

Effect of gender differences on impulsivity in adolescents with attention-deficit/hyperactivity disorder

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ABSTRACT

Objective: Impulsiveness has been considered the core symptom of attention-deficit/hyperactivity disorder (ADHD). In this study, we aimed to assess effect of gender differences on impulsivity in adolescents diagnosed with ADHD. **Methods:** One hundred and fifty-six adolescents (91 males, 65 females) who were admitted to the Erenköy Research and Training Hospital for Psychiatry and Neurology Child and Adolescent Clinic between 01.01.2016 and 01.05.2016 and diagnosed with ADHD were recruited to participate in this study. Adolescents filled out Barratt Impulsiveness Scale and parents completed the SNAP IV ADHD Scale. **Results:** Of the participants, 41.6% (n=65) were female and 58.3% (n=91) were male. The mean age of girls was 14.3±1.7 years, and the mean age of boys was 14.4±1.7 years. The Barratt impulsivity mean total scores, the Barratt attentive impulsivity subscale mean scores, and the Barratt motor impulsivity subscale mean scores were significantly higher in the female ADHD group than in the male ADHD group. In multiple linear regression analysis, gender was significantly correlated with the Barratt impulsivity total mean score, the Barratt attentive impulsivity mean score, and the Barratt motor impulsivity mean score. **Conclusion:** The finding of greatest interest in this analysis is that the adolescent girls who were diagnosed with ADHD had greater attentive and motor impulsivity scores than boys as measured by the BIS-11. Although, some previous research reported inconsistent findings of impulsivity levels by gender, our findings confirm prior reports of higher impulsivity in the female clinical population. (*Anatolian Journal of Psychiatry* 2017; 18(4):379-386)

Keywords: adolescent, attention-deficit/hyperactivity disorder, gender, impulsivity

Dikkat-eksikliği/hiperaktivite bozukluğu tanısı konan ergenlerde cinsiyet farklılıklarının dürtüsellik üzerine etkisi

ÖZ

Amaç: Dürtüsellik özellikle dikkat-eksikliği/hiperaktivite bozukluğunun (DEHB) ana belirti kümelerinden biri olarak kabul edilmektedir. Bu çalışmada DEHB tanısı konan ergenlerde cinsiyet farklılıklarının dürtüsellik üzerine etkilerinin araştırılması planlanmıştır. **Yöntem:** 01.01.2016-01.05.2016 tarihleri arasında Erenköy Ruh ve Sinir Hastalıkları Eğitim ve Araştırma Hastanesi Çocuk ve Ergen Psikiyatri Polikliniği'nde DEHB tanısı konan 156 ergen (91 erkek, 65 kadın) bu araştırmanın örneklem grubunu oluşturmaktadır. Çalışmaya katılan ergenler Barratt Dürtüsellik Ölçeğini (BIS-11), anne-babalar SNAP DEHB Ölçeğini doldürmüşlerdir. **Bulgular:** Katılımcıların %41.7'si (s=65) kadın, %58.3'ü (s=91) erkektir. Kızların yaş ortalaması 14.3±1.7 yıl, erkeklerin yaş ortalaması 14.4±1.7 yıldır. BIS-11 toplam dürtüsellik ortalama puanı, motor alt test dürtüsellik ortalama puanı ve dikkate bağlı dürtüsellik alt test ortalama puanı kadınlarda erkeklere göre anlamlı oranda daha yüksek bulunmuştur. Çoklu doğrusal regresyon

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analizinde bağımsız değişken olarak cinsiyet, toplam dürtüsellik, motor dürtüsellik, dikkate bağlı dürtüsellik puanı ile ilişkili bulunmuştur. **Sonuç:** Bu çalışmada DEHB'li kız ergenlerin BIS-11 ile ölçülen toplam dürtüsellik, motor dürtüsellik ve dikkate bağlı dürtüsellik puanları DEHB'li erkek ergenlere göre daha yüksek bulunmuştur. Önceki çalışmalarda cinsiyet ve dürtüsellik ilişkisi ile ilgili tutarlı sonuçlar bulunmamıştır. Bu çalışma klinik örneklemede kadın cinsiyetinde daha fazla dürtüsellik olduğunu gösteren çalışmaların sonuçlarını desteklemektedir. (*Anadolu Psikiyatri Derg* 2017; 18(4):379-386)

