

ORIGINAL RESEARCH

Relationship between Internet Gaming Disorder Symptoms with Attention Deficit Hyperactivity Disorder and Alexithymia Symptoms among University Students

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Main Points

- Severity of Internet gaming disorder (IGD) symptoms, duration of daily Internet gaming, and problems related to Internet gaming were higher in the probable ADHD group than the group without probable ADHD.
- Probable ADHD, severity of alexithymia (particularly “difficulty identifying feelings” [DIF] and “externally oriented thinking” [EOT] dimensions), depression, and anxiety symptoms were associated with higher severity of IGD symptoms.
- ADHD, alexithymia (as a binary variable), depression, and anxiety predicted the severity of IGD symptoms, although these effects involving probable ADHD and alexithymia did not interact.
- Probable ADHD and both the severity of alexithymia (particularly DIF and EOT dimensions) and presence of probable alexithymia are related with the severity of IGD symptoms, even when controlling the effects of depression and anxiety.

Abstract

The aim of the present study was to evaluate the relationship between Internet gaming disorder (IGD) symptom severity with probable attention deficit hyperactivity disorder (ADHD) and alexithymia symptoms, while controlling anxiety and depression symptoms. The cross-sectional online study was conducted with 987 volunteer university students in Ankara, Turkey. Age was lower and first Internet use was earlier among the group with probable ADHD (n=166, 16.8%) than that without (n=821, 83.2%). There were no significant differences in gender or romantic relationship status between these groups, whereas the scale scores, duration of daily Internet gaming, and problems related to Internet gaming were higher in the probable ADHD group. Probable ADHD, continuous scores on alexithymia (particularly “difficulty identifying feelings” [DIF] and “externally oriented thinking” [EOT] dimensions), depression, and anxiety symptoms were associated with higher severity of IGD symptoms. ADHD, alexithymia (as a binary variable), depression, and anxiety predicted the severity of IGD symptoms, although these effects involving probable ADHD and alexithymia did not interact. These findings suggest that probable ADHD and both the severity of alexithymia (particularly DIF and EOT dimensions) and presence of probable alexithymia are related with the severity of IGD symptoms, even when controlling the effects of depression and anxiety, among university students.

Keywords: ADHD, alexithymia, anxiety, depression, internet gaming disorder

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Introduction

Although playing video games is an enjoyable activity most of the time, excessive involvement in gaming can be considered to be pathological for some players when the activity cannot be controlled, despite the associated social, occupational, family, school, and psychological problems (Gentile et al., 2011; Griffiths, 2005; Lemmens, Valkenburg & Peter, 2009). Accordingly, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) included “Internet gaming disorder” (IGD) as a condition that required further studies before being fully acknowledged and approved as a distinct disorder in subsequent DSM publications (American Psychiatric Association, 2013; Mihara & Higuchi, 2017; Petry & O’Brien, 2013). Further, IGD has been classified as a mental disorder in the International Classification of Diseases, 11th Revision (ICD-11) (World Health Organization, 2019). According to these classifications, the prevalence of IGD has ranged from 0.7% to 27.5% in earlier studies (Petry et al., 2014). However, very little is known about the relationship between IGD and mental health disorders, particularly regarding attention deficit hyperactivity disorder (ADHD).

