

Disordered eating behaviors in internet gaming disorder: Clinical and treatment correlates of a naturalistically treated youth sample

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Abstract

This study aimed to evaluate the clinical correlates of disordered eating behaviors among adolescents diagnosed with Internet Gaming Disorder (IGD) in a clinical setting. Participants were evaluated using a semi-structured clinical interview to assess psychiatric comorbidities. The severity of IGD was measured using the Internet Gaming Disorder Scale–Short Form. Disordered eating behaviors were assessed with the Eating Disorder Examination Questionnaire (EDE-Q) and the Eating Attitudes Test (EAT). Associations between clinical characteristics and disordered eating were analyzed using multiple linear regression models. The study included 80 male patients diagnosed with IGD and 36 healthy male adolescents. Generalized Anxiety Disorder (GAD) emerged as a significant predictor of elevated EDE-Q total scores in the IGD group ($\beta = 0.41$, 95% CI = 0.19–0.62, $p < 0.001$). GAD was also significantly associated with the EDE-Q subscales of restrictive eating, eating concern, shape concern, and weight concern, but not with the binge eating subscale ($p = 0.117$). Other psychiatric diagnoses did not show significant associations with disordered eating behaviors. Among pharmacological treatments, antipsychotic medication use was significantly associated with higher EAT scores ($\beta = 0.24$, 95% CI = 0.02–0.46, $p = 0.035$), whereas antidepressants and stimulants were not. These findings indicate that GAD and antipsychotic medication use are significant correlates of disordered eating behaviors in male adolescents with IGD. The results underscore the importance of screening for anxiety symptoms and monitoring eating behaviors in this clinical population.

Keywords: internet gaming disorder, adolescent, eating disorder, eating behaviors

Main points

- Antipsychotics were related to dysfunctional eating habits.
- Generalized Anxiety Disorder is associated with disordered eating behaviors.
- There were similar levels of disordered eating behaviors between male patients with IGD and the comparison group.

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Introduction

Internet Gaming Disorder (IGD) is characterized by excessive engagement in online gaming for a period of at least one year, resulting in significant social and functional impairments. IGD is included in Section III of the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (DSM-5) as a condition warranting further clinical research before it can be considered a formal disorder (American Psychiatric Association, 2013). Although IGD can be diagnosed across the lifespan, it is most frequently observed in adolescents and young adults (American Psychiatric Association, 2013). Individuals with IGD often exhibit a range of psychosocial difficulties, including antisocial behaviors, heightened irritability or anger, emotional dysregulation, and diminished self-esteem (Wartberg et al., 2019).

Individuals with eating disorders typically exhibit significant concerns related to body weight, shape, and eating behaviors (Duncan et al., 2007). These disorders are often accompanied by a range of maladaptive eating behaviors, including binge eating, self-induced vomiting, and food restriction (Duncan et al., 2007). Such patterns of disordered eating are associated with a spectrum of adverse psychosocial outcomes, including impairments in family functioning, emotional and behavioral dysregulation, and detrimental physical health consequences (Micali et al., 2014). Similarly, excessive engagement in internet gaming has been linked to weight fluctuations (both gain and loss), musculoskeletal discomfort due to poor posture, and disturbances in sleep patterns (Fernández-Villa et al., 2015; King & Delfabbro, 2018). In line with these findings, symptoms indicative of disordered eating have been reported at higher rates among individuals with Internet Gaming Disorder (IGD) (Hinojo-Lucena et al., 2019). Moreover, both online gaming and disordered eating behaviors appear to share common neurobiological substrates, particularly within neural circuits involved in reward processing (Harrison et al., 2010; Raiha et al., 2020; Turan et al., 2021). For instance, behaviors such as binge eating and self-starvation have been associated with alterations in reward sensitivity (Harrison et al., 2010). Correspondingly, neuroimaging studies have demonstrated disruptions in reward circuitry among individuals diagnosed with IGD (Hwang et al., 2020; Raiha et al., 2020).