Anahtar sözcükler: Cinsiyet, dikkat-eksikliği/hiperaktivite bozukluğu, dürtüsellik, ergen

INTRODUCTION

Impulsiveness is defined as lacking conscious judgement or cognitive control over behavior, or a tendency to act with little forethought.¹ Impulsivity can be viewed as a dimension of normal personality and a characteristic of adolescence; however, maladaptive impulsivity is associated with deficits in executive function, and it is related with psychiatric disorders such as attention-deficit/hyperactivity disorder (ADHD), mania, substance abuse, and personality disorders.²⁻⁴

ADHD is the most common neurodevelopmental disorder in children and adolescents that is characterized by hyperactivity and deficiencies in impulse control, as well as difficulties with sustained attention and distractibility.⁵ Studies that investigate the etiology of ADHD are focused on dysfunction in the prefrontal cortex and impaired executive functions in ADHD.^{6,7} As expected, dysfunction within the prefrontal cortex and executive functions is known to be responsible for generating impulsive behavior in ADHD.⁸ Impulsivity in ADHD has motor (hyperactivity), cognitive (impulsive cognitive style and lack of attentional control), emotional (uncontrolled temper), and social (social disinhibition) domains.⁹ Lack of perseverance, lack of premeditation, and sensation seeking are significantly associated with impulsivity in ADHD in research.¹⁰

Adolescence is a period marked by significant psychosocial and neurobiological changes. The most impressive finding of neurodevelopment in adolescence is maturation of the prefrontal cortex and parietal lobes. Pruning of neuronal axons begins at approximately 11 years of age, and this pruning results in decreased synapses and thinning of gray matter. Myelination increases at this time. The largely intact limbic system in adolescence is believed to drive reward-seeking and goal-directed behavior, and unfortunately, the under-developed prefrontal systems may not be able to inhibit and control impulses to reduce risks and unhealthy outcomes.¹¹⁻¹⁵

The risk of unhealthy outcomes due to impulsivity is increased when individuals are diagnosed with ADHD in adolescence⁴. When ADHD is severe, symptoms persist in adolescence, and females with ADHD were found to be more vulnerable to emotional and psychological problems as compared with males.¹⁶

To our knowledge few studies have investigated sex differences of impulsivity in adolescents, and contradictory results were obtained. Generally, impulsivity is greater in males in population-based studies; however, when the study sample is selected from patients who have a psychiatric diagnosis, women exhibit more impulsivity than men.¹⁷

The aim of this study was to investigate effect of sex differences on impulsivity in adolescents diagnosed with ADHD and its relationship with ADHD symptoms, subtypes of ADHD, and comorbid diagnoses in ADHD-diagnosed adolescents. We hypothesized that girls have more impulsivity independent to the severity of ADHD.

METHODS

This study was conducted in the Child and Adolescent Psychiatry Clinic at Erenköy Research and Training Hospital for Psychiatry and Neurology. The procedures were approved by a local ethics committee in the Erenköy Research and Training Hospital for Psychiatry and Neurology.

Study population

One hundred and fifty-six adolescents (65 female, 91 male) aged between 11 and 18 years who were admitted to the Erenköy Research and Training Hospital for Psychiatry and Neurology Child and Adolescent Clinic between 01.01.2016 and 01.05.2016 and diagnosed with ADHD were recruited to participate in this study. The participants had no previous psychiatric evaluation or psychiatric drug history. Adolescents diagnosed with neurologic disorders, intellectual disability, autism spectrum disorders, bipolar disorders and psychotic disorders were excluded. Adolescents who were adopted, living in an institution,

or were not living with their parents were not included in the study in order to compose a homogeneous group in terms of familial factors.

Materials

Sociodemographic Information Form: Information on the sociodemographic characteristics of the adolescents participating in the study was obtained using a Sociodemographic Information Form, which was developed by researchers. This questionnaire included questions about birthdate, gender, parents' age, level of education, monthly income of parents, and average lesson scores (1=failed, 2=passed, 3=average, 4=good, 5=very good).