As reported by a meta-analysis conducted by Ho et al. (2014), the prevalence of ADHD is high (21.7%) among patients with Internet addiction (IA). Some of the symptoms reported for ADHD, such as “being rapidly bored” and “having an aversion for delayed reward” (Diamond, 2005; Ramos-Quiroga, Montoya, Kutzelnigg, Deberdt & Sobanski, 2013), may also frequently be seen in individuals suffering from IA. Indeed, studies have found positive associations between IA and constructs such as ADHD, depression, and anxiety (Carli et al., 2013; Ho et al., 2014; Kim et al., 2016; Kitazawa et al., 2018; Leménager et al., 2018; Wang, Yao, Zhou, Liu & Lv, 2017). Similar findings were observed in Turkish university students (Dalbudak & Evren, 2014; Dalbudak et al., 2015). Further, the severity of ADHD symptoms is more significantly associated with the severity of IA among young adults with IA than adolescents with IA (Kim, Lee, Lee, Namkoong & Jung, 2017). ADHD has been reported to be a distinct risk factor for depression, anxiety, and IA (Kahraman & Demirci, 2018). Bielefeld et al. (2017) reported that ADHD and IA share psychopathological features, and they have advised clinicians and parents to be careful of this relationship, both diagnostically and therapeutically. In particular, IGD has been repeatedly found to be related with ADHD (Bioulac, Arfi & Bouvard, 2008; Dalbudak et al., 2013; Han, Kim, Bae, Renshaw & Anderson, 2017; Weinstein & Weizman, 2012). Elevated IGD and ADHD comorbidities have been found among Korean children (Ha et al., 2006). Finally, the findings of a study conducted by Yen et al. (2017) have revealed that the diagnoses of IGD and ADHD are related in young adults, and that young adults with these comorbidities induce higher impulsivity and hostility, which mediate the relationship between ADHD and IGD. This may indicate a causal relationship between these two disorders and/or a common etiology shared by them. Earlier studies have indicated that clinicians and parents should be careful regarding the ADHD symptoms among those who excessively involve themselves in gaming activities, and IGD among individuals with ADHD should be monitored (Wang et al., 2017). Therefore, this comorbidity and the factors related to this comorbidity are worth investigating since it may shed light on the treatment of such disorders.

Another relevant construct is alexithymia—a multifaceted personality construct identified as the failure to differentiate one’s emotions from accompanying bodily sensations, the inability to communicate emotions to others, and externally orientated cognitive features reflecting an absence of inner thoughts and fantasies (Taylor & Bagby, 1997). Nowadays, alexithymia has been defined as a deficit in the cognitive – experiential component of the emotional response systems and in the interpersonal regulation of emotions (Taylor & Bagby, 2013; Taylor, Bagby & Parker, 1997). The dysregulation of emotions has been widely accepted as a key feature of ADHD (van Stralen, 2016), which may, at least in part, result from alexithymia (Friedman et al., 2003). Indeed, studies conducted both among children (Donfrancesco et al., 2013) and among adults (Edel et al., 2010) have suggested that alexithymia is related to ADHD. Edel et al., (2010) reported that 22% adult subjects in their sample (n=73) were alexithymic. In particular, they suggested that alexithymia may be a major risk factor for emotional dysregulation among adults with ADHD.

Alexithymia was considered not only to impair the identification and expression of one’s emotions, but also to be a widespread deficiency in emotional processing and deficits in the regulation of emotions (Taylor & Bagby, 1997). Alexithymia was suggested to be related with addictive disorders, because alexithymic persons attempted to avoid negative emotions (Taylor, Bagby, & Parker, 1999) and they tried to regulate their emotions through compulsive (Taylor, Bagby, & Parker, 1991) or impulsive (Kandri, Bonotis, Floros, & Zafropoulou, 2014) behaviors. Consistent with this, it was suggested that alexithymia may play an important role in the etiopathogenesis of addictive disorders (Morie et al., 2016). Earlier studies have suggested that alexithymia is related to not only substance use disorders (Evren et al., 2008; Evren, Cınar, & Evren, 2012), but also with behavioral addictions such as gambling (Bonnaire, Bungener & Varescon, 2013), mobile phone overuse (Gao et al., 2018), and IA (Mahapatra & Sharma, 2018), whereas depression and/or anxiety may have important mediating effects in these relationships (Dalbudak et al., 2013). The association between alexithymia and IA is well documented in earlier studies, which suggest that alexithymia may play an important role in the development of IA (Baysan-Arslan, Cebeci, Kaya & Canbal, 2016; Craparo, 2011; Dalbudak et al., 2013; De Berardis et al., 2009; Hamdi, Kadriye, Nusret, & Ibrahim, 2014; Kandri et al., 2014; Lyvers, Karantonis, Edwards, & Thorberg, 2016; Mahapatra & Sharma, 2018; Schimmenti et al., 2015; Scimeca et al., 2014; Scimeca et al., 2017; Yates, Gregor, & Haviland, 2012). Alexithymia was also found to mediate the relationship between childhood maltreatment and IA severity in university students (Yates et al., 2012). Nevertheless, the nature of this association between alexithymia and IA among young adults is still uncertain, since alexithymia is also associated and confounded with anxiety and depression (Lyvers et al., 2016; Thorberg et al., 2011). Further, in their review, Ko, Yen, Yen, Chen & Chen (2012) suggested that IA may lead to emotional stability. Consistent with these points, a recent review that evaluated the relationships between alexithymia and IA suggested that the causal direction of this association is not certain, as the interplay of various factors that might influence this relationship has not been studied (Mahapatra & Sharma, 2018). We did not find any study directly

