

# Online gaming features in adolescents with attention-deficit/hyperactivity disorder

Dikkat eksikliği/hiperaktivite bozukluğu olan ergenlerde çevrimiçi oyun özellikleri



## Abstract

**Aim:** Leisure activities in adolescents with Attention-deficit/hyperactivity disorder (ADHD) tend to focus on Internet activities, especially online games. Online gaming addiction has been observed in ADHD populations. Game genres and characteristics may affect addiction in ADHD adolescents who play online games. This study aims to contribute to the literature by examining the Internet gaming disorder (IGD) risk effects and game genres of hyperactivity/impulsivity, inattention, and ADHD index separately.

**Methods:** A total of 884 adolescents playing online games were included. Participants answered the online game features form, Conners-Wells' adolescent self-report scale—long version and digital gaming addiction scale—short form under the observation of their teachers. Game genres and ADHD symptomatology (Inattention, Hyperactivity/impulsivity, ADHD index) were categorized within themselves.

**Results:** IGD was significant in all subcomponents of ADHD symptomatology. In all subcomponents, insulting/threatening speeches were found in the chat tab. In the Hyperactivity/impulsivity component, more hours of online gaming and spending real money on in-game advantages were found. In the Inattention and ADHD index, the amount of gaming in the social environment of the adolescents was high. In ADHD symptomatology, no significant results were found in game genres (except sports in the Inattention component).

**Conclusion:** Although levels of online gaming are high in adolescents with ADHD, a bidirectional relationship is likely. We believe that social factors and communicative characteristics are important in relational factors in adolescents. Longitudinal studies should be conducted to answer important empirical questions about the relationship between ADHD-IGD and game genres.

**Keywords:** Attention deficit; hyperactivity; video game addiction

## Öz

**Amaç:** Dikkat eksikliği/hiperaktivite bozukluğu (DEHB) olan ergenlerde boş zaman aktiviteleri internet aktivitelerine, özellikle online oyunlara odaklanma eğilimindedir. DEHB popülasyonlarında çevrimiçi oyun bağımlılığı gözlenmiştir. Çevrimiçi oyun oynayan DEHB'li ergenlerde oyun türleri ve özellikleri bağımlılığı etkileyebilir. Bu çalışma, hiperaktivite/dürtüsellik, dikkatsizlik ve DEHB indeksinin çevrimiçi oyun bağımlılığı risk etkilerini ve oyun türlerini ayrı ayrı inceleyerek literatüre katkı sağlamayı amaçlamaktadır.

**Yöntemler:** Çevrimiçi oyun oynayan toplam 884 ergen çalışmaya dahil edilmiştir. Katılımcılar, çevrimiçi oyun özellikleri formu, Conners-Wells'in ergen öz bildirim ölçeği - uzun versiyon ve dijital oyun bağımlılığı ölçeği - kısa formunu öğretmenlerinin gözetiminde yanıtladılar. Oyun türleri ve DEHB semptomatolojisi (Dikkatsizlik, Hiperaktivite/dürtüsellik, DEHB indeksi) kendi içinde kategorize edilmiştir.

**Bulgular:** Çevrimiçi oyun bağımlılığı, DEHB semptomatolojisinin tüm alt bileşenlerinde anlamlıydı. Tüm alt bileşenlerde sohbet sekmesinde aşağılayıcı/tehdit edici konuşmalar saptandı. Hiperaktivite/dürtüsellik bileşeninde, daha fazla saat çevrimiçi oyun oynama ve oyun içi avantajlar için gerçek para harcama bulundu. Dikkatsizlik ve DEHB indeksinde ergenlerin sosyal çevrelerinde oyun oynama miktarı yüksek saptandı. DEHB semptomatolojisinde oyun türlerinde (Dikkatsizlik bileşenindeki sporlar hariç) anlamlı bir sonuç bulunamadı.

