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The Relationship between Internet Gaming Disorder and Cognitive Status Disorders in Middle School Students in the Urban Area of Yogyakarta

Cempaka Thursina[1], Agus Budi Bowo Leksono[1], Indarwati Setyaningsih[1], Paryono[1], Rosmala Nur[2], Muh Zainuddin Badollahi[3]

[1]Department of Neurology Faculty of Medicine, Public Health and Nursing, Gadjah Mada University/Dr. Sardjito Central General Hospital Yogyakarta

[2]Department of Public Health, Faculty of Public Health, Universitas Tadulako, Palu, Indonesia. Address: Jl. Soekarno Hatta, KM 9, 90417

[3]Anthropology Study Program, Universitas Tadulako, Indonesia

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Abstract

The emergence of Internet Gaming Disorder (IGD) is linked to the inability to regulate internet and video game usage. As technology advances, the occurrence of IGD tends to rise. Given the widespread access to the internet in the Indonesian population, rural areas are susceptible to this issue. IGD has adverse effects on cognitive functions, particularly attention, due to prolonged use of video games or the internet. This research aims to examine cognitive status disorders in junior high school adolescents affected by IGD. The objective of this study is to demonstrate the correlation between cognitive status disorders in junior high school adolescents affected by Internet Gaming Disorder in urban settings. Conducted as a cross-sectional investigation, this study involved students from SMP N 1 Yogyakarta and SMP N 8 Yogyakarta as research subjects. Participants meeting the specified inclusion and exclusion criteria underwent the GAS-7 Ina examination and a cognitive status assessment utilizing the modified mini mental state examination –Ina (MMMSE-Ina). Statistical analysis was used to determine the connection between IGD and demographic characteristics. Cognitive function was measured using the MMMSEC-Ina with a total of 37 consisting of 5 domains. Each cognitive domain was assessed with a maximum value of orientation of 12, registration of 3, calculation/attention of 7, recall of 3, and language of 12. The study revealed a significant association between decreased cognitive status and Internet Gaming Disorder (IGD) with a p-value of 0.014. In the bivariate analysis, the variable significantly linked to cognitive status was the type of game (p= 0.050). In multivariate analysis, IGD status (R2 = 0.469) was identified as a significant factor for CTS. Junior high school teenagers in urban Yogyakarta, who suffer from Internet Gaming Disorder (IGD), exhibit compromised cognitive function, particularly in the areas of attention, recall, and language.

Keywords: Cognitive Status, Adolescents, Internet Gaming Disorder, Junior High School Students

Introduction

Pathological internet use is characterized by excessive or poorly controlled desires and habits of internet use which lead to impairment and distress (Shaw et al, 2008). Internet addiction has been associated with dimensionally measured depression and indicators of social isolation. Psychiatric co-morbidities are common, especially mood swings, anxiety, impulse control and substance use disorders. The causes are still uncertain, but probably involve psychological,

neurobiological, and cultural factors (Shaw et al, 2008). According to Petry et al. (2015), IGD refers to the use of video games both online and offline, having 9 criteria such as; (1) preoccupation with playing internet games, (2) withdrawal symptoms such as irritability, anxiety, or sadness, (3) development of tolerance, (4) unsuccessful attempts to control the behavior, (5) loss of interest in other activities, (6) continuation of excessive use despite insight into the psychosocial consequences, (7) deceiving others regarding the amount of time spent gaming, (8) use of this behavior to escape or weaken negative moods, and (9) risk or lose relationships/job/educational opportunities significantly. To determine a diagnosis of IGD, at least of 5 of the following 9 criteria must have appeared in the last 12 months (American Psychiatric Association, 2013). The cutoff point of 5 criteria has been verified in several studies (Lemmens et al., 2015).

Limited data and research have been conducted on Internet Gaming Disorder (IGD) both in Indonesia and globally. The research conducted continues to present numerous inconsistencies and variations in opinions. Previous studies have focused on rural areas in Yogyakarta, revealing that individuals with Internet Gaming Disorder (IGD) in rural Cangkringan exhibited compromised cognitive function, particularly in the calculation/attention domain (Medikanto et al, 2019).

Given these limitations, the study will examine the cognitive status of junior high school students affected by Internet Gaming Disorder (IGD) in urban areas. This study was conducted in junior high schools in Yogyakarta city, using a sample of junior high school students to identify and analyze cognitive disorders present in adolescents suffering from IGD.