evaluating the relationship between alexithymia and IGD, which seems to be an important subject to evaluate.

The aim of the present study was to evaluate the relationship between IGD symptoms with probable ADHD and alexithymia among university students. As no studies have evaluated the association between IGD with alexithymia and no studies have evaluated the effects of both ADHD and alexithymia on IGD symptoms, this study can provide important and novel findings. Since negative emotions are associated with IGD (Chang, Chiu, Lee, Chen & Miao, 2014; Frangos, Frangos, & Kiohos, 2010), alexithymia (Lumley, 2000), and ADHD (Dalbudak & Evren, 2014), we also wanted to control the symptoms of anxiety and depression. We hypothesized that both probable ADHD and alexithymia may still be associated with the severity of IGD symptoms even after controlling anxiety and depression symptoms. Further, we examined if the relationships of probable ADHD and alexithymia on IGD interact with each other.

Methods

Participants and Procedure

The present study was conducted using a cross-sectional online self-report survey among university student participants in Ankara, Turkey. The approval from the Ethical Committee of the Çankaya University was first obtained (IRB approval no.: 80281877-050.99, dated April 12, 2018). After obtaining informed consent, the participants were asked to anonymously complete an Internet survey. We excluded participants who did not complete the survey. We also excluded duplicate entries. The effective sample size was 987 participants, out of which 567 were men (57.4%) and 420 were women (42.6%).

Measures

Toronto Alexithymia Scale

Alexithymia was assessed using the 20-item version of the Toronto Alexithymia Scale (TAS-20) (Bagby, Parker & Taylor, 1994; Bagby, Taylor & Parker, 1994). The Turkish version of TAS-20 has already been validated (Gulec et al., 2009). Each TAS-20 item was rated on a five-point (1 – 5) Likert scale, with total scores ranging from 20 to 100. The three dimensions of the TAS-20 are as follows: (1) difficulty in identifying feelings (DIF); (2) difficulty in describing feelings (DDF); and (3) externally oriented thinking (EOT). The total scores were categorized according to the recommendations made by Gulec et al. (2009); therefore, a score ≥ 61 indicated alexithymia, and a score < 61 indicated no alexithymia. Cronbach's alpha value for the total TAS-20 scale was 0.77; the alpha values for the three subscales (DIF, DDF, and EOT factors) were 0.80, 0.57, and 0.63, respectively.

Adult ADHD Self-Report Scales (ASRS-v1.1)

ADHD symptoms were measured with ASRS (Kessler, Chiu, Demler, Merikangas, & Walters, 2005), an 18-item scale based on the DSM-IV-TR criteria (American Psychiatric Association, 2000). The Turkish version of ASRS has demonstrated good reliability and validity in university students (Dogan, Oncu, Varol-Saracoglu, & Kucukgoncu, 2009). We used only six items of the ASRS, which were developed for community-based studies and exhibited strong concordance with clinical diagnoses as well as

sound psychometric properties (Chamberlain et al., 2016; Kessler et al., 2005; Kessler et al., 2006). The 5-point Likert scale ranged from "0" (never) to "4" (very often). Each response of sometimes or greater (2 or more) on screening items 1 – 3 equated to 1 point; each response of 10 or greater (3 or more) on screening items 4 – 6 yielded 1 point. A total score of 4 or more indicated probable ADHD. Therefore, we used this recommended definition to identify highly likely ADHD cases in our sample and labeled them as "probable ADHD." Nevertheless, these test results do not replace a clinical diagnosis, and the clinician must take false positives into consideration by evaluating ASRS positives with more lengthy, gold standard interviews.

