

# PSYCHIATRIC COMORBIDITY AND SLEEP PROBLEMS IN CHILDREN AND ADOLESCENTS WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER IN RELATION TO ATTENTION DEFICIT HYPERACTIVITY DISORDER PRESENTATION, AGE AND GENDER

DİKKAT EKSİKLİĞİ HİPERAKTİVİTE BOZUKLUĞU TANILI ÇOCUK VE ERGENLERDE DİKKAT EKSİKLİĞİ HİPERAKTİVİTE BOZUKLUĞU GÖRÜNÜMÜ; YAŞ VE CİNSİYETE GÖRE PSİKİYATRİK KOMORBİDİTE VE UYKU PROBLEMLERİ

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## ABSTRACT

**Objective:** This study aimed to investigate psychiatric comorbidity and sleep problems and their relationships with ADHD presentation, age and gender in a clinical sample of children and adolescents with ADHD.

**Material and Method:** One hundred fifty-four subjects aged 6-17 were included in the study. A semi-structured diagnostic interview was conducted to screen psychiatric disorders. The Child Depression Inventory (CDI), Screen for Child Anxiety Related Emotional Disorders (SCARED) and Children's Sleep Habits Questionnaire (CSHQ) were used to investigate internalizing difficulties and sleep problems.

**Results:** Overall high rates of comorbid disorders (78%) and sleep problems (97%) were found. ADHD-C was significantly more frequent in males and ADHD-I was more frequent in females ( $p<0.001$ ). While oppositional defiant disorder (ODD), enuresis and encopresis were more frequent in subjects with ADHD-C ( $p<0.05$ ), generalized anxiety (GAD) and social anxiety (SAD) disorders were more frequent in subjects with ADHD-I ( $p<0.05$ ). Females, compared to males, had more frequent diagnoses of depression ( $p=0.021$ ) and SAD ( $p=0.03$ ). The majority of subjects (96.7%) scored above the cut off score of 41 in CSHQ (50.51±5.86). The ADHD-C group had significantly higher CSHQ total scores than the ADHD-I group ( $p<0.05$ ). There was a significant positive correlation between CSHQ total scores and the

## ÖZET

**Amaç:** Bu çalışmada, DEHB tanılı çocuk ve ergenlerden oluşan klinik bir örnekleme psikiyatrik komorbidite, uyku problemleri ve bunların DEHB görünümü, yaş ve cinsiyetle olan ilişkilerinin incelenmesi amaçlanmıştır.

**Gereç ve Yöntem:** Çalışmaya 6-17 yaş arası 154 katılımcı dahil edildi. Psikiyatrik bozuklukları değerlendirmek amacıyla yarı yapılandırılmış bir klinik görüşme gerçekleştirildi. İçselleştirme ve uyku sorunlarını değerlendirmek için Çocuklar için Anksiyete Bozuklukları Tarama Ölçeği (ÇATÖ), Çocuk Depresyon Envanteri (ÇDE) ve Çocuk Uyku Alışkanlıkları Anketi (ÇUAA) kullanıldı.

**Bulgular:** Katılımcılar arasında komorbid hastalık (%78) ve uyku problemleri (%97) sıklıkları oldukça yüksekti. DEHB bileşik görünüm erkeklerde daha sık olarak tespit edildi ( $p<0,001$ ) ve karşı olma-karşı gelme bozukluğu, enüresi ve ekoprezi bileşik görünümdeki olgularda daha sıkı ( $p<0,05$ ). Dikkatsizlik görünümündeki olgularda ise sosyal anksiyete bozukluğu ve yaygın anksiyete bozukluğu görülme sıklıkları bileşik görünümdeki olgulara göre daha fazlaydı ( $p<0,05$ ). Erkeklerle karşılaştırıldığında, kızlarda sosyal anksiyete bozukluğu ( $p=0,03$ ) ve depresyon ( $p=0,021$ ) daha sık olarak görülmekteydi. Katılımcıların %96,7'si ÇUAA'nde kesme puanı olan 41'in üzerinde skora sahipti (50,51±5,86). Bileşik görünümdeki olguların ÇUAA skorları dikkatsizlik görünümündeki olgulardan anlamlı olarak daha yüksekti ( $p<0,05$ ). ÇUAA skorları ile toplam yaşam boyu psikiyatrik hastalık sayısı ve

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number of lifetime comorbid diagnoses ( $p=0.006$ ), self-reported anxiety ( $p=0.009$ ) and depressive ( $p=0.004$ ) symptoms.

**Conclusion:** Comorbidity and sleep problems may be common in young people with ADHD and may have complex reciprocal relations with several factors including ADHD presentation, age, and gender.

**Keywords:** ADHD, BMI, children, comorbidity, sleep

öz-bildirime dayalı depresyon ( $p=0,006$ ) ve anksiyete ( $p=0,009$ ) belirti şiddeti arasında pozitif yönde bir korelasyon saptandı.

**Sonuç:** DEHB'de psikiyatrik komorbid bozukluklar ve uyku problemleri yaygın olarak görülür ve DEHB görünümü, yaş ve cinsiyet gibi faktörler ile etkileşimleri kompleks ve karşılıklı olabilir.

