

Relationship between Internet Gaming Disorder with Depressive Syndrome and Dopamine Transporter Condition in Online Games Player

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Abstract

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BACKGROUND: Internet game playing is experiencing rapid growth in both youth and adult populations. The excess playing this game cause negative consequences, including game addiction. Internet Gaming Disorder is an increasingly prevalent disorder, which can have severe consequences in affected young people and their life.

AIM: To observe the depressive syndrome and dopamine transporter condition (DAT) to find out the severity of internet gaming disorder.

METHODS: To analyse the relationship between IGD and Depressive Syndrome and to analyse the relationship between IGD and DAT in online games player by using Spearman Rank Correlation Analysis. Depression testing is done by using the Patient Health Questionnaire-9 method (PHQ-9). The sample of the experiments of this research was 48 online games players in the internet cafe at Medan Area sub-district, which ages between 20 – 40 years old and have been playing games for at least 12 months

RESULTS: It was found that there was strong one-way relation (0.625) between IGD and PHQ-9 significantly ($p < 0.01$), however, it was found that strong enough (-0.465) relation between IGD and DAT ($p < 0.01$) and strong opposite relation (-0.680) between PHQ-9 and DAT ($p < 0.01$).

CONCLUSION: There was a relationship between Internet Gaming Disorder (IGD) with depressive symptoms and Dopamine Transporter (DAT) level. PHQ-9 score was higher in people with a higher score of IGDS9-SF. As well as DAT level, there was opposite strong enough correlation between IGD and DAT that indicating the higher IGD score, the lower DAT level.

Introduction

Playing excessive online games can cause a disorder known as Internet Gaming Disorder (IGD) that is detrimental to mental health [1]. The prevalence of IGD ranges from 5% to 8% in North America, between 0.2% and 12% in Europe, around 4.78% in China, and 1.8% in Australia [2], [3], [4], [5]. In Indonesia, about 10.15% of students in Indonesia played online games excessively [6]. In the same year, a study that examined the influence of online games on behaviour change in children in Samboja Middle School 1, East Kalimantan, the results obtained about 10.2% of students skipped classes to play online games [7].

In the past few decades, research on the impact of playing online games has increased. Playing

online games has been associated with (and can also lead to) other mood disorders such as depression, stress and anxiety disorders [8]. In 2015, a study suggested that the amount of time spent on playing online games was strongly associated with the occurrence of depression symptoms. It showed that playing for more than 5 hours per day can increase the likelihood of symptoms of depression [9]. Likewise, in Korea, It was found that 13.8% of the samples were at high risk of suffering from IGD and had more depressive symptoms [10].

Research by Manniko, Billieux and Kaariainen in 2015 found that a strong attachment to the game can cause individuals to ignore sleep, hobbies and social interactions. Game players will prefer interacting in the game rather than face-to-face interaction [11].

Dopamine Transporter (DAT) is a plasma membrane protein that actively removes dopamine released from the extracellular space into presynaptic neurons. Many diseases such as depression, bipolar disorder and Parkinson's disease are associated with abnormalities in dopamine levels, where DAT is involved as an etiological factor in these diseases [12]. Research by Weinstein in 2017 regarding brain imaging in IGD found that patients with IGD showed a decrease in the level of willingness of dopamine D2 receptors in the striatum and reduced availability of striatal dopamine transporter (DAT) [13].

Previous research has shown that online game can be related to depression, but a similar study has not been conducted in Indonesia. On this basis, researchers want to examine the relationship of Internet Gaming Disorder (IGD) with the depressive syndrome and level of Dopamine Transporter (DAT) in online gamers in Medan Area sub-district, North Sumatera.

