Iranian Journal of Health Psychology
Vol. 4, No.2, Serial Number 8, p.9-20, Spring 2021

Received: 09/28/2020
Accepted: 01/15/2021
Paper Type: Research Paper

Improving the Health-Related Quality of Life in Adolescents with Internet Gaming Disorder

Saeed Nasiry*[1], Zahra Ebrahimi[2], Arash Monadjem[3]

Abstract

Objective: The present study aimed to examine whether the treatment of Internet Gaming Disorder (IGD) in adolescents via Attentional Bias Modification (ABM) improves their health-related quality of life.

Method: 34 adolescents with IGD who were 12-17 years old were randomly assigned to experimental (n = 16) and control (n = 18) groups. The experimental group received ABM, while no interventions were delivered to the control group. Attentional bias, IGD severity, and health-related quality of life were assessed using Modified Stroop Task, Internet Gaming Disorder-20 (IGD-20), and KIDSCREEN-52 questionnaires, respectively. Data from pre-test, post-test, and two months follow-up measurements were analyzed using two-way mixed measures ANOVA and Fisher's least significant difference (LSD) via SPSS software.

Results: ABM successfully reduced attentional bias and IGD severity and improved health-related quality of life in adolescents of the experimental group ($p < 0.05$). These significant changes were observed at post-test and two months follow-up. Meanwhile, no significant change occurred in the control group ($p > 0.05$).

Conclusion: It could be concluded that ABM not only reduces the severity of IGD in adolescents, but also improves their health-related quality of life, although further research is required for the understanding of its mechanisms of effects.

Keywords: Internet Gaming Disorder, Quality of Life, Health Promotion, Attentional Bias Modification, Adolescents.

Introduction

Internet gaming is one of the most common activities among youth and adults and is regarded as a harmless or even beneficial activity if done in a controlled amount (Wilms, Petersen & Vangkilde, 2013). About 2 billion people engage in internet gaming regularly across the world (Jeromin, Rief & Barke, 2016). Among them, about 0.2 to 8.7 lose control over their behavior, leading to Internet Gaming Disorder (Gentile, 2009). This disorder is temporarily added to the third section of the last version of the Diagnostic and Statistical Manual of Mental Disorders (DSM 5) and is conceptualized as frequent and continuous preoccupation with the use of Internet games which leads to clinically significant distress and impairment (Argyriou, Davison & Lee, 2017). The diagnostic criteria for this disorder are based on substance use disorder and gambling disorder (Jeromin, Nyenhuis & Barke, 2016). Further research needs to be conducted before IGD could be recognized as a definite clinical disorder (Pontes & Griffiths, 2015).

Previous research has revealed that IGD has several negative influences on physical and mental health, including but not limited to dietary issues, sleeping problems, deficits in occupational and educational function, interpersonal difficulties, increase of anxiety, stress, and depression, and decrease of well-

1. MSc, Department of Clinical Psychology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2. Associate Professor, Department of Psychology and Educational Sciences, Arak University, Arak, Iran.
3. MSc, Department of Psychology and Educational Sciences, University of Tehran, Tehran, Iran.
* Corresponding Author: Saeed Nasiry, Email: snasiry@sbmu.ac.ir

being (J Kuss, D Griffiths, Karila, & Billieux, 2014; Jeromin, Nyenhuis, et al., 2016; Kuss & Griffiths, 2012; Lam, 2014; Sublette & Mullan, 2012). These extensive adverse effects of IGD on physical and mental health demonstrate the importance of exploring different aspects of this understudied disorder in health psychology.

IGD is similar to substance use disorders and gambling disorder in terms of diagnosis criteria, clinical features, comorbid disorders, genetic factors, responsiveness to therapy, and underlying cognitive processes (Yau & Potenza, 2015). One of the processes which have been of particular interest in the cognitive theories of etiology and maintenance of addictive behaviors is selective attention to information. Attention is the central core of many aspects of cognition and influences perception, memory, language, and problem solving (Aghayousefi, Zare, & Mohammadi, 2018). Based on cognitive theories, people with addictive behaviors pay more attention to information and stimuli related to the object of their addiction, a phenomenon which is known as attentional bias (Metcalf & Pammer, 2011). There is substantial and growing evidence, indicating that addictive disorders are associated with attentional bias (Field & Cox, 2008; Hønsi, Mentzoni, Molde, & Pallesen, 2013), for example, youth and young adults who suffer from IGD, exhibit an attentional bias towards game-related stimuli (Chia & Zhang, 2020; van Holst et al., 2012). Also, the results of a study conducted in Iran suggest that lack of attentional control is associated with addictive behaviors in youth (Azarmehr & Ahmadi, 2020).