**Anahtar Kelimeler:** DEHB, çocuk, uyku, komorbidite, VKİ

## INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common psychiatric disorders of childhood with an estimated prevalence of 5% to 7% of school-age children worldwide (1). Left untreated ADHD may cause significant psychosocial, academic, and long-term negative consequences (2, 3). In addition to the impairment directly related to ADHD symptoms, a majority of subjects with ADHD have comorbid psychiatric disorders that warrant clinical attention (4–7). Comorbidity in ADHD is an important issue with multiple dimensions in terms of clinical practice and research (5, 7). It has been reported that there may be significant differences in terms of sociodemographic and clinical characteristics, family history, choice of optimal ADHD treatment, response to treatment and long-term outcome in subjects with and without comorbidity (5, 8, 9). The prevalence and patterns of comorbid disorders in ADHD may differ according to the study methodology (such as clinical vs epidemiological samples), different clinical presentations of ADHD and several sociodemographic variables such as age and gender. Comorbidity studies in clinical samples have reported more than 90 percent comorbidity rates in ADHD with externalizing (oppositional defiant and conduct disorders), anxiety, mood and learning disorders, and sleep problems as the most frequent comorbid conditions (5, 10-14). Meanwhile, sleep disorders or problems have been reported in the majority of young subjects, up to 70 percent, with ADHD (10, 11, 14-16). Presence of comorbidity, ADHD presentation, and medication treatment have been reported as important factors related to sleep problems in subjects with ADHD (10, 11, 14, 16). It is important to note that psychiatric comorbidity and sleep problems are important factors in all stages of ADHD management that includes diagnosis, choice of optimal treatment for ADHD, treatment response, and long term prognosis of ADHD (2, 8, 10, 14, 17). Therefore, it may be important to know the prevalence and patterns of psychiatric comorbidity and sleep problems and their relationship between clinical (such as ADHD presentation) and sociodemographic (such as age and gender) variables in young subjects with ADHD. Despite there having been several reports on the prevalence and patterns of comorbid psychiatric disorders in relation to different ADHD presentations, age and gender among

adults with ADHD, there is a lack of studies on these issues among young subjects with ADHD (18, 19). In this study, the researchers investigated the prevalence and patterns of psychiatric comorbidity and sleep problems in relation to different ADHD presentations, age (children vs adolescents), and gender in a clinical sample of children and adolescents with ADHD.

## MATERIAL AND METHOD

### Participants and procedure

This study was conducted in the Child and Adolescent Psychiatry Department of Istanbul Medical Faculty, Istanbul University. Subjects in this study were among the patients who have been followed up with the diagnosis of ADHD in this center. Subjects (and parents) were approached for participation in the study during their clinical visits. Subjects and/or families who agreed to participate were then interviewed for their eligibility to take part in the study. Inclusion criteria were as follows; a) aged between 6 to 18 years old, b) having diagnosis of ADHD according to DSM-5 criteria, c) no evidence of intellectual disability or autism spectrum disorders during clinical interviews, d) having a score of 70 or above in psychometric tests and e) parents and subjects agreed to participate and signed informed consent. Participating subjects were then scheduled for a detailed interview for the study. Subjects were assessed using a semi-structured diagnostic instrument to investigate the presence of lifetime psychiatric disorders. Diagnosis of ADHD in these subjects was confirmed through several interviews with collateral information using parents' and teachers' reports. While subjects were asked to fill out self-reported scales for anxiety and depressive symptoms, parents filled out a sleep questionnaire regarding sleep habits of their children. The study was approved by the Istanbul Medical Faculty Ethical Committee.

### Instruments

#### Schedule for affective disorders and schizophrenia for school-age children–present and lifetime version–Turkish version (K-SADS-PL-T)

K-SADS-PL is a semi-structured diagnostic interview schedule designed to assess major psychiatric disorders in children and adolescents based on DSM-IV criteria

(20). It has been used in several clinical and epidemiological studies in Turkey (21, 22). The Turkish version K-SADS-PL-T was used in this study (23).

#### The children's sleep habits questionnaire (CSHQ)

CSHQ is one of the most widely used parent-report measures of sleep for children (24). CSHQ characterizes sleep in a number of key domains including total sleep duration, sleep latency, sleep anxiety, parasomnias, bedtime behavior, night awakenings, sleep-disordered breathing, and daytime sleepiness. A cut-off total CSHQ score of 41 was accepted as clinically significant sleep problems. The Turkish version of CSHQ was used in the study (25).

#### Child depression inventory (CDI)

CDI is a 27 item self-report measure and is used commonly to measure depressive symptoms in children (26). The Turkish form was used in the study (27).

#### The screen for child anxiety related emotional disorders (SCARED)-child form

SCARED is a child and parent self-report instrument used to screen for childhood anxiety disorders including generalized anxiety disorder, separation anxiety disorder, panic disorder, and social phobia (28). In addition, it assesses symptoms related to school phobias. The Turkish form was used in the study (29).

#### Statistical analysis

SPSS 22.0 was used in statistical analysis. Descriptive statistics were used to report minimum, maximum, mean, standard deviation, frequency, and percentage data. Distribution of the variables was assessed with the Kolmogorov Smirnov test. The Mann-Whitney U test and an independent sample t-test were used in the analysis of quantitative data. The Chi-square test and Fischer test,

when chi-square test conditions not met, were used in the analysis of qualitative data. The Spearman correlation test was used for correlation analysis.

