High risk gaming is associated with frequent substance use: an exploratory survey among young adults

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High risk gaming and substance use among young adults

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Statement of Ethics

All the research procedures were conducted ethically in accordance with the World Medical Association Declaration of Helsinki. The study protocol was reviewed and approved by the Ethics Committee of the University of Chieti-Pescara, Italy, approval number richcuv5x.
Written informed consent was obtained from participants to participate in the study.

Conflict of Interest Statement

All authors declare no conflict of interest.

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Author Contributions

Giovanni Martinotti: study concept and design, analysis and interpretation of data, writing - original draft;
Francesco Di Carlo: study concept and design, analysis and interpretation of data, writing - original draft, final editing;
Maria Chiara Alessi, Antonella Sociali, Arianna Ida Altomare, Chiara Di Natale: recruitment of the participants, literature searches and summaries of previous research studies and writing - original draft;
Gianfranco Stigliano, Andrea Miuli, Aliseo Lalli: recruitment of the participants;
Mauro Pettorruso, Stefania Chiappini: review of the original draft;
Henrietta Bowden-Jones, Mark D Griffiths, Gilberto Di Petta: review of the final draft, supervision;
Massimo di Giannantonio: supervision, visualization, project administration.

All authors contributed to and have approved the final manuscript. All authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Data Availability Statement

All data generated or analysed during this study are included in this article. Further enquiries can be directed to the corresponding author.

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Author Contributions

Author 1: study concept and design, analysis and interpretation of data, writing - original draft;
Author 2: study concept and design, analysis and interpretation of data, writing - original draft, final editing;
Authors 3, 4, 5, 6: recruitment of the participants, literature searches and summaries of previous research studies and writing - original draft;
Authors 7, 8, 9: recruitment of the participants;
Authors 10, 11: review of the original draft;
Authors 12, 13, 14: review of the final draft, supervision;
Author 15: supervision, visualization, project administration.

All authors contributed to and have approved the final manuscript. All authors had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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ABSTRACT

Introduction: internet gaming disorder (IGD) is an emerging conditions within the field of behavioural addictions. IGD has been demonstrated to be highly comorbid with many other mental health disorders. Among these, substance use has been associated with IGD, and there are underlying similarities between behavioural addictions and substance use disorders (SUDs). The aims of the present study were (i) to investigate the association between high risk gaming and substance use among young adults drawn from the general Italian population; (ii) to explore the psychopathological correlates of high risk gaming.

Methods: lifetime substance use, type of substances consumed, and frequency of use were investigated through an online survey in a sample of 913 adults aged 18-40 years. High risk gaming was assessed using the ten-item Internet Gaming Disorder Test (IGDT-10). Psychopathology was assessed using the Revised 90-item Symptom Checklist (SCL-90-R).

Results: high risk gaming prevalence rate was 4.4%. High risk gamers scored higher on all dimensions of psychopathology, confirming the association between high risk gaming and psychiatric distress. Regarding substance use, high risk gamers were more commonly polysubstance users and more commonly made use of psychodysleptic substances. High risk gamers were more commonly frequent substance users, and 32.5% of high risk gamers used or had used psychoactive substances often or everyday throughout their lives.

Discussion and conclusion: The findings are in line with the concept of a common neurobiological vulnerability for both gaming and substance use. There is the need for more research to examine the phenomenology of gaming and its interplay with substance use to help develop effective interventions and prevention strategies.

Keywords: internet gaming disorder; problematic gaming; substance use; psychopathology; addiction; psychoactive substances.

