

Characteristics and Psychiatric Symptoms of Internet Gaming Disorder among Adults Using Self-Reported DSM-5 Criteria

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Objective The Section III of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) proposed nine diagnostic criteria and five cut-point criteria for Internet Gaming Disorder (IGD). We aimed to examine the efficacy of such criteria.

Methods Adults (n=3041, men: 1824, women: 1217) who engaged in internet gaming within last 6 months completed a self-report online survey using the suggested wordings of the criteria in DSM-5. Major characteristics, gaming behavior, and psychiatric symptoms of IGD were analyzed using ANOVA, chi-square, and correlation analyses.

Results The sociodemographic variables were not statistically significant between the healthy controls and the risk group. Among the participants, 419 (13.8%) were identified and labeled as the IGD risk group. The IGD risk group scored significantly higher on all motivation subscales (p<0.001). The IGD risk group showed significantly higher scores than healthy controls in all nine psychiatric symptom dimensions, i.e., somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism (p<0.001).

Conclusion The IGD risk group showed differential psychopathological manifestations according to DSM-5 IGD diagnostic criteria. Further studies are needed to evaluate the reliability and validity of the specific criteria, especially for developing screening instruments.

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Key Words Internet gaming disorder, DSM-5, Psychiatric symptoms.

INTRODUCTION

In 2013, the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) of the American Psychiatric Association included Internet Gaming Disorder (IGD) in Section III, thus warranting more research before it might

gain official recognition.¹

According to recent studies,² researchers discussed the addition of non-substance-related addictive disorders to DSM-5. IGD was added based upon reviews, a voting process, about 250 research publications, and from the growing medical risk of IGD.

There are several difficulties in properly diagnosing and treating IGD. While the number of publications related to 'internet game addiction',³⁻⁵ 'internet game dependency',⁶⁻⁸ 'IGD',^{2,9-14} and other names^{11,14} has been steadily on the rise, the consensus on the standards of IGD has not yet been reached. Therefore, concept of IGD needs to be clarified further and standardized criteria for research has to be developed.

Research on IGD prevalence^{7,15-20} has shown limited con-

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sistency. Depending on the criteria used, prevalence rates vary from less than 1%¹⁵⁻¹⁷ to approximately 10%^{2,18-20}. In addition, many reports focus on children, adolescents, and young adults, resulting in a general lack of adult-targeted research.

To address the efficacy of the IGD classification of DSM-5¹² and the limited consensus on the proposed criteria,¹ the appropriateness of the proposed diagnostic criteria of DSM-5 should be examined systematically. To this end, studies to develop standardized and refined criteria and integrated assessment methods are necessary.²

This study aimed to characterize different psychiatric symptoms of IGD, including internet gaming experience, motivation and impulsivity by comparing the risk group and healthy control group applying DSM-5 diagnostic criteria as an extension of an international collaborative research effort involving eight countries (including for example, Korea, Hungary, and the United Kingdom). Secondly, we also aimed to estimate IGD prevalence among adults in Korea.

METHODS

Cross-cultural data collection and questionnaire translation

The same online questionnaire was used to collect data from gamers speaking Hungarian, English, Italian, Norwegian, Slovenian, French, Romanian, and Korean. For the Korean survey, however, we included additional questions pertaining to the DSM-5 diagnostic criteria in order to derive the estimation of adult IGD Characteristics.

Translations of the survey were carried out by research colleagues from the respective collaborating countries and back translated by another expert. The back-translations of the initial Korean version of the survey were compared with the original English version and differences were discussed until a consensus was reached by a graduate-level bilingual. The final version was shown to a group of gamers who gave their opinions regarding the clarity and comprehension of the items.

Subjects

A total of 3041 adults (20 to 49 years of age) who had engaged in Internet gaming within 6 months from the start of the study participated (data collected from March 17–28, 2014). The data collection was carried out by Korea's Most Prestigious Market and Opinion Research Firm (KMPMORF) through the Computer Aided Web Interview (CAWI) method. The informed consent was obtained from participants prior to their inclusion in the survey. This study was approved by the Institutional Review Board of the Eötvös Loránd University in Hungary and Eulji University in Korea, respectively. The sample was not nationally representative.

The survey was completed through random in Korea. Total sample size was 3041 (Men n=1824, Women n=1217).

