The Correlation Between Internet Addiction Symptoms Level with Depressive Symptoms Level in High School Adolescent during COVID-19 Pandemic

Oni As'ad Hadi[a], Soetjipto[b]

[a] *dopendips@gmail.com*
[a]*Faculty of medicine, Jl. Prof. DR. Moestopo No.47, Pacar Kembang, Kec. Tambaksari, Surabaya, East Java and 60132, Indonesia*
[b]*Department of Psychiatry, l. Prof. DR. Moestopo No.6-8, Airlangga, Kec. Gubeng, Surabaya, East Java and 60286, Idnonesia*

Abstract

Internet addiction is an excessive internet use which resulting in social withdrawal and poor performance. If continued, it can have an impact on other symptoms such as depression. This is supported by the COVID-19 pandemic situation which requires adolescents to learning by online.

This study was a cross-sectional analytic that used high school student of SMA Al Hikmah Surabaya as population. This study used random sampling as sampling method. The data was taken at SMA Al Hikmah, Surabaya on January of 2022. 99 respondents which meet the criteria were subjects who agreed to informed consent. The data was taken using Kuesioner Diagnostik Adiksi Internet (KDAI) questionnaire and Beck Depression Inventory (BDI) questionnaire.

The highest results in internet addiction symptoms were found in normal values (54.5%). Meanwhile, the highest depressive symptom results were minimal or normal (53.5%). The Chi-Square test showed a significant association between the level of symptoms of internet addiction and the level of depressive symptoms (p=0.024).

There is a significant correlation between the level of symptoms of internet addiction and the level of depressive symptoms in high school students.

Keywords: Adolescent; depression; COVID-19; internet addiction; social isolation

1. Main text

1.1 Introductions

In this era of globalization, the internet is a tool for people to get information remotely and as a medium for education. The development of the internet could also bring a negative impact called the internet addiction (IA). Internet addiction is identified as excessive internet use that triggers social isolation behavior, emotional disturbances, time consuming, and symptoms of dysthymia.[1,2] A study using a total sampling method spread across 34 provinces in Indonesia stated that in 2020, 14.4% of adults had internet addiction. The duration of excessive internet use is also a major predilection factor for internet addiction, followed by the use of social media and online games.[3]

On the other hand, depression is a serious medical event that causes a person to feel sad and/or lose interest in something. Areas in the brain such as anterior cingulate and prefrontal cortex, subgenual cingulate, and ventrial striatum will decrease.[4] Low levels of serotonin trigger the increase of 5HT1A receptor in the hippocampus and cortisol, resulting stress and migraines symptomps.[5] Symptoms such as loss of appetite, lack of energy, difficulty sleeping, and suicide ideation can also be recognized within two weeks.[6] Nationally, only 38.14% of patients in Indonesia received treatment, with the lowest in the eastern side of the country.[7] A study in Surabaya showed as much as 9.5% of the total sample experienced depression, achieving higher results than the provincial scale (4.4%) and the national scale (6.1%).[8]

COVID-19 pandemic has forced the government to impose large-scale social restrictions or physical distancing in Indonesia to reduce the virus from spreading. This regulation lead people to use more internet in their daily activities to communicate, which causes 52% increase from before the pandemic.[3] One of the community part which have been impacted is high school student. Online learning forces them to use the internet more often which could lead to internet addiction. There had yet to be any data showing the impact of increase use of internet in high school student during COVID-19 pandemic. A cross sectional study conducted in America shows that excessive internet use with social isolation symptoms could lead to depression.[9] To bridge this gap, this study aims to examine the correlation between internet addiction symptoms level and depressive symptoms level, especially in high school adolescents.

1.2 Methods

This research was an analytical observational study with a cross-sectional method to find the correlation between the two variable. The independent variable was the internet addiction symptoms level, meanwhile the dependent variable was depressive symptoms level. This research was also conducted in SMA Al Hikmah Surabaya with the population of 708 high school adolescents. Ethical clearance were approved by the ethics commission of the Faculty of Medicine Universitas Airlangga with the number 285/EC/KEPK/FKUA/2021.

The sample of this research was SMA Al Hikmah Surabaya students which were determined by using random sampling. A minimum of 94 respondent were required from the cross sectional formula. The students were given informed consent form which to be signed by their parents. The questionnaires were sent through google form to maintain physical distancing. After being sorted with the inclusion and exclusion criteria, 99 respondent were qualified as respondents. Participants were instructed to filed two questionnaires required for this research, Kuesioner Diagnostik Adiksi Internet (KDAI) and Beck Depression Inventory (BDI).