Methods

Research Design

This study employed a cross-sectional design utilizing cluster random sampling. It took place from August 2018 to August 2019 and was carried out in five randomly selected junior high schools in Yogyakarta. Subjects included those who met specific inclusion and exclusion criteria. Inclusion criteria consist of: 1) Middle school students with a maximum age of 15 years; 2) Afflicted by Internet Gaming Disorder (IGD) as per the modified Indonesian GAS-7 criteria; 3) Subjects are willing to participate in the research. Exclusion criteria: 1) Subjects experiencing pain; 2) Individuals with a history of intracranial infection, head trauma, cerebral palsy; 3) Subjects unwilling to participate in the research.

This study consisted of two stages. The initial stage involved categorizing subjects into IGD and non-IGD groups using the Indonesian version of the GAS-7 questionnaire. The subsequent phase focused on identifying subjects within each IGD and non-IGD group with and without cognitive status disorders using the Modified Mini Mental State Examination – Ina questionnaire (Figure 1).

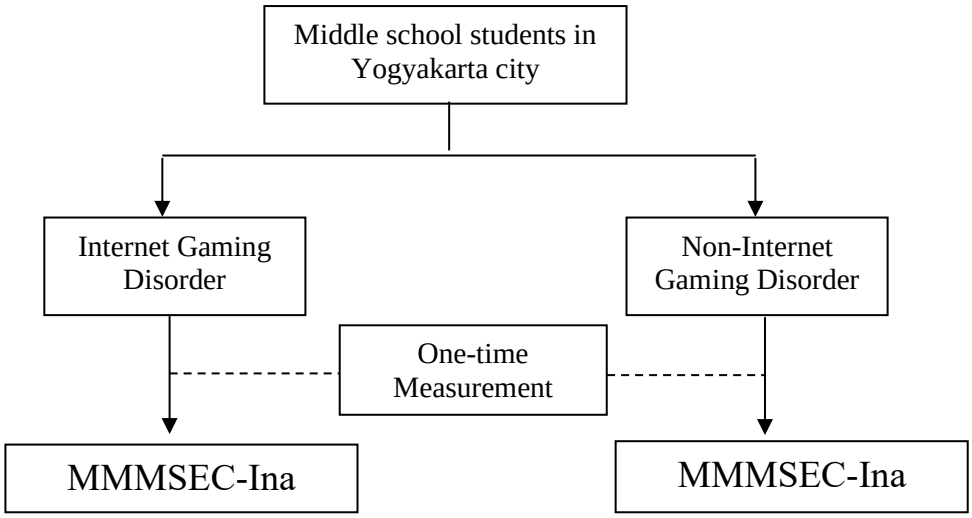

Figure 1. Research Flow

Sample Size

The necessary sample size for this study is determined through the application of the unpaired categorical comparative analytical sample size formula.

Where:

N2: sample size required (control group)

Zα: alpha standard derivative (1.96)

Zβ: beta standard derivative (0.84)

X1 – X2: minimum difference in mean that is considered significant = 0.41 (Jain & Passi, 2005)

S: standard deviation = 0.63 (Jain & Passi, 2005)

In this study, a significance level (α) of 5% and β of 20% were employed. With the specified sample size, a minimum of 37 participants is required for each group, resulting in a total sample requirement of 74.

Research Ethics

This research obtained recommendations from the Human Biomedical Research Ethics Committee, Faculty of Medicine, Gadjah Mada University, under the registration number KE/FK/1381/EC in July 2018. Each participant and their parents received detailed information about the study's objectives, procedures, potential benefits, and associated risks. Consent was sought from both the prospective participants and their parents, and they were required to sign a written agreement if they agreed to participate in the study.

Statistical Analysis

The recorded observations are documented on the provided form. The descriptive stage was carried out to determine the characteristics of the research subjects. The data obtained from the study was analyzed using a computer program. The Mann-Whitney test was employed for examining differences in means of variables on a scale. The statistical significance for all tests is established if the p-value is <0.05.

Results and Discussion

Characteristics of Research Subjects

This research was carried out in the Yogyakarta City area, Yogyakarta Special Region, from October 2018 to May 2019, using cluster random sampling. The sampling technique was carried out in two stages. Initially, subjects with Internet Gaming Disorder (IGD) and those without IGD were identified using the GAS-7 questionnaire. In that period, a total of 142 subjects were obtained, comprising 71 with IGD and 71 without IGD. The distribution included 46 IGD subjects and 44 non-IGD subjects at SMP 1 Yogyakarta, as well as 25 IGD subjects and 27 non-IGD subjects at SMP N 8 Yogyakarta.