Measurements

Sociodemographic data

Major sociodemographic characteristics such as gender, age, marital status, educational level, and current work status were obtained.

Gaming-related questions

Gaming-related questions such as online game type preference and weekly playing time were given. Based on previous findings,²¹ three popular game types [first-person shooter (FPS), role playing games (RPGs), and real time strategy (RTS) games] and an 'other' categories were offered to identify main game type preference.

Categories for weekly playing time were the following: less than 1 hour a day (less than seven hours weekly), 1–2 hours per day (7–14 hours weekly), 2–4 hours per day (15–28 hours weekly), 4–6 hours per day (29–42 hours weekly), and more than 6 hours per day (more than 42 hours weekly).

The Motives for Online Gaming Questionnaire²² (MOGQ)

MOGQ is a 27-item self-reported questionnaire assessing the full range of motives for online gaming, including escape (4 items), coping (4 items), fantasy (4 items), skill development (4 items), recreation (3 items), competition (4 items), and social (4 items). The instrument uses a 5-point Likert scale from "never" to "almost always/always," with higher scores indicating higher frequency of the respective motivational dimension. Internal consistencies were reported for all seven dimensions, ranging from 0.79 to 0.90²² and the present sample as well (Cronbach's alpha=0.912).

The diagnostic criteria of IGD in DSM-5

In DSM-5, IGD is identified in section III as a condition warranting more clinical research and experience before it might be considered for inclusion in the main book as a formal disorder. The diagnostic criteria of IGD in the DSM-5 are composed of 9 items: preoccupation, withdrawal, tolerance, unsuccessful attempts to control, loss of other interests, continued excessive use despite psychosocial problems, deceiving regarding online gaming, escape, and functional impairment. Meeting five or more DSM-5 criteria of IGD proved to be the best cut-off point in a previous study.¹¹ The suggested wordings of the DSM-5 criteria was applied in this computer aided web interview using a "yes" or "no" response form. According to these DSM-5 criteria, we divided the participants into risk group and healthy controls. We used the

term ‘risk group,’ not ‘patient group,’ because we did not confirm the diagnosis with clinical interview.

BSI²³⁻²⁷

To assess self-reported clinically relevant psychological symptoms and distress, the present study used the Brief Symptom Inventory (BSI).²⁴ This 53-item questionnaire uses a 5-point Likert scale (from “not at all” to “extremely”) and comprises nine symptom dimensions: somatization (7 items), obsession-compulsion (6 items), interpersonal sensitivity (4 items), depression (6 items), anxiety (6 items), hostility (5 items), phobic anxiety (5 items), paranoid ideation (5 items), and psychoticism (5 items). Good reliability and validity have been found across various samples^{23,24,28} and the present

sample as well (Cronbach’s alpha=0.982).

BIS²⁹

Impulsivity was measured by the 21-item revised version of the original Barratt Impulsiveness Scale (BIS).²⁹ The 21 items comprise three factors [self-control (9 items), impulsive behavior (5 items), and impatience (7 items)] and the factors are rated on a 4-point Likert scale (from “rarely/never” to “almost always/always”). The Cronbach’s alpha of present sample was 0.769.

Statistical analysis

All analyses were conducted with SPSS software version 18.0 (SPSS, IBM corp., NY, USA). A p level lower than 0.05 was

Table 1. Comparison of sociodemographic characteristics between healthy controls and the risk group

Variables (% within group)	Total (N=3041)	DSM-5 diagnosis		χ^2	P
		Healthy control group (N=2622)	Risk group (N=419)		
Sex					
Male	1824 (60.0)	1586 (60.5)	238 (56.8)	2.045	0.153
Female	1217 (40.0)	1036 (39.5)	181 (43.2)		
Age (years)					
20-29	1221 (40.2)	1061 (40.5)	160 (38.2)	0.873	0.646
30-39	1215 (40.0)	1040 (39.7)	175 (41.8)		
40-49	605 (19.8)	521 (19.9)	84 (20.0)		
Marital status					
Single	1659 (54.6)	1435 (54.7)	224 (53.5)	1.783	0.619
Married	1325 (43.6)	1139 (43.4)	186 (44.4)		
Divorced/Widowed	57 (1.9)	42 (1.8)	9 (2.1)		
Educational status					
≤High school	487 (16.0)	421 (16.1)	66 (15.8)		
≤College	1760 (57.9)	1513 (57.7)	247 (58.9)	1.019	0.797
≤University	354 (11.6)	311 (11.9)	43 (10.3)		
Graduate school≤	440 (14.5)	377 (14.4)	63 (15.0)		
Employment status					
Full-time	1630 (53.6)	1400 (53.4)	230 (54.9)		
Half-time	245 (8.1)	216 (8.2)	29 (6.9)	1.022	0.906
Part-time	78 (2.6)	68 (2.6)	10 (2.4)		
Temporary	106 (3.5)	92 (3.5)	14 (3.3)		
Unknown	982 (32.3)	846 (32.3)	136 (32.5)		
Monthly pay (10,000 Won)					
≤200	513 (16.9)	432 (16.5)	81 (19.3)	3.230	0.358
201≤400	1345 (44.2)	1157 (44.1)	188 (44.9)		
401≤600	802 (26.4)	703 (26.8)	99 (23.6)		
600<	381 (12.5)	330 (12.6)	51 (12.2)		