The data were analyzed using two methods. Univariate method was used to describe the number of

internet addiction and depression in the school. Bivariate method analyzed the relationship between internet addiction and depression using SPSS (Statistical Package for Social Sciences) with the chi-square formula.

1.3. Results

1.3.1.Characteristic of subjects

This study included 99 Al Hikmah Surabaya students consisted with 22 males (22,2%) and 77 females (77,8%). The age was ranging between 14 and 18 years old, which dominated by 15 years old. Most respondents used handphone (98,9%) followed by laptop (89,8%) as their electronic device for using internet. The highest group of internet usage duration was 5-10 hours per day.

Table 1. Distribution of subject characteristic of SMA Al Hikmah Surabaya students in 2022

No.	Characteristic Distribution	Category	n	%
1	Sex	Male	22	22,2
		Female	77	77,8
2	Age	14	1	1
		15	33	33,3
		16	29	29,3
		17	29	29,3
		18	7	7,1
3	The use of internet[1]	Online learning	95	96
		Social media	94	94,9
		Online gaming	51	51,5
		Entertainment	12	12,1
		Information	11	11,1
		Online transportation	2	2
		Online shop	2	2
		Others	4	4
4	Electronic devices used for internet[1]	Handphone	98	98,9
		Tablet	20	20,2
		Laptop	89	89,8
		TV	3	3
		Computer	3	3
5	Internet usage duration	< 3 hour	4	4
		3-5 hour	11	11,1

	5-10 hour	57	57,6
	> 10 hour	27	27,3

[1] Respondent may chose more than one answer

1.3.2. Data Results

Table 2. Distribution of KDAI of SMA Al Hikmah Surabaya students in 2022

KDAI	Sex				n	%
	Male		Female			
	f	%	f	%		
Normal	8	36,3	46	59,7	54	54,5
Internet Addiction	14	63,7	31	40,3	45	45,5
Total Respondents	22	100	77	100	99	100

Table 3. Distribution of BDI of SMA Al Hikmah Surabaya students in 2022

BDI	Sex				n	%
	Male		Female			
	f	%	f	%		
Minimal	16	72,7	37	48,1	53	53,5
Mild	4	18,3	13	16,9	17	17,2
Moderate	1	4,5	16	20,7	17	17,2
Severe	1	4,5	11	14,3	12	12,1
Total Respondents	22	100	77	100	99	100

Based on the table presented, the distribution of KDAI data shows that from 99 respondents, the level of internet addiction is mostly in the normal category with a total of 54 respondents or 54.5%. The majority of male had internet addiction with a total of 14 respondents or 63.7% of all male respondents, while in female it is found the majority was in the normal category with a total of 46 respondents (59.7%). On the other hand, the distribution of BDI showed that most respondents had minimum depressive symptoms level with 53 respondents (53.5%). Male and female respondents also had the highest number in the minimal category with 16 respondents (72.7%) and 37 respondents (48.1%) respectively.

Table 4. The correlation between internet addiction symptoms level and depressive symptoms level of SMA Al Hikmah Surabaya students in 2022

Variable		KDAI				p[1]
		Normal	%	IA	%	
BDI	Minimal	36	36,3	17	17,1	0,024
	Mild	7	7	10	10,1	
	Moderate	5	5	12	12,1	
	Severe	6	6	6	6	

[1]The result of Chi-Square Test

The correlation on table 4 between KDAI and BDI showed the Chi-Square test results with a significance value of p = 0.024 (<0.05) indicating the correlation the internet addiction symptoms level and depressive symptoms level.

Table 5. The correlation between internet addiction symptoms level and depressive symptoms level of male students of SMA Al Hikmah Surabaya in 2022

Variable		KDAI				p[1]
		Normal	%	IA	%	
BDI	Minimal	8	36,3	8	36,3	0,194
	Mild	0	0	4	18,1	
	Moderate	0	0	1	4,5	
	Severe	0	0	1	4,5	

[1]The result of Chi-Square Test

Table 5 shows the results of the male respondent's Chi-Square test on KDAI and BDI. The value data shows a significance of p = 0.194 (> 0.05) indicating no correlation between the variables.