Internet Gaming Disorder Scale – Short-Form (IGDS9-SF)

IGDS9-SF assesses the symptoms and severity of IGD and the detrimental effects by examining both online and/or offline gaming activities occurring over a 12-month period (Pontes & Griffiths, 2015). The scale comprises nine items corresponding to the nine core criteria defined by DSM-5. Items are rated on a 5-point Likert scale ranging from 1 (never) to 5 (very often); higher scores translate to higher levels of gaming disorder. In the present study, the Turkish version was used (Evren, Evren, Dalbudak, Topcu, & Kutlu, 2018).

90-Item Symptom Checklist-Revised

SCL-90-R is a self-report measure used to assess psychopathology symptoms (Derogatis, 1983). It has 90 items rated in a 5-point Likert scale (from 1 [no problem] to 5 [very serious]) to assess the extent to which individuals experienced symptoms during the previous 7 days. These 90 items are grouped into nine subscales, although we only used the depression and anxiety subscales that were relevant to the scope of the present study. Higher subscale scores indicate greater psychological distress. In the present study, the Turkish version was used (Dag, 1991).

Statistical Analysis

Statistical Package for the Social Sciences version 17.0 for Windows (SPSS Inc.; Chicago, IL, USA) was used for the analyses. Categorical sociodemographic variables were compared by means of χ^2 statistics. Odds ratios and 95% confidence intervals were calculated. We used the Student's t-test to compare groups with and without probable ADHD on continuous variables. Using the severity of IGD symptoms as a dependent variable, probable ADHD was determined to be a fixed independent factor; the severities of alexithymia (dimensions of alexithymia in the second ANCOVA), depression, and anxiety were covariates in the ANCOVA analysis. In the third ANCOVA, we used IGD symptoms as the dependent variable, probable ADHD and alexithymia (a binary variable in this analysis) were fixed independent factors, and severities of depression and anxiety were covariates. For all the statistical analysis, p values were two-tailed, and associations were considered to be significant at $p < 0.05$.

Results

Age was lower among the group with probable ADHD ($n=166$, 16.8%) than that without ($n=821$, 83.2%), whereas there were no significant differences according to gender and romantic relationship status between the groups. First Internet use was earlier,

Table 1.*Comparing Sociodemographic Variables and Scale Scores According to the Presence of Probable ADHD*

	Probable ADHD				t (or χ^2)	p	Cohen's d
	Absent n=821, 83.2%		Present n=166, 16.8%				
	M	SD	M	SD			
Age	24.00	6.80	21.90	3.03	6.284	<0.001	0.399
Gender					$\chi^2=2.596$	0.107	
Male	481	58.6	86	51.8			
Female	340	41.4	80	48.2			
Romantic relationship (n, %)	373	45.4	70	42.2	$\chi^2=0.595$	0.441	
First Internet use is early*	605	73.7	145	87.3	$\chi^2=14.118$	<0.001	
Daily Internet gaming					$\chi^2=7.845$	0.049	
Less than 3 hours	580	70.6	105	63.3			
3 to 6 hours	165	20.1	34	20.5			
6 to 9 hours	43	5.2	14	8.4			
More than 9 hours	33	4.0	13	7.8			
Problems related with gaming	227	27.6	71	42.8	$\chi^2=14.981$	<0.001	
IGDS9-SF	17.05	6.54	23.14	8.32	-8.890	<0.001	0.758
Probable alexithymia**	108	13.2	60	36.1	$\chi^2=51.671$	<0.001	
TAS-20	50.28	10.50	57.48	11.10	-7.981	<0.001	0.666
Difficulty Identifying Feelings	15.49	5.70	19.83	6.20	-8.825	<0.001	0.729
Difficulty Describing Feelings	12.53	3.83	14.97	4.21	-7.369	<0.001	0.606
Externally-Oriented Thinking	22.26	3.77	22.68	3.55	-1.303	0.193	0.115
Depression	17.43	10.47	25.85	11.17	-9.337	<0.001	0.778
Anxiety	9.28	8.01	15.63	9.26	-8.238	<0.001	0.733