Methods

Subjects and Procedure

This cross-sectional study was conducted in April 2019. Subjects were recruited from several internet cafes in Medan Area sub-district. Online gamers aged 20 – 40, playing online games for at least 12 months and fulfilling the IGD criteria based on IGDS9-SF questionnaire, cooperative to follow the course of the study and understanding Indonesian were included as samples. Subjects that had a history of psychiatric disorders previously excluded through the MINI-ICD questionnaire and had a history of alcohol use and addictive substance were excluded in this study. About 48 subjects were invited. Subjects who agreed to be sampled were asked to fill out questionnaires, and then their blood would be collected. Ethical clearance was obtained from the Health Research Ethical Committee of North Sumatera, Medical School, Universitas Sumatera Utara.

Measurements

Demographic and personal information obtained included age, gender, job status, education level, frequency of playing online games in a typical week period, and duration time of playing online game in a day. The psychometric assessment involved the administration of the following tools: Internet Gaming Disorder Scale 9-Short Form (IGDS9-SF) [x], and Patient Health Questionnaire 9 (PHQ-9) [x]. Dopamine Transporter (DAT) level is measured using ELISA (Enzyme-Linked Immunosorbent Assay) kit.

The internet gaming disorder scale nine short

forms (IGDS9-SF) is a scale used to assess the severity of Internet Gaming Disorder (IGD). This scale is suitable for adults and children and is claimed to be efficient for extensive scale surveys. This scale consists of nine questions; each question is assessed with a five-point Likert scale (value 1 for answers never, value 2 for rare, value 3 for sometimes, value 4 for frequent and value 5 for very frequent). The total score can be obtained by summing all responses given to nine IGDS9-SF questions and can range from a minimum of 9 to a maximum of 45 points, with higher scores indicating higher levels of disruption to network play. To distinguish between players who are disrupted and those who are not affected, researchers must check whether participants agree on at least five criteria from the nine criteria by considering "very often" answers [14].

The patient health questionnaire-9 (PHQ-9) is a nine-point depression rating scale that matches the criteria for DSM-IV main depressive with a four-point Likert scale. PHQ-9 questionnaire is one of the instruments used to measure the severity of depression. As a measure of severity, PHQ-9 has a score with range 0-27, where each question has a value 0 (not at all) to 3 (almost every day). The total value of the whole will explain below [15], [16]:

- Score 0 to 4 = none until depression is minimal
- Score 5 to 9 = mild depression
- Score 10 to 14 = moderate depression
- Score 15 to 19 = moderate depression
- Score 20 to 27 = severe / heavy depression

Data Analysis

Data was analysed by using SPSS ver. 18, the correlation was analyzed by using Spearman Rank. For determining the level of relations between variables, based on the correlation coefficient value which is the output of SPSS as below:

- Coefficient correlation 0,00 – 0,25 = very weak relationship
- Coefficient correlation 0,26 – 0,50 = enough
- Coefficient correlation 0,51 – 0,75 = strong relationship
- Coefficient correlation 0,76 – 0,99 = very strong relationship
- Coefficient correlation 1,00 = perfect relationship

Results

The sample of the experiments of this study included 48 peoples diagnosed with an IGD. Table 1 presents a summary of the socio-demographic characteristics of the overall samples. From Table 1,

the age that diagnosed with IGD of the samples has higher come from range age 20 – 30 years old. There were significant gender differences in online game players. It shows that online game players are more male (96%) than female (4%). Subjects with jobless status are more often to suffer from IGD (68.8%). The level of education that is more often diagnosed with IGD from the table is University education (60.5%) and then followed by high school education (35.5%). Based on the results, showed that 37.6% players play an online game with the duration time about 5 to 7 hours per day (43.8%), with almost everyday duration day of playing (62.4%) in a week.