**Sonuç:** DEHB olan ergenlerde çevrimiçi oyun oynama düzeyleri yüksek olmakla birlikte çift yönlü bir ilişki olasıdır. Ergenlerde ilişkisel faktörlerde sosyal faktörlerin ve iletişimsel özelliklerin önemli olduğuna inanıyoruz. DEHB ile çevrimiçi oyun bağımlılığı ve oyun türleri arasındaki ilişki hakkında önemli ampirik soruları cevaplamak için boylamsal çalışmalar yapılmalıdır.

**Anahtar Sözcükler:** Bağımlılık; dikkat eksikliği bozukluğu; hiperaktivite; video oyunları

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## INTRODUCTION

Attention Deficit/Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders increasing worldwide among children and adolescents (1,2). Three subtypes of ADHD recognize the behaviors of predominantly hyperactive/impulsive, predominantly inattentive, and a combined type, described by a combination of the first two subtypes (3). Adolescents with ADHD tend to focus on online games within their free time internet activities (4,5). To date, research in adolescents with ADHD has focused on the potential risk of increased internet activities associated with Internet gaming disorders (IGD) (6,7). Internet gaming has been associated with ADHD among adolescents (8,9).

The relationship between ADHD behaviors and IGD has been observed as well as observational, as well as pharmacological studies examining the effectiveness of ADHD drugs in reducing IGD symptoms (10-12). ADHD and IGD share a two-way relationship where ADHD symptoms make playing video games more appealing and gaming; may exacerbate ADHD symptoms such as inattention, disinhibition, impulsive response, and craving for immediate reward (6,12). Han et al. stated that online video games can be a self-treatment method for adolescents with ADHD (13). New evidence is emerging that there is a neurobiological relationship between IGD and ADHD (12,14). Compared to populations without ADHD, rates of internet addiction, including predominantly online gaming, were seen in both inattentive and hyperactive/impulsive ADHD populations (15). These studies suggest that ADHD symptoms may be an important risk factor for online game addiction. ADHD and IGD individuals share common clinical features such as high impulsivity, dysfunction in daily life, and focusing on their own fun activities (3,16). Studies show that there is a decrease in activity in cortical regions associated with attention, impulse control, and stimulus integration, which are the main problems in adolescents with ADHD (17). These make the person more sensitive to reinforcing stimuli, especially in video games (18).

In the fifth edition of Chapter III of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), published in 2013, IGD has been proposed as a new psychiatric disorder requiring further investigation

(3). It is also included in the International Classification of Diseases (ICD-11), substance use-related disorders, or addictive behaviors (19).

In the current studies, it has been stated that adolescents with IGD spend long periods gaming, have social difficulties, use real money for advantages in their games, and employ insulting/threatening speech during gaming (20,21).

Various genres of games affect the severity of IGD. Because different genres of games increase reinforcement, the type of video game played can affect the likelihood of developing addictive gaming behaviors. There are studies reporting the relationship between multiplayer and real-time game genres and IGD (22-25). However, there are limited studies investigating the effects of game genres on ADHD adolescents. While the bidirectional relationship between IGD and ADHD is being discussed, the effect of some multiplayer game genres that increase the development of IGD in ADHD remains a mystery. A correlation of ADHD with some genres of games has been reported (27). Recent research has shown that IGD susceptibility differs between game genres due to its unique structural features (5,27).

## The Present Study

The present study aims to examine separately the IGD risk effects of hyperactivity/impulsivity and inattention in online game features and genres. There are few studies on IGD and game genres among participants with ADHD, and these studies were conducted on young adults (28). This study was designed to investigate the relationship between ADHD and IGD in adolescents and game genres. Furthermore, this study is a stimulating study on adolescents about the potential relationship between ADHD symptomatology and IGD and game genres. Information about game features relating to adolescents with ADHD, such as insulting/threatening speech in games, playing online in one's social environment, spending more time playing online games, and spending money on prizes and advantages in games were investigated.