Since empirical evidence has demonstrated that attentional bias is associated with a wide variety of mental disorders (Ziaee, Fadardi, Cox, & Yazdi, 2016), researchers have explored different ways of manipulating attentional bias. These methods, which are collectively known as Attentional Bias Modification (ABM), are interventions designed by adjusting the methods of assessing attentional bias, in a way that trains the participants to focus their attention towards a certain kind of stimuli (increased attentional bias) or shift their attention away from a certain kind of stimuli (reduced attentional bias). It has been observed that ABM effectively reduces attentional bias in many psychological disorders like substance use disorders, gambling disorder, anxiety disorders and mood disorders (Browning, Holmes, & Harmer, 2010; Heitmann, Bennik, van Hemel-Ruiter, & de Jong, 2018; MacLeod & Clarke, 2015; Wittekind et al., 2019). A preliminary study has also revealed that ABM can reduce attentional bias in people with IGD and ameliorate the severity of their disorder (Rabinovitz & Nagar, 2015). Although that study was an essential step towards understanding IGD and its treatment, it had limitations that warrant further research. For instance, only adult males were included in that study, merely one session of ABM was implemented, no follow-up measurements were conducted, and no information was provided regarding the effects of ABM on health-related quality of life, which is one of the severe impairments associated with IGD (Fazeli et al., 2020; Wartberg, Kriston, & Kammerl, 2017). Pharmacotherapy with serotonin reuptake inhibitors can only improve one aspect of quality of life (psychological health) in individuals with IGD (Lim et al., 2016), and it is essential to investigate the extent of ABM's effect on the quality of life, especially since previous research has demonstrated that successful modification of cognitive biases can improve quality of life (Dietel et al., 2020).

Considering the lack of enough research in the field of IGD as a newly recognized psychological disorder, especially regarding its treatment using the novel method of ABM, the purpose of the present study was to examine the effects of 8 sessions of online ABM on health-related quality of life in adolescents with IGD. Based on previous research, we hypothesized that a successful reduction of IGD severity through ABM would improve health-related quality of life in adolescents.

Method

This study was a quasi-experimental research with a control group and pre-test, post-test, and follow-up. The target population of the research was all the students in the middle schools and high schools of Tehran. The inclusion criteria were: 1) DSM-5 diagnosis of IGD, 2) having 12-17 years old, and 3) willingness to participate in the research. The study's exclusion criteria included: 1) having any severe physical illnesses requiring immediate therapy, 2) DSM-5 diagnosis of comorbid mental disorders, 3) receiving any psychological interventions, and 4) decision to terminate the participation in the research. Because of the Covid-19 quarantine, all of the procedures were carried out distantly.

Participants were sampled using the convenience sampling method via contacting the staff of several middle schools and high schools in various parts of Tehran and requesting them to introduce the study's website to their students to get more information about the study and start their online participation. Overall, 1024 students filled the Internet Gaming Disorder-20 (IGD-20) questionnaire, from which 59 students scored higher than 71 and diagnostic interviews with them were conducted via telephone. Among them, 36 students diagnosed with IGD, who did not have any comorbid disorders or severe illnesses and were not receiving any psychotherapeutic interventions, were selected as participants and were randomly assigned to experimental and control groups. Two participants did not complete their task and were excluded from the research. Finally, the data obtained from 34 students (11 females and 23 males) were used in this study, 16 of which belonged to the experimental group, and the other 18 were from the control group.

Ethical statements

All the ethical guidelines were considered in the present study, and the protocol of research was in accordance with the ethical principles of the 1975 declaration of Helsinki. All the participants received information about the purpose and the procedure of the study and could stop their participation at any time. Before starting the research, informed consent was obtained from all the participants and their mothers, and after the study ended, its results were explained to them. The participants of the control group had the option of receiving the intervention after getting informed about the study's results.

Measures

Internet Gaming Disorder-20 (IGD-20)

IGD-20 was utilized to assess IGD severity (Pontes, Kiraly, Demetrovics, & Griffiths, 2014). This questionnaire consists of of 20 items and 6 subscales: salience, mood modification, tolerance, withdrawal, conflict, and relapse. Previous research has revealed that IGD-20 is applicable for adolescents (Fuster, Carbonell, Pontes, & Griffiths, 2016; Shu M, Ivan Jacob, Meng Xuan, & Anise MS, 2019). Pontes et al. (2014) found out that IGD-20 has good structural validity (CFI = 0.93; RMSEA = 0.048), criterion validity (r = 0.77), and internal consistency (a = 0.88). The results of a study by Vahidi, Zamanzadeh, Musavi, Janani, and Namdar (2019) showed that the Persian version of IGD-20 has good structural validity (CFI = 0.93; RMSEA = 0.043), criterion validity (r = 0.35), internal consistency (a = 0.91), and test-retest reliability (r = 0.95).