## RESULTS

A total of 154 subjects, aged 6 to 17 years, were included in the study (11.84±2.79 years). Of those, 115 subjects were male (74.7%) and 79 subjects were children below 12 years of age (51%). 91 subjects had a diagnosis of ADHD-combined presentation (ADHD-C) (59%) and 63 subjects had a diagnosis of ADHD-inattentive presentation (ADHD-I) (41%). There were no significant age differences between the two groups ( $p>0.05$ ). ADHD-C was significantly more frequent in males and ADHD-I was more frequent in females ( $p<0.001$ ). No subjects had ADHD-predominantly hyperactive/impulsive presentation. The body mass index (BMI) among the sample changed between 13.66-36.51 (20.24±4.14). There were no significant differences between ADHD-C and ADHD-I groups in terms of BMI ( $p=0.098$ ). All subjects were on medications at the time of evaluation for the study. Methylphenidate (86.4%) was the most frequently used medication for ADHD. Sociodemographic and clinical characteristics of the subjects are shown in Table 1.

#### Lifetime comorbidity and sleep problems

One hundred twenty-one subjects received at least one diagnosis of comorbidity. Of those with a comorbid diagnoses ( $n=121$ ), 42 subjects received two, 40 subjects received three and 39 subjects received more than three comorbid diagnoses. Prevalence of the lifetime comorbid diagnoses among the whole sample were (in decreasing order); enuresis (21.4%), generalized anxiety disorder (GAD) (20.8%), special phobia (19.5%), separation anxiety

**Table 1:** Sociodemographic and clinical characteristics of the subjects

Age	11.84±2.79 years (6-17)		
	n		%
Children (under 12 years)	79		51.3
Gender (male)	115		74.7
<b>ADHD diagnosis</b>	<b>ADHD-C</b>	<b>ADHD-I</b>	
Male (n=115)	n=78	n=37	<b>*p&lt;0.001</b>
Female (n=39)	n=13	n=26	
Maternal age (years)	38.5±6.1	39.0±6.5	**p=0.681
Paternal age (years)	42.3±7.0	43.7±6.9	**p=0.162
Diagnosed ADHD in first degree relatives (n=61)	n=40	n=21	p=0.167
Consanguineous marriage (n=14)	n=4	n=10	<b>*p=0.015</b>
CSHQ scores	35 to 74		50.51±5.86

\*X<sup>2</sup> test, \*\*t test

ety disorder (18.8), oppositional defiant disorder (15.6%), social anxiety disorder (SAD) (14.9%), Tourette disorder (14.3%), obsessive compulsive disorder (11.7%), motor/vocal tic disorder (10.4%), encopresis (9.1%), depression (7.1%), post-traumatic stress disorder (3.2%), conduct disorder (2.6%), cigarette use disorder (1.3%), bipolar disorder (0.6%), panic disorder (0.6%), and bulimia nervosa (0.6%). Prevalence of lifetime psychiatric diagnoses in different gender, age, and ADHD presentation groups are shown in Table 2.

The majority of subjects (n=149; 96.7%) scored above the cutoff score of 41 in CSHQ (50.51±5.86) which is considered a clinically significant sleep problem. There was a significant positive correlation between the number of lifetime comorbid diagnoses and CSHQ total scores (r=0.224; p=0.006). In terms of current diagnosis, while participants with enuresis scored significantly higher on CSHQ than those without enuresis (58.66±6.5 vs. 53.57±5.94, p=0.022<sup>m</sup>), no such difference was found for other diagnoses including internalizing disorders (such as GAD, MDB and SAD) and externalizing disorders (ODD and CD).

**Table 2:** Prevalence of lifetime psychiatric diagnoses

Lifetime psychiatric diagnoses	n		Males (n=115)				Females (n=39)			
			Children (n=55)		Adolescents (n=60)		Children (n=24)		Adolescents (n=15)	
			ADHD-I n=16	ADHD-C n=39	ADHD-I n=21	ADHD-C n=39	ADHD-I n=15	ADHD-C n=9	ADHD-I n=11	ADHD-C n=4
Depression	11	7.1	0	1	2	2	3	0	2	1
Bipolar disorder	1	0.6	0	1	0	0	0	0	0	0
Psychosis	0	0	0	0	0	0	0	0	0	0
Panic disorder	1	0.6	0	0	0	1	0	0	0	0
Separation anxiety disorder	29	18.8	2	8	3	6	2	3	4	1
Social anxiety disorder	23	14.9	3	3	3	4	6	0	3	1
Specific phobia	30	19.5	1	7	4	8	6	0	3	1
Generalized anxiety disorder	32	20.8	4	4	6	6	5	2	3	2
Obsessive compulsive disorder	18	11.7	2	7	2	4	0	1	1	1
Enuresis	33	21.4	3	15	2	7	2	2	2	0
Encopresis	14	9.1	1	7	1	3	0	1	0	1
Anorexia nervosa	0	0	0	0	0	0	0	0	0	0
Bulimia nervosa	1	0.6	0	0	0	0	0	0	0	1
Oppositional defiant disorder	24	15.6	0	11	1	8	4	0	0	0
Conduct disorder	4	2.6	0	3	0	1	0	0	0	0
Tourette disorder	22	14.3	7	3	3	6	3	0	0	0
Motor/vocal tic disorder	16	10.4	2	3	4	5	1	1	0	0
Cigarette use	2	1.3	0	0	1	1	0	0	0	0
Alcohol use disorder	0	0	0	0	0	0	0	0	0	0
Substance use disorder	0	0	0	0	0	0	0	0	0	0
Post-traumatic stress disorder	5	3.2	0	1	0	2	0	0	2	0

However, there was a significant positive correlation between total CSHQ scores, self-reported anxiety ( $r=0.270$ ,  $p=0.009$ ), and depressive ( $r=0.300$ ,  $p=0.004$ ) symptoms.