The existing literature has consistently demonstrated a relationship between symptoms of internet addiction and disordered eating behaviors (Alpaslan et al., 2015; Fernández-Villa et al., 2015; Rodgers et al., 2013; Tao, 2013). A recent meta-analysis substantiated these findings, reporting significantly increased odds of disordered eating among individuals exhibiting problematic internet use (Hinojo-Lucena et al., 2019). However, the majority of these studies have been conducted in community-based samples, primarily comprising adults, university students, and adolescents from high school settings. Consequently, research examining this association within clinically diagnosed populations remains limited. In particular, disordered eating among individuals formally diagnosed with IGD according to DSM-5 criteria is notably underexplored, as the overwhelming majority of existing studies rely on self-report screening tools rather

than structured clinical interviews. Furthermore, individuals with IGD are known to have elevated rates of psychiatric comorbidities, including Major Depressive Disorder (MDD), Social Anxiety Disorder (SAD), Generalized Anxiety Disorder (GAD), and Attention-Deficit/Hyperactivity Disorder (ADHD) (Ho et al., 2014; Ko et al., 2012; Wang et al., 2017). Despite this, the potential associations between disordered eating behaviors and these comorbid psychiatric conditions in clinically diagnosed IGD populations have not been systematically investigated, representing a significant gap in the literature.

Recent studies have continued to demonstrate associations between problematic internet use and disordered eating behaviors across adolescent and young adult populations (Hsieh et al., 2018; Yu et al., 2021). Moreover, emerging evidence suggests that alterations in reward processing and inhibitory control may represent shared mechanisms underlying both IGD and disordered eating (Li et al., 2020; Raiha et al., 2020). In addition, more recent findings have emphasized the role of psychiatric comorbidities, particularly anxiety disorders, in exacerbating maladaptive eating patterns among adolescents with IGD (Wang et al., 2017; Yu et al., 2021). These studies highlight the necessity of examining these variables in clinically diagnosed populations, which remains limited in the current literature.

Considering there is a lack of knowledge to explicate the relationship between disordered eating attitudes and IGD in the clinical population, further efforts are needed to extend previous findings to clinical settings. Additionally, given the paucity of knowledge regarding the clinical correlates of dysfunctional eating attitudes in the clinical population, the effects of comorbid psychiatric disorder and medications on eating behaviors are still unresolved research questions in this population.

The present study addresses these critical gaps by examining disordered eating behaviors in a clinically diagnosed adolescent IGD sample. Unlike previous research that has predominantly relied on community-based samples using self-report measures of problematic internet use, we recruited adolescents who received formal IGD diagnoses through structured clinical interviews based on DSM-5 criteria in a specialized outpatient clinic in Türkiye. This clinical sample provides a unique opportunity to investigate disordered eating behaviors in adolescents experiencing clinically significant impairment from IGD, rather than subclinical or self-reported gaming problems. Furthermore, by systematically examining how specific psychiatric comorbidities (MDD, SAD, GAD, ADHD, and disruptive behavior disorders) and their pharmacological treatments relate to eating behaviors, this study provides the first comprehensive clinical characterization of factors associated with disordered eating in adolescents formally diagnosed with IGD.

In the present study, we aimed to examine several clinical and treatment-related variables as potential correlates of disordered eating behaviors among adolescents with IGD. These variables included the severity and duration of IGD

symptoms, common psychiatric comorbidities (e.g., Major Depressive Disorder, Social Anxiety Disorder, Generalized Anxiety Disorder, Attention-Deficit/Hyperactivity Disorder, and disruptive behavior disorders), and current psychotropic medication use (antidepressants, stimulants, and antipsychotics). By systematically investigating these factors, we sought to clarify which clinical characteristics are most strongly associated with disordered eating in this clinical population. Accordingly, we formulated the following hypotheses:

1. Adolescents with IGD would demonstrate higher levels of dysfunctional eating behaviors compared to healthy controls.
2. Disordered eating behaviors would be significantly associated with psychiatric comorbidities, particularly MDD, SAD, OCD, and GAD.
3. Psychotropic medications, especially stimulant and antipsychotic treatments, would influence disordered eating behaviors in the IGD group.

Method

Participants

This cross-sectional study was conducted at a tertiary-care, university-affiliated psychiatry hospital between January and April 2021. Participants in the Internet Gaming Disorder (IGD) group consisted of male children and adolescents who consecutively presented to a specialized outpatient clinic for the assessment and treatment of IGD. Each participant was evaluated by a trained clinician, and diagnoses were made according to the DSM-5 criteria for IGD. All diagnostic procedures were supervised by board-certified child and adolescent psychiatry consultants. In addition to diagnostic assessments, sociodemographic and clinical characteristics, as well as current pharmacological treatments, were recorded using a standardized data collection form. Psychiatric comorbidities were assessed using the semi-structured *Kiddie Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime Version* (K-SADS-PL, DSM-5).