*Before the age of 12 years; ** Odds ratio (95% C.I.)=3.737 (2.566 – 5.441); IGDS9-SF: Internet Gaming Disorder Scale – Short-Form; TAS-20: Toronto Alexithymia Scale; M: Mean; SD: standard deviation

Table 2.*Associated Variables with the Severity of IGD Symptoms in ANCOVA*

Source	Type III Sum of Squares	df	M Square	F	p	Partial Eta Squared
Covariates						
Depression	114.168	1	114.168	2.763	0.097	0.003
Anxiety	80.277	1	80.277	1.943	0.164	0.002
TAS-20	2221.672	1	2221.672	53.763	<0.001	0.052
Fixed factor						
Probable ADHD	2096.476	1	2096.476	50.733	<0.001	0.049

ADHD: attention deficit hyperactivity disorder; TAS-20: Toronto Alexithymia Scale; $R^2=0.213$ (adjusted $R^2=0.210$).

Table 3.*Associated Variables with the Severity of IGD Symptoms in ANCOVA*

Source	Type III Sum of Squares	df	M Square	F	p	Partial Eta Squared
Covariates						
Depression	105.474	1	105.474	2.556	0.110	0.003
Anxiety	46.264	1	46.264	1.121	0.290	0.001
DIF	856.245	1	856.245	20.748	<0.001	0.021
DDF	16.520	1	16.520	0.400	0.527	0.000
EOT	417.553	1	417.553	10.118	0.002	0.010
Fixed factor						
Probable ADHD	2089.361	1	2089.361	50.628	<0.001	0.049

ADHD: attention deficit hyperactivity disorder; DIF: difficulty identifying feelings; DDF: difficulty describing feelings; EOT: externally oriented thinking; $R^2=0.216$ (adjusted $R^2=0.211$).

Table 4.
Associated Variables with the Severity of IGD Symptoms in ANCOVA

Source	Type III Sum of Squares	df	M Square	F	p	Partial Eta Squared
Covariates						
Depression	376.799	1	376.799	8.750	0.003	0.009
Anxiety	276.533	1	276.533	6.422	0.011	0.007
Fixed factors						
Probable ADHD	1868.548	1	1868.548	43.392	<0.001	0.042
Probable Alexithymia	475.610	1	475.610	11.045	0.001	0.011
Interaction						
ADHD * Alexithymia	0.127	1	0.127	0.003	0.957	0.000

ADHD: attention deficit hyperactivity disorder; $R^2=0.181$ (adjusted $R^2=0.177$).

while the duration of daily Internet use, problems related with Internet use, and the scale scores were higher among the group with probable ADHD (Table 1).

Probable ADHD as well as alexithymia severity predicted the severity of IGD symptoms via the two ANCOVA analyses. Among the alexithymia dimensions, DIF and EOT were significant predictors. The severities of depression and anxiety symptoms also predicted the severity of IGD symptoms in these analyses (Table 2, 3).

In the third ANCOVA analysis, probable ADHD and alexithymia (as well as depression and anxiety) predicted the severity of IGD symptoms, although these effects involving probable ADHD and alexithymia did not interact (Table 4).