KIDSCREEN-52

In order to evaluated health-related quality of life, KIDSCREEN-52 (Ravens-Sieberer et al., 2008) was utilized, which is a questionnaire for children and adolescents consisting of 52 items that measures multiple dimensions of health-related quality of life, including physical and psychological well-being, emotions and moods, relationships with family and peers, life at home and school, social acceptance and bullying, self-perception, financial resources, and autonomy. Ravens-Sieberer et al. (2008) demonstrated that this instrument has good structural validity (CFI = 0.97; RMSEA = 0.062), construct validity (r = 0.44 to 0.61), internal consistency (a = 0.77 to 0.89), and test-retest reliability (ICC = 0.56

to 0.77). Nik, Naenian, and Shairi (2014) confirmed that the Persian version of KIDSCREEN-52 has good structural validity (CFI = 0.97; RMSEA = 0.053), construct validity (r = 0.18 to 0.71), internal consistency (a = 0.65 to 0.89), and test-retest reliability (r = 0.58 to 0.85).

Modified Stroop Task

Attentional bias towards game-related stimuli was measured via the Modified Stroop Task, which was developed based on theoretical examinations and methodological guidelines provided by Cox, Fadardi, and Pothos (2006). In this task, participants are randomly presented with game-related and neutral words shown in different colors and are asked to name the color of each word as quickly and accurately as possible. The total time (in milliseconds) spent to respond to game-related stimuli minus the total time spent to respond to neutral stimuli is considered as a quantitative indicator of attentional bias towards game-related stimuli. Previous research has shown that the internal consistency (Splithalf correlation = 0.83 to 0.89) and test-retest reliability (r = 0.65 to 0.74) of the English version of this task is good (Brown et al., 2014). The psychometric properties of the Persian version of this task has also been confirmed with the Cronbach's alpha of 0.83 to 0.94 and the test-retest reliability of 0.80 to 0.91 (Khodadadi, Feyzi Daryati, Movahedi, & Ahmadi, 2014; Rasti & Taghavi, 2006).

Procedure

ABM was delivered online to the experimental group, and the control group received no interventions. Eightfold ABM sessions were conducted once every two days, and evaluations using IGD-20, KIDSCREEN-52, and Modified Stroop Task were conducted at pre-test, post-test and two months follow-up. Data were analyzed using two-way repeated measures ANOVA and Fisher's least significant difference (LSD) with the 26th version of SPSS software.

Attentional Bias Modification (ABM)

The first use of ABM as a method of altering attentional bias was conducted by MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) and was successful at reducing attentional bias towards threat-related stimuli and decreasing the participants' stress reactivity. Since then, ABM has been used as an intervention for a wide variety of psychological disorders, including substance use disorders, gambling disorder, anxiety disorders and mood disorders (Browning et al., 2010; Heitmann et al., 2018; MacLeod & Clarke, 2015; Wittekind et al., 2019). Because this method has not been previously implemented for the modification of attentional bias towards game-related stimuli, in this study ABM training was developed based on the training that Ziaee et al. (2016) designed for the modification of attentional bias towards drug-related stimuli. In this version of the training, game-related and neutral stimuli were used in lexical and pictorial format, and the number of sessions was increased from 3 to 8 sessions. In the first 4 sessions, single stimuli

Table 1. Demographic and Clinical Characteristics of the Participants at Baseline

Variable	Group		Statistic	p-Value
	Experimental	Control		
Age (years)	13.96 (1.52)	14.43 (1.18)	t = 1.01	0.31
Gender (male - female)	10 - 6	13 - 5	$x^2 = 0.36$	0.54
Education (middle school - high school)	7 - 9	10 - 8	$x^2 = 0.47$	0.49
Age of first gameplay (years)	7.28 (2.03)	8.41 (2.65)	t = 1.38	0.17
Weekly gameplay (hours)	20.88 (12.49)	22.57 (10.23)	t = 0.43	0.66