The inclusion criteria for the case group were: i) aged between 10-18 years, ii) a clinical diagnosis of IGD per DSM-5. Severe and chronic psychiatric disorders that could confound hypothesis tests were excluded. Thus, the exclusion criteria of the study were clinical diagnoses of: i) psychotic disorder, ii) bipolar disorder, iii) autism spectrum disorder, iv) intellectual disability, and v) severe neurologic conditions that could impair the clinical interview and/or data collection. Since all patients in the IGD unit were male, we only included male subjects between 10-18 years of age.

The healthy control group was recruited from the same geographic and sociodemographic area as the IGD group to ensure comparability. Participants were recruited via hospital bulletin board advertisements and community announcements. All controls were systematically screened

with the K-SADS-PL to confirm the absence of current or past psychiatric diagnoses. In addition, controls were matched to the IGD group on age and educational background, and group equivalence was statistically verified (see Table 1). Since the IGD group consisted of male participants, we only included male youth in the comparison group. Disordered eating behaviors and attitudes were assessed using two standardized instruments: the 40-item *Eating Attitudes Test* (EAT-40) and the *Eating Disorder Examination Questionnaire* (EDE-Q). Written informed consent was obtained from all participants and their legal guardians. Participation was voluntary, and no financial incentives were provided. The Local Ethics Committee reviewed and approved the study protocol (Protocol Code: 2021.10.01.10).

Measures

Sociodemographic Data Form

Sociodemographic data and IGD characteristics (e.g. age, sex, education, weekly game hours, internet access, preferred game types, etc.) were collected using a sociodemographic data form. The total duration of IGD (years), total duration of education (years), current educational status, and current medications were also recorded. A detailed Table 1 is included to present the sociodemographic and clinical characteristics of both groups for clarity.

The Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS-PL)

The K-SADS-PL is a semi-structured diagnostic interview developed by Kaufman and colleagues (1997) (Kaufman et al., 1997). The interview evaluates any past or present psychiatric disorders in children and adolescents. Information obtained from families, children, and teachers is also recorded in the K-SADS-PL. The Turkish validity and reliability study of the DSM-5 version was performed by Unal and colleagues, in which there was no structural equation modeling or confirmatory factor analysis; therefore, no fit indices were calculated (Unal et al., 2019).

Eating Attitudes Test (EAT-40)

The EAT-40 was developed to assess dysfunctional eating behaviors, particularly those observed in subjects with anorexia nervosa (Garner & Garfinkel, 1979). The questionnaire includes 40 items scored on a 6-point Likert-type scale (never=6, rarely=5, sometimes=4, often=3, very often=2, always=1). The EAT-40 was translated into Turkish by Savasir and Erol (Savasir & Erol, 1989). Cronbach's alpha value of the scale was 0.70 and the test-retest reliability was found as $r=0.65$ in the Turkish validation study (Savasir & Erol, 1989). Cronbach's alpha for internal consistency was 0.84 in the present study. However, no confirmatory factor analysis or fit indices were reported in the original validation study.

Table 1. Sociodemographic, clinical characteristics and eating attitudes of study participants

Variables, mean ± SD	IGD, n=80	HC, n=36	Statistics	p
Age, years	14.9 ± 2.1	15.5 ± 1.5	t=1.5	0.143
Education, years	8.4 ± 1.9	9.5 ± 1.6	t=3.0	0.003
Duration of IGD, years	3.2 ± 1.6	-	-	-
IGDS9-SF	32.0 ± 8.1	13.4 ± 2.4	t=18.8	<0.001
<i>Psychiatric Comorbidities, n (%)</i>				
ADHD	64 (80.0)	-	-	-
MDD	22 (27.5)	-	-	-
SAD	23 (28.8)	-	-	-
GAD	10 (12.5)	-	-	-
OCD	6 (7.5)	-	-	-
ODD	33 (41.3)	-	-	-
CD	7 (8.8)	-	-	-
Separation anxiety disorder	9 (11.3)	-	-	-
Tic disorders	6 (7.5)	-	-	-
PTSD	0 (0.0)	-	-	-
<i>Medications, n (%)</i>				
Antipsychotics	9 (11.3)	-	-	-
Antidepressants	13 (16.3)	-	-	-
Stimulants	25 (31.3)	-	-	-
Mood Stabilizers	0 (0.0)	-	-	-
Benzodiazepines	0 (0.0)	-	-	-
<i>Eating pathology</i>				
Disordered eating symptoms, n (%) ^a	11 (13.8)	3 (8.3)	χ ² = 0.7	0.407
The total score of EDE-Q ^b	0.89 ± 0.50	0.96 ± 0.39	F=0.3 ^b	0.618
The total score of EAT ^b	3.58 ± 1.21	3.37 ± 0.71	F= 1.1 ^b	0.292