Table 1: Socio-demographic Characteristics

No	Characteristics	Total	%
1	Age		
	20 – 30 years old	43 persons	90
	31 – 40 years old	5 persons	10
2	Gender		
	Male	46 persons	96
	Female	2 persons	4
3	Job Status		
	Employer	15 persons	31.2
	Jobless	33 persons	68.8
4	Education		
	Elementary School	0 person	0
	Junior High School	2 persons	4
	Senior High School	17 persons	35.5
	University	29 persons	60.5
5	Duration day of Playing		
	Everyday	18 persons	37.6
	Almost everyday	30 persons	62.4
	Weekend	0 person	0
6	Duration time of playing		
	3 to 5 hrs	8 persons	16.6
	5 to 7 hrs	21 persons	43.8
	>7hrs	19 persons	39.6

Table 2 showed that there was about 23% of online game player IGD score 39 – 40.

Table 2: IGD

No	IGD	%
1	36	12.5
2	37	18.7
3	38	12.5
4	39	23
5	40	23
6	41	8.3
7	42	2

Table 3 showed the PHQ-9 scale result, the highest percentage of the PHQ-9 score is found at moderate-severe (15 – 19), it is about 64.58%. The second highest percentage is at score 20 – 27, which indicates a severe depression (18.75%). Meanwhile, none of the samples had a PHQ-9 score of less than 10; this indicates that all samples experienced a depression syndrome.

Table 3: PHQ-9 Results

No	PHQ-9 Score	%
1	0 – 4	0
2	5 – 9	0
3	10 – 14	16.67
4	15 – 19	64.58
5	20 – 27	18.75

Table 4 showed the DAT conditions of online game players; the highest DAT is about 5.21 – 5.95 nmol/L (27.07%) followed by 2.05 – 3.92 nmol/L (18.74%).

Table 4: DAT

No	DAT nmol/L	%
1	0.81 – 0.98	6.25
2	1.12 – 1.64	10.42
3	2.05 – 2.92	18.74
4	3.04 – 3.92	18.74
5	4.1 – 4.96	16.70
6	5.21 – 5.95	27.07
7	6.86	2.08

Figure 1 showed a distribution of IGD vs DAT.

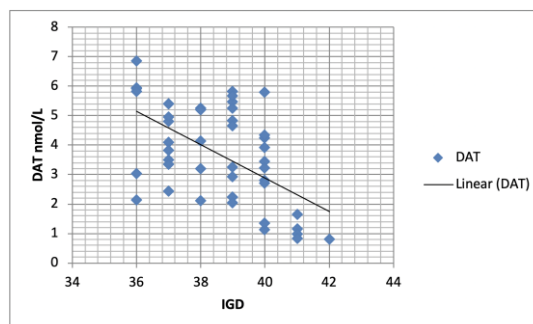


Figure 1: Distribution of IGD vs DAT

Correlation Analysis

Correlation analysis was done by using Spearman rank analysis. Table 5 showed the results of correlation between IGD, DAT and PHQ-9.

Table 5: Correlation analysis

Correlations				
		Concentration n_DAT	Score_IGD9S F	Score_PHQ9
Spearman's rho	Concentration_DAT	1,000	-.472**	-.672**
			.001	.000
			48	48
Score_IGD9SF	Concentration_DAT	-.472**	1,000	.643**
			.001	.000
			48	48
Score_PHQ9	Concentration_DAT	-.672**	.643**	1,000
			.000	.000
			48	48

** Correlation is significant at the 0.01 level (2-tailed).

From Table 5, it showed that there was a relationship between IGD, PHQ-9, and DAT significantly ($p < 0.01$). The results showed that IGD had a strong correlation with PHQ-9 (0,643). The more IGD score the higher PHQ-9 score (positive correlation). However, there was opposite strong enough correlation between IGD and DAT (-0,472), it indicated that the higher IGD score the lower DAT level. Furthermore, there was an opposite strong correlation between PHQ-9 and DAT level (-0,672). The higher PHQ-9 score, the lower DAT level was performed.