Table 2. Means and Standard Deviations of the Study's Dependent Variables

Variable / Measure	Group					
	Experimental			Control		
	Pre-test	Post-test	Follow-up	Pre-test	Post-test	Follow-up
Attentional Bias						
Modified Stroop Test	3314 (528)	1126 (413)	1359 (422)	3145 (315)	2964 (476)	3071 (540)
IGD Severity						
IGD-20	81.84 (14.29)	59.45 (16.81)	57.31 (15.63)	79.35 (16.24)	82.10 (17.51)	77.58 (14.85)
Salience	4.51 (1.06)	3.18 (0.89)	3.02 (0.86)	4.41 (1.08)	4.62 (1.13)	4.32 (1.06)
Mood Modification	3.96 (0.94)	3.42 (0.92)	2.95 (0.91)	3.90 (0.98)	4.12 (1.01)	3.81 (0.82)
Tolerance	3.65 (0.91)	2.71 (0.79)	2.76 (0.82)	3.83 (0.94)	3.92 (0.88)	3.86 (0.79)
Withdrawal	4.32 (1.02)	2.98 (0.81)	2.84 (0.85)	4.06 (1.03)	4.18 (0.96)	4.25 (0.97)
Conflict	3.79 (0.87)	2.57 (0.74)	2.63 (0.77)	3.62 (0.89)	3.96 (0.93)	3.48 (0.79)
Relapse	4.10 (0.83)	2.49 (0.76)	2.22 (0.73)	3.89 (0.91)	3.77 (0.84)	3.62 (0.77)
Health-Related Quality of Life						
KIDSCREEN-52	52.08 (16.43)	59.36 (14.92)	69.71 (15.20)	54.66 (18.47)	51.19 (17.83)	55.74 (15.71)
Physical Well-Being	53.36 (15.16)	60.33 (15.48)	62.81 (14.76)	49.13 (17.02)	44.91 (18.11)	53.61 (14.21)
Psychological Well-Being	49.09 (14.51)	58.23 (13.21)	74.54 (14.09)	60.36 (16.66)	52.42 (16.09)	60.49 (13.35)
Moods & Emotions	53.61 (15.43)	57.99 (13.60)	71.96 (14.17)	55.76 (16.84)	57.35 (15.33)	59.17 (13.44)
Self-Perception	58.12 (18.40)	65.22 (16.06)	72.15 (16.43)	53.91 (19.75)	50.46 (18.36)	58.29 (13.07)
Autonomy	55.07 (19.23)	61.14 (16.22)	67.03 (16.87)	52.63 (19.11)	53.52 (18.21)	56.43 (16.92)
Parent Relation & Home Life	53.16 (16.59)	62.67 (13.84)	74.08 (15.30)	60.33 (18.03)	55.19 (15.78)	58.94 (14.76)
Social Support & Peers	44.63 (16.51)	48.72 (14.93)	66.92 (16.39)	53.70 (18.34)	44.76 (19.26)	51.07 (16.88)
School Environment	49.31 (17.36)	56.11 (14.35)	60.97 (16.71)	48.84 (18.92)	47.26 (17.90)	44.38 (17.69)
Social Acceptance & Bullying	60.77 (14.41)	70.52 (13.57)	79.64 (14.99)	64.16 (16.12)	62.03 (15.16)	60.11 (16.20)
Financial Resources	51.39 (23.09)	61.61 (18.22)	66.18 (18.13)	51.65 (22.88)	46.81 (24.53)	51.44 (21.04)

were presented randomly and participants had to ignore their contents and specify the color of their backgrounds or borders. In the second 4 sessions, paired stimuli (one game-related, and one neutral, side by side with random placement) were presented, and participants had to direct their attention towards the neutral stimuli and specify the color of their backgrounds or borders. Each session was more complex than the previous one, and the criteria for passing from one session to the next were response time to each stimulus and total errors.

Results

Analysis of the participants' demographic and clinical baseline data showed no significant difference between groups in terms of age, gender, education, age of first gaming, and weekly hours of gaming ($p > 0.05$). These results are presented in Table 1.

The study's hypothesis was tested using two-way repeated measures ANOVA with the group as the between-subjects factor, time as the within-subjects factor and scores of IGD-20, KIDSCREEN-52, and