Discussion

The major finding of this research, which is also compatible with our hypothesis, was that the presence of probable ADHD and alexithymia are both associated to the severity of IGD symptoms, even after controlling the negative effects such as depression and anxiety symptoms. This finding is in line with an earlier study conducted in the different samples of university students, which found that probable ADHD, emotion dysregulation, and depression severity were related to the severity of IA symptoms (Evren et al., 2018). Further, we examined the interaction of probable ADHD and alexithymia, which was not significant. This may suggest that the enjoyment induced by Internet gaming may provide immediate pleasure to young adults with probable ADHD, alexithymia, and negative effects, which can regulate their negative emotions. These students may find the online gaming atmosphere appealing, probably due to the lack of physical presence and anonymity, and therefore, may be more susceptible to IGD (Kandri et al., 2014). ADHD appears to be associated with the loss of self-control, which is related to excessive Internet gaming; this can disturb the daily life of an individual (Bioulac et al., 2018; Weinstein & Weizman, 2012) and make them even more vulnerable to IGD.

Earlier studies have reported that IGD is consistently related with ADHD (Dalbudak et al., 2013; Han et al., 2017). Studies conducted among children (Ha et al., 2006) have reported high IGD and ADHD comorbidities, whereas another study conducted among young adults (Yen et al., 2017) reported that IGD is related to ADHD alone. In line with these, we found that the sever-

ity of IGD symptoms and the presence of probable ADHD were significantly related. Nevertheless, the cross-sectional design used in this study excludes the interpretation of causal relationships between probable ADHD and IGD symptoms.

Earlier studies have also suggested that IA was related to emotional problems, such as depression and anxiety (Carli et al., 2013; Ha et al., 2007; Ko et al., 2012; Morrison & Gore, 2010; Wu, Li, Lau, Mo, & Lau, 2016; Yen, Chou, Liu, Yang & Hu, 2014). In line with this, the severity of IGD symptoms was associated with the severities of depression and anxiety symptoms in the present study. Since Internet gaming can provide a platform to escape reality and distract from stress and negative emotions, it may be plausible that people with ADHD and/or alexithymic features may use Internet gaming as an avenue to manage their negative emotions, leading to higher severity of IGD (Ko et al., 2012; Gross, Juvonen & Gable, 2002; Selfhout, Branje, Delsing, ter Bogt, & Meeus, 2009; Spada & Marino, 2017).

Our results are similar to the studies showing that alexithymia can play a significant role in the development of IA (Baysan-Arslan et al., 2016; Craparo, 2011; Dalbudak et al., 2013; De Bernardis et al., 2009; Hamdi et al., 2014; Kandri et al., 2014; Lyvers et al., 2016; Schimmenti et al., 2015; Scimeca et al., 2014; Scimeca et al., 2017; Yates et al., 2012). Alexithymia is regarded both as a stable personality trait that constitutes a factor of vulnerability to negative emotions (Tolmunen et al., 2011) and as a defensive mechanism secondary to psychological distress (Mikolajczak & Luminet, 2006). Therefore, both Internet gaming and alexithymic features may be used for coping with or relieving symptoms of anxiety and depression. Students with negative emotions may use Internet gaming to externally relieve such emotions (Gross et al., 2002; Selfhout et al., 2009) and may internally experience alexithymia as a defense mechanism (Besharat & Shahidi, 2011; Evren et al., 2012). Pathological and excessive Internet gaming can also lead to or exacerbate alexithymia (Ko et al., 2012), anxiety, and depression symptoms (Tonioni et al., 2012); moreover, anxiety and depression may, at least in part, mediate the association between IGD symptoms and alexithymia. Spending time on Internet gaming could be an escape from feelings that would otherwise be emotionally painful, which can be considered as self-induced alexithymia. Consistent with this, it has been suggested that a loss of control over Internet gaming may lead to emotional stability (Ko et al., 2012). Therefore, although our cross-sectional

design does not allow for the analysis of the stability of alexithymia or causal relationships between alexithymia and IGD, alexithymia is associated with the severity of IGD symptoms in university students.