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

considered significant. Prevalence was derived based on the percentage of participants giving positive responses to five or more DSM-5 criteria of IGD as suggested by previous clinical research.^{1,2,11}

Further, we analyzed the differences between the healthy control and risk group in order to investigate the sociodemo-

graphic characteristics, and psychiatric symptoms associated with internet game overuse.

The descriptive data were expressed as frequency and percentage or mean and standard deviation. Chi-square analyses and analysis of variance (ANOVA) were used to test the difference of distribution, and the mean differences between the

Table 2. Weekly online game playtime

Playtime (per day) (% within group)	Total (N=3041)	DSM-5 diagnosis		χ^2	P
		Healthy control group (N=2622)	Risk group (N=419)		
<1 hour	1178 (38.7)	1083 (41.3)	95 (22.7)	106.169	<0.001
1–2 hours	1015 (33.4)	886 (33.8)	129 (30.8)		
2–4 hours	619 (20.4)	488 (18.6)	131 (31.3)		
4–6 hours	150 (4.9)	114 (4.3)	36 (8.6)		
6 hours<	79 (2.6)	51 (1.9)	28 (6.7)		

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Table 3. Online game typology

Variables (% within group)	Total (N=3041)	DSM-5 diagnosis		χ^2	P
		Healthy control group (N=2622)	Risk group (N=419)		
RPG					
Never	1167 (38.4)	1079 (41.2)	88 (21.0)	79.820	<0.001
Than once a month	465 (15.3)	408 (15.6)	57 (13.6)		
At least monthly	435 (14.3)	360 (13.7)	75 (17.9)		
At least weekly	697 (22.9)	554 (21.1)	143 (34.1)		
Daily	227 (9.1)	221 (8.4)	56 (13.4)		
FPS					
Never	1545 (50.8)	1425 (54.3)	120 (28.6)	131.090	<0.001
Than once a month	521 (17.1)	451 (17.2)	70 (16.7)		
At least monthly	429 (14.1)	342 (13.0)	87 (20.8)		
At least weekly	441 (14.5)	327 (12.5)	114 (27.2)		
Daily	105 (3.5)	77 (2.9)	28 (6.7)		
RTS					
Never	1403 (46.1)	1307 (49.8)	96 (22.9)	179.220	<0.001
Than once a month	524 (17.2)	471 (18.0)	53 (12.6)		
At least monthly	452 (14.9)	350 (13.3)	102 (24.3)		
At least weekly	519 (17.1)	400 (15.3)	119 (28.4)		
Daily	143 (4.7)	94 (3.6)	49 (11.7)		
Other online games					
Never	553 (18.2)	56 (19.2)	50 (11.9)	16.182	0.003
Than once a month	445 (14.6)	389 (14.8)	56 (13.4)		
At least monthly	577 (19.0)	496 (18.9)	81 (19.3)		
At least weekly	922 (30.3)	776 (29.6)	146 (34.8)		
Daily	544 (17.9)	458 (17.5)	86 (20.5)		

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, RPG: role playing game, FPS: first-person shooter, RTS: real time strategy

healthy control and risk group. Lastly, to investigate the relationship among variables in the diagnosis of IGD, the Pearson's correlation coefficient was used.