### Psychiatric comorbidity and sleep problems in relation to ADHD presentation, age and gender

In subjects with ADHD-I generalized anxiety (GAD) and social anxiety (SAD), disorders were found more frequently than subjects with ADHD-C ( $p<0.05$ ). Subjects with ADHD-C were found to have more frequent diagnoses of oppositional defiant disorder (ODD), enuresis and encopresis than subjects with ADHD-I ( $p<0.05$ ). There were no significant differences between the two groups regarding other comorbid diagnoses. Table 3 shows the prevalence and significance of lifetime comorbid diagnoses in ADHD-C or ADHD-I presentations.

Regarding the age and gender effects on lifetime comorbidity children as compared to adolescents, they have

more frequent diagnosis of enuresis ( $p=0.046$ ); females, compared to males, have more frequent diagnoses of depression ( $p=0.021$ ) and social anxiety disorder ( $p=0.030$ ). There were no significant differences in the mean number of comorbid diagnoses between different ADHD presentations, such as age and gender groups ( $p>0.05$ ). The ADHD-C group had significantly higher CSHQ total scores than the ADHD-I group ( $p<0.05$ ). Both groups did not differ significantly in subscales of CSHQ. There were no significant differences between children versus adolescents and males versus females with regard to total scores of CSHQ. Regarding BMI scores, while there was no significant difference between males vs females, mean scores ( $p<0.001$ ) and rates of being overweight ( $\geq 25$ ) ( $p=0.008$ ) were higher in adolescents compared to children. Table 4 shows the number of comorbid diagnoses, CSHQ, and BMI scores in regard to ADHD presentation, age, and gender.

**Table 3:** Lifetime comorbid diagnoses in regard to different ADHD presentations

Lifetime diagnoses	ADHD-C		ADHD-I		p*
	n	%	n	%	
Depression	4	4.4	7	11.1	0.101
Bipolar disorder	1	1.1	0	0.0	0.410
Psychosis	0	0.0	0	0.0	-
Panic disorder	1	1.1	0	0.0	0.408
Separation anxiety disorder	18	19.8	11	17.5	0.777
Social anxiety disorder	8	8.8	15	23.8	<b>0.008</b>
Specific phobia	16	17.6	14	22.2	0.425
Generalized anxiety disorder	14	15.4	18	28.6	<b>0.038</b>
Obsessive compulsive disorder	13	14.3	5	7.9	0.251
Enuresis	25	27.5	8	12.7	<b>0.034</b>
Encopresis	12	13.2	2	3.2	<b>0.038</b>
Anorexia nervosa	0	0.0	0	0.0	-
Bulimia nervosa	1	1.1	0	0.0	0.410
Oppositional defiant disorder	24	26.4	0	0.0	<b>0.000</b>
Conduct disorder	4	4.4	0	0.0	0.096
Tourette disorder	14	15.4	8	12.7	0.687
Motor/vocal tic disorder	9	9.9	7	11.1	0.764
Cigarette use	1	1.1	1	1.6	0.777
Alcohol use disorder	0	0.0	0	0.0	-
Substance use disorder	0	0.0	0	0.0	-
Post-traumatic stress disorder	3	3.3	2	3.2	0.990

\*X<sup>2</sup> test (Fisher's exact test)

**Table 4:** Number of comorbid diagnoses and CSHQ scores in regard to ADHD presentation, age and gender

	Mean±SD		Mean±SD	P
<b>Number of comorbid diagnoses</b>				
ADHD-C**	1.73±1.24	ADHD-I	1.58±1.43	0.468*
Children***	2.75±1.30	Adolescents	2.62±1.40	0.543*
Males***	2.68±1.30	Females	2.71±1.48	0.902*
<b>CSHQ z</b>				
ADHD-C**	50.80±9.10	ADHD-I	47.80±8.20	<b>0,033*</b>
Children***	51.13±6.14	Adolescents	49.87±5.52	0.281*
Males***	50.78±6.02	Females	49.72±5.35	0.644*
BMI<25	53.78±6.12	BMI≥25	53.59±5.89	0.996*
<b>Body mass index (BMI) (n=147)</b>				
ADHD-C**	18.8±3.2	ADHD-I	19.4±3.7	0.098*
Children***	18.72±3.78	Adolescents	21.71±3.97	<b>&lt;0.001*</b>
BMI<25	67 (93.1%)	BMI<25	58 (77.3%)	
BMI≥25	5 (6.9%)	BMI≥25	17 (22.7%)	<b>0.008****</b>
Males***	20.14±3.69	Females	20.55±5.36	0.732*
BMI<25	97 (87.4%)	BMI<25	28 (77.8%)	
BMI≥25	14 (12.6%)	BMI≥25	8 (22.2%)	0.160****