Table 3. Results of Two-Way Repeated Measures ANOVA

Variables	Between-Subjects		Within-Subjects		Interaction	
	$F_{(DF)}$	p-Value	$F_{(DF)}$	p-Value	$F_{(DF)}$	p-Value
AB						
MDS	$88.31_{(1, 32)}$	< 0.001	$62.84_{(2, 64)}$	< 0.001	$115.69_{(2, 64)}$	< 0.001
IGD-S						
IGD-20	$8.41_{(1, 32)}$	< 0.01	$6.54_{(2, 64)}$	< 0.01	$11.05_{(2, 64)}$	< 0.001
SA	$7.86_{(1, 32)}$	< 0.01	$5.32_{(2, 64)}$	< 0.01	$9.84_{(2, 64)}$	< 0.001
MM	$7.32_{(1, 32)}$	0.01	$6.16_{(2, 64)}$	< 0.01	$9.67_{(2, 64)}$	< 0.001
TO	$7.67_{(1, 32)}$	< 0.01	$3.89_{(2, 64)}$	0.02	$8.45_{(2, 64)}$	< 0.001
WI	$7.91_{(1, 32)}$	< 0.01	$4.37_{(2, 64)}$	0.01	$9.13_{(2, 64)}$	< 0.001
CO	$6.79_{(1, 32)}$	0.01	$5.76_{(2, 64)}$	< 0.01	$9.32_{(2, 64)}$	< 0.001
RE	$6.93_{(1, 32)}$	0.01	$5.44_{(2, 64)}$	< 0.01	$8.97_{(2, 64)}$	< 0.001
HRQOL						
KDSN-52	$7.12_{(1, 32)}$	0.01	$5.03_{(2, 64)}$	< 0.01	$9.46_{(2, 64)}$	< 0.001
PHY	$2.64_{(1, 32)}$	0.11	$1.39_{(2, 64)}$	0.25	$2.02_{(2, 64)}$	0.14
PSY	$7.89_{(1, 32)}$	< 0.01	$4.16_{(2, 64)}$	0.02	$8.19_{(2, 64)}$	< 0.001
M&E	$7.31_{(1, 32)}$	0.01	$3.84_{(2, 64)}$	0.02	$7.66_{(2, 64)}$	< 0.01
S-PE	$6.73_{(1, 32)}$	0.01	$4.78_{(2, 64)}$	0.01	$7.97_{(2, 64)}$	< 0.001
AUT	$1.20_{(1, 32)}$	0.28	$2.47_{(2, 64)}$	0.09	$2.13_{(2, 64)}$	0.12
P&H	$7.06_{(1, 32)}$	0.01	$5.39_{(2, 64)}$	< 0.01	$8.85_{(2, 64)}$	< 0.001
S&P	$7.57_{(1, 32)}$	< 0.01	$5.58_{(2, 64)}$	< 0.01	$9.79_{(2, 64)}$	< 0.001
SCH	$2.31_{(1, 32)}$	0.13	$2.20_{(2, 64)}$	0.11	$2.38_{(2, 64)}$	0.10
S&B	$6.92_{(1, 32)}$	0.01	$4.62_{(2, 64)}$	0.01	$6.44_{(2, 64)}$	< 0.01
FIN	$3.11_{(1, 32)}$	0.08	$1.03_{(2, 64)}$	0.36	$1.51_{(2, 64)}$	0.22

Abbreviations: DF = Degrees of Freedom; AB = Attentional Bias; MDS = Modified Stroop Test; IGD-S = IGD Severity; SA = Salience; MM = Mood Modification; TO = Tolerance; WI = Withdrawal; CO = Conflict; RE = Relapse; HRQOL = Health-Related Quality of Life; KDSN-52 = KIDSCREEN-52; PHY = Physical Well-Being; PSY = Psychological Well-being; M&E = Moods & Emotions; S-PE = Self-Perception; AUT = Autonomy; P&H = Parent Relation & Home Life; S&P = Social Support & Peers; SCH = School Environment; S&B = Social Acceptance & Bullying; FIN = Financial Resources.

Modified Stroop Test as dependent variables, which are shown in Table 2.

The results of ANOVA revealed that the effects of group, time and group*time interaction on the dependent variables have been significant ($p < 0.05$). In other words, there have been significant differences between the groups at multiple measurements, regarding attentional bias (Modified Stroop Test), IGD severity (IGD-20 and all of its subscales) and health-related quality of life (KIDSCREEN-52 and all of its subscales except Physical Well-Being, Autonomy, School Environment, and Financial Resources). These findings are shown in detail in Table 3.

After significant effects were found in the analysis, post-hoc pairwise comparisons were made to detect the exact points of significant change, using Fisher's LSD. The results of these comparisons illustrated that significant change had only occurred in the experimental group, and this change was observed in their attentional bias, IGD severity, and health-related quality of life ($p < 0.05$). As Table 4 shows, all subscales of IGD-20 had changed significantly at post-test, while six subscales of KIDSCREEN-52 had changed significantly, and this change was evident only at follow-up. Meanwhile, no significant change was observed in the data of the control group ($p > 0.05$).

