- [7] Pinho TD, Manz PH, DuPaul GJ, Anastopoulos AD, Weyandt LL. Predictors and moderators of quality of life among college students with ADHD. *J Atten Disord.* 2019;23(14):1736-1745. doi: 10.1177/108.705.4717734645.
- [8] Brown TE. ADHD Comorbidities: Handbook for ADHD Complications in Children and Adults. Washington, DC: American Psychiatric Pub;2009.
- [9] Thompson MJ, Brooke XM, West CA, Johnson HR, Bumby, EJ, Brodrick P, et al. Profiles, co-morbidity and their relationship to treatment of 191 children with AD/HD and their families. *Eur Child Adolesc Psychiatry* 2004;13:234-242. doi: 10.1007/s00787.004.0380-4.
- [10] Biederman J, Newcorn J, Sprich S. Comorbidity of attention deficit hyperactivity disorder with conduct, depressive, anxiety, and other disorders. *Am J Psychiatry* 1991;148:564-577. doi: 10.1176/ajp.148.5.564.
- [11] Zorlu A, Unlu G, Cakaloz B, Zencir M, Buber A, Isildar Y. The prevalence and comorbidity rates of ADHD among school-age children in Turkey. *J Atten Disord* 2015. doi: 10.1177/108.705.4715577991.
- [12] Inci SB, Ipci M, Akyol Ardic U, Ercan ES. Psychiatric comorbidity and demographic characteristics of 1,000 children and adolescents with ADHD in Turkey. *J Atten Disord.* 2019; 23(11):1356-1367. doi: 10.1177/108.705.4716666954.
- [13] Hechtman L. Assessment and diagnosis of attention-deficit/ hyperactivity disorder. *Child Adolesc Psychiatr Clin N Am.* 2000; 9:481-498.
- [14] Hurtig T, Ebeling H, Taanila A, Miettunen J, Smalley S, McGough J, et al. ADHD and comorbid disorders in relation to family environment and symptom severity. *Eur Child*

- Adolesc Psychiatry 2007;16(6):362-369. doi: 10.1007/s00787.007.0607-2.
- [15] Rosa Neto F, Goulardins JB, Rigoli D, Piek JP, Oliveira JAD. Motor development of children with attention deficit hyperactivity disorder. *Braz J Psychiatry* 2015;37(3):228-234. doi: 10.1590/1516-4446-2014-1533.
- [16] Fliers EA, Franke B, Lambregts-Rommelse NN, Altink ME, Buschgens CJ, Nijhuis-van der Sanden MW, et al. Undertreatment of motor problems in children with ADHD. *Child Adolesc Ment Health* 2010;15(2):85-90. doi: 10.1111/j.1475-3588.2009.00538.x.
- [17] Pitcher TM, Piek JP, Hay DA. Fine and gross motor ability in males with ADHD. *Dev Med Child Neurol*. 2003;45(8):525-535. doi: 10.1017/s001.216.2203000975.
- [18] Kooistra L, Crawford S, Dewey D, Cantell M, Kaplan BJ. Motor correlates of ADHD: contribution of reading disability and oppositional defiant disorder. *J Learn Disabil*. 2005;38:195-206. doi: 10.1177/002.221.9405038.003.0201.
- [19] Tseng MH, Henderson A, Chow SM, Yao G. Relationship between motor proficiency, attention, impulse, and activity in children with ADHD. *Dev Med Child Neurol*. 2004;46:381-388. doi: 10.1017/s001.216.2204000623.
- [20] Shen IH, Lee TY, Chen CL. Handwriting performance and underlying factors in children with Attention Deficit Hyperactivity Disorder. *Res Dev Disabil*. 2012;33:1301-1309. doi: 10.1016/j.ridd.2012.02.010.
- [21] Goulardins JB, Marques JC, Casella EB: Quality of life and psychomotor profile of children with attention deficit hyperactivity disorder (ADHD). *Arq Neuropsiquiatr*. 2011; 69(4):630-635. doi: 10.1590/s0004-282x201.100.0500011.
- [22] Engel-Yeger B. The role of poor motor coordination in predicting adults' health related quality of life. *Research in Developmental Disabilities* 2020; 103:103686. doi:10.1016/j.ridd.103686.
- [23] Colizzi M, Ciceri ML, Di Gennaro G, Morari B, Inglese A, Gandolfi M, et. al. Investigating gait, movement, and coordination in children with neurodevelopmental disorders: Is there a role for motor abnormalities in atypical neurodevelopment?. *Brain Sciences* 2020; 10(9): 601. doi:10.3390/brainsci10090601.