Barratt Impulsivity Scale-11 (BIS-11): The BIS-11 is a 30-item self-reporting questionnaire designed to measure impulsiveness. All items are measured on a 4-point Likert scale (1=rarely/never; 2=occasionally; 3=often; 4=almost always/always). Statistical factor analysis revealed three components as follows: (1) attentional impulsiveness, (2) motor impulsiveness, and (3) non-planning impulsiveness. The higher the BIS-11 total score, the higher the impulsiveness level. BIS-11 is a valid and reliable instrument for Turkish healthy and psychiatric populations.¹⁸ Cronbach's alphas for internal consistency were 0.78 (students) and 0.81 (patients), and the two-month test-retest reliability was 0.83 (students).¹⁸

SNAP IV ADHD Scale: The SNAP IV Scale is an 18-item questionnaire derived from DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) criteria for ADHD that may be completed by parents or teachers. Each item is rated from 0 to 3, where 0=not at all; 1=just a little, 2=quite a bit, 3=very much. There are nine items related to inattention and nine items for hyperactivity/impulsivity. The SNAP IV Scale has been used as an outcome measure in clinical trials and in community surveys to identify children with a probable diagnosis of ADHD. The SNAP IV Scale has solid psychometric properties with coefficient alpha values on parent ratings of 94 for the total score, and 0.90 and 0.79 for the inattention and hyperactivity scores, respectively.¹⁹⁻²¹

Procedures

A total of 214 adolescents who had presented to Child and Adolescent Clinic for the first time with diagnosis of ADHD between 01.01.2016 and 01.05.2016 were invited to participate in the study. Of these, 172 adolescents agreed to participate and written informed consent was

obtained from parents. Sociodemographic Information Forms were completed by clinicians. Psychiatric diagnoses were made according to DSM-IV-based clinical interview by child and adolescent psychiatry specialists. After the clinical interview, adolescents who had epilepsy (n=2), intellectual disabilities (n=9), psychosis (n=1), bipolar disorders (n=2), and autism spectrum disorders (n=2) were excluded from the study. Adolescents filled out the BIS-11 and parents filled out the SNAP IV ADHD Scale.

Data analysis

Statistical analyses were performed using the computer package SPSS Complex Samples Statistics (IBM SPSS Statistics version 20.0). Group comparisons were conducted using χ^2 tests for categorical variables. Continuous variables were normally distributed (Kolmogorov-Smirnov test of normality, $p>0.05$). Independent sample t-tests were used for the differences between groups for continuous variables. The associations between ADHD subtype, gender, age, SNAP ADHD scores and impulsivity scores were examined with a multiple linear regression model using the block enter method with 95% confidence intervals (CI). Preliminary analysis was conducted to ensure no violation of the assumptions of normality, linearity, and multicollinearity. The p value <0.05 was accepted as statistically significant for all analyses.

RESULTS

The participants were divided into two groups: 41.6% (n=65) were female and 58.3% (n=91) were male. The mean age of girls was 14.3 ± 1.7 years (ranging from 11.0-18.0 years), and the mean age of boys was 14.4 ± 1.7 years (ranging from 11.2-18.0 years). The sociodemographic properties of the sample are depicted in Table 1.

Of the participants, 50.7% of the females had the inattentive type of ADHD, 50.3% of the females had the combined type of ADHD; 60.4% of the males had the combined type of ADHD, and 39.6% of the males had the inattentive type of ADHD. There were no subjects with the hyperactive type of ADHD. In the female ADHD group, 55.3% (n=36) had comorbid diagnoses, 36.2% (n=33) of the male ADHD group had comorbid diagnoses. The major comorbidity of the female ADHD group (30.8%) was mood disorders (major depression or dysthymia). The mood disorder (depressive disorder, dysthymia) comorbidity of the males (9.9%) was significantly lower than for females ($p<0.001$). Externalizing disorder