\*Mann-Whitney U Test; \*\*Comorbid diagnoses; \*\*\*All diagnoses including ADHD; \*\*\*\*X<sup>2</sup> test

## DISCUSSION

Psychiatric comorbidity in ADHD is common in clinical practice and has significant implications on different dimensions of the disorder (2, 30). Psychiatric comorbidity tends to show variability, between individuals, throughout development in relation to individual and environmental factors (5, 8, 30). Sleep problems are also another area of concern that may have an influence on the clinical course and management of ADHD and even on its differential diagnosis as they might mimic ADHD-like symptoms (31). In clinical practice sleep problems are common, affecting up to 70 percent of children and adolescents with ADHD without any type of sleep problem specifically associated with ADHD (32, 33). The frequency and nature of sleep problems may be influenced by various factors including a predominant presentation of ADHD and a presence of comorbidity and medication status (34). Due to the complex associations between several aspects of ADHD, psychiatric comorbidity, sleep problems, and other individual factors such as gender, age, and BMI, it is important to enhance our understanding on the interplay between these factors. In this study, the researchers looked for these issues and found several important findings that may have clinical and research implications.

### Lifetime comorbidity and sleep problems

both total number and distribution of comorbid diagnoses reported in children and adolescents with ADHD

tend to show variability between studies depending on sample population characteristics, diagnostic instruments used, and other methodological issues. In general, a higher frequency of psychiatric comorbidity in children and adolescents with ADHD is reported in studies from clinical settings, ranging from 52 to 76 percent (30, 35, 36). In these clinic-based studies, oppositional defiant disorder was as frequently reported as comorbidity, followed by anxiety disorders (35). As consistent with the previous literature, 78 percent of participants included in our study met criteria for at least one comorbid diagnosis throughout their lifetime; while enuresis (21.4%), generalized anxiety disorder (GAD) (20.8%), special phobia (19.5%), separation anxiety disorder (18.8%), oppositional defiant disorder (ODD) (15.6%), and social anxiety disorder (SAD) (14.9%) were the most frequent comorbid diagnoses. Subjects with ODD may be less adherent to clinical follow up and less volunteering to participate in time taking assessment than the subjects with anxiety. This may partly explain higher rates of anxiety disorders than ODD in our study (37). The higher frequency of enuresis found in our study may reflect a lifetime assessment of comorbidities, as enuresis tend to improve through age (38).

The effect of comorbid disorders on sleep is multifaceted and probably confounded by numerous other conditions (11, 15, 16). In general, an increased frequency of sleep disturbances have been reported in children with ADHD and comorbid disorder (11, 34). Anxiety disorders



are more consistently found to be associated with sleep anxiety and awakenings, while externalizing disorders are associated with bedtime resistance (11). As supporting in the literature, most of the participants in our study were having difficulties with sleep and there was a positive correlation between the number of lifetime psychiatric comorbidity and CSHQ scores. In terms of current diagnoses, participants with enuresis scored significantly higher on CSHQ than those without enuresis. No such difference was detected for any of the other comorbid diagnoses. Nevertheless, there was a positive correlation between self-reported anxiety/depressive symptoms and CSHQ total scores. This finding may underscore the importance of routine questioning about sleep problems in children with ADHD regardless of clinically evident anxiety or depressive disorders.

### **Psychiatric comorbidity and sleep problems in relation to ADHD presentation, age and gender**

While psychiatric comorbidity profiles in individuals with ADHD may differ throughout their lives according to gender and ADHD presentation, the researchers made an attempt to explore these effects. Predominant presentation of ADHD may alter the course and treatment of ADHD, as well as the comorbid disease profile (39, 40). In general, ODD and other disruptive behavioral problems are more common in individuals with ADHD-C than those with ADHD-I (39), while higher frequencies of anxiety disorders, both as a group and as particular subtypes, were reported with predominantly inattentive presentation. For example, in a study of adults with ADHD and SAD from Turkey, the authors concluded that SAD may have a more specific relationship with inattentive presentation than combined presentation (18). Another study conducted on 108 children and adolescents found a higher frequency of SAD in subjects with ADHD-I than those with ADHD-C (39). As consistent with previous literature, we found a higher frequency of ODD and lower frequency of SAD and GAD in ADHD-C compared to the ADHD-I group. Elimination disorders were also more frequent in the ADHD-C group than ADHD-I group. With respect to nocturnal enuresis, the effect of ADHD presentation is less investigated. In contrast to our study, two previous studies reported higher incidences of nocturnal enuresis in children and adolescents with ADHD-I (41, 42).

The effects of ADHD presentation on sleep problems are somewhat less investigated and inconclusive. In one study, sleep problems were found to be increased in children with ADHD-C than ADHD-I, and no difference was found between children with ADHD-I and healthy controls (34). However, more recent studies reported greater daytime sleepiness in subjects with ADHD-I than subjects with ADHD-C (31); and one study on adolescents with ADHD-I reported increased sleep disturbances as compared with subjects without ADHD (43). One recent

study conducted on 83 children (aged between 6 and 12) reported higher sleep problems in children with ADHD-C when compared with ADHD-I (44). In this study, an increased burden of sleep problems reported on CSHQ was found in children and adolescents with ADHD-C than those with ADHD-I. Nevertheless, lower but still considerably high scores in subjects with ADHD-I should not be overlooked. In addition, the researchers couldn't detect any statistical difference at the level of subscales between the two groups.