Table 6. The correlation between internet addiction symptoms level and depressive symptoms level of female students of SMA Al Hikmah Surabaya in 2022

Variable		KDAI				p[1]
		Normal	%	IA	%	
BDI	Minimal	28	36,3	9	11,6	0,022
	Mild	7	9	6	7,7	
	Moderate	5	6,4	11	14,2	
	Severe	6	7,7	5	6,4	

[1]The result of Chi-Square Test

Based on table 6, the result of the Chi-Square test for only female respondents shows a significance value of p = 0,022 (0,05) indicating a correlation between internet addiction symptoms level and depressive symptoms level.

1.4 Discussions

The Based on the subject's characteristic, 96% of the respondents claimed their use of the internet by online learning. Research conducted by Magdalena, et al. showed during the COVID-19 pandemic, online learning considered as an effective method for teacher-student interactions. This is supported by Zoom or Google Meet web applications provide attractive appearances in learning such as quizzes with animations,

video content, and the easiness of sending and receiving material sources.[10] However, online learning had a few drawbacks such as distinctive learning patterns for students which lead to more assignments, boredom, and lack of enthusiasm.[11]

Descriptive qualitative research conducted at SMA Muhammadiyah 4 Porong, Indonesia showed that even though schools have developed learning strategies during the COVID-19 pandemic that are in accordance with the recommendations of the Indonesian Minister of Education, students still feel burdened. KI (Kompetensi Inti) and KD (Kompetensi Dasar) targets that have not adapted to online learning conditions make the assignments given very large. The teacher can only evaluate students' understanding through the assignments given. The interaction between teachers and students cannot be maximized due to a lack of question and answer sessions.[12] Likewise in Finland, both students and teachers have difficulty learning online. For students, they need more discipline to be able to take part in learning, not forgetting also the lack of social interaction. Nearly half of the teachers had difficulty interacting with students because not all of them turned on their cameras. Even so, there are still good impacts that can arise such as students who do not have the motivation to come to school can enjoy their time studying outdoors with good weather. Technology provides them with different learning methods such as simulations, DVDs, Kahoots, and others so that they can be motivated even during the COVID-19 pandemic.[13]

In addition, 94% of respondents also use the internet to access social media. During the COVID-19 pandemic, social media has a positive impact on means of communication, entertainment, and a method for online learning. Even though, negative impacts such as cyberbullying, anxiety due to COVID-19 news, tendency to lose track of time could arise.[14] Qualitative and quantitative research in Slovakia showed social media as a credible educational medium for high school teachers and students. Online learning takes various forms such as online courses via YouTube (collaborative learning), emphasizing practical learning (self-learning), studying and creating projects in groups (collaborative learning), as well as gathering information from various educational institutes via Facebook (media social nets).[15]

In the next demographic data, it can be seen that 84.9% of respondents spend more than 5 hours on the internet a day with 98.9% using mobile phones. Although the use of mobile phones is considered to be able to maintain relationships between friends, the use of more than 4 hours a day will increase the tendency for addiction.[16] Students can experience a decrease in academic performance, liveliness, participation in school activities, until signs of depression appear.[17]

KDAI showed the highest result was in the normal category with 54 (54.5%) respondents. This result were consistent with the research conducted in Yogyakarta which showed 74% students had no internet addiction.[18] A study in Bangladesh also showed the same results and stated irregular internet use can affect

a person's quality of life and reducing time to socialize, despite it is not strongly correlated with the use for educational purposes.[19] Research in China reported a 23% increase in the prevalence of internet addiction during the COVID-19 pandemic, followed by an increase in relapses in alcohol and other addictive substances. Internet addiction also has a significant relationship with maternal and paternal well-being in a family. Adolescent with permissive parenting style have difficulties in controlling their impulses with the internet. Therefore, the role of parents is very important in monitoring internet use for children at home. In order to reduce internet use, parents need to set a good example by participating in social activities and fostering a positive environment.[20]

The highest score on KDAI is in point 3 in the form of "My life feels more comfortable when I am on the Internet". Research conducted by Zhao and Zhou explains one form of internet use which is social media played an important role as stress reliever during the COVID-19 pandemic. Being active in social media brought the advantage of establishing long-distance social relationships, personal well-being, and reducing desolation. Therefore, it is very possible that someone who is experiencing prolonged stress during the COVID-19 pandemic has a social media addiction.[21]