Table 1. Sociodemographic characteristics of the sample

	Female (n=65)		Male (n=91)		t	p
	n	%	n	%		
Age of patient (Mean±SD, years)	14.3±1.7 (11-18.0) ^a		14.4±1.7 (11.2-18.0) ^a		-0.28	0.774
Lecture notes (Mean±SD, years)	3.2 (1-5)		3.0 (1-5)		1.31	0.194
Age of mother (Mean±SD, years)	40.7±6.5		41.3±4.9		-0.65	0.514
Age of father (Mean±SD, years)	46.0±6.5		45.0±6.6		0.92	0.358
Monthly income of families (TL) ^b						0.229
<2000	46	70.7	60	65.9		
2,000-5,000	14	21.5	25	27.5		
5,000-10,000	3	4.6	4	4.4		
>10,000	2	3.2	2	2.2		
Educational level of mother						0.167
Primary school	28	43.1	34	37.4		
Secondary school	10	15.4	12	13.2		
High School	22	33.8	26	28.6		
University	5	7.7	19	20.9		
Educational level of father						0.234
Primary school	25	38.1	24	26.7		
Secondary school	7	10.8	15	15.6		
High school	27	41.5	36	40.6		
University	6	9.2	16	17.8		

^a Range of ages in years; ^b Turkish Liras

Table 2. ADHD subgroups and comorbid psychiatric diagnosis of males and females

	Female (n=65)		Male (n=91)		χ^2	p
	n	%	n	%		
ADHD ^a subgroups					15.22	<0.001 ^c
ADD ^b	33	50.7	36	39.6		
Combined ADHD	32	49.3	55	60.4		
Comorbidities						
Mood disorders	20	30.8	9	9.9	10.92	<0.001 ^c
Anxiety disorders	6	9.2	4	4.4	1.48	0.321
Externalizing disorders	10	15.4	10	11.0	0.66	0.284

^a ADHD: Attention-deficit/hyperactivity disorder; ^b ADD: Attention deficit disorder; ^c Significant comparisons.

disorder (conduct disorder-CD and oppositional defiant disorder-ODD) comorbidity was similar - 15.4% for females and 11.0% for males ($p>0.05$). ADHD subtypes and comorbidities of the participants were listed in Table 2. Two of the females (3.07%) reported previous suicide attempts, but no previous suicide attempts were reported among the males.

Between females and males, the SNAP IV ADHD Scale scores were not statistically different ($p>0.05$). The Barratt impulsivity mean total scores, Barratt attentive impulsivity subscale mean scores, and Barratt motor impulsivity sub-

scale mean scores were significantly higher in the female ADHD group ($p=0.006$, $p=0.005$, and $p=0.005$, respectively). The Barratt non-planning impulsivity subscale mean scores were not significantly different between groups ($p>0.05$). Mean scores of the scales were listed in Table 3.

Table 4 represents the association between the Barratt impulsivity mean scores and gender, age, ADHD subtype, and comorbid diagnoses in a multiple linear regression model. The Barratt impulsivity total mean score, the Barratt attentive impulsivity mean score, the Barratt motor impul-

Table 3. Attention-deficit/hyperactivity and impulsivity scores among females and males

Instrument	Females (n=65) Mean±SD	Males (n=91) Mean±SD	t	p	Effect size
SNAP total score	31.6±11.5	33.8±10.9	-1.21 ^a	0.230	0.20
SNAP inattention score	18.5±5.7	19.3±6.4	-0.784	0.435	0.13
SNAP H/I ^b score	13.1±7.2	14.5±6.5	-1.26	0.210	0.20
BIS ^c total impulsivity score	71.2±12.4	66.2±9.8	2.80	0.006 ^b	0.44
BIS attentive impulsivity score	9.6±4.7	17.7±3.9	2.82	0.005	0.43
BIS nonplanning impulsivity score	29.2±5.0	28.2±4.7	1.38	0.169	0.20
BIS motor impulsivity score	22.4±5.4	20.3±3.7	2.85	0.005	0.45

^a Independent t-test; ^b Hyperactivity/impulsivity; ^c Barratt Impulsivity Scale

Table 4. Linear regression models for Barratt impulsivity total and subscale scores