Age may be another important mediator of comorbid disease profile in children and adolescents with ADHD (39). ODD is reported to be higher in children, while internalizing disorders such as depression and anxiety disorders more frequent in adolescents (45). However, a study by Yuze et al. reported a higher prevalence of ODD and several anxiety disorders such as special phobia and separation anxiety disorders in children with ADHD (39). In this study, the researchers looked for lifetime occurrence of psychiatric disorders and found that only enuresis was higher in children than adolescents. Since elimination disorders tend to improve throughout development, this finding was expected. There was no significant difference in total CSHQ scores between children and adolescents. This finding may reflect the fact that sleep problems are common in youth with ADHD during both childhood and adolescence; and this should encourage child mental health professionals to inquire about sleep related problems routinely during patients' clinic visits regardless of age.

Gender has also an effect on accompanying comorbidity in ADHD (46). The higher internalizing disorders ratio as a psychiatric comorbidity in females to males has been shown in literature with little controversy (39, 46). In accordance with this literature, we found higher frequencies of depression and SAD in females than males. It could be helpful for clinicians to pay particular attention when investigating comorbid internalizing disorders in young females with ADHD. Depressive and anxiety symptoms including concentration difficulties may be the first reason to engage in treatment-seeking behavior in females and may obscure underlying ADHD symptoms (47). Thus, clinicians should be aware of the possibility of underlying ADHD in female youth admitted to a clinic with complaints of anxiety and depression for the first time. There was no difference in CSHQ total score in terms of gender. This may suggest that other variables such as ADHD presentation, comorbidity, and medication status may affect sleep problems in young subjects with ADHD, rather than age and gender.

Meanwhile, the risk of being overweight doubled in subjects with ADHD and it has been reported that they may have higher BMI score compared to the non-ADHD peers

(48). Tendency for being overweight may be greater from age 10-12 onwards (48). As consistent with this, we found higher mean BMI scores in adolescents than children.

## CONCLUSIONS AND LIMITATIONS

High rates of psychiatric comorbidity and sleep problems were found in children and adolescents with ADHD in this study. Subjects with ADHD-C had more frequent lifetime diagnosis of ODD, elimination disorders, and sleep problems compared to subjects with ADHD-I. In subjects with ADHD-I generalized anxiety (GAD) and social anxiety (SAD) disorders were found more frequently than with ADHD-C. Females, compared to males, have more frequent diagnoses of depression and SAD. There was a positive correlation between the mean number of comorbid diagnoses, self-reported anxiety/depressive symptoms, and CSHQ total scores. While BMI scores did show significant differences between ADHD and gender groups, adolescents had higher scores compared to children. Children and adolescents with ADHD should be routinely evaluated for psychiatric comorbidity and sleep problems regardless of ADHD presentation, age, or gender.

Regarding study limitations, it may be important to note that this study was conducted in a university hospital clinic with voluntary participation and all subjects were on medication. Findings of the study may be biased due to voluntary participation and medication use; and may not reflect ADHD subjects in general.

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## REFERENCES

1. Willcutt EG. The prevalence of DSM-IV attention-deficit/hyperactivity disorder: a meta-analytic review. *Neurotherapeutics* 2012;9:490-9. [CrossRef]
2. Dulcan M, Dunne JE, Ayres W, Arnold V, Benson RS, Bernet W, et al. Practice parameters for the assessment and treatment of children, adolescents, and adults with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry* 1997;36:85S-121S. [CrossRef]
3. Agnew-Blais JC, Moffitt TE, Arseneault L, Polanczyk G V, Wertz J, Danese A. Young adult mental health and functional outcomes among individuals with remitted, persistent and late-onset ADHD. *Br J Psychiatry* 2018;213:526-34. [CrossRef]
4. Jensen PS, Martin D, Cantwell DP. Comorbidity in ADHD: Implications for research, practice, and DSM-V. *J Am Acad Child Adolesc Psychiatry* 1997;36:1065-79. [CrossRef]
5. Pliszka SR. Conceptual issues in understanding comorbidity in ADHD. *Attention-Deficit Hyperact Disord Adults Child* 2015:63-71. [CrossRef]
6. İnci SB, İpci M, Akyol Ardiç U, Ercan ES. Psychiatric Comorbidity and Demographic Characteristics of 1,000 Children and Adolescents With ADHD in Turkey. *J Atten Disord* 2019;23:1356-67. [CrossRef]
7. Jensen PS, Hinshaw SP, Kraemer HC, Lenora N, Newcorn JH, Abikoff HB, et al. ADHD comorbidity findings from the MTA study: Comparing comorbid subgroups. *J Am Acad Child Adolesc Psychiatry* 2001;40:147-58. [CrossRef]
8. Cuffe SP, Visser SN, Holbrook JR, Danielson ML, Geryk LL, Wolraich ML, et al. ADHD and Psychiatric Comorbidity: Functional Outcomes in a School-Based Sample of Children. *J Atten Disord* 2015. pii: 1087054715613437. [Epub ahead of print] [CrossRef]
9. Takahashi K, Miyawaki D, Suzuki F, Mamoto A, Matsushima N, Tsuji H, et al. Hyperactivity and comorbidity in Japanese children with attention-deficit/hyperactivity disorder. *Psychiatry Clin Neurosci* 2007;61:255-62. [CrossRef]
10. Mick E, Biederman J, Jetton J, Faraone S V. Sleep Disturbances Associated with Attention Deficit Hyperactivity Disorder: The Impact of Psychiatric Comorbidity and Pharmacotherapy. *J Child Adolesc Psychopharmacol* 2002;10:223-31. [CrossRef]
11. Cortese S, Brown TE, Corkum P, Gruber R, O'Brien LM, Stein M, et al. Assessment and management of sleep problems in youths with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry* 2013;52:784-96. [CrossRef]