BDI results showed normal results (minimum level of depressive symptoms) in 53 (53.6%) respondents and depression (mild, moderate, and severe depressive symptoms) in 46 (46.4%) respondents. These results are consistent with the research conducted at SMAN 4 Denpasar, Indonesia which showed 30% of total respondents had mild to severe depression. Depression also shown to have strong correlation with decrease academic achievement ($p = 0.004$).[22] The same result were also obtained in West India with a prevalence of depressive symptoms of 43.4%. Negative environmental factors, such as peer pressure, physical abuse, and negative parental influences, can cause depression in adolescent.[23] However, a study in Chandigarh, North India showed different result with a higher prevalence of depression at 55%. This could be caused by Chandigarh, an advance city with high level of competitiveness in school exams. In addition, early detection and counselling in depression is still inadequate compared to countries such as the United States.[24]

The highest score on BDI questionnaire were in “self-critical”. People with depression have a tendency to blame themselves if bad things happened.[25] People with hypercritical mindset are likely to show depressive symptoms such as feeling inadequate, unworthy, and low self-esteem.[26] Although people with depression have difficulty changing their negative self-image, the symptoms of depression would reduce by decreasing excessive critical thinking.[27]

The results of the analysis between internet addiction symptoms level and the depressive symptoms level showed a significant correlation ($p = 0.024$). Most respondents who do not have internet addiction also

have minimal levels of depressive symptoms. These results are supported by research conducted by Seki et al. stated the level of internet addiction symptoms was related to the level of depressive symptoms. The greater the level of depression a person has, the greater the level of internet addiction can arise.[28] The use of mobile phones and social media is also strongly correlated with internet addiction, which is in line with the subject's in this study with 98,9% and 94% respectively. In addition, the research conducted in Korea supports this study by stating depressive symptoms have the greatest impact on the emergence of internet addiction symptoms. Depression in adolescents has different characteristics than adults such as the emergence of impulsiveness, aggressive behavior, and irritability which projected to others. Those who chose to hold back depression internally would withdraw from social interaction and avoid current problems. Some adolescent who have depression chose to vent their negative emotions through the internet or playing PC, which also has the potential to increase the risk of internet addiction.[29] However, research by Kraut et al. showed different relationship results by dividing the sample with introverted and extroverted personalities. Extroverts were considered to have more positive impact from using the internet due to its association with increasing community participation and reducing feelings of loneliness. Introverts would obtain detrimental impact because they don't usually participate in the environment which lead to sense of loneliness, insecurity, and other negative impacts.[30]

A total of 17 adolescents get internet addiction results, but have a minimal level of depressive symptoms. This is because internet addiction can also be influenced by other causes, such as substance abuse. The internet makes it easy for people with substance abuse to obtain prohibited substances. The more often they use the internet, the easier internet addiction can occur. In parts of the brain of people with substance abuse and internet addiction, there are disturbances in the function of visual images and memory. In addition, smoking also has a strong relationship with internet addiction because it is thought to originate from the same underlying disease, even though it has different symptoms.[31] Morioka et al. found that smoking and internet addiction originate from the activation of the same brain area.[32]

In adolescents who have symptoms of severe depression, 6 of them do not have internet addiction results. This can be caused because depression has causes from various other perspectives such as from genetic, endocrine, and immunological factors. Genetic factors contribute to depression with associated genes such as alipoprotein (APOE ε2 and APOE ε4), guanine nucleotide-binding protein (GND3), methylenetetrahydrofolate reductase (MTHFR 677T), dopamine transporter (SLC6A3), serotonin transporter (SLC6A4) and dopamine genes receptors (DRD 4). Whereas in endocrine factors, the HPA axis can experience dysfunction, causing excessive personal guilt and hopelessness, decreased appetite, weight loss, decreased sexual behavior, disturbed sleep, altered psychomotor activity, and overactive responses to

psychological stressors. Then on immunological factors, pro-inflammatory cytokines stimulate receptors in the brain to initiate a combination of behavioral responses such as hyperthermia, nausea, loss of appetite, sleep disturbances, anhedonia, easy obesity, and loss of interest in socializing.[33]

The research analysis also showed a different relationship based on gender. Female respondents had a significant relationship to the two symptoms in the study compared to male. Depression contributes to the severity of internet addiction due to manifestations of childhood trauma. Childhood trauma in female is considered to contribute more to the emergence of internet addiction compared to boys, even though the experiences of trauma experienced by boys are more severe.[34] The previous study by Shi et al. also found that childhood trauma had a significant impact on online gaming behavior in adolescents among university students, and depression significantly mediated the relationship between childhood trauma and online gaming. In addition to depression, childhood trauma can trigger the emergence of alcohol addiction and pathological gambling behavior, which has a close relationship with addictive behavior.[35] Different results were obtained in a study by Liang et al. which stated that depression can significantly predict the occurrence of internet addiction in male, but does not apply other way around.[36] Depression cognitively interferes with the individual's ability to self-regulate resulting in internet addictions. Compared to female, men tend to suppress emotions internally or avoid expressing emotions so they lack emotional regulation strategies. Ko et al. suggested that efforts to get rid of depression and other problems using online activities can lead to a bad cycle that exacerbates depression itself.[37]