Table 1. Basic Characteristics of Subjects

		IGD		Non IGD		p
Age		**14 (12-16)**		**14 (13-15)**		**0.870**
Gender	Male	30	42.3%	32	45.1%	0.735
	Female	41	57.7%	39	54.9%	
Nominal BMI	Underweight	26	36.6%	18	25.4%	0.175
	Normal	36	50.7%	36	50.7%	
	Overweight	9	12.7%	15	21.1%	
	Obese	0	0.0%	2	2.8%	
Duration	> 3 hours/day	41	57.7%	35	49.3%	0.313
	< 3 hours/day	30	42.3%	36	50.7%	
Types of Gadgets	Smartphone	30	42.3%	42	59.2%	0.014
	Computer	17	23.9%	5	7.0%	
	Both	24	33.8%	24	33.8%	
Game Type	MOBA	10	14.1%	9	12.7%	0.166
	MMORPG	28	39.4%	20	28.2%	
	MMOFPS/TPS	15	21.1%	27	38.0%	
	Others	18	25.4%	15	21.1%	

Table 2. Description of Cognitive Function Scores and Their Distribution

	Mean	Standard Deviation	Median	Minimum	Maximum	p Kolmogorov Smirnov
Attention	10.85	1.19	11.00	7.00	12.00	0.000
Registration	3.00	.00	3.00	3.00	3.00	0.000
Calculation	4.49	2.44	4.00	.00	7.00	0.000
Recall	2.43	.85	3.00	.00	3.00	0.000
Language	11.68	.66	12.00	9.00	12.00	0.000
Cognitive Function	32.44	3.43	32.00	25.00	37.00	0.000

Table 3. Differences in Cognitive Function between IGD and non-IGD (Mann Whitney)

	IGD			Non IGD			p
	Median	**Minimum**	**Maximum**	**Median**	**Minimum**	**Maximum**	
Attention	10.00	7.00	12.00	12.00	8.00	12.00	0.000*
Registration	3.00	3.00	3.00	3.00	3.00	3.00	1.000
Calculation	4.00	.00	7.00	2.00	1.00	7.00	0.225
Recall	2.00	.00	3.00	3.00	1.00	3.00	0.000*
Language	12.00	9.00	12.00	12.00	11.00	12.00	0.009*

Cognitive Function	32.00	25.00	37.00	32.00	28.00	37.00	0.014*

The attention domain has obtained a median value for the IGD group (10) which is lower than the control group (12), though not statistically significant (p=0.00). This indicated a noteworthy relationship between IGD and cognitive function. In the registration domain, the IGD group's median value did not significantly differ from the control group, with results showing no significance (p=1.00). Similarly, in the calculation domain, the IGD group's median value was comparable to the control group, with non-significant results (p=0.225). This result contrasts with the results of Medikanto et al (2019), where significant impairment was observed in the attention and calculation domains.

The Recall domain showed a lower median number, with significant results (p=0.00). In the language domain, the IGD group's median value was identical to that of the control group, and the difference was statistically significant (p=0.009).

Analysis of the Relationship between External Variables and Cognitive Disorders

External variables such as age, gender, BMI, game type/genre, duration of playing games, and type of gadget were analyzed in terms of the subjects' cognitive status through bivariate analysis. Statistical calculations revealed that there was no significant correlation between age and cognitive status (p=0.74), BMI value and cognitive status (p=0.399), duration of playing games and cognitive status (p=0.143), game type/genre and cognitive status (p=0.05). Additionally, no significant relationship was found between the duration of internet activity and cognitive status (p=0.149), and there was no significant relationship between gender and cognitive status (p=0.688).

Based on the aforementioned data, there was no statistically significant relationship between age and cognitive status (p=0.74). This finding contradicts prior research suggesting that age influences cognitive status disorders (Paik et al, 2017). The statistical tests did not reveal significant results regarding the relationship between gender and IGD sufferers (p=0.864). Although not statistically significant, this result is in accordance with previous studies indicating a higher prevalence of IGD among men than women (Yu & Cho, 2016). The results indicated no significant relationship between BMI and cognitive function based on numerical data (p=0.399), consistent with Ko et al (2019) research, which found no significant correlation between body mass index and cognitive impairment. Regarding MOBA and non-MOBA game types/genres with cognitive status, the results were not significant (p=0.050), in accordance with prior studies showing a positive correlation between IGD and the duration of internet/gaming activities (Bargeron & Hormes, 2017). Insignificant results were also observed between the type of gadget and a decline in cognitive function (p=0.557), contradicting Choi et al (2015) research suggesting a relationship between the type of gadget and a decline in cognitive function. The data, including duration and type of game, can serve as a reference for multivariate analysis.