Individuals with elevated alexithymia levels show difficulty in creating healthy and intimate social relationships due to their failure to correctly recognize and handle emotional states (Heaven, Ciarrochi, & Hurrell, 2010; Rieffe, Oosterveld & Terwogt, 2006). Indeed, the lack of emotion or high and dysregulated emotional arousal may be experienced by alexithymic subjects (Taylor et al., 1997). Some authors have suggested that people with emotional dysregulation are more likely to participate in addictive behaviors in an effort to escape from or relieve negative emotions (Yu, Kim, & Hay, 2013). A research has found that students with severe IA symptoms were more likely to report higher emotion dysregulation (Spada & Marino, 2017). Even though they are separate constructs, alexithymia and emotional intelligence significantly overlap and have a strong but inverse association (Parker, Taylor, & Bagby, 2001). In line with this, emotional intelligence has been shown to be a protective factor for IGD (Che et al., 2017; Parker, Taylor, Eastabrook, Schell, & Wood, 2008), whereas people who have problems of emotion dysregulation seem to be more susceptible to addictive behaviors (such as Internet gaming) that offer immediate pleasure to regulate negative emotions (Engelberg & Sjöberg, 2004; Thompson, 1994; Tice, Bratslavsky, & Baumeister, 2001). In the present study, both severity (particularly DIF and EOT dimensions) and presence of alexithymia can predict the severity of IGD symptoms independently from probable ADHD. A possible explanation for this relationship is that via addictive behaviors, alexithymic people may attempt to self-regulate their emotional states (Taylor & Bagby, 1997).

University students with alexithymia, particularly those with high DIF dimension, were found to have a higher potential risk for developing IA (De Berardis et al., 2009). Similarly, high school students with pathological levels of alexithymia, particularly DIF, reported higher scores on IA severity (Scimeca et al., 2014). An earlier study conducted among Turkish university students showed that DIF along with DDF were associated with the severity of IA (Dalbudak et al., 2013). Further, a study conducted among Turkish medical students found positive correlations with the severity of IA symptoms and severity of all alexithymia subscales, whereas the coefficient was >0.25 only for the DIF dimension ($r=0.34$) (Hamdi et al., 2014). Finally, another study conducted among Turkish university students found that all the three subscale scores were higher among those with IA than those without IA (Baysan-Arslan et al., 2016). Consistent with these findings, DIF and EOT predicted the severity of IGD symptoms independently from anxiety and depression symptoms in the present study.

It has been suggested that Internet gaming may be the favorite medium for individuals who find it difficult to establish relationships due to the lack of physical presence, as well as the absence of others people's actual observations (McKenna & Bargh, 2000). This can provide a chance for alexithymic people to better regulate their emotions during social interactions in Internet gaming and to develop a more adaptive way to cope with human relationships (Scimeca et al., 2017). Therefore, people who have difficulty identifying, expressing, and communicating emotions may over-use Internet gaming to better control their emotions and meet

their unmet social requirements; as a result, alexithymia may increase the severity of IGD (Mahapatra & Sharma, 2018).

Limitations and Directions

The present study has some limitations. First, the research sample consisted of single university students, and therefore, may not generalize to more heterogeneous cultural and socioeconomic samples. Second, severe symptoms of ADHD may be related with weaker cognitive function, making these findings less reliable as we used self-rated scales in this study. Using self-rated measures, which may only show high risk rather than the diagnosis, limit the generalizability of these findings. Finally, it is impossible to comment on the casual relationships among the primary constructs of interest because our study was not prospectively designed. Thus, the results of the present study should be supported by further prospective researches conducted in clinical samples with structured interviews.

Conclusion

Despite these limitations, the obtained results highlight the association between IGD symptoms with the presence of probable ADHD as well as alexithymia (particularly DIF and EOT dimensions), even when controlling the negative effects in university students. Therefore, these variables should be investigated as potential risk factors for IGD and potential targets for treatment. This study may suggest that clinicians need to closely assess the symptoms of ADHD, alexithymia, depression, and anxiety to better identify IGD among university students, which are potentially important variables to be regarded in IGD intervention programs to reduce IGD among young adults.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of the Çankaya University (date: 12 April 2018; no: 80281877-050.99).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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