RESULTS

Sociodemographic characteristics

Among the 3041 participants, 419 subjects (13.8%) were identified and labeled as the IGD risk group and 2622 subjects (86.2%) were labeled as healthy controls (Table 1). The frequency of men (60.0%) was higher than that of women (40.0%), and most individuals were in their twenties to thirties, accounting for 80.2% of participants. Most were single (54.6%), followed by married (43.6%) individuals. Most had not graduated college (57.9%) and held a full-time job (56.3%). In-come levels show that the highest proportion (44.2%) of people earned monthly income between 2,000,000 and 4,000,000 won (approximately 1800–3600 USD).

Online-game playing time

The online-game playing time is shown in Table 2. Most individuals played less than 1 hour a day (less than 7 hours

weekly) (38.7%), followed by 1–2 hours per day (7–14 hours weekly) (33.4%), 2–4 hours per day (15–28 hours weekly) (20.4%), 4–6 hours per day (29–42 hours weekly) (4.9%), and more than 6 hours per day (more than 42 hours weekly) (2.6%). The risk group subjects tended to belong significantly more to the categories with a relatively high weekly online game playtime than healthy controls ($p < 0.001$).

Online-game type

On average, 22.9% of subjects played RPGs at least once a week, and 9.1% played them every day (Table 3). The frequency of RPG use in the risk group was on average about 1.6 times higher than for healthy controls ($p < 0.001$). In the case of FPS games, 14.5% played at least once a week on average, and 3.5% played every day. The FPS games were played by the risk group approximately 2 times more frequently than by healthy controls ($p < 0.001$). For RTS games, 17.1% of subjects played at least once a week on average, and 4.7% played every day. The frequency of RTS game play in the risk group was on average about 2 times higher than in the case of healthy controls ($p < 0.001$). The frequency of 'other' online games (sports, puzzle, etc.) was about 1.2 times higher in the risk

Table 4. Motives for online gaming questionnaire

Factors	DSM-5 diagnosis		F	p
	Healthy control group (N=2622)	Risk group (N=419)		
Escape	9.03±3.61	13.33±3.29	526.25	<0.001
Coping	10.32±3.15	13.28±3.04	339.63	<0.001
Fantasy	7.45±3.63	12.07±3.92	577.09	<0.001
Skill development	8.30±3.61	11.66±3.64	317.88	<0.001
Recreation	10.37±2.71	11.16±2.40	38.52	<0.001
Competition	8.83±3.76	12.51±3.89	362.69	<0.001
Social	8.20±3.73	11.63±3.86	325.63	<0.001

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

Table 5. Correlation between online game typology and MOGQ (N=3041)

Factors	Escape	Coping	Fantasy	Skill development	Recreation	Competition	Social
Risk group (N=419)							
RPG	0.293†	0.339†	0.408†	0.350†	0.211†	0.331†	0.417†
FPS	0.209†	0.285†	0.350†	0.397†	0.127†	0.341†	0.387†
RTS	0.208†	0.338†	0.391†	0.429†	0.192†	0.449†	0.384†
Others	0.180†	0.180†	0.140†	0.234†	0.145†	0.175†	0.104*
Healthy control group (N=2622)							
RPG	0.221†	0.291†	0.299†	0.271†	0.285†	0.161†	0.387†
FPS	0.229†	0.267†	0.304†	0.298†	0.146†	0.290†	0.302†
RTS	0.239†	0.293†	0.297†	0.334†	0.206†	0.318†	0.370†
Others	0.118†	0.097†	0.058†	0.112†	0.051†	0.129†	-0.010

* $p < 0.05$, † $p < 0.01$. MOGQ: Motives for Online Gaming Questionnaire, RPG: role playing game, FPS: first-person shooter, RTS: real time strategy

group as compared with healthy controls ($p < 0.003$). On average 30.3% played 'other' games at least once a week, and 17.9% played them every day.

The motives for online gaming

Using the MOGQ to assess the motives for online gaming, the risk group used online gaming to escape from reality or specific issues more than the healthy controls (13.33 vs. 9.03, $p < 0.001$, respectively) (Table 4). Also, the risk group showed higher score in the use of online gaming as a coping mechanism compared to the healthy control group (13.28 vs. 10.32, $p < 0.001$, respectively). Likewise, the risk group scored significantly higher on all other motivation subscales (12.07/7.45, 11.66/8.30, 0.16/10.3711, 12.51/8.83, and 11.63/8.20 for fantasy, skill development, recreation, competition, and social, respectively, $p < 0.001$).