Introduction

Diagnostic characteristics of internet gaming disorder

Problematic use of videogames is a mental health concern of modern times, developed after the technological advances of the 1990s, when videogames started to move online [1]. It was first introduced the latest (fifth) version of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) [2,3] under the name of internet gaming disorder (IGD) as a condition warranting further clinical research before being classified as an official mental disorder [4]. At least five of the nine diagnostic criteria are required for IGD to be diagnosed [5]. Symptoms of IGD include: (i) total preoccupation with gaming; (ii) withdrawal symptoms when gaming is not possible (e.g. sadness, anxiety, irritability); (iii) tolerance (i.e., increase in the amount of time spent gaming over a protracted period of time); (iv) loss of control in gaming; (v) reduced interest in previously enjoyed activities due to gaming; (vi) continuing to play videogame despite negative consequences; (vii) deceiving family members or others about the amount of time spent gaming; (viii) need of gaming to relieve negative moods, such as guilt or hopelessness; and (ix) functional impairment (e.g., losing a job or relationship due to gaming) [6]. Moreover, in the eleventh revision of the International Classification of Diseases (ICD-11), gaming disorder was classified under 'Addictive Behaviours' alongside substance use disorders (SUDs), gambling disorder, and impulse control disorders [7].

Epidemiology of internet gaming disorder

IGD is a significant emerging issues not only for mental health providers but also for primary care services and politicians [8,9]. Recently, governments in China, Japan and South Korea have imposed strict bans with regard to the types of videogame, the time spent by users, and the related economic costs, in order to reduce children leaving school early [10]. There are no current similar European

bans in existence, and videogame content is classified by the Pan European Game Information (PEGI) system, which was developed to promote responsible, healthy, and safe content that does not affect the psychophysical integrity of the player as well as alerting players of possible distressing content. Updated in 2009, it has now been adopted by more than thirty-five European countries given the spread of online gaming [11]. IGD is currently a problem of global concern [12]. Like other addictive disorders, the prevalence of IGD may have increased in the past year due to the forced quarantine and isolation adopted to prevent the spread of coronavirus disease 2019 (Covid-19) [13–17]. Indeed, movement restrictions have led to a worldwide increase in the use of online videogames (+ 70-75%) and the streaming of videogames on the *YouTube* gaming platform (+10%) [18].

IGD appears to be more prevalent among males [19], particularly those who are unemployed, less educated, and single [20]. As to prevalence rates, high variability has been reported due to many factors, such as the specific evaluation tool used, the country of study, and the percentage of males in the sample studies [21]. As to a recent review, the worldwide prevalence of gaming disorder was 3.05%, and 1.96% if considering only studies that met more stringent sampling criteria. Gender rates were approximately 2.5:1 in favour of males compared to females [22].

Psychopathological characteristics and comorbidities

From a psychopathological perspective, videogaming might be adopted as a coping strategy in order to cope with stressful conditions and comorbidities [23,24], in an attempt to escape from reality [25,26], or the need to manage relationship problems including social withdrawal (e.g., Hikikomori; [27,28]). People with IGD may have several comorbid mental health problems, such as depression, anxiety, social phobia [24,29,30], attention deficit and hyperactivity disorder (ADHD) [31–33], obsessive-compulsive disorder [34,35], psychoticism, and neuroticism [36]. These conditions appear to be contributing risk factors, which can increase the development of IGD and determine symptomatologic differences between players [37]. For example, some personality traits, like

schizotypal, could predispose individuals to immersive phenomena, especially with regard to Massive Multiplayer Online Role-Playing Game (MMORPG) [38,39].

Dissociative symptoms such as depersonalization and derealization may also be present [40], often associated with alexithymia [41]. Overall, a low quality of life is reported among individuals with IGD. This might be related to both physical problems (e.g., sleep) and mental health issues (e.g. memory and concentration), reduced educational/occupational performance, interpersonal difficulties, including aggressiveness and violent behaviours [42–45].

With regards to substance use, IGD can be highly comorbid. Nicotine, alcohol, and cannabis are the most widely used substances among people with IGD [46,47]. A few studies have also evaluated affinities in addiction mechanisms between IGD and alcohol use disorder (AUD) [48], finding the possibility of a clinical worsening in the case of dual diagnosis [49]. However, other studies showed opposite results [50]. Moreover, research exploring the association between IGD and illicit substance use is sparse. One study reported that the use of stimulants was associated with an intensification in the duration time of gaming in terms of hours: +9.8 hours a week for stimulant-type pharmaceuticals (e.g., Ritalin), +9.6 hours a week for ecstasy/ methylenedioxymethamphetamine (MDMA), and +3.8 hours a week for caffeine [51].