For these purposes, the following hypotheses have been defined. We estimate the association of IGD and game genres within three groups of ADHD symptoms. In ADHD symptomatology, we test the effect of game

genres on symptoms such as inattention and hyperactivity/impulsivity on the development of IGD and the effect of online gaming features on the situation.

## MATERIALS AND METHODS

The study was conducted in three secondary and three high schools with the approval of Malatya Provincial Directorate of National Education. All participants and parents were given detailed information and written consent was obtained. All procedures performed in studies involving participants comply with the ethical standards of the Declaration of Helsinki. Ethics committee approval was obtained from İnönü University Health Sciences Non-interventional Clinical Research Ethics Committee for the study (date: 07.09.2021, decision no: 2021/2392).

### Participants

The study was conducted with 2.703 adolescents aged 12–18 years, and all participants were students. Participants answered the sociodemographic form, online game features form, Conners-Wells' adolescent self-report scale—long version (CASS:L), and digital

gaming addiction scale—short form (GAS) under the observation of their teachers. Nine hundred and seventy-six adolescents (976) who did not fully respond to the scales or surveys were excluded from the study and 1.727 participants were included in the study. In the second step, 843 participants who did not play any games were excluded from the study. Ultimately, the study included 884 participants who played online games. This assessment is shown in Fig. 1. Participants declared that they had not received any psychiatric treatment.

### Evaluation and Measurements

#### *Demographic characteristics, online game features, and game genres*

Demographic characteristics and online game questions of the participants were determined by the questions prepared by the researchers. Demographic characteristics evaluated in the study were age, gender, residential area, family structure, and family income.

The online game features of the participants were examined with five questions.

Question 1: “How many hours a day do you play video games?” The possible answers were 0 = less than 1 hour, 1 = 1–3 hours, and 2 = 4–6 hours.

Question 2: “Does anyone around you have online games?” The possible answers were 0 = no, 1 = any in the family, 2 = friends and 3 = family and friends

Question 3: “Are there any awards in the game?” The possible answers were 0 = no, 1 = prize money, 2 = advantage (extra feature, bonus, weapon, etc.)

Question 4: “Do you pay for games?” The possible answers were 0 = no and 1 = yes

Question 5: “Is there any insulting/threatening speech in the online chat?” The possible answers were 0 = no, 1 = yes but there is no insulting/threatening speech and 2 = yes and there is insulting /threatening speech.

The participants were asked to list the three online games they played the most. Game names written by participants were searched on the GameFAQs forum on the GameSpot website and the game genres were determined. Game genre categories were adapted from GameFAQs as follows: massively multiplayer online role-playing game (MMORPG), multiplayer online battle arena (MOBA), first-person shooter (FPS),