ADHD=attention-deficit hyperactivity disorder, CD=conduct disorder, CI=confidence interval, IGD=internet gaming disorder, IGDS9-SF=Internet Gaming Disorder Scale - Short Form, GAD=generalized anxiety disorder, HC=healthy controls, MDD=major depressive disorder, OCD= obsessive-compulsive disorder, ODD=oppositional defiant disorder, SAD= social anxiety disorder; SD=standard deviation; ^aEDE-Q scores ≥ 2.3 based on the previous literature (24, 25); ^b The mean scale scores were converted to the normal distribution using square root transformation.; ^c Adjusted for age, and education using ANCOVA models.

Eating Disorder Examination Questionnaire (EDE-Q)

The EDE-Q was developed as an interview-based or self-report inventory to evaluate symptoms associated with eating disorders (Fairburn & Beglin, 1994). The EDE-Q includes 33 items and five subscales: eating concern, weight concern, shape concern, binge eating, and restraint. The frequency of dysfunctional eating behaviors is measured using a Likert-type scale (0=No days, 1=1-5 days, 2=6-12 days, 3=13-15 days, 4=16-22 days, 5=23-27 days, 6=every day). Subscale scores are calculated by dividing the sum of item scores by the number of items in each subscale; thus, the sum scores range from 0 to 6. Higher scores indicate more problematic eating behaviors. The total score of EDE-Q was also the average score of eating concern, weight concern, shape concern subscales (except for binge eating). The Turkish version of the EDE-Q demonstrated high internal consistency ($\alpha = 0.93$) and excellent test-retest reliability ($r = .91$). However, no confirmatory factor analysis or fit indices were reported (Yucel et al., 2011). Cronbach's alpha calculated in this study was also 0.91. Previous studies used ≥ 2.3 as a cut-off score for disordered eating symptoms (Hilbert et al., 2012; Quesnel et al., 2018).

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

The Internet Gaming Disorder Scale–Short Form (IGDS9-SF) was developed by Pontes and Griffiths (2015) to assess IGD-related symptoms in accordance with the diagnostic criteria of DSM-5 (Pontes & Griffiths, 2015). The IGDS9-SF includes nine items rated on a 5-point Likert scale from never to very often (1=never, 2=rarely, 3=sometimes, 4=often, 5=very often). The Turkish version of the scale demonstrated high internal consistency in the reference study (Cronbach's alpha = 0.89) (Evren et al., 2018). Cronbach's alpha calculated in this study was 0.94. The Turkish version of the IGDS9-SF demonstrated good model fit indices in confirmatory factor analysis: $\chi^2/df = 4.32$, The Goodness of Fit = 0.982, Comparative Fit Index = 0.985, Tucker Lewis Index = 0.976, and The Root Mean Square Error of Approximation = 0.052.

Data Analysis

Continuous variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. Group comparisons of categorical variables were conducted using the chi-

square test. To compare sociodemographic characteristics between the IGD and healthy control groups, independent samples *t*-tests were used. Given that the distribution of disordered eating scale scores was non-normal, a square root transformation was applied to approximate normality.

To examine group differences in the severity of disordered eating behaviors, analysis of covariance (ANCOVA) models were utilized, adjusting for age and years of education. To test the study's second and third hypotheses—namely, the associations between disordered eating behaviors and clinical psychiatric diagnoses or psychotropic medication use—univariate and multivariate linear regression analyses were conducted within the IGD group. Predictor variables in the regression models included age, IGD severity and duration, and the presence of psychiatric comorbidities or medication use.