Table 4. Results of Bivariate Analysis of External Variables on the Incidence of Cognitive Status Disorders

		Cognitive Function			**p**
		Median	**Minimum**	**Maximum**	
Age		32.00	25.00	37.00	0.740*
Gender	Male	32.00	25.00	37.00	0.864
	Female	32.00	25.00	37.00	
	Underweight	32.00	25.00	37.00	0.399**

Nominal BMI	Normal	32.50	25.00	37.00	
	Overweight	31.50	25.00	37.00	
	Obese	34.50	32.00	37.00	
Duration	> 3 hours/day	32.00	25.00	37.00	0.143
	< 3 hours/day	34.00	25.00	37.00	
Types of Gadgets	Smartphone	32.00	25.00	37.00	0.557**
	Computer	33.50	26.00	37.00	
	Both	32.00	25.00	37.00	
Game Type	MOBA	32.00	25.00	37.00	0.050**
	MMORPG	32.00	25.00	37.00	
	MMOFPS/TPS	34.50	25.00	37.00	
	Others	32.00	26.00	37.00	

Note: MOBA= *multiplayer online battle arena;* *=Spearman correlation, Mann Whitney;**= Kruskal Wallis test

Multivariate Analysis of Variables that influence cognitive status disorders

Multivariate analysis was conducted using linear regression, incorporating variables with p values <0.25 in the bivariate test, specifically IGD, duration of internet activity, and game type/genre. The calculation results revealed that the primary factor influencing cognitive status was IGD (p=0.050), while age, gender, BMI, duration of internet activity, type of gadget, and type/genre of games did not demonstrate significance (p>0.05).

Table 5. Multivariate Analysis of Variables that Influence Cognitive Status Disorders

	B	**p**	**95.0% Confidence Interval for B**		**R^2**
			Lower Bound	**Upper Bound**	
(Constant)	28.062	.000	25.400	30.725	0.469
IGD	1.607	.005	.501	2.714	
Duration	.775	.169	-.333	1.883	
game type/genre	.318	.265	-.243	.879	

Note: *p<0.05; IGD=*Internet Gaming Disorder*

Discussion

The provided data indicates no significant correlation between age and cognitive status (p=0.74). This contrasts with prior research suggesting that age is a factor influencing cognitive status disorders (Paik et al, 2017). Statistical tests do not yield significant results concerning the relationship between gender and IGD sufferers (p=0.864). Although not statistically significant, this finding aligns with previous studies indicating a higher prevalence of IGD among men than women (Yu & Cho, 2016). The results also demonstrate no significant association between BMI and cognitive function based on numerical data (p=0.399). This is in accordance with research by Ko et al (2019), which found no significant relationship between body mass index and cognitive impairment. In terms of MOBA and non-MOBA game types/genres with cognitive status, the results are not significant (p=0.050), consistent with prior studies showing a positive correlation between IGD and the duration of internet/gaming activities (Bargeron & Hormes, 2017). The analysis does not reveal a significant relationship between the type of gadget and a decline in cognitive function (p=0.557). This contradicts Choi et al. (2015) research, which stated that there was a relationship between the type of gadget and

a decrease in cognitive function. The data identified can be used as a reference for inclusion in multivariate analysis, particularly focusing on the duration and type of game.

In the multivariate analysis, only Internet Gaming Disorder (IGD) exhibited a significant impact on cognitive function with a p-value of 0.005 ($p<0.05$). Conversely, the duration and type of game does not show significance for cognitive function ($p>0.05$). The regression coefficient (B) for IGD is 1.607, indicating that subjects with IGD have a cognitive function score 1.607 lower than those without IGD. The coefficient of determination (R^2) is 0.469, meaning that the IGD variable and type of game contribute to a 46.9% influence on cognitive function, with the remaining variance attributed to other factors.

Conclusion

This study highlights the significant impact of Internet Gaming Disorder (IGD) on the cognitive function of junior high school students in urban Yogyakarta. Adolescents with IGD demonstrated compromised abilities in specific cognitive domains, notably attention, recall, and language. The findings emphasize that IGD is a critical factor influencing cognitive impairments, as evidenced by its significant correlation ($p=0.005$) and explanatory power ($R^2=0.469$) for cognitive function variations. Although variables such as age, gender, BMI, duration of internet activity, and game type were analyzed, none showed a significant direct relationship with cognitive status. This underlines IGD as a predominant factor compared to other demographic and behavioral characteristics. The study contributes to the growing body of evidence on the adverse effects of IGD and calls for targeted interventions to mitigate its impact on adolescents' cognitive health. Future research could explore broader contextual factors and intervention strategies to address IGD and its consequences.

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