Some of these associations with substance use were also reported for phenomenologically similar disorders such as problematic use of the internet (PUI) [52,53], being related with both a common hypodopaminergic state in reward circuits and an alteration in the impulse control areas [54,55]. For some individuals, the use of gaming, gambling, smartphones, and psychoactive substances might then become an attempt to self-medicate and for a minority might contribute to the onset of both behavioural addictions and SUDs [56].

Aim of the present study

Given the aforementioned considerations, the aims of the present study were: (i) to explore the relationship between the use of videogames and substance use among a sample of young adults. Single substances and broader categories of substances were investigated in their relationship to gaming; (ii) to investigate the associations between gaming, socio-demographic characteristics and general psychopathological traits. Finally, (iii) possible predictors of high risk gaming emerged in these analyses were tested using a logistic regression analysis, to build the model with the best likelihood of estimation in the present sample.

Methods

Participants and procedure

An online survey was carried out in Italy from November 2019 to May 2020 in order to investigate the correlates of IGD among a sample drawn from the general population. The only inclusion criterion was the age between 18 and 40 years. The only exclusion criterion was having a psychiatric diagnosis or chronically taking psychotropic medications. This was self-assessed through a screening question at the beginning of the questionnaire, in order to exclude patients with major psychiatric disorders from the analysis. Participants were recruited through social media advertisement (i.e., Facebook, Twitter, Instagram) and utilizing "snowball" sampling (i.e., participants were invited to share the survey with their friends and family). Recruitment was implemented with this latter sampling method to also include participants not using social networks. Recruitment was organized to collect an homogeneous volume of responses from Northern, Central and Southern Italy. The survey was conducted via the online platform *Google Forms*, where the participants completed the survey independently using an electronic online link.

Measures

The first section of the survey asked for information concerning demographic data (e.g., sex, age, education, job status). Other variables investigated included consumption of licit substances as alcohol, nicotine, and coffee.

In a separate section, lifetime illicit psychoactive substance use was quantified on a five-point scale: 0="I never used it", 1="I rarely use or used it", 2="I sometimes use or used it", 3="I often use or used it", and 4="I use or used it every day". The substances asked about were cannabis, synthetic cannabinoids, cocaine, heroin, amphetamines/methamphetamines, cathinones, LSD/mushrooms, ketamine, psychoactive plants (e.g., salvia, kratom, peyote), GHB/GBL, and poppers (alkyl nitrites).

In the final section of the survey, two self-report psychometric scales were included: the 10-item Internet Gaming Disorder Test (IGDT-10) and the Revised 90-item Symptom Checklist (SCL-90-R). The IGTD-10 assesses IGD. This instrument was selected among the others because of many factors as DSM-5 and ICD-11 coverage, existence of longitudinal studies, adaptation of structured interview, dimensionality, criterion validity, validation in different languages [57]. The instrument was developed based on the nine DSM-5 criteria for IGD. Participants rate items (e.g., "Have you risked or lost a significant relationship because of gaming?") on a three-point scale (0=*never*, 1=*sometimes*, 2=*often*). Only "often" receives one point, whereas "never" and "sometimes" are not considered to meet the criterion (and score nothing). Questions 9 and 10 explore the same DSM-5 criterion in IGD (i.e., negative consequences), so an "often" answer on either or both receives a score of only 1. Consequently, the total score for the IGDT-10 ranges from 0 to 9. According to validation studies, a score ≥ 5 is the best in terms of specificity, sensitivity, and diagnostic accuracy in predicting IGD [58]. Cronbach's alpha for this instrument in the present sample was 0.742, suggesting acceptable internal consistency. IGDT-10 has not been validated at a country level yet. The scale was translated in Italian and back-translated in English to ensure reliability.

The SCL90-R assesses various somatic and psychological signs of distress [59]. The 90 items are rated on a five-point scale from 0 (*not at all*) to 4 (*very much*). The instrument comprises nine sub-scales including somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism. Each of these nine symptom dimensions comprises 6-13 items; the scores on each dimension are means of the scores of all items of the dimension. The Italian version of the instrument has been widely used among community samples and its factor structure and psychometric properties rated good [60,61]. Cronbach's alpha for this instrument in the present sample was 0.983, suggesting excellent internal consistency.