A significance level of $p < 0.05$ was considered statistically significant for all analyses. Data analyses were performed using the Statistical Package for the Social Sciences (SPSS), Version 24.0 (IBM Corp., Armonk, NY, USA)

Results

Of the 132 patients initially screened, 30 individuals who did not meet the DSM-5 diagnostic criteria for Internet Gaming Disorder (IGD) and 22 individuals who declined to provide informed consent were excluded. Consequently, the final study sample comprised 80 male adolescents with IGD and 36 age-matched healthy controls. Table 1 presents the sociodemographic and clinical characteristics of the study participants, along with measures of disordered eating. There were no significant differences between the IGD and control groups in terms of age. However, a significant group difference was observed in years of education, with the IGD group demonstrating a lower mean level of educational

attainment compared to the control group (IGD=8.4 ± 1.9 years vs. healthy controls=9.5 ± 1.6, $p=0.003$).

The IGD group demonstrated higher levels of online gaming-related symptoms compared to the comparison group (32.0 ± 8.1 vs. 13.4 ± 2.4, $p<0.001$). The most common psychiatric comorbidity was ADHD (80.0%), followed by oppositional defiant disorder (ODD) (41.3%), SAD (28.8%), and MDD (27.5%). Also, the most commonly used medications were stimulants (31.3%), followed by antidepressants (16.3%) and antipsychotics (11.3%). No patient received mood stabilizers or benzodiazepines. The frequency of disordered eating symptoms was similar in both groups. (IGD=13.8% vs. healthy controls=8.3%, $p=0.407$). Additionally, the severity of dysfunctional eating behaviors did not differ between the groups.

The influence of psychiatric comorbidities on eating behaviors is summarized in Table 2. Multiple linear regression analyses indicated that, among anxiety and mood disorders, only Generalized Anxiety Disorder (GAD) was significantly associated with higher total scores on the Eating Disorder Examination Questionnaire (EDE-Q) within the IGD group ($\beta = 0.41$, 95% CI = 0.19–0.62, $p < 0.001$), after controlling for age, IGD severity, and duration. Other psychiatric diagnoses did not have significant associations with disordered eating. No association was found between EAT scores and the presence of GAD. Specifically, the diagnosis of GAD was associated with restrictive eating ($\beta=0.40$, 95%CI=0.18 – 0.61, $p<0.001$), eating concern ($\beta=0.40$, 95%CI=0.18 – 0.61, $p<0.001$), shape concern ($\beta=0.34$, 95%CI=0.12–0.56, $p=0.003$), and weight concern ($\beta=0.35$, 95%CI=0.13–0.57, $p =0.002$) subscales, but not with the binge eating subscale ($p=0.117$). Likewise, ADHD, separation anxiety disorder, tic disorders and disruptive behavior-related diagnoses (e.g. ODD, and conduct disorder) did not have any significant effect on eating attitudes. These findings suggest that anxiety may contribute to increased preoccupation with body shape and control over eating, even in the absence of overt binge behaviors.

Table 2. Multiple linear regression analyses to investigate the association between clinical diagnoses and eating attitudes within the IGD group

Diagnoses	EDE-Q Total ^a		EAT Total ^a	
	β	95%CI	β	95%CI
MDD	0.17	- 0.08 to 0.41	0.02	- 0.22 to 0.26
OCD	0.12	- 0.11 to 0.36	0.08	- 0.15 to 0.32
GAD	0.41***	0.19 to 0.62	- 0.06	- 0.29 to 0.17
SAD	0.12	- 0.12 to 0.36	- 0.18	- 0.41 to 0.06
ADHD	0.08	- 0.15 to 0.31	0.10	- 0.13 to 0.33
ODD	0.02	- 0.23 to 0.26	- 0.12	- 0.35 to 0.12
CD	0.01	- 0.23 to 0.25	0.12	- 0.12 to 0.35
Separation anxiety disorder	- 0.14	- 0.37 to 0.09	0.12	-0.10 to 0.34
Tic disorders	0.03	-0.21 to 0.26	0.17	-0.06 to 0.39

ADHD=attention-deficit hyperactivity disorder, CD=conduct disorder, CI=confidence interval, EAT= Eating Attitudes Test, EDE-Q=Eating Disorder Examination Questionnaire, GAD=generalized anxiety disorder, MDD=major depressive disorder, OCD= obsessive-compulsive disorder, ODD=oppositional defiant disorder, SAD=social anxiety disorder.; * Significant at <0.05 level.; *** Significant at <0.001 level.; ^a Mean scale scores were converted to the normal distribution using square root transformation. Other independent variables were age, the severity of IGD, and the duration of IGD.