Discussion

The present study is probably the first to examine the relationship between Internet Gaming

Disorder (IGD) with depressive disorder and dopamine transporter (DAT) in Indonesia. The result showed that there was a relationship between IGD, depressive syndrome and DAT significantly. Depression screening can be done by using the Patient instrument Health Questionnaire-9 (PHQ-9). PHQ-9 is a scale depression with nine items to help in diagnoses depression [15]. In this study, we use the PHQ-9 scale to see the severity of the depressive syndrome experienced by people with IGD. Based on this study, subjects with IGD have PHQ-9 score higher than ten that indicate a moderate depressive syndrome. As we already know, depression can be characterised by loss of interest or pleasure in several activities almost every day. As shown in this study, our samples claimed to have lost interest in previous hobbies and other entertainment activities when playing online games. This is in line with research by Manniko, Billieux, and Kaariainen in 2015 [11]. They also ignore the sensation of fatigue, hunger, thirst, etc [17].

Depression is also associated with premature loss of sleep (slow-wave) and increased consciousness at night (arousal). Individuals who play excessive online games will ignore the sensation of fatigue that causes the neglect of sleep and having a low quality of sleep. In our knowledge, this can cause depressive symptoms as recognised by the subjects of this study [18].

The samples of this study also claimed that they would feel irritable, anxious, or sad if they are kept away from online games. This shows that there are withdrawal symptoms experienced by people who play excessive online games, one of which is depression [19].

Neurotransmitters such as DA, serotonin (5-HT) had an important role in drug and alcohol dependence, especially by mediating the mechanism of dopamine reward and symptoms of withdrawal [12]. The consistency with evidence in the drug and alcohol addiction associated with poor dopamine reward activity, samples with IGD showed a decrease in the level of availability of Dopamine D2 receptors in the striatum and reduced availability of sterile DAT. In our study, we found that people with IGD have a lower DAT concentration, which in line with the study done by Weinstein in 2017 [13].

In conclusion, our findings support earlier finding that there was a relationship between Internet Gaming Disorder (IGD) with depressive symptoms and Dopamine Transporter (DAT) level. PHQ-9 score was higher in people with a higher score of IGDS9-SF. As well as DAT level, there was opposite strong enough correlation between IGD and DAT that indicating the higher IGD score, the lower DAT level.

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References

- Sarda E, Bègue L, Bry C, Gentile D. Internet gaming disorder and well-being: A scale validation. *Cyberpsychology, Behavior, and Social Networking*. 2016; 19(11):674-9. <https://doi.org/10.1089/cyber.2016.0286> PMID:27831752
- Wittek CT, Finserås TR, Pallesen S, Mentzoni RA, Hanss D, Griffiths MD, Molde H. Prevalence and predictors of video game addiction: A study based on a national representative sample of gamers. *International journal of mental health and addiction*. 2016; 14(5):672-86. <https://doi.org/10.1007/s11469-015-9592-8> PMID:27688739 PMCID:PMC5023737
- Yu C, Li X, Zhang W. Predicting adolescent problematic online game use from teacher autonomy support, basic psychological needs satisfaction, and school engagement: A 2-year longitudinal study. *Cyberpsychology, Behavior, and Social Networking*. 2015; 18(4):228-33. <https://doi.org/10.1089/cyber.2014.0385> PMID:25803769
- King DL, Delfabbro PH, Zwaans T, Kaptis D. Clinical features and axis I comorbidity of Australian adolescent pathological Internet and video game users. *Australian & New Zealand Journal of Psychiatry*. 2013; 47(11):1058-67. <https://doi.org/10.1177/0004867413491159> PMID:23719181
- Tejeiro R, Chen A, Gómez-Vallecillo JL. Measuring Internet Gaming Disorder in Chinese International Students in the United Kingdom. *Journal of Education, Society and Behavioural Science*. 2016; 17(1):1-11. <https://doi.org/10.9734/BJESBS/2016/27855>
- Jap T, Tiatri S, Jaya ES, Suteja MS. The development of Indonesian online game addiction questionnaire. *PLOS ONE*. 2013; 8(4):1-5. <https://doi.org/10.1371/journal.pone.0061098> PMID:23560113 PMCID:PMC3616163
- Fauziah ER. Pengaruh game online terhadap perubahan perilaku anak SMP Negeri 1 Samboja. *Ejournal Ilmu Komunikasi*. 2013; 1(3):1-16.
- Pontes HM, Griffiths MD. Measuring DSM-5 Internet gaming disorder: Development and validation of a short psychometric scale. *Computers in Human Behavior*. 2015; 45:137-43. <https://doi.org/10.1016/j.chb.2014.12.006>
- Hellström C, Nilsson KW, Leppert J, Åslund C. Effects of adolescent online gaming time and motives on depressive, musculoskeletal, and psychosomatic symptoms. *Upsala J Med Sci*. 2015; 120(4):263-275. <https://doi.org/10.3109/03009734.2015.1049724> PMID:26072677 PMCID:PMC4816887
- Kim NR, Hwang SS, Choi JS, Kim DJ, Demetrovics Z, Király O, Nagygörgy K, Griffiths MD, Hyun SY, Youn HC, Choi SW. Characteristics and psychiatric symptoms of Internet gaming disorder among adults using self-reported DSM-5 criteria. *Psychiatry investigation*. 2016; 13(1):58-66. <https://doi.org/10.4306/pi.2016.13.1.58> PMID:26766947 PMCID:PMC4701686
- Männikkö N, Billieux J, Käariäinen M. Problematic digital gaming behavior and its relation to the psychological, social and physical health of Finnish adolescents and young adults. *J. Behave Addict*. 2015; 4(4):281-288. <https://doi.org/10.1556/2006.4.2015.040> PMID:26690623