Discussion and Conclusion

The present study's findings revealed that ABM successfully reduces attentional bias towards game-related stimuli in adolescents with IGD since the reduction in the experimental group's scores in Modified Stroop Task was seen in comparing pre-test with post-test, and was sustained at two months follow-up. These findings are in congruence with previous research showing that ABM interventions are capable of modification of attentional bias (Arsanjani, Zargham hajebi, & Mirzahosseini, 2020; Heitmann et al., 2018; MacLeod & Clarke, 2015; Wittekind et al., 2019) and can be implemented online (Denissen, Neumann, & Van Zalk, 2010). In contrast to these results, Wen et al. (2020) found that web-based ABM is not capable of significantly decreasing attentional bias in individuals suffering from addictive behaviors, but the reason for the insignificant results in that study could be the very high rate of dropout, and the very low frequency of training usage.

It was observed in this study that ABM reduces the severity of IGD in adolescents with this disorder, as the experimental group's scores in the IGD-20 questionnaire and all of its subscales were reduced at post-test compared to pre-test, and this reduction lasted for two months. Consistent with previous studies, this confirms that deficits in selective attention in cognitive processing of information play an essential role in causation, sustenance and worsening of IGD, and interventions targeting this issue, have therapeutic value for this disorder (Rabinovitz & Nagar, 2015).

More importantly, it was found in the current research that successful reduction of IGD severity via ABM, improves health-related quality of life in adolescents with this disorder. The increase of the experimental group's scores in the KIDSCREEN-52 questionnaire was observed at follow-up compared with pre-test and post-test. The reason that significant difference was seen only at two months follow-up and not in post-test, might be that the effects of ABM on health-related quality of life requires time and only occurs after adolescents with modified attentional bias and reduced severity of IGD interact with their family and peers in a new way, start to perceive themselves in a new light, and engage in activities other than gaming. Gradually, these factors contribute to their psychological health and help them have meaningful relationships, which in turn increase their health-related quality

Table 4. Mean Differences of Variables in Fisher's Least Significant Difference (LSD)

Variables	Experimental			Control		
	Pre-test / Post-test	Pre-test / Follow-up	Post-test / Follow-up	Pre-test / Post-test	Pre-test / Follow-up	Post-test / Follow-up
AB						
MDS	2188*	1955*	-233	181	74	-107
IGD-S						
IGD-20	22.39*	24.53*	2.14	-2.75	1.77	4.52
SA	1.33*	1.49*	0.16	-0.21	0.09	0.30
MM	0.54	1.01*	0.47	0.22	-0.09	-0.31
TO	0.94*	0.89*	-0.05	0.09	0.03	-0.06
WI	1.34*	1.48*	0.14	0.12	0.19	0.07
CO	1.22*	1.16*	-0.06	0.34	-0.14	-0.48
RE	1.61*	1.88*	0.27	-0.12	-0.27	-0.15
HRQOL						
KDSN-52	-7.28	-17.63*	-10.35	-3.47	1.08	4.55
PHY	-6.97	-9.45	-2.48	-4.22	4.48	8.70
PSY	-9.14	-25.45*	-16.31*	-7.94	0.13	-8.07
M&E	-4.38	-18.35*	-13.97*	1.59	3.41	1.82
S-PE	-7.10	-14.03*	-6.93	-3.45	4.38	7.83
AUT	-6.07	-11.96	-5.89	0.89	3.80	2.91
P&H	-9.51	-20.92*	-11.41*	-5.14	-1.39	3.75
S&P	-4.09	-22.29*	-18.20*	-8.94	-2.63	6.31
SCH	-6.80	-11.66	-4.86	-1.58	-4.46	-2.88
S&B	-9.75	-18.87*	-9.12	-2.13	-4.05	-1.92
FIN	-10.22	-14.79	-4.57	-4.84	-0.21	4.63

Abbreviations: AB = Attentional Bias; MDS = Modified Stroop Test; IGD-S = IGD Severity; SA = Salience; MM = Mood Modification; TO = Tolerance; WI = Withdrawal; CO = Conflict; RE = Relapse; HRQOL = Health-Related Quality of Life; KDSN-52 = KIDSCREEN-52; PHY = Physical Well-Being; PSY = Psychological Well-being; M&E = Moods & Emotions; S-PE = Self-Perception; AUT = Autonomy; P&H = Parent Relation & Home Life; S&P = Social Support & Peers; SCH = School Environment; S&B = Social Acceptance & Bullying; FIN = Financial Resources.

* The mean difference is significant at the 0.05 level

of life. Although, the results show that some of the subscales of KIDSCREEN-52 (Physical Well-Being, Autonomy, School Environment, and Financial Resources) did not improve significantly after intervention, and the reason for this might be that these aspects of health-related quality of life either need longer periods of follow-ups to become evident, or require more thorough interventions targeting several cognitive components in addition to selective attention. Nevertheless, with the confirmation of the effects of ABM on health-related quality of life in adolescents with IGD, more studies need to be conducted in order to investigate the mechanisms of these effects.