Data analysis

Statistical analysis was performed with IBM SPSS Statistics 25.0 for Windows (SPSS Inc., Chicago, Illinois). The *t*-test for independent samples, chi-square test, and Fisher's exact test were used to compare the groups. Correlations between the variables were explored using the Pearson's correlation coefficient. Sample size for the correlation analysis was determined to detect correlations with $r > 0.1$, considering a significance level (α) of 0.05 and a power of 80% (β=0.2) [62]. The sample size needed resulted of n = 783. Bonferroni corrections were used to reduce Type I error probability due to multiple comparisons. As 10 different SCL-90 dimensions were possibly associated with IGTD-10, the *p*-value was divided by the number of dependent variables (0.05/10 = 0.005).

A logistic regression was performed using high risk gaming as dependent variable. All the variables showing a significant *p*-value were included in the multivariate analysis as predictors, to find the model with the maximum likelihood estimation. Statistical significance was set at $p < 0.05$.

Ethics

All the study procedures were conducted in line with the Declaration of Helsinki [63] and were approved by the research team's University ethics committee. The survey was completed by each participant anonymously only after having read the information sheet and having signed the informed consent form.

Results

Demographic characteristics, IGD rates and psychometric assessment

The final sample comprised 913 participants (male/female: 335/578; females = 63.3%). Mean age of the participants was 25.8 years (SD ± 5.9 years; age range 18-40 years). The sample was composed mainly by students (i.e., 43.6% of full-time students and 11.2% of working-students), followed by full-time employees (40.2%) and unemployed (4.2%). About half of the sample (n = 456, 49.9%) had an high school degree. The prevalence rate of IGD according to the validated cut-off of IGDT-10 was 1.4% (n = 13).

Considering the low prevalence rate of IGD emerged, a broader cut-off of IGDT-10 ≥ 3 was adopted in the present sample to indicate "high risk gamers". The aim was capturing both individuals with IGD and those with a higher use of video games. The cut-off point of 3 was chosen because it was closest to the 95th percentile of the sample. The prevalence rate of high risk gaming according to the adopted cut-off of IGDT-10 ≥ 3 was 4.4% (n = 40). This wider sample of high risk gamers was thus considered for subsequent analysis.

Comparing non-gamers and low risk gamers with high risk ones showed that males were more likely to be high risk gamers compared to females ($p < 0.001$). The prevalence rate was 8.7% among males, and 1.9% among females. No differences were found in relation to job status, while both the number of alcoholic units per day and of cigarettes smoked per day were higher among high risk gamers (p

= 0.018 and p = 0.001). High risk gamers scored significantly higher in all the nine domains of SCL-90. Detailed results are presented in Table 1.

-Table 1-

Correlations between IGDT-10 and SCL-90 were calculated using Pearson's *r*. All domains of SCL-90 correlated significantly with IGDT-10. Pearson's coefficient indicated small to moderate correlations. The highest correlations were between IGDT-10 and paranoid ideation ($r = 0.235$, $p < 0.001$), and IGDT-10 and psychoticism ($r = 0.232$, $p < 0.001$) (see Table 2).

-Table 2-

Substance use characteristics and relationship with high risk gaming.

Lifetime substance use (yes/no) and frequency of use of the different psychoactive substances were assessed in the whole sample and between the groups (non-gamers and low risk gamers vs. high risk gamers). Almost two-thirds of participants (61.8%) reported having used psychoactive substances other than alcohol, nicotine, and caffeine in their lifetime (n = 564). Lifetime frequencies of psychoactive substance use are reported in Table 3. The most used substance was cannabis (61.5%, n = 561) with 12.6% of the sample (n = 115) using cannabis "often" or "everyday". Almost all of the substance users (99.4%) reported using cannabis, either on its own or with other substances (n = 561). The second most used substance was cocaine (11.1%, n = 101). The least used substances were GHB/GBL (1.4%, n = 13), heroin (1.5%, n = 14) and cathinones (1.5%, n = 14).