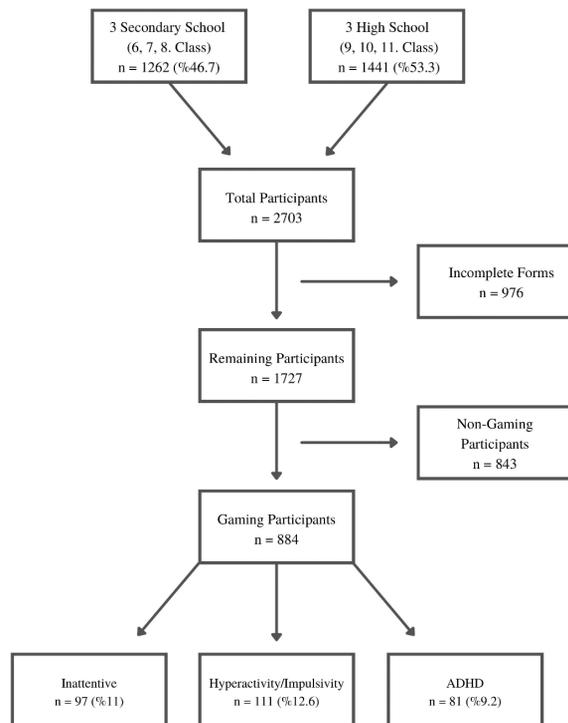


Figure 1. All participants and gaming participants, elimination process

**Table 1.** Participants' characteristics

		n	%
<b>Gender</b>	Female	225	25.5
	Male	659	74.5
<b>Residential Area</b>	Rural area	222	25.1
	Urban area	662	74.9
<b>Family structure</b>	Nuclear	769	87.0
	Extended	72	8.1
	Dispersed	43	4.9
<b>Family income</b>	Low	420	47.5
	Moderate	388	43.9
	High	76	8.6
		<b>Mean±SD</b>	<b>Min-Max</b>
<b>Age</b>		15.3±1.7	12-18
<b>Conners Scores</b>	Inattention	7.6±6.4	0-27
	Hyperactivity/impulsivity	6.8±6.5	0-27
	ADHD index	11.0±8.2	0-36

ADHD: Attention Deficit/Hyperactivity Disorder, Max: Maximum, Min: Minimum, n: number, SD: Standard Deviation

action-adventure, real-time strategy (RTS), simulation, sports and driving (29).

**MMORPG:** Massively multiplayer online role-playing games in which players develop a character and interact collaboratively and competitively with other players in a shared online world.

**MOBA:** Multiplayer online battle arena games are a subgenre of real-time strategy games in which two teams, typically consisting of five players each, compete against each other with each player controlling a single character.

**FPS:** First-Person Shooter, kill-or-be-killed games with fast, violent action, usually with military or sci-fi themes.

**Action-Adventure:** It is mostly played from a third-person perspective and is full of action and adventure.

**Real-Time Strategy:** Strategic combat-oriented games from an aerial perspective with no wait between moves.

**Simulation:** Video games that are often designed to closely simulate real-world situations.

**Sports:** Realistic simulations, primarily of team sports, interactive motion-controlled sports, and workout games.

**Driving:** Primarily car racing games.

### Conners-Wells' Adolescent Self-report Scale—Long Version (CASS:L)

Conners-Wells' adolescent self-report scale—long version (CASS:L) is an 87-item (both male and female) self-report scale designed for adolescents aged 12-17 years (30). Turkish validity and reliability studies of the scale were performed by Kaner et al. (31). ADHD index (2 items); It consists of DSM-IV symptom subscales reflecting inattention (9 items) and hyperactivity/impulsivity (9 items). Participants mark the item as “Not at all True” (never, rarely), “Sometimes True” (sometimes), “Quite True” (usually, quite a lot), or “Very True” (very often). The reliability and internal consistency coefficients for different subscales are 0.75-0.9, and the test-retest reliability is 0.6-0.9. In this study, the 18-item ADHD scale, which evaluates the same symptoms as the 18 criteria in DSM-IV, was used for the diagnosis of ADHD. The 9-item inattention ADHD symptom (ADHD-Inattention) subscale measures difficulties in organizing and completing tasks that require sustained mental effort and focus. The 9-item hyperactive/impulsive symptom (ADHD-Hyperactivity/impulsivity) subscale (6 hyperactive items and 3 impulsive items) measures inactivity or delay of a response and task persistence.