There were certain limitations in this research that need to be addressed here and considered in future studies. Namely, because of the Covid-19 quarantine, evaluations of participants were all

done indirectly (via internet and telephone) and using self-report questionnaires, while behavioral measures and clinical examinations by experts may provide more complete evaluations. Moreover, the follow-up assessment of participants was conduction only after two months, which does not confirm long-term maintenance of ABM's effects, specifically since it was observed in the study's results that some of the effects required long periods of time even to be observed. Therefore, future researchers in this field are encouraged to use more direct assessment methods and more extended follow-up assessments of their participants.

Acknowledgements

The authors of this article would like to extend their gratitude to the staff of the schools that helped with the sampling of the participants, and they also sincerely thank and appreciate all the participants for the time and effort that they spent to make this research possible.

References

Aghayousefi, A., Zare, H., & Mohammadi, R. (2018). The Effect of Cognitive Computer-based Training Program on Attention and Memory Function of the Students with Diabetes. *Quarterly Journal of Health Psychology, 6*(24), 162-179.

Argyriou, E., Davison, C. B., & Lee, T. T. (2017). Response inhibition and internet gaming disorder: a meta-analysis. *Addictive behaviors, 71*, 54-60.

Arsanjani, M., Zargham hajebi, M., & Mirzahosseini, H. (2020). The Effect of Cognitive Bias Modification in the Attention Bias of Students With Test Anxiety. *Bimonthly of Education Strategies in Medical Sciences, 13*(4), 325-334.

Azarmehr, R., & Ahmadi, E. (2020). The role of anxiety sensitivity and attentional control in predicting the tendency toward addiction in youth. *Iranian Journal of Health Psychology, 2*(2), 45-50. doi:10.30473/ijohp.2020.47685.1054

Brown, H. M., Eley, T. C., Broeren, S., MacLeod, C., Rinck, M., Hadwin, J. A., & Lester, K. J. (2014). Psychometric properties of reaction time based experimental paradigms measuring anxiety-related information-processing biases in children. *Journal of Anxiety Disorders, 28*(1), 97-107. doi:j.janxdis.2013.11.004

Browning, M., Holmes, E. A., & Harmer, C. J. (2010). The modification of attentional bias to emotional information: A review of the techniques, mechanisms, and relevance to emotional disorders. *Cognitive, Affective, & Behavioral Neuroscience, 10*(1), 8-20. doi:10.3758/CABN.10.1.8

Chia, D. X., & Zhang, M. W. (2020). A Scoping Review of Cognitive Bias in Internet Addiction and Internet Gaming Disorders. *International Journal of Environmental Research and Public Health, 17*(1), 373. doi:10.3390/ijerph17010373

Cox, W. M., Fadardi, J. S., & Pothos, E. M. (2006). The addiction-stroop test: Theoretical considerations and procedural recommendations. *Psychological bulletin, 132*(3), 443. doi:10.1037/0033-2909.132.3.443

Denissen, J. J., Neumann, L., & Van Zalk, M. (2010). How the internet is changing the implementation of traditional research methods, people's daily lives, and the way in which developmental scientists conduct research. *International Journal of Behavioral Development, 34*(6), 564-575. doi:10.1177/0165025410383746

Dietel, F. A., Zache, C., Bürkner, P. C., Schulte, J., Möbius, M., Bischof, A., . . . Buhlmann, U. (2020). Internet-based interpretation bias modification for body dissatisfaction: A three-armed randomized controlled trial. *Int J Eat Disord, 53*(6), 972-986. doi:10.1002/eat.23280

Fazeli, S., Mohammadi Zeidi, I., Lin, C.-Y., Namdar, P., Griffiths, M. D., Ahorsu, D. K., & Pakpour, A. H. (2020). Depression, anxiety, and stress mediate the associations between internet gaming disorder,

insomnia, and quality of life during the COVID-19 outbreak. *Addictive Behaviors Reports, 12*, 100307. doi:10.1016/j.abrep.2020.100307

Field, M., & Cox, W. M. (2008). Attentional bias in addictive behaviors: a review of its development, causes, and consequences. *Drug and alcohol dependence, 97*(1-2), 1-20. doi:10.1016/j.drugalcdep.2008.03.030

Fuster, H., Carbonell, X., Pontes, H. M., & Griffiths, M. D. (2016). Spanish validation of the internet gaming disorder-20 (IGD-20) test. *Computers in Human Behavior, 56*, 215-224. doi:10.1016/j.chb.2015.11.050