-Table 3-

High risk gamers showed higher rates of lifetime polysubstance use, intended as the simultaneous use of more than one substance apart from alcohol and nicotine ($p < 0.001$). Moreover, some substances were more used among high risk gamers including synthetic cannabinoids (22.5%, p =

0.001), LSD/mushrooms (15%, p = 0.003), and poppers (15%, p = 0.004). Psychoactive substances were then grouped into classes: cannabis and synthetic cannabinoids, psychostimulants (cocaine, amphetamines/methamphetamines, cathinones) and psychodyspleptics (LSD/mushrooms, ketamine, psychoactive plants, GHB/GBL), partly on the basis of previously published research [64,65]. The rate of psychodysleptic use was significantly higher among high risk gamers (p = 0.035).

Severity of substance use was also assessed. Frequent use of any substance apart from alcohol and nicotine (i.e., "often" or "everyday" responses) had higher rates among high risk gamers (p < 0.001; 32.5%) (see Table 4).

-Table 4-

High risk gaming logistic regression analysis

A logistic regression model was built to find the maximum likelihood of estimation for high risk gaming (IGDT-10 ≥ 3). Predictors inserted in the model were age, sex, total SCL-90 score, and frequent substance use (as dichotomous variable). Total SCL-90 score was preferred to other more specific SCL-90 dimensions as a variable encompassing all main psychopathological aspects. Variables were controlled for multicollinearity using variance inflation factor (VIF) [66]. Male sex (OR = 7.189, p < 0.001), total SCL-90 score (OR = 1.014, p < 0.001), and frequent substance use (OR = 2.303, p = 0.032) were all significant predictors for high risk gaming. Logistic regression analysis is detailed in Table 5.

-Table 5-

Discussion

The present study assessed the rates of IGD, high risk gaming and the associations between high risk gaming and lifetime substance use through an online survey. A probabilistic sample of Italian

individuals aged 18-40 years was included. Polysubstance use and the use of some specific types of psychoactive substance were more prevalent among high risk gamers. Moreover, frequent use of substances (i.e., “often” or “everyday” use) was higher among high risk gamers. This association remained after accounting for age, sex, and general psychopathology in a logistic regression model.

Prevalence of internet gaming disorder and of high risk gaming

The prevalence rate of IGD (IGTD-10 ≥ 5) was 1.4%, while that of high risk gaming according to the adopted cut-off (IGDT-10 ≥ 3) was 4.4%. IGDT-10 validation studies conducted in various countries have reported prevalence rates of IGD ranging between 1.61% and 4.48%, except for one study among a Peruvian sample reporting a rate of 13.44% [67]. The results of the present study appear in line with previously reported European data, considering that the present study was conducted in a probabilistic sample rather than in a sample of gamers, as did Kiraly et al.’s original validation study [68].

The present study had a predominance of females in the sample examined, possibly due to a sampling bias (i.e., greater trend of the female sex to take part in the survey). This may have resulted in lower rates of IGD and high risk gaming. Despite this predominance, a statistically significant association was found between high risk gaming and male sex. This is in line with previous published scientific literature [69–71]. The sample had also a predominance of high-school education over higher qualifications. Both these predominancies are elements of non-representativeness of the present sample to be accounted.

High risk gaming and psychopathological symptomatology

Regarding the psychopathological assessment of the sample, high risk gamers showed significantly higher scores in all nine SCL-90 dimensions. The associations were highest in the dimensions of psychoticism and paranoia. The evidence of a more severe psychiatric symptomatology among high

risk gamers has been found in many previous studies [72,73]. These associations have also been described for phenomenologically similar disorders such as problematic use of the internet [74,75]. The exclusion of participants with a psychiatric diagnosis was made through a self-assessed question. Thus, these associations might not be representative of the general population. Identifying and treating psychiatric comorbidities as early as possible has been proposed as effective in preventing the transition from at-risk online behaviours toward problematic ones [76].