Dependent variables	Independent variable	F	R ² Change	B	t	p
Barrat impulsivity total score	Gender			-0.231	-2.827	0.005
	Age			0.51	0.636	0.526
	ADHD ^b subtype	3.339	0.101	0.139	1.572	0.118
	Comorbid diagnosis			0.77	0.928	0.355
	SNAP total score			0.93	1.006	0.316
Barrat attention score	Gender			-0.230	-2.836	0.005
	Age			0.072	0.894	0.373
	ADHD subtype	3.856	0.115	0.151	1.722	0.087
	Comorbid diagnosis			0.093	1.134	0.259
	SNAP total score			0.106	1.162	0.247
Barrat motor impulsivity score	Gender			-0.262	-3.196	0.002
	Age			0.046	0.573	0.568
	ADHD subtype	2.900	0.079	0.156	1.752	0.082
	Comorbid diagnosis			-0.031	-0.374	0.709
	SNAP total score			0.070	0.763	0.447
Barrat nonplanning score	Gender			0.097	-1.150	0.252
	Age			0.014	0.162	0.871
	ADHD subtype	1.042	0.034	0.065	0.705	0.482
	Comorbid diagnosis			0.108	1.258	0.210
	SNAP total score			0.028	0.294	0.769

^a Significant comparisons are denoted in bold font

^b Attention-deficit/hyperactivity disorder

sivity mean score and the Barratt non-planning impulsivity mean score were dependent variables. Gender, age, ADHD subtype, having comorbid diagnosis and SNAP IV scale total mean score were independent variables in the regression models. Gender was significantly related with the Barratt impulsivity total mean score ($p=0.005$), the Barratt attentive impulsivity mean score ($p=0.005$), and the Barratt motor impulsivity mean score ($p=0.002$) (Table 4).

DISCUSSION

This study examined the gender differences in behavioral measures of impulsive behavior and its association with ADHD symptoms, ADHD subtypes, comorbid diagnoses, and several demographic characteristics of individuals in a clinical sample of ADHD-diagnosed, drug-naive adolescents. The finding of greatest interest in this analysis was that the adolescent girls who were diagnosed with ADHD had greater atten-

tive/cognitive impulsiveness and motor impulsivity than boys as measured by the BIS-11 instrument. Non-planning impulsivity did not differ significantly with gender. To our knowledge, this is the first study that investigates gender differences of impulsivity in adolescents with ADHD.

The BIS-11 instrument measures three dimensions of impulsivity. The attentional impulsiveness subscale assesses the ability to focus on the task at hand and the cognitive speed in decision making. The motor impulsiveness subscale assesses acting without thinking and restlessness, and the non-planning impulsiveness subscale assesses the lack of future-oriented problem-solving strategies.²²⁻²⁴ Researchers defined emotional impulsivity and impulsive behaviors as reactions to emotions. They correlated impulsivity to emotional instability in ADHD and Bipolar Disorder, and related it to problem behaviors and suicidality. Violence, vandalism, risky sexual behaviors, compulsive spending, gambling, and substance use are linked to emotion-relevant impulsivity in research. Emotional regulation and impulsivity have stronger attentional domains and were related to attentional impulsivity measured by the BIS-11 instrument.^{10,25,26}

A recent study examined impulsivity in 381 adolescents aged 13-19 years, recruited from an inpatient unit. Consistent with our findings, girls reported higher scores on the feelings trigger actions item of self-report impulsivity scale which is defined as a form of emotional impulsivity.¹⁰

Researchers suggest that emotional impulsivity is relevant to suicidality.^{26,27} There were two adolescent girls in our sample who had previously attempted suicide. Although boys are more likely to die by suicide, adolescent girls report higher rates of suicidal ideation and attempts.²⁸⁻³⁰ Rucklidge and Tannock showed that adolescent females with ADHD were more impaired than males with ADHD in self-reported and parent-teacher reported issues of anxiety, distress, depression, and locus of control.¹⁶ Some research suggests that females with ADHD have a greater risk of substance abuse as compared with ADHD males independent from comorbid externalizing disorders.³¹ Externalizing comorbid diagnoses were similar in females and males in our study, consistent with previous studies, indicating that comorbid externalizing problems, such as ODD and CD, are generally similar in ADHD diagnosed males and females.^{32,33}