Table 2. Online game features

Questions	Inattention				Hyperactivity/Impulsivity				ADHD Index						
	t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P	t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P	t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P			
Q1.	Less than 1 hour	389	49.4	43	44.3	387	50.1	45	40.5	395	49.2	37	45.7		
	1-3 hours	255	32.4	31	32.0	253	32.7	33	29.7	265	33.0	21	25.9	5.71	0.067
	3-6 hours	143	18.2	23	23.7	133	17.2	33	29.7	143	17.8	23	28.4		
Q2.	No	150	19.1	21	21.6	153	19.8	18	16.2	149	18.6	22	27.2		
	Any in the family	171	21.7	20	20.6	169	21.9	22	19.8	176	21.9	15	18.5		
	Friends	412	52.4	36	37.1	394	51.0	54	48.6	419	52.2	29	35.8	18.07	0.001**
Q3.	Family and Friends	54	6.9	20	20.6	57	7.4	17	15.3	59	7.3	15	18.5		
	No	352	44.7	35	36.1	343	44.4	44	39.6	357	44.5	30	37.0		
	Prize money	67	8.5	13	13.4	60	7.8	20	18.0	69	8.6	11	13.6	3.04	0.222
Q4.	Advantage	368	46.8	49	50.5	370	47.9	47	42.3	377	46.9	40	49.4		
	No	683	86.8	80	82.5	671	86.8	92	82.9	697	86.8	66	81.5	1.76	0.178
	Yes	104	13.2	17	17.5	102	13.2	19	17.1	106	13.2	15	18.5		
Q5.	No	613	77.9	61	62.9	603	78.0	71	64.0	625	77.8	49	60.5	12.21	0.001**
	Yes	174	22.1	36	37.1	170	22.0	40	36.0	178	22.2	32	39.5		

ADHD: Attention Deficit/Hyperactivity Disorder, n: Number, X2: Chi-square, Q1. How many hours a day do you play video games?, Q2. Do you have online games anyone around?, Q3. Are there any awards in the game?, Q4. Do you pay for games?, Q5. Is there any insulting or threatening speeches in the chat section? \* p<0.05, \*\* p<0.005, \*\*\* p<0.001

Table 3. Internet gaming disorder and game genres

		Inattention				Hyperactivity/Impulsivity				ADHD Index					
		t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P	t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P	t score <65 n (%)	t score ≥65 n (%)	X <sup>2</sup>	P		
IGD	Absent	629	79.9	52	53.6	621	80.3	60	54.1	636	79.2	45	55.6		
	Present	158	20.1	45	46.4	152	19.7	51	45.9	167	20.8	36	44.4	23.25	<0.001***
MMORPG	Absent	688	87.4	89	91.8	678	87.7	99	89.2	703	87.5	74	91.4	1.00	0.375
	Present	99	12.6	8	8.2	95	12.3	12	10.8	100	12.5	7	8.6		
MOBA	Absent	507	64.4	57	58.8	493	63.8	71	64.0	509	63.4	55	67.9	0.64	0.468
	Present	280	35.6	40	41.2	280	36.2	40	36.0	294	36.6	26	32.1		
FPS	Absent	581	73.8	72	74.2	570	73.7	83	74.8	590	73.5	63	77.8	0.70	0.430
	Present	206	26.2	25	25.8	203	26.3	28	25.2	213	26.5	18	22.2		
Action-Adventure	Absent	703	89.3	81	83.5	688	89.0	96	86.5	713	88.8	71	87.7	0.09	0.714
	Present	84	10.7	16	16.5	85	11.0	15	13.5	90	11.2	10	12.3		
RTS	Absent	570	72.4	70	72.2	558	72.2	82	73.9	580	72.2	60	74.1	0.12	0.795
	Present	217	27.6	27	27.8	215	27.8	29	26.1	223	27.8	21	25.9		
Simulation	Absent	752	95.6	94	96.9	738	95.5	108	97.3	767	95.5	79	97.5	0.72	0.569
	Present	35	4.4	3	3.1	35	4.5	3	2.7	36	4.5	2	2.5		
Sports	Absent	578	73.4	81	83.5	576	74.5	83	74.8	596	74.2	63	77.8	0.49	0.592
	Present	209	26.6	16	16.5	197	25.5	28	25.2	207	25.8	18	22.2		
Driving	Absent	747	94.9	91	93.8	734	95.0	104	93.7	759	94.5	79	97.5	1.35	0.426
	Present	40	5.1	6	6.2	39	5.0	7	6.3	44	5.5	2	2.5		

ADHD: Attention Deficit/Hyperactivity Disorder, FPS: First Person Shooter, MMORPG: Massively Multiplayer Online Role-playing Game, MOBA: Multiplayer Online Battle Arena, n: Number, X2: Chi-square, RTS: Real-Time Strategy  
As a result of the independent sample t-test, the effect size between the groups was found to be (in order of eta squared = 0.038, 0.043, 0.025).