Table 3. The association between medications and eating attitudes within the IGD group

Medications	EDE-Q total ^a		EAT ^a	
	β	95%CI	β	95%CI
Antipsychotic	0.15	-0.08 to 0.39	0.24*	0.02 - 0.46
Antidepressants	0.02	-0.22 to 0.26	-0.16	- 0.39 to 0.08
Stimulants	0.04	-0.19 to 0.27	0.08	- 0.15 to 0.31

CI=confidence interval, EAT= Eating Attitudes Test, EDE-Q=Eating Disorder Examination Questionnaire; * Significant at <0.05 level.; ^a The mean scale scores were converted to the normal distribution using square root transformation. Other independent variables were age, the severity of IGD, and the duration of IGD.

Similarly, Table 3 presents the regression outcomes regarding psychotropic medication use. Antipsychotic medication remained significantly associated with higher EAT scores ($\beta = 0.24$, 95% CI = 0.02–0.46, $p = 0.035$) even after adjusting for ADHD, whereas antidepressants and stimulants showed no significant effects. The relationship between antipsychotic treatment and EAT scores also remained significant after adjusting for the presence of ADHD ($\beta=0.23$, 95%CI=0.01–0.46, $p=0.041$). In univariate regression analyses, antipsychotic treatment was also significantly associated with eating concern ($\beta=0.23$, 95%CI=0.01–0.45, $p=0.041$) and shape concern ($\beta=0.23$, 95%CI=0.01–0.45, $p=0.041$). However, these findings remained at the trend level and did not reach statistical significance after adjusting for sociodemographic and clinical covariates, and ADHD ($p=0.062$ and $p=0.069$, respectively). Neither antidepressant medications nor stimulant use showed a significant relationship with disordered eating behaviors. These results indicate that antipsychotic use may contribute modestly to disturbed eating attitudes, possibly reflecting medication-related appetite or weight changes, whereas antidepressants and stimulants do not appear to exert a similar effect.

Discussion

This study aimed to investigate the clinical correlates of disordered eating attitudes among individuals diagnosed with IGD, a topic that remains relatively unexplored in clinical populations. The findings indicate that male adolescents with IGD exhibit comparable levels of disordered eating behaviors to those observed in a community-based control group. Notably, the presence of GAD was significantly associated with heightened disordered eating attitudes, whereas no such associations were identified for other psychiatric comorbidities. Among pharmacological treatments, the use of antipsychotic medication was associated with elevated levels of dysfunctional eating behaviors, while antidepressant and stimulant use showed no significant associations. Importantly, neither GAD nor antipsychotic treatment was linked to increased binge eating behaviors specifically.

Previous research conducted in different regions has yielded variable findings regarding the association between IGD and disordered eating, and the prevalence of IGD, suggesting higher rates in Asia and the Middle East (Pike et al., 2014; Thomas et al., 2024). Findings from a Turkish study with

children and adolescents aged between 9–15 indicated an association between screen time and risky eating behaviors (Kayhan Tetik et al., 2018). Another recent study in Jordan suggested weak but positive correlations between gaming addiction and disordered eating (Alnaimi et al., 2025). Similar associations have been reported in research from Russia and Kazakhstan (Konstantinov et al., 2024), and United States of America (Ellithorpe et al., 2023). Additionally, findings from German adults showed correlations between disordered eating behaviors and gaming in men but not women (Müller et al., 2015).

IGD commonly presents with various psychiatric comorbidities including depression, anxiety, and ADHD (Ho et al., 2014; Ko et al., 2012; Wang et al., 2017). Notably, in our study, GAD was the only comorbid condition found to have a significant association with disordered eating behaviors. This finding suggests that trait anxiety may serve as a vulnerability factor, predisposing individuals with IGD to maladaptive eating patterns. Prior research has similarly highlighted the role of social media use and body image avoidance in contributing to disordered eating (Mabe et al., 2014; Rodgers et al., 2013). In line with our results, a recently published study demonstrated a significant link between GAD and IGD (Wang et al., 2017). In that same study, it was also suggested that this link was partially mediated by behavioral inhibition, leading to avoidance of the real world and negative feelings (Wang et al., 2017). The current findings extend previous research by suggesting that GAD and disordered eating may share common underlying mechanisms. Individuals with GAD often exhibit impaired interpersonal functioning and are prone to chronic worry as a maladaptive coping strategy for regulating negative affect (Newman et al., 2013). This shared vulnerability—characterized by poor coping strategies—may manifest as various forms of escapism, including both disordered eating and problematic gaming. Consequently, the co-occurrence of these conditions may reflect broader deficits in emotional regulation and coping mechanisms. Future studies are warranted to further explore the mediating and moderating factors underlying the association between anxiety and disordered eating in individuals with IGD. Moreover, interventions targeting anxiety symptoms and enhancing adaptive coping strategies may not only ameliorate disordered eating but also reduce the severity of IGD symptoms.