Correlation between online game types and the motives for online game

Table 5 shows the correlations between online game type by subjects and the motives for online game play (MOGQ). The seven motivation factors for online gaming were positively correlated with the game type choice for individuals in the risk group. The range of correlations between game type and MOGQ was 0.104–0.449.

The use of RPGs by subjects of the IGD risk group was strongly correlated with fantasy ($r = 0.408$, $p < 0.01$) and social ($r = 0.417$, $p < 0.01$) factors. FPSs users in the IGD risk group were significantly correlated with skill development ($r = 0.397$, $p < 0.01$), and RTS game users in the IGD risk group were significantly correlated with both skill development ($r = 0.429$, $p < 0.01$) and competition ($r = 0.449$, $p < 0.01$).

The use of RPGs and RTS games by healthy controls were

significantly correlated with social factors (RPGs: $r = 0.387$, $p < 0.01$; RTS: $r = 0.370$, $p < 0.01$, respectively). FPSs healthy control use was significantly correlated with fantasy ($r = 0.304$, $p < 0.01$) and social ($r = 0.302$, $p < 0.01$) factors as the motives to play online games.

Difference between the healthy control and risk group in the nine proposed DSM-5 diagnostic criteria

The risk group showed higher frequency of endorsement of all nine DSM-5 diagnostic criteria compared to the healthy control group. The results are presented in Table 6.

Psychiatric symptoms & impulsivity

The BSI and BIS were used to assess the symptoms related to IGD. The mean scores of the risk group were noted to be significantly higher than those of healthy controls (Table 7). 'Obsession-compulsion', 'depression', and 'somatization' symptoms of the BSI were markedly higher in risk subjects than in the healthy control subjects, and the total BIS scores related to impulsivity were higher in the risk group as well.

DISCUSSION

This report presents the prevalence and symptoms of IGD as measured by an online survey of adults who engaged in recent Internet gaming. It was based on self-reported data on the criteria listed in the DSM-5. DSM-5 section III highlights the need for further investigation on IGD, and has proposed nine diagnostic criteria as suitable tools for IGD diagnosis. Applying the 5 cut-off point criteria as based on major preceding research^{2,10,11} and as suggested by the DSM-5, 13.8% of all participants were categorized into the at-risk IGD group. Approximately 7.4% of adults aged 20–40 years were deter-

Table 6. Positive responsive rate to DSM-5 Criteria (N=3041)

Variables (% within group)	DSM-5 diagnosis		χ^2	p
	Healthy control group (N=2622)	Risk group (N=419)		
Q4	444 (16.9)	356 (85.0)	862.461	<0.001
Q6	246 (9.4)	342 (81.6)	1208.796	<0.001
Q1	235 (9.0)	334 (79.7)	1188.960	<0.001
Q8	465 (17.7)	330 (78.8)	696.776	<0.001
Q5	263 (10.0)	319 (76.1)	1020.060	<0.001
Q3	133 (5.1)	297 (70.9)	1288.782	<0.001
Q2	127 (4.8)	274 (65.4)	1157.032	<0.001
Q7	143 (5.5)	256 (61.1)	981.283	<0.001
Q9	94 (3.6)	242 (57.8)	1078.695	<0.001

Q1: Preoccupation, Q2: Withdrawal, Q3: Tolerance, Q4: Unsuccessful attempts to control, Q5: Loss of other interests, Q6: Continued excessive use despite psychosocial problems, Q7: Deceiving regarding online gaming, Q8: Escape, Q9: Functional impairment. DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition

mined to be in the IGD risk group in our study, taking into account that 53.4% of this age group plays online games, as surveyed by the National Information Society Agency in Korea.³⁰ In Germany, a study by Festl et al.¹⁵ showed a prevalence of 3.7% in adolescents and adults. In addition, Ferguson and colleagues reported the prevalence of IGD in the United States to be 3.1% in a meta-analysis of 33 published studies.¹⁷ In light of these data, the prevalence rate appears to be higher in Korea. In these studies, the disparity among the prevalence rates seems to be attributable to a number of factors, such as Internet environment, participants, diagnostic criteria, research methods, research period, and culture.

In this study, the difference in sociodemographic variables were not statistically significant between the healthy controls and the risk group. Therefore, sociodemographic variables do not appear to be significant factors in IGD diagnosis.