12. Coskun M, Emine A, Ozturk M. Mirtazapine treatment for comorbid anxiety/depressive disorders in young subjects with attention-deficit hyperactivity disorder: Case series. *Klin Psikofarmakol Bul* 2010;20:246-51. [CrossRef]
13. 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. pii: 1087054715577991. [Epub ahead of print] [CrossRef]
14. Lambek R, Virring A, Jennum PJ, Thomsen PH, Møller LR. Sleep Problems and Daily Functioning in Children With ADHD: An Investigation of the Role of Impairment, ADHD Presentations, and Psychiatric Comorbidity. *J Atten Disord* 2014;21:731-40. [CrossRef]
15. Tarakçioğlu MC, Kadak MT, Gürbüz H, Doğan E, Erdoğan F. Sleep Habits In Children And Adolescent Diagnosed With Attention Deficit Hyperactivity Disorder. *Med J Haydarpaşa Numune Train Res Hosp* 2016;56:71-7.
16. Öner P, Üneri ÖŞ, Rezaki B, Bodur Ş. Dikkat Eksikliği Hiperaktivite Bozukluğu olan Çocuklarda Uyku Sorunları ve Klinik Değişkenlerle İlişkisi. *Kriz Derg* 2008;16:25-32. [CrossRef]
17. Coskun M, Kaya İ. Dikkat Eksikliği Hiperaktivite Bozukluğu ve Diğer Komorbid Durumlar. *Türkiye Klin J Child Psychiatry-Special Top* 2015;1:68-76.
18. Koyuncu A, Çelebi F, Ertekin E, Kök BE, Tükel R. Clinical Effects of ADHD Subtypes in Patients With Social Anxiety Disorder. *J Atten Disord* 2019;23:1464-9. [CrossRef]
19. Soendergaard HM, Thomsen PH, Pedersen E, Pedersen P, Poulsen AE, Winther L, et al. Associations of Age, Gender, and Subtypes With ADHD Symptoms and Related Comorbidity in a Danish Sample of Clinically Referred Adults. *J Atten Disord* 2016;20:925-33. [CrossRef]
20. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, et al. Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): Initial reliability and validity data. *J Am Acad Child Adolesc Psychiatry* 1997;36:980-8. [CrossRef]
21. Coskun M, Hajdini A, Alnak A, Karayagmurlu A. Internet Use Habits, Parental Control and Psychiatric Comorbidity in Young Subjects with Asperger Syndrome. *J Autism Dev Disord* 2020;50:171-9. [CrossRef]
22. Ercan ES, Polanczyk G, Akyol Ardic U, Yuçe D, Karacetin G, Tufan AE, et al. The prevalence of childhood psychopathology in Turkey: a cross-sectional multicenter nationwide study (EPICPAT-T). *Nord J Psychiatry* 2019;73:132-40. [CrossRef]
23. Gokler B, Unal F, Pehlivan Türk B, Cengel Kultur E, Akdemir D. Reliability and validity of schedule for affective disorders and Schizophrenia for school age children-present and lifetime version-Turkish version (K-SADS-PL-T) [in Turkish]. *Turkish J Child Adolesc Ment Heal* 2004;11:109-16.
24. Owens JA, Spirito A, McGuinn M. The Children's Sleep Habits Questionnaire (CSHQ): Psychometric Properties of A Survey Instrument for School-Aged Children. *Sleep* 2017;23:1-9. [CrossRef]
25. Fis NP, Arman A, Ay P, Topuzoglu A, Gueler AS, Imren SG, et al. The validity and the reliability of Turkish Version of Children's Sleep Habits Questionnaire. *Anatol J Psychiatry* 2010;11:151-60. [CrossRef]
26. Kovacs M. Rating scales to assess depression in school-aged children. *Int J Child Adolesc Psychiatry* 1981;46:305-15.
27. Öy B. Çocuklar İçin Depresyon Ölçeği: Geçerlik ve Güvenirlik Çalışması. *Türk Psikiyatri Dergisi* 1991;2(2):132-136.
28. Birmaher B, Khetarpal S, Brent D, Cully M, Balach L, Kaufman J, et al. The Screen for Child Anxiety Related Emotional Disorders (SCARED): Scale construction and psychometric characteristics. *J Am Acad Child Adolesc Psychiatry* 1997;36:545-53. [CrossRef]
29. Çakmakçı F. Çocuklarda Anksiyete Bozukluklarını Tarama Ölçeği Geçerlik Ve Güvenirlik Çalışması [in Turkish]. *Turkish J Child Adolesc Ment Heal* 2004;11.
30. Jensen CM, Steinhausen H-C. Comorbid mental disorders in children and adolescents with attention-deficit/hyperactivity disorder in a large nationwide study. *ADHD Atten Deficit Hyperact Disord* 2015;7:27-38. [CrossRef]
31. Corkum P, Davidson F, MacPherson M. A Framework for the Assessment and Treatment of Sleep Problems in Children with Attention-Deficit/Hyperactivity Disorder. *Pediatr Clin North Am* 2011;58:667-83. [CrossRef]
32. Sung V, Hiscock H, Sciberras E, Efron D. Sleep problems in children with attention-deficit/hyperactivity disorder: Prevalence and the effect on the child and family. *Arch Pediatr Adolesc Med* 2008;162:336-42. [CrossRef]
33. Tarakcioglu MC, Akkin Gurbuz G, Kadak MT, poyraz BC, aksoy umut mert, erdogan firat. Is there a relationship between the symptoms of Attention Deficit Hyperactivity Disorder, ADHD, and chronotype in medication-free children? A preliminary study in children under 12 years of age. *Arch Neuropsychiatry* 2018;55:54-8. [CrossRef]
34. Mayes SD, Calhoun SL, Bixler EO, Vgontzas AN, Mahr F, Hillwig-Garcia J, et al. ADHD subtypes and comorbid anxiety, depression, and oppositional-defiant disorder: Differences in sleep problems. *J Pediatr Psychol* 2009;34:328-37. [CrossRef]
35. Souza I, Pinheiro MA, Denardin D, Mattos P, Rohde LA. Attention-Deficit/Hyperactivity Disorder and comorbidity in Brazil: Comparisons between two referred samples. *Eur Child Adolesc Psychiatry* 2004;13:243-8. [CrossRef]
36. Ahmad G. Psychiatric comorbidity differences in clinic-referred children and adolescents with ADHD according to the subtypes and gender. *J Child Neurol* 2009;24:679-84. [CrossRef]
37. Thiruchelvam D, Charach A, Schachar RJ. Moderators and mediators of long-term adherence to stimulant treatment in children with ADHD. *J Am Acad Child Adolesc Psychiatry* 2001;40:922-8. [CrossRef]
38. Franco I, Von Gontard A, De Gennaro M. Evaluation and treatment of nonmonosymptomatic nocturnal enuresis: A standardization document from the international children's continence society. *J Pediatr Urol* 2013;9:234-43. [CrossRef]
39. Yuçe M, Zoroglu SS, Ceylan MF, Kandemir H, Karabekiroglu K. Psychiatric comorbidity distribution and diversities in children and adolescents with attention deficit/hyperactivity disorder: A study from Turkey. *Neuropsychiatr Dis Treat* 2013;9:1791-9. [CrossRef]
40. Ushijima H, Usami M, Saito K, Kodaira M, Ikeda M. Time course of the development of depressive mood and oppositional defiant behavior among boys with attention deficit hyperactivity disorder: Differences between subtypes. *Psychiatry Clin Neurosci* 2012;66:285-91. [CrossRef]