High risk gaming and substance use

The present study showed a 61.8% rate of lifetime illicit substance use. Data drawn from the World Mental Health Surveys by World Health Organization (WHO) revealed a 66.8% lifetime illicit drug use or extra-medical use of prescription drugs among the Italian population [77]. The latest findings by European Monitoring Centre for Drugs and Drugs Addiction (EMCDDA) reported a lifetime cannabis use of 41.5% among Italian young adults (15-34 years). As to frequency of use, 19.7% of last-months cannabis users consumed it frequently (i.e., 20 or more days per month) [78]. Among the factors that could explain the high percentages from the present survey is online sampling method, that could provide a sense of anonymity and privacy. Sex imbalance should also be mentioned.

High risk gamers showed an higher use of synthetic cannabinoids, LSD/mushrooms, and poppers (alkyl nitrites). Psychodyspleptics as a class of psychoactive substance were also more used by high risk gamers. Polysubstance use was more common among high risk gamers. As aforementioned, associations between psychoactive substance use and gaming have been investigated mainly for cannabis, alcohol, and nicotine. These substances have been considerably associated with problematic video gaming [79] [80]. Further studies conducted in different countries have addressed the comorbidity between the use of psychoactive substances and addictive behaviours

in general [81–83] and found a significant rate of co-occurrence. An epidemiological analysis conducted in Hungary on 3,003 adolescents and young adults showed a significant association between cigarette smoking and problematic internet use, and between alcohol use, marijuana use, and problematic online gaming [55]. Similarly, another study found that both lifetime nicotine use, and lifetime illicit drug use were significantly associated with a poorly controlled internet use among students [84]. In a cross-sectional study among 4,957 Turkish adolescents, lifetime use of nicotine, alcohol, and other drugs, were predictors of higher risk for problematic internet use [85]. More recent studies indicated that both the earlier onset of substance use and polysubstance use may predict a higher risk for problematic internet use [86]. The relation between problematic use of video games and substance use might also be influenced by external factors from the societal context. Among the others, economic wealth might moderate this relation in the sense of a smaller risk for those living in high-income countries [87]

In the present sample, the frequent (i.e., “often” or “everyday”) use of cannabis was more common among high risk gamers. On one hand, this may be explained by the tendency to socially withdraw among individuals who severely use cannabis [88,89]. This may promote an increase in the time spent gaming. On the other hand, the anxiolytic and antidepressant effect of cannabis [90] could be used as a self-therapy to overcome mental health distress linked to a problematic use of video games.

The main finding of the present study was the significant association between frequent substance use and high risk gaming. This association persisted even when accounting for age, sex, and SCL-90 score, with an odds ratio of 2.303. In many cases, frequency of consumption could be an indicator of SUD [91–94]. Consequently, our cross-sectional finding suggests a possible association between SUDs and high risk gaming.

Phenomenologically, SUDs and problematic use of video games share various characteristics [95]. In fact, the DSM-5 diagnostic criteria for SUDs were the starting point for the development of such behavioural addictions including IGD [96]. Common features of substance and non-substance addictions include: (i) the multifactorial aetiology, in which premorbid personality and genetic factors (both still under study for problematic gaming) play important roles [97]; (ii) the psychological features of addiction in general, especially the tendency to socially withdraw, mood modification, and tolerance [98]; (iii) the reward dysregulation system which has been widely documented among participants with SUDs and recently suggested among people with IGD, with studies proposing an altered regulation of craving as a transdiagnostic construct for both SUDs and behavioural addictions [99]; and (iv) the neurobiological and neurofunctional dysregulations that both individuals with SUDs and problematic gamers have. According to a recent meta-analysis, the dysregulations of the prefrontal region are predominant in both disorders [100].

Moreover, a shared aspect between individuals suffering from SUD and IGD may be the attempt to escape to a different reality or to an alternative self. Substance use can be engaged in by individuals to hide in an altered state of reality, while the act of gaming, if problematic, could project the person into an avatar-led virtual reality. Therefore, the more common use of psychodysleptics among the group of high risk gamers may be explained according to this assumption.