### Game addiction scale—short form (GAS)

The short form of the game addiction scale (GAS) was used for the definition of IGD. Scale Lemmens et al. (32) It was created to determine online game addiction in adolescents aged 12-18. The Cronbach  $\alpha$  value of the scale is 0.92 and can be used for adolescents. The scale is a five-point Likert-type scale and the answers given are as follows; possible responses are never, rarely, sometimes, often, and very often. Individuals are considered to be online game addicts if they have at least four answers to seven questions: sometimes, often or very often (32). Turkish validity-reliability studies of the scale were carried out by Irmak and Erdoğan (33).

### Study Design

Adolescents were examined in three groups, primarily ADHD index, Inattention, and Hyperactivity/impulsivity. While the ADHD symptomatology was determined, the cases used were those with a t-score  $\geq 65$ . In all three groups, those with a t-score  $< 65$  constituted the control group. Thus, sociodemographic characteristics, online game features, IGD, and game genres were compared between the groups.

### Statistical Analysis

Statistical analyses were completed using the Statistical Package for the Social Sciences package program, version 22.0 (SPSS Inc., Chicago, IL, USA). Descriptive data related to the quantitative variables are given as the mean ( $\bar{x}$ )  $\pm$  standard deviation (sd) and minimum-maximum, while data related to the qualitative variables are given as numbers and percentages. The groups were compared in terms of demographic characteristics and online game features. In this assessment, the Fisher Chi-Square test was used for the analysis of qualitative variables, and the Independent Sample T-test was used for the analysis of quantitative variables. T-score was used to create the groups.

## RESULTS

The study was completed with a total of 884 adolescents and more boys than girls (male = 74.5%; female = 25.5%). The mean age of the participants was 15.3 years (SD = 1.7, min = 12, max = 18). In the statis-

tical t-score study, the participants were determined as 11.0% (n = 97) Inattention component, 12.6% (n = 111) Hyperactivity/impulsivity component, and 9.2% ADHD index (n = 81). The other socio-demographic data of the groups are shown in **Table 1**.

Online game features were compared. Q2 ( $X^2 = 23.82$ ,  $p < 0.001$ ) and Q5 ( $X^2 = 10.73$ ,  $p = 0.002$ ) items were significant in the Inattention component. Q1 ( $X^2 = 10.17$ ,  $p = 0.005$ ), Q3 ( $X^2 = 12.40$ ,  $p = 0.005$ ), and Q5 ( $X^2 = 10.56$ ,  $p = 0.002$ ) items were significant in the Hyperactivity/impulsivity component. Q2 ( $X^2 = 18.07$ ,  $p = 0.001$ ) and Q5 ( $X^2 = 12.21$ ,  $p = 0.001$ ) items were significant in the ADHD index. Q4 was not significant in any group. These findings are shown in **Table 2**.

Findings were found in the comparison made about IGD and game genres. There was a significant relationship between IGD and ADHD symptomatology. Accordingly, a significant relationship was found between IGD and the Inattention component ( $X^2 = 33.80$ ,  $p < 0.001$ ), Hyperactivity/impulsivity component ( $X^2 = 37.90$ ,  $p < 0.001$ ), and ADHD index ( $X^2 = 23.25$ ,  $p < 0.001$ ). However, no significant results were found in all game genres (except sports in the Inattention component,  $X^2 = 4.60$ ,  $p = 0.035$ ). These findings are shown in **Table 3**.