1.5 Conclusions

Based on the result of data analysis, most respondents in SMA Al Hikmah Surabaya were in normal range of internet addiction and having minimal level of depressive symptoms. It is also concluded that there is a correlation between the internet addiction symptoms level and depressive symptoms level. For future research, the research needs a direct approach to the respondents in order to avoid miscommunication and misunderstanding in filling out the questionnaire.

Acknowledgements

The authors would like to thank SMA Al Hikmah Surabaya for their generosity and willingness to provide respondents in this study.

References

1. Fradelos evangelos C, Kourakos M, Velentza O, Polykandriotis T, Papathanasiou I V. Internet addiction in children and adolescents: etiology, signs of recognition and implications in mental health nursing practice. Med Res Chronicles [Internet]. 2016;3(4):264–72.
2. Rahmawati NA, Setiawati Y, Ardani GAI, Zain E, Pereira-Sanchez V. Internet gaming disorder in an adolescent during the COVID-19 pandemic: a case report. Pan Afr Med J. 2022;41(June).
3. Siste K, Hanafi E, Sen LT, Christian H, Adrian, Siswidiani LP, et al. The Impact of Physical Distancing and Associated Factors Towards Internet Addiction Among Adults in Indonesia During COVID-19 Pandemic: A Nationwide Web-Based Study. Front Psychiatry. 2020;11(September):1–11.
4. Arini Izzah D, Yitnamurti S, Rehatta NM. Prevalence of Depression in First-Year Medical Students At Universitas Airlangga, Surabaya, Indonesia. Maj Biomorfologi. 2021;31(2):39.
5. Bintari DC, Sudibyo DA, Karimah A. Correlation between depression level and headache severity: A study among medical students during the COVID-19 pandemic. Narra J. 2021;(May):1–16.
6. Torres F. What is depression? American Psychiatric Association [Internet]. 2020;5(1):20–2.
7. Riset Kesehatan Dasar. Situasi Kesehatan Jiwa DI Indonesia. InfoDATIN. 2019. p. 12.
8. Maramis MM, Pantouw JG, Lesmana CBJ. Depression screening in Surabaya Indonesia: Urgent need for better mental health care for high-risk communities and suicide prevention for men. Int J Soc Psychiatry. 2021;67(5):421–31.
9. Christakis DA, Moreno MM, Jelenchick L, Myaing MT, Zhou C. Problematic internet usage in US college students: A pilot study. BMC Med. 2011;9.
10. Magdalena I, Sahara AM, Tazkiah D, Mahira NSS, Septiani R, Qolbi I. Efektifitas Penggunaan Media Online Dalam Meningkatkan Hasil Belajar Siswa di Masa Pandemi COVID-19 di SDN Cikokol 3. Ed 33. 2021;3:377–91.
11. Fauziyah N. Dampak Covid-19 Terhadap Efektivitas Pembelajaran Daring Pendidikan Islam. Al-Mau'Izhoh. 2020;2(2):1–11.
12. Amrullah M, Hanim M. Learning Strategies at SMA Muhammadiyah 4 Porong During Covid-19 Pandemic. Proc ICECRS. 2021;10.
13. Niemi HM, Kousa P. A Case Study of Students' and Teachers' Perceptions in a Finnish High School during the COVID Pandemic. Int J Technol Educ Sci. 2020;4(4):352–69.
14. Zahara S, Mulyana N, Darwis RS. Peran Orang Tua Dalam Mendampingi Anak Menggunakan Media Sosial Di Tengah Pandemi Covid-19. J Kolaborasi Resolusi Konflik. 2021;3(1):105.
15. Tkacová H, Králik R, Tvrdoň M, Jenisová Z, Martin JG. Credibility and Involvement of Social Media in Education—Recommendations for Mitigating the Negative Effects of the Pandemic among High School Students. Int J Environ Res Public Health. 2022;19(5):1–22.
16. Aljomaa SS, Mohammad MF, Albursan IS, Bakhiet SF, Abduljabbar AS. Smartphone addiction among university students in the light of some variables. Comput Human Behav [Internet]. 2016;61:155–64.
17. Utami AN, Kurniawati F. Dampak Negatif Adiksi Penggunaan Smartphone terhadap Aspek-Aspek Akademik Personil Remaja. Perspekt Ilmu Pendidik. 2019;33(1):1–14.