The present study has some important limitations. Firstly, the use of an online sampling method, with a self-selected, Italian-only sample could reduce the generalisability of the findings. The use of only self-report instruments to investigate complex psychopathological dimensions is another possible limitation. In particular, due to the too low prevalence of IGD in the sample, the IGDT-10 was used outside its validated cut-off. Moreover, no detailed information about quantities of substances used was obtained. The self-exclusion of participants with psychiatric disorders is another limitation. Due to the cross-sectional nature of the survey, no causal relationship can be

drawn between the variables from the analyses performed. Finally, the sample size of high risk gamers in the present study was small. Therefore, this could have limited the power of the statistical associations observed.

Conclusions

The findings obtained from the present study confirmed the association between high risk gaming and the use of psychoactive substances. This association has not been fully explored in previous research. Therefore, the study may help provide further insight into the connection between this emerging problematic behaviour and psychoactive substance addiction. Importantly, frequent use of psychoactive substances appeared to be associated with high risk gaming. This is a novel finding that warrants further research, ideally by means of prospective studies or larger cross-sectional samples. Gaining more insight into the trajectory of common vulnerability factors involved in the development of IGD and SUDs may contribute to the development of effective interventions to tackle them from a clinical perspective.

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Table 1. Demographic characteristics and psychometric assessment.

	Non-gamers and low risk gamers N = 873		High risk gamers N = 40		Statistics	*p*
Age (mean ± SD)	25.8	5.9	24.4	5.1	1.463	0.144
Sex (F) (n and %)	567	64.9	11	27.5	23.310	< 0.001
Job status (n and %)						
Full-time student	378	43.3	20	50	1.138	0.566
Working student	104	11.9	3	7.5		
Employed	356	40.8	15	37.5		
Education level (n and %)						
High school	434	49.7	22	55	0.583	0.747
Bachelor's degree	222	25.4	10	25		
Master's degree or higher	217	24.9	8	20		
Alcohol use (n and %)	578	66.2	30	75	1.286	0.257
If yes, alcoholic units per day (mean ± SD)	1.5	1	1.9	1.4	-2.382	0.018

Smoking habit (n and %)	369	42.3	21	52.5	1.604	0.205
If yes, cigarettes per day (mean ± SD)	8.3	5.6	12.6	9.1	-3.270	0.001
Coffee use (n and %)	694	79.5	29	72.5	1.203	0.273
If yes, cups of coffee per day (mean ± SD)	2.6	1.3	2.6	1.3	-0.127	0.899
IGDT-10 (mean ± SD)	0.1	0.4	4.1	1.2	-51.705	< 0.001
SCL-90 (mean ± SD)						
Somatization	8.0	8.2	14.7	12.4	-4.934	0.003
Obsessiveness	8.5	7.6	16.4	10.8	-6.341	< 0.001
Interpersonal Sensitivity	5.9	6.1	12.8	9.8	-6.755	< 0.001
Depression	10.4	9.7	21.2	14.5	-6.758	< 0.001
Anxiety	6.9	7.0	13.2	10.2	-5.363	< 0.001
Hostility/Aggressivity	3.6	4.1	7.7	6.8	-5.940	< 0.001
Phobic Anxiety	2	3.6	5.9	8.0	-6.166	< 0.001
Paranoid Ideation	4.3	4.6	9.1	6.9	-6.180	< 0.001
Psychoticism	4.2	5.5	10.4	8.1	-6.874	< 0.001
Total SCL-90	59.1	53.9	121.5	82.3	-6.971	< 0.001

Statistics: independent samples t-test, Chi-Square test, Fisher exact test.

Table 2. Correlations between IGDT-10 and SCL-90.

		IGDT-10
Somatization	**r**	0.156
	p	<0.001
Obsessiveness	**r**	0.208
	p	<0.001
Interpersonal Sensitivity	**r**	0.228
	p	<0.001
Depression	**r**	0.222
	p	<0.001
Anxiety	**r**	0.172
	p	<0.001
Hostility/Aggressivity	**r**	0.223
	p	<0.001
Phobic Anxiety	**r**	0.206
	p	<0.001
Paranoid Ideation	**r**	0.235
	p	<0.001
Psychoticism	**r**	0.232
	p	<0.001
Total SCL-90	**r**	0.234
	p	<0.001

Statistics: Pearson's correlation coefficient.