## DISCUSSION AND CONCLUSION

The aim of this study is to investigate the relationship between online game features, game genres, and IGD in ADHD gamers. All subcomponents of ADHD in online games were strongly associated with insulting/threatening speech and IGD. In the Inattentive component and ADHD index, in the social environment of the adolescents, the number of those who played online was significantly higher. In the Hyperactivity/impulsivity component, two findings we also found were spending more time playing and more money spent on prizes and advantages in online games.

In terms of gender, it is known that the frequency of playing online games is higher for boys than for girls (34). In our study, naturally, it is seen that boys are more dominant than girls (Male: 74.5%, Female: 25.5%). The main reason for this is; as stated in the study methodology (**Fig. 1**), due to the exclusion of those who did not play at all.

“Insulting/threatening speech”, which can be seen as a communication problem among adolescents, can create important social problems. In our study, we found a very strong correlation of this problem in all ADHD groups playing online games.

We measured “gaming time” in terms of ADHD characteristics among adolescents who play online games (see Q1). We found a significant relationship only in the Hyperactivity/impulsivity group. Considering that adolescents with ADHD are more susceptible to being tempted by games, spending longer hours playing is an expected result. With the effect of impulsivity, the adolescent does not want to end the game that attracts them. It has been reported that high gaming time spent on online gaming has a negative effect on the mental health of young people. It has been reported that the playing time of adolescents with mental problems is prolonged (28,35,36).

ADHD is an important disorder in which social difficulties and social problems are experienced. This situation can cause serious social interaction problems with the people living around them. ADHD individuals may be more affected by their social environment (32). In our study, Q2 is significant in the ADHD index and Inattentive component. The frequency of gaming in the social environment attracts ADHD adolescents.

Sensitivity to short-term rewards attracts adolescents with ADHD. IGD increases symptomatic intensity, and money spent on prizes and advantages can provoke more pleasure, especially in ADHD with impulsivity (8,37). In our study, Q3 was also found to be significant in the Hyperactivity/impulsivity component. Accordingly, it was thought that winning a monetary prize or advantage in a game impulsively attracted adolescents with ADHD. Short-term awards received in Hyperactivity/impulsivity-predominant ADHD patients create more pleasure.

There are evidence-based studies about the association between ADHD and IGD. Increasing IGD intensity affects ADHD symptomatology, worsens the prognosis, and causes higher IGD severity and more development of impulsivity and hostility in those with ADHD (38,39). In our study, IGD was significantly positive in all groups and supports existing studies. Accordingly, IGD was found to be significant in the Inattentive and Hyperactivity/impulsivity components

and ADHD index of ADHD. This is a remarkable finding and supports other studies (38-40). Higher rates of Internet addiction have been observed in both inattentive and hyperactivity/impulsivity ADHD populations and predominantly involve playing video games on the Internet (15). Similarly, in our study, all ADHD symptomatology reported a relationship with IGD. IGD may share an association where ADHD symptoms make playing video games online more appealing (6). Adolescents with ADHD are more likely to choose small but immediate rewards rather than delayed and later rewards (8,37). This suggests that reinforcement probabilities in video games are stronger. These individuals may be at higher risk for problematic video game playing. It is possible that this is why longer time spent gaming (Q1), playing games in a social environment (Q2), winning prizes and advantages in games (Q3), and using insulting/threatening speech while chatting in games (Q5) were found to be significantly related.

It seems easy to explain that item Q4 is unrelated in all groups, as paying money comes at a cost to the adolescent. However, ADHD adolescents are less sensitive to long-term rewards (8,37). In addition, the lack of direct economic income in the adolescent age group may be a separate factor. However, adolescents having ADHD does not mean that they will not need to pay for games.