PMCID:PMC4712762

12. Vaughan RA, Foster JD. Mechanisms of dopamine transporter regulation in normal and disease states. *Trends in pharmacological sciences*. 2013; 34(9):489-96.

<https://doi.org/10.1016/j.tips.2013.07.005> PMID:23968642

PMCID:PMC3831354

13. Weinstein AM. An update overview on brain imaging studies of Internet gaming disorder. *Frontiers in psychiatry*. 2017; 8:185.

<https://doi.org/10.3389/fpsy.2017.00185> PMID:29033857

PMCID:PMC5626837

14. Gomez R, Stavropoulos V, Beard C, Pontes HM. Item response theory analysis of the recoded internet gaming disorder scale-short-form (IGDS9-SF). *Int J Ment Health Addiction*. 2018; 17(4):859-79. <https://doi.org/10.1007/s11469-018-9890-z>

15. Haug S, Castro RP, Kwon M, Filler A, Kowatsch T, Schaub MP. Smartphone use and smartphone addiction among young people in Switzerland. *Journal of behavioral addictions*. 2015; 4(4):299-307.

<https://doi.org/10.1556/2006.4.2015.037> PMID:26690625

PMCID:PMC4712764

16. Rathore JS, Jehi LE, Fan Y, Patel SI, Foldvary-Schaefer N, Ramirez MJ, Busch RM, Obuchowski NA, Tesar GE. Validation of the Patient Health Questionnaire-9 (PHQ-9) for depression screening in adults with epilepsy. *Epilepsy & Behavior*. 2014; 37:215-20. <https://doi.org/10.1016/j.yebeh.2014.06.030>

PMid:25064739 PMCID:PMC4427235

17. Young KS, De Abreu CN, editors. *Internet addiction: A handbook and guide to evaluation and treatment*. John Wiley & Sons; 2011.

18. Sadock BJ, Saddock VA, Ruiz P. Kaplan & Sadock's synopsis of psychiatry behavioral science clinical psychiatry. 11th ed. Philadelphia: Wolters Kluwer Health, 2015.

19. Kaptis D, King DL, Delfabbro PH, Gradisar M. Withdrawal symptoms in Internet gaming disorder: A systematic review. *Clinical Psychology Review*. 2016; 43:58-66.

<https://doi.org/10.1016/j.cpr.2015.11.006> PMID:26704173