The findings of the present study indicate that eating and shape concerns were modestly associated with antipsychotic use, whereas no significant associations were observed with stimulant or antidepressant medications. Several neurobiological mechanisms may underlie this observation, particularly those involving dopaminergic pathways implicated in appetite and reward regulation. Key brain regions contributing to food-related dopaminergic reward circuitry include the nucleus accumbens, insula, amygdala, anterior cingulate cortex, orbitofrontal cortex, and hypothalamus (Petrovich et al., 2005; Volkow et al., 2011). Dysregulation within these neural substrates may contribute to maladaptive eating behaviors (Bernier et al., 2019). Also, despite their clinical benefits, antipsychotic medications may reduce cognitive control over satiety, causing dysregulation in food-related

rewards and appetite (Elman et al., 2006). Given that youth with IGD demonstrate deficits in inhibitory control within the reward system (Hwang et al., 2020; Li et al., 2020; Raiha et al., 2020), the antidopaminergic effects of antipsychotics may further exacerbate difficulties in modulating food-related reward sensitivity, potentially contributing to the emergence of disordered eating patterns (Arnsten, 2006). On the other hand, stimulant medications, which act as dopaminergic agonists, may enhance executive functioning and reduce eating-related impulsivity. This interpretation aligns with theoretical frameworks suggesting that impulsivity interacts with cognitive distortions, emotion-regulation difficulties, and reward-driven behavioral tendencies, thereby contributing to both disinhibited eating behaviors and compulsive gaming patterns (Keshen et al., 2022; Pearlstein et al., 2024). Taken together, it could be argued that patients with IGD may be sensitive to antidopaminergic effects of antipsychotic medications and they may subsequently develop disordered eating as well as comorbid eating disorders. Therefore, a clinical implication of these findings is the need to carefully monitor the eating habits among individuals with internet addiction who receive antipsychotic treatment in clinical practice.

No significant association was found between stimulant use and eating psychopathology in the present study. However, it is important to note that the evaluation did not explore subgroups of ADHD or the optimization of stimulant dosages, both of which may influence eating behaviors (Turan & Akay, 2019). Moreover, a previous study has suggested that ADHD-specific stimulant misuse is associated with increased rates of disordered eating, although stimulants have therapeutic effects on ADHD (Gibbs et al., 2016). Nevertheless, stimulants may also reduce IGD symptoms (Han et al., 2009); hence, these medications may alleviate the risk of general psychopathology in susceptible youth.

Another important consideration is the cultural context of the study. In Türkiye, online gaming is more strongly associated with male adolescents, which is reflected in the overwhelming male predominance of our IGD outpatient clinic (Yar et al., 2019). This cultural trend influences not only the composition of the clinical sample but also gaming motivations, body image concerns, and help-seeking tendencies. Indeed, prior literature indicates that gender roles substantially shape both eating behaviors and the ways in which psychiatric symptoms are expressed. Yıldırım et al. (2025) further demonstrated that social isolation and anxiety may directly increase the risk of eating disorders among male adolescents, highlighting the need to reconsider the widespread assumption that such risk factors are primarily relevant to girls. These findings suggest that characteristics commonly observed in male adolescents with IGD—such as impulsivity, reward-seeking tendencies, and social avoidance—may interact with gendered sociocultural norms, thereby influencing both gaming behaviors and eating attitudes (Yıldırım et al., 2025). Therefore, while our findings provide insight into the clinical correlates of disordered eating in Turkish male adolescents with IGD, caution should be exercised when generalizing the results to other cultural settings or to female populations. Future cross-cultural

research including both genders would provide a more comprehensive understanding of these associations.