Fields et al. found higher impulsivity in adolescent smoking girls than smoking boys in a popu-

lation-based sample, but they found higher impulsivity in nonsmoking boys than nonsmoking girls.³⁴ More motor and attentive impulsivity in females was documented with the BIS-11 instrument, as in our study, in a sample consisting of inpatient drug-using individuals aged 18 to 67 years.¹⁷ Another study in a nonclinical sample of adults in which psychiatric diagnosis and addiction were excluded from the sample, found that women had higher motor and non-planning impulsivity as measured by the BIS-11 instrument similar with our study.³⁵ Stoltenberg et al. found significantly higher levels of impulsivity in men for each of the three subscales (attentional, non-planning, and motor) of the BIS-11 instrument in young adults from a college (n=200; 73 men/124 women).³⁶ One hundred and twenty-five healthy undergraduate students having a mean age of 24 were evaluated with computerized behavioral tests in a recent study. Men had higher motor impulsivity scores than women. No significant differences existed between the group scores for attentional impulsivity or non-planning impulsivity.³⁷ These findings are inconsistent with our study, but they assessed a nonclinical sample. Other similar studies have found no significant sex differences on any dimension of impulsivity.^{25,38} Research findings have not consistently demonstrated gender differences in impulsivity.

Girls and boys did not differ in the SNAP-IV ADHD scores in our sample, so we can suggest that differences in impulsivity are independent from the severity of ADHD. In our sample, the comorbidity of mood disorders (depression and dysthymia) was significantly greater in adolescent girls with ADHD than boys, in line with previous studies.¹⁶ Although having a comorbid diagnosis was not related to impulsivity in regression analysis, the emotional construct in adolescent girls that did not lead to a diagnosis may play a role in attentional and motor impulsivity. Attentional impulsivity, which is associated with emotionally relevant impulsivity, leads to cognitive and behavioral mistakes or acting-out behaviors, especially under emotional conditions.⁹ One of the reasons that higher impulsivity scores were exhibited in the girls in our study, and in previous research whose findings are coherent with ours, may be explained by considering that boys with higher impulsivity scores may have been treated in childhood, and girls might not be referred to a hospital until adolescence. Girls with primarily inattentive ADHD symptoms are often diagnosed later than their male peers exhibiting hyperactive/impulsive

symptoms.³⁹ Moreover, hormonal differences may explain the gender differences, especially in adolescence.

Barkley and other researchers reported that emotional impulsiveness is a significant part of ADHD in the lives of patients with the disorder, particularly in adults.^{40,41} Researchers suggested that mood swings, irritability, and lack of patience causing temper outbursts and emotional 'dyscontrol' are the characteristics of impulsive women and are closely related to their social problems.⁹ Females with ADHD were found to be at high risk for more comorbidity, emotional, and psychological problems due to their higher emotional impulsivity and vulnerability as compared with males, despite having very similar cognitive profiles.¹⁶

In conclusion, our results confirm findings from a previous study that documented higher impulsivity levels in females, especially in clinical samples. Primary interventions and treatment may

need to focus on the vulnerability of females with ADHD since childhood.

Limitations

The primary limitation of this study was that adolescents were recruited from clinically referred patients for this research, which is not an epidemiological sample, and may not be representative of all youth with ADHD. Because the number of cases was low, the effects of each comorbid psychiatric disorder on impulsivity could not be studied. The absence of a healthy control group, evaluation of limited familial and environmental factors that may effect the impulsivity, and failure to determine intellectual disabilities through testing were also limitations of this study. Additionally, we used only the BIS-11 instrument, which is a self-report, to assess impulsivity in this research. Information from the parents and teachers might also be taken for a more objective evaluation.

Yazarların katkıları: S.G.: Finding issue, literature review, conducting of study, statistical analysis, writing of manuscript; C.Y.: Conducting of study; E.A.: Conducting of study; M.A.: statistical analysis, writing of manuscript.

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