Studies on the relationship between ADHD adolescents and video game genres are limited. Research shows that MMORPGs are most strongly linked to problematic gameplay. MMORPG game genre; It has a never-ending structure and intensifies competition in social interaction. This condition is portrayed as addictive and is reported to be the highest among problem game MMORPG players (22-24). On the other hand, MMORPG is not the only game genre associated with problematic usage; other popular video game genres, such as FPS and RTS games, have also been associated with higher levels of pathological gaming (18,25). Studies show that FPS, MOBA, and MMORPG games are more preferred by gamers with IGD symptoms (25). Aggarwal et al. states that IGD and ADHD are correlated in MOBA games (26). In our study, according to the statistical comparison made between game genres, no relationship was found between all ADHD subcomponents and game genres. We have categorized all game

genres as online games, grouping them according to the content and features of online games. However, we found that there was no difference between those with and without ADHD. We found that a specific orientation to different game genres was not specific to ADHD. We consider sports games, in which a single significant difference is seen, to have minimal significant positivity, making an accurate critique of sports games difficult.

Similar to our study, there are studies that found the IGD-ADHD relationship to be significant and the game genres' relationship to be meaningless (41). In a comprehensive functional Magnetic Resonance Imaging (fMRI) study, the ADHD-IGD relationship was examined with the help of fMRI and strong findings were obtained. The relationship between IGD-ADHD, IGD and ADHD in FPS, MMORPG and RTS games was examined and the effect of Internet gaming disorder was discussed rather than the relationship that developed according to game genres (38). In a recent study designed similarly to our study, the relationship between ADHD symptomatology and IGD-game genres was studied. It was stated that players with high ADHD symptom severity predicted IGD independently of the game genres that players preferred (28). However, there are also studies stating the opposite, especially about MMORPG (21-23). Accordingly, it can be said that MMORPG-genre games especially lead to the faster development of IGD. Whether it speeds up IGD development when every MMORPG gamer has ADHD looks uncertain. However, it is difficult to derive a conclusion because this pathology was not covered in our study. We emphasize that these game genres have no effect on ADHD symptomatology.

As ADHD symptom severity increases, problematic gaming rates also increase (14). We emphasize the impact of the content of problematic games, the duration of the game, the presence of role models around them, and factors such as the prize money earned in the game. Let us say that insulting/threatening speech during the game is already known to people with ADHD (42). Regardless of what game is played, our focus should be on IGD, as it can be thought that controlling addiction according to game genres will create an insufficient solution (43).

Our study was created using a large sample. While this is a powerful feature, our study has some limita-

tions. Since self-report questionnaires are used, it can be questioned whether the participants correctly estimated the playing time.

The cross-sectional comparison of video game-playing habits between adolescents with ADHD and healthy adolescents does not allow for causal relationships to be established. Our work is of a cross-sectional nature. However, longitudinal studies can reveal how the ADHD subcomponents are related. The confounding effect of age and gender was not looked at. This may affect the interpretation of results regardless of age and gender.

Further, we did not look for symptomatic aggravation in IGD according to game genres. In the studies conducted, symptomatic aggravation of IGD is supported according to the genres of games (18,22-25).

On the other hand, we excluded those who did not play any games (second step). Instead, we could have taken the non-players as the control group.

Although playing video games is often viewed as a healthy activity that can have beneficial effects for gamers, there is growing evidence that overly addictive games are associated with significant health and behavioral disadvantages (44-46). If it meets the IGD criteria, care should be taken in terms of symptomatic worsening in children with ADHD. IGD; It can make time management difficult for adolescents with ADHD. It can cause social relational problems. It can lead to their inability to manage to play video games as it also affects their behaviours.

Male adolescents with ADHD symptoms are known to be at risk for IGD (43). The pathological nature of ADHD allows for greater influence in adolescents exhibiting IGD features. Spending more time playing online games can magnify existing problems such as greater influence from the social gaming environment, focus on prizes and advantages in games and insulting/threatening speech in game chat. In addition, although we have determined that there is no effect of game genres, longitudinal studies are needed on the effect of game genres. We believe that more detailed studies are needed on IGD-ADHD and game genres. Longitudinal studies on the ADHD-IGD relationship will provide us with much more detailed information.

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