In our study, the prevalence of disordered eating was found to be 13.8% in the clinical male population, which was comparable to the 8.3% observed in healthy controls. These values were lower than those reported in previous studies (Alpaslan et al., 2015; Hsieh et al., 2018). This finding was not surprising since eating disorders are more commonly seen in female adolescents. Nevertheless, previous studies have reported that males are more prone to internet addiction (Canan et al., 2014; Yu et al., 2021). The current findings are also in line with the previous works conducted in our IGD outpatient clinic, which reported that there was an overwhelming male predominance in terms of IGD diagnosis (Bulanik Koc et al., 2020). The lack of female participants in our sample may reflect cultural factors such as the lack of awareness among society and clinicians.

IGD is mainly characterized by a constellation of psychiatric disorders that may require psychotropic medications and psychosocial interventions (Ho et al., 2014; Ko et al., 2012; Wang et al., 2017). Considering that antidepressant and stimulant medications were not related to disordered eating, clinical implications of our study also include the importance of timely and appropriate treatment of psychiatric comorbidities such as ADHD and anxiety disorders. On the other hand, the benefit to risk ratio of antipsychotic medications should be taken into account cautiously, compared to psychosocial interventions, since they might give rise to impairments in eating patterns.

Limitations and Directions for Future Research

Limitations and strengths of the study have to be discussed when interpreting the results. The sample size of the study was modest to investigate the association between internet gaming disorder and eating attitudes. Additionally, there were only male patients and healthy controls. However, the study was implemented in the IGD outpatient clinic of the hospital. Accordingly, patients were consecutively recruited and there were no female participants. However, this finding was also compatible with previous reports conducted in our IGD outpatient clinic (Bulanik Koc et al., 2020). While this reflects real-world clinical practice and increases ecological validity, it restricts the generalizability of our findings to female adolescents. Future studies including both genders across different cultural contexts are warranted to provide a more comprehensive understanding of disordered eating behaviors in IGD. Moreover, we focused on disordered eating behaviors, as eating disorders were not present in the sample. Another limitation is the cross-sectional nature of the study, which precludes the establishment of causality between eating symptoms and clinical variables. Given that patients and healthy controls did not differ significantly in terms of dysfunctional eating behaviors, larger clinical samples, including individuals with and without disordered eating, are required to yield more definitive conclusions. Furthermore, the small subsample sizes of individuals with specific

characteristics in the linear regression analyses may limit the generalizability of the results. Although all research diagnoses were confirmed via a semi-structured interview, the severity of psychiatric symptoms was not assessed using Likert-type scales, which could have provided more nuanced data. Sociodemographic and clinical data were used to covariate the results of the study. The number of healthy controls was modest for between-group comparisons, which also increases the possibility of Type II error. Despite these limitations, the findings of the present study offer several practical implications for clinicians. The observed associations between GAD comorbidity and antipsychotic treatment with eating attitudes in adolescents with IGD suggest that incorporating brief screening instruments for eating behaviors and anxiety symptoms into routine clinical assessments may be beneficial. Furthermore, careful monitoring of appetite changes, weight fluctuations, and body-image-related concerns both prior to initiating antipsychotic treatment and throughout the course of therapy may facilitate a more comprehensive evaluation of the potential effects of these medications on both gaming behavior and eating attitudes.

Conclusion

Generalized anxiety and antipsychotic treatment were found to be clinical correlates of disordered eating behaviors among individuals engaged in excessive online gaming. Anxiety traits could be the underlying mechanism triggering both IGD and eating disorders in this population. Future studies should focus on the effects of different psychotropic and behavioral interventions on eating pathologies.

Author contributions

Conception: C.E., M.T., S.T., G.K.; Design: C.Y., C.E., M.T., G.Y.A., S.T.; Data acquisition: C.Y., S.A., M.C., E.H., N.A., B.B., A.A., G.E.A.; Data interpretation: C.E., M.T., S.A., G.Y.A., S.T., G.K.; Drafting of this study: C.Y., S.A., M.C., E.H., N.A., B.B., A.A., G.E.A.; Critical revision of this study: C.E., M.T., G.Y.A., S.T., G.K. All authors reviewed the results, approved the final version of this study, and agreed to be accountable for all aspects of this study.

Ethical approval

This study was approved by the Tekirdağ Namik Kemal University Ethics Committee (Date: January 26, 2021, Decision/Protocol No: 2021.10.01.10). Informed consent was obtained from all participants involved in this study.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Generative AI statement

The authors declare that no generative AI or AI-assisted technologies were used in the writing or preparation of this study.

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