Table 3. Frequency of substance use in the whole sample (n = 913).

		n	%
Cannabis	Never	350	38.3
	Rarely	145	15.9
	Sometimes	301	33.0
	Often	66	7.2
	Everyday	49	5.4
Synthetic cannabinoids	Never	838	91.8
	Rarely	13	1.4
	Sometimes	46	5.0
	Often	12	1.3
	Everyday	2	0.2
Cocaine	Never	810	88.7
	Rarely	31	3.4
	Sometimes	58	6.4
	Often	11	1.2
	Everyday	1	0.1
Heroin	Never	897	98.2
	Rarely	7	0.8
	Sometimes	2	0.2
	Often	5	0.5
Amphetamines/ Methamphetamines	Never	852	93.3
	Rarely	20	2.2

	Sometimes	31	3.4
	Often	7	0.8
	Everyday	1	0.1
Cathinones	Never	897	98.2
	Rarely	6	0.7
	Sometimes	4	0.4
	Often	4	0.4
LSD/mushrooms	Never	865	94.7
	Rarely	26	2.8
	Sometimes	14	1.5
	Often	6	0.7
Ketamine	Never	864	94.6
	Rarely	21	2.3
	Sometimes	18	2.0
	Often	8	0.9
Psychoactive plants (e.g., salvia, kratom, peyote)	Never	879	96.3
	Rarely	22	2.4
	Sometimes	6	0.7
	Often	4	0.4
GHB/GBL	Never	898	98.4
	Rarely	7	0.8
	Sometimes	1	0.1
	Often	5	0.5

Poppers (alkyl nitrites)	Never	864	94.6
	Rarely	29	3.2
	Sometimes	10	1.1
	Often	8	0.9

Table 4. Comparison between participants as to lifetime (yes/no) substance use.

	Non-gamers and low risk gamers N = 873		High risk gamers N = 40		Chi-Square	p
	n	%	n	%		
Substance use, yes	536	61.4	28	70	1.199	0.274
Patterns of use						
Cannabis alone	390	44.7	13	32.5	2.336	0.126
Cannabis and one or more substances	143	16.4	15	37.5	11.921	<0.001
Other substances without cannabis	3	0.3	0	3		1.000
Types of substances						
Cannabis	533	61.1	28	70	1.253	0.263
Synthetic cannabinoids	64	7.3	9	22.5	11.912	0.001
Cocaine	95	10.9	6	15	0.650	0.420
Heroin	13	1.5	1	2.5		0.469
Amphetamines/Methamphetamines	57	6.5	2	5	0.151	1.000
Cathinones	14	1.6	0	0		1.000
LSD/mushrooms	40	4.6	6	15	8.640	0.003
Ketamine	44	5	3	7.5		0.494
Psychoactive plants (e.g., salvia, kratom, peyote)	3	0.3	2	5		0.601
GHB/GBL	13	1.5	0	0		1.000

Poppers (alkyl nitrites)	41	4.7	6	15	8.280	0.004
Class of substances						
Cannabis/synthetic cannabinoids	534	61.2	28	70	1.222	0.269
Psychostimulants	102	11.7	6	15	0.396	0.529
Psychodyspleptics	70	8	7	17.5	4.426	0.035
Frequency of use						
Substance use, often/everyday	103	11.8	13	32.5	14.711	<0.001
Cannabis use, often/everyday	103	11.8	12	30	11.453	0.001
Other substances use, often/everyday	18	2	4	10		0.013

Statistics: Chi-Square test and Fisher's Exact test as appropriate.

Table 5. Logistic regression model to estimate high-risk gaming in the whole sample.

	B	Std. Error	Odds Ratio	p
Sex (M)	1.973	0.407	7.189	<0.001
Age	-0.041	0.035	0.959	0.241
SCL-90 total	0.014	0.002	1.014	<0.001
Substance use, often/everyday	0.834	0.389	2.303	0.032
Constant	-4.516	0.965	0.011	<0.001

Statistic: logistic regression.