The risk group subjects tended to belong significantly more to the categories with a relatively high weekly online game playtime than healthy controls. However, in the risk group, almost all subjects belonged to the categories with a relatively low weekly online game playtime (<1 hour: 22.7%, <4 hour: 84.8%). This is because DSM-5 criteria do not have the concept of exact game playtime. Our results are merely a clinical reference, and did not show the importance of game playtime in IGD, exactly. Therefore, we think that more detailed and systematic studies on the relationship between IGD and game playtime are needed.

In the assessment of motivations for online gaming, all factors measured in the MOGQ were significantly higher in the risk group; the primary motivations (those with the highest scores) for online gaming were ‘escape’ and ‘coping’. To our best knowledge, there has not been a comprehensive study on the IGD in adults based on MOGQ. One study³¹ of ado-

lescents using the Internet Motive Questionnaire for Adolescents (IMG-A) demonstrated that ‘coping’ was a major motivation for online gaming use in subjects diagnosed with IGD. In addition, one study³² for pathological use of Internet games among Korean adolescents using the Internet Game Addiction (IGA) showed that ‘escape’ from self best explained the IGD. These results are in agreement with the data from this study.

Correlation analysis between online game types and the motives for online gaming revealed that there is a difference in the motives according to online game types between the risk group and healthy controls. In healthy controls, the motive for online game use strongly correlated with ‘social’ motivation regardless of the game type. On the other hand, the motives for online game use in risk individuals appeared to be different according to characteristics of each game type. These results suggest that risk subjects have more various motives for online game use than healthy controls, and have tendency to select game type by motives.

A positive response to the nine symptoms delineated in the DSM-5 diagnostic criteria of IGD was significantly higher in the risk group. This study found the DSM-5 criteria well identified the risk group.

The risk group scores were significantly higher in the factors of the BSI and BIS related to pathologic internet gaming use. The results show that the IGD risk group experienced more episodes of difficulty concentrating, loneliness, and insomnia. The risk subjects were also five times more likely to attempt suicide, be impulsive, and exhibit aggression than the healthy control group (p<0.001). These results are consistent with existing research^{3,33-36} on the relationship between psychiatric symptoms and disordered internet use which most studies have focused on thus far. Therefore comparison between our

Table 7. Brief Symptom Inventory and BIS scoring (N=3041)

Factors (mean±SD)	DSM-5 level		F	p
	Healthy control group (N=2622)	Risk group (N=419)		
Somatization	2.40±4.35	10.08±7.11	912.10	<0.001
Obsession-compulsion	3.55±4.52	11.36±5.59	1007.92	<0.001
Interpersonal sensitivity	1.99±3.05	7.16±4.08	941.26	<0.001
Depression	2.86±4.32	10.89±5.94	1109.13	<0.001
Anxiety	2.19±3.94	9.73±6.08	1106.07	<0.001
Hostility	2.05±3.26	8.13±4.90	1067.58	<0.001
Phobic anxiety	1.65±3.14	7.63±5.04	1073.07	<0.001
Paranoid ideation	2.08±3.30	8.26±4.79	1092.84	<0.001
Psychoticism	2.00±3.24	8.06±4.75	1093.35	<0.001
BIS total	38.56±8.74	49.00±7.78	530.135	<0.001

DSM-5: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, BIS: Barratt Impulsiveness Scale

results and those of previous research should be done with caution. Nonetheless, this research may serve as a basis for developing prevention strategies, education, and therapeutic interventions for IGD to include adult population.

There are some limitations of this study. First, the sample of our study may not be considered as representative of the Korean population as a whole. The results of our study are also limited in its generalizability to other countries. Second, the diagnostic criteria of IGD in DSM-5 used in this study were not standardized and were based upon self-reporting; therefore, we did not confirm the diagnostic criteria with clinical interview. In addition, all other survey tool including psychometric questionnaire was also based upon self-reporting. However, it is important to note that DSM-5 diagnostic criteria were applied to a large number of adult individuals rather than children and adolescents. In addition, this study examined the various psychopathological aspects using scales and provided important baseline data and evidences supporting the suggestions for the IGD diagnostic criteria of the DSM-5. Future studies should attempt to overcome the limitations of this paper with respect to the sociodemographic background and environment of subjects and seek further validation of our results with clinical diagnostic interviews.

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