41. Baeyens D, Roeyers H, Hoebeke P, Verté S, Van Hoecke E, Vande Walle J. Attention deficit/hyperactivity disorder in children with nocturnal enuresis. *J Urol* 2004;171:2576-9. [\[CrossRef\]](#)
42. Khazaie H, Eghbali F, Amirian H, Moradi MR, Ghadami MR. Risk Factors of Nocturnal Enuresis in Children with Attention Deficit Hyperactivity Disorder. *Shanghai Arch Psychiatry* 2018;30(1):20-6.
43. Lin L-Y, Soong W-T, Tai Y-M, Shang C-Y, Chiu Y-N, Gau SS-F, et al. Association between symptoms and subtypes of attention-deficit hyperactivity disorder and sleep problems/disorders. *J Sleep Res* 2010;19:535-45. [\[CrossRef\]](#)
44. Eyuboglu M, Eyuboglu D. Behavioural sleep problems in previously untreated children with attention deficit hyperactivity disorder. *Psychiatry Clin Psychopharmacol* 2018;28:19-24. [\[CrossRef\]](#)
45. Connor DF, Edwards G, Fletcher KE, Baird J, Barkley RA, Steingard RJ. Correlates of comorbid psychopathology in children with ADHD. *J Am Acad Child Adolesc Psychiatry* 2003;42:193-200. [\[CrossRef\]](#)
46. Wilens TE, Biederman J, Faraone S V., Martelon M, Westerberg D, Spencer TJ. Presenting ADHD symptoms, subtypes, and comorbid disorders in clinically referred adults with ADHD. *J Clin Psychiatry* 2009;70:1557-62. [\[CrossRef\]](#)
47. Quinn PO, Madhoo M. A review of attention-deficit/hyperactivity disorder in women and girls: Uncovering this hidden diagnosis. *Prim Care Companion J Clin Psychiatry* 2014;16:PCC.13r01596. [\[CrossRef\]](#)
48. Fliers EA, Buitelaar JK, Maras A, Bul K, Höhle E, Faraone S V., et al. ADHD is a risk factor for overweight and obesity in children. *J Dev Behav Pediatr* 2013;34:566-74. [\[CrossRef\]](#)