- [24] Conners CK. *Conners' Rating scales-revised: Instruments for use with children in adolescents*. Toronto: MHS; 1997.
- [25] Kaner S, Buyukozturk S, İseri E. Yenilenmiş Conners anababa derecelendirme ölçeği kısa Türkçe formu'nun psikometrik özellikleri. *Uluslararası Gelişimsel Nöropsikiyatri Toplantıları-III, İstanbul-Türkiye* 2006; 80-81 [Turkish].
- [26] Bruininks RH, Oseretsky BD. *Bruininks-Oseretsky test of motor proficiency, second edition, brief form*. Bloomington: Psych Corp; 2010.
- [27] Kose, B. Bruininks-Oseretsky motor yeterlik testi 2 kısa formunun Türkçe uyarlaması ve özgül öğrenme güçlüğü olan çocuklarda geçerlilik ve güvenilirliği (Master's thesis, Sağlık Bilimleri Enstitüsü) 2018 [Turkish].
- [28] Varni JW, Burwinkle TM, Seid M, Skarr D. The PedsQL™ 4.0 as a pediatric population health measure: feasibility, reliability, and validity. *Ambul Pediatr*. 2003;3(6):329-341. doi: 10.1367/1539-4409(2003)003<0329.
- [29] Memik NC, Agaoglu B, Coskun A, Uneri OS, Karakaya I. The validity and reliability of the Turkish Pediatric Quality of Life Inventory for children 13-18 years old. *Turk Psikiyatri Derg*. 2007;18(4), 353-363.
- [30] Uneri O, Memik NC. Çocuklarda yaşam kalitesi kavramı ve yaşam kalitesi ölçeklerinin gözden geçirilmesi. *Turk J Child Adolesc Ment Health* 2007;14:48-56. (Turkish).
- [31] Montgomery DC, Peck EA, Vining GG. *Introduction to Linear Regression Analysis*. Nobel Akademik Yayıncılık; 2013. [Turkish].
- [32] Thapar A, Holmes J, Poulton K, Harrington R. Genetic basis of attention deficit and hyperactivity. *The British Journal of Psychiatry* 1999; 174(2):105 - 111.
- [33] Pliszka SR. Comorbidity of attention-deficit/hyperactivity disorder with psychiatric disorder: an overview. *J Clin Psychiatry* 1998;59: 50-58.
- [34] Galloway H, Newman E. Is there a difference between child self-ratings and parent proxy-ratings of the quality of life of children with a diagnosis of attention-deficit hyperactivity disorder (ADHD)? a systematic review of the literature. *Attention Deficit and Hyperactivity Disorders* 2017;9(1): 11-29.
- [35] Lee YC, Yang HJ, Lee WT, Teng MJ. Do parents and children agree on rating a child's HRQOL? A systematic review and meta-analysis of comparisons between children with attention deficit hyperactivity disorder and children with typical development using the PedsQL™. *Disability and Rehabilitation* 2019; 41(3): 265-275.
- [36] Yildiz O, Cakin-Memik N, Agaoglu B. Quality of life in children with attention-deficit hyperactivity disorder: a cross-sectional study. *Archives of Neuropsychiatry* 2010;47(4):314 [Turkish].
- [37] Tseng MH, Henderson A, Chow SM, Yao G. Relationship between motor proficiency, attention, impulse, and activity in children with ADHD. *Dev Med Child Neurol*. 2004;46(6): 381-388. doi: 10.1017/s001.216.2204000623.
- [38] Schlack R, Mauz E, Hebebrand J, Hoelling H. Has the prevalence of parent-reported diagnosis of attention deficit hyperactivity disorder (ADHD) in Germany increased between 2003-2006 and 2009-2012? results of the KiGGS-study: first follow-up (KiGGS Wave 1). *Bundesgesundheitsblatt, Gesundheitsforschung, Gesundheitsschutz* 2014;57(7): 820-829. doi: 10.1007/s00103.014.1983-7.
- [39] Rasmussen P, Gillberg C. Natural outcome of ADHD with developmental coordination disorder at age 22 years: a controlled, longitudinal, community-based study. *J Am Acad Child Adolesc Psychiatry* 2000; 39:1424-31. doi: 10.1097/00004.583.200011000-00017.
- [40] Smyth MM, Anderson HI. Coping with clumsiness in the school playground: social and physical play in children with coordination impairments. *British Journal of Developmental Psychology* 2000; 18:389-413.