18. Juniarti D, Kristanto CS, Ismanto SH. Hubungan antara Adiksi Internet dengan Gangguan Emosi dan Perilaku pada Siswa SMA di Kota Yogyakarta. Diss Univ Gadjah Mada. 2020;
19. Jahan I, Hosen I, Al Mamun F, Kaggwa MM, Griffiths MD, Mamun MA. How has the covid-19 pandemic impacted internet use behaviors and facilitated problematic internet use? A bangladeshi study. Psychol Res Behav Manag. 2021;14:1127–38.
20. Putri AN, Setiawati Y, Shieh YT, Lin S-H. High-Risk Internet Addiction in Adolescents. J Berk Epidemiol. 2022;10(1):11–20.
21. Zhao N, Zhou G. COVID-19 Stress and Addictive Social Media Use (SMU): Mediating Role of Active Use and Social Media Flow. Front Psychiatry. 2021;12(February):1–8.
22. Praptikaningtyas AAI, Wahyuni AAS, Aryani LNA. Hubungan Tingkat Depresi pada Remaja dengan Prestasi Akademis Siswa SMA Negeri 4 Denpasar. J Med Udayana [Internet]. 2019;8(7):1–5.
23. Chauhan PA, Rupani MP. High-risk health behaviors predict depression among school-going adolescents: the need for integration of mental health with school health program in India. J Community Psychol. 2021;49(6):1891–903.
24. Chauhan S, Lal P, Nayak H. Prevalence of Depression among School Children aged 15 years and above in a Public School in Noida, Uttar Pradesh. J Acad Ind Res [Internet]. 2014;3(6):269–73.
25. Beck AT. Thinking and Depression: II. Theory and Therapy. Arch Gen Psychiatry. 1964;10(6):561–71.
26. Blatt SJ, Homann E. Parent-child interaction in the etiology of dependent and self-critical depression. Clin Psychol Rev. 1992;12:47–91.
27. Beck A, Rush J, Shaw B, Emery G. Cognitive therapy of depression. Oxford Handb Mood Disord. 1979;411–22.
28. Seki T, Hamazaki K, Natori T, Inadera H. Relationship between internet addiction and depression among Japanese university students. J Affect Disord [Internet]. 2019;256(July):668–72.
29. Ha JH, Kim SY, Bae SC, Bae S, Kim H, Sim M, et al. Depression and internet addiction in adolescents. Psychopathology. 2007;40(6):424–30.
30. Kraut R, Kiesler S, Boneva B, Cummings J, Helgeson V, Crawford A. Internet paradox revisited. J Soc Issues. 2002;58(1):49–74.
31. Nur Rahmawati AI. Internet Addiction pada Remaja Pelaku Substance Abuse: Penyebab atau Akibat? Bul Psikol. 2018;26(1):64–70.
32. Morioka H, Itani O, Osaki Y, Higuchi S, Jike M, Kaneita Y, et al. Association between Smoking and Problematic Internet Use among Japanese Adolescents: Large-Scale Nationwide Epidemiological Study. Cyberpsychology, Behav Soc Netw. 2016;19(9):557–61.
33. Jesulola E, Micalos P, Baguley IJ. Understanding the pathophysiology of depression: From monoamines to the neurogenesis hypothesis model - are we there yet? Behav Brain Res [Internet]. 2018;341:79–90.
34. Dong X, Zhang R, Zhornitsky S, Le TM, Wang W, Li CSR, et al. Depression mediates the relationship between childhood trauma and internet addiction in female but not male chinese adolescents and young adults. J Clin Med. 2021;10(21):1–16.
35. Shi L, Wang Y, Yu H, Wilson A, Cook S, Duan Z, et al. The relationship between childhood trauma and Internet gaming disorder among college students: A structural equation model. J Behav Addict. 2020;175–180.
36. Liang L, Zhou D, Yuan C, Shao A, Bian Y. Gender differences in the relationship between internet addiction and depression: A cross-lagged study in Chinese adolescents. Comput Human Behav [Internet]. 2016;63:463–70.

37. Ko CH, Liu TL, Wang PW, Chen CS, Yen CF, Yen JY. The exacerbation of depression, hostility, and social anxiety in the course of Internet addiction among adolescents: A prospective study. Compr Psychiatry [Internet]. 2014;55(6):1377–84.