Gentile, D. (2009). Pathological video-game use among youth ages 8 to 18: A national study. *Psychological science, 20*(5), 594-602. doi:10.1111/j.1467-9280.2009.02340.x

Heitmann, J., Bennik, E. C., van Hemel-Ruiter, M. E., & de Jong, P. J. (2018). The effectiveness of attentional bias modification for substance use disorder symptoms in adults: a systematic review. *Systematic reviews, 7*(1), 160. doi:doi.org/10.1186/s13643-018-0822-6

Hønsi, A., Mentzoni, R. A., Molde, H., & Pallesen, S. (2013). Attentional bias in problem gambling: A systematic review. *Journal of Gambling Studies, 29*(3), 359-375. doi:10.1007/s10899-012-9315-z

J Kuss, D., D Griffiths, M., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current pharmaceutical design, 20*(25), 4026-4052.

Jeromin, F., Nyenhuis, N., & Barke, A. (2016). Attentional bias in excessive Internet gamers: Experimental investigations using an addiction Stroop and a visual probe. *Journal of Behavioral Addictions, 5*(1), 32-40. doi:10.1556/2006.5.2016.012

Jeromin, F., Rief, W., & Barke, A. (2016). Using two web-based addiction Stroops to measure the attentional bias in adults with Internet Gaming Disorder. *Journal of Behavioral Addictions, 5*(4), 666-673. doi:10.1556/2006.5.2016.075

Khodadadi, M., Feyzi Daryati, M. R., Movahedi, Y., & Ahmadi, I. (2014). Assessment of attention bias in the cognitive processing of neutral and emotional words Using semantic Strop test. *Shenakht Journal of Psychology and Psychiatry, 1*(1), 23-30.

Kuss, D. J., & Griffiths, M. D. (2012). Internet gaming addiction: A systematic review of empirical research. *International Journal of Mental Health and Addiction, 10*(2), 278-296. doi:10.1007/s11469-011-9318-5

Lam, L. T. (2014). Internet gaming addiction, problematic use of the internet, and sleep problems: a systematic review. *Current psychiatry reports, 16*(4), 444. doi:10.1007/s11920-014-0444-1

Lim, J. A., Lee, J. Y., Jung, H. Y., Sohn, B. K., Choi, S. W., Kim, Y. J., . . . Choi, J. S. (2016). Changes of quality of life and cognitive function in individuals with Internet gaming disorder: A 6-month follow-up. *Medicine (Baltimore), 95*(50), e5695. doi:10.1097/md.0000000000005695

MacLeod, C., & Clarke, P. J. (2015). The attentional bias modification approach to anxiety intervention. *Clinical Psychological Science, 3*(1), 58-78. doi:10.1177/2167702614560749

MacLeod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of abnormal psychology, 111*(1), 107.

Metcalf, O., & Pammer, K. (2011). Attentional bias in excessive massively multiplayer online role-playing gamers using a modified Stroop task. *Computers in Human Behavior, 27*(5), 1942-1947. doi:10.1016/j.chb.2011.05.001

Nik, A. A., Naenian, M. R., & Shairi, M. R. (2014). Validity and reliability of the health related Quality of Life Questionnaire (Kidscreen-52) in a sample of Iranian Students. *Journal of Community Health*

Research, 3(3), 210-224.

Pontes, H. M., & Griffiths, M. D. (2015). Internet gaming disorder and its associated cognitions and cognitive-related impairments: A systematic review using PRISMA guidelines. *Revista Argentina de Ciencias del Comportamiento, 7*(3), 102-118.

Pontes, H. M., Kiraly, O., Demetrovics, Z., & Griffiths, M. D. (2014). The conceptualisation and measurement of DSM-5 Internet Gaming Disorder: The development of the IGD-20 Test. *PloS one, 9*(10), e110137. doi:10.1371/journal.pone.0110137

Rabinovitz, S., & Nagar, M. (2015). Possible end to an endless quest? Cognitive bias modification for excessive multiplayer online gamers. *Cyberpsychology, Behavior, and Social Networking, 18*(10), 581-587. doi:10.1089/cyber.2015.0173

Rasti, A., & Taghavi, M. (2006). Implicit Memory Bias for Negative Information in Patients With Generalized Anxiety Disorder and Major Depressive Disorder and Normal Individuals. *Advances in Cognitive Sciences, 8*(3), 25-32.

Ravens-Sieberer, U., Gosch, A., Rajmil, L., Erhart, M., Bruil, J., Power, M., . . . Czemy, L. (2008). The KIDSCREEN-52 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Value in health, 11*(4), 645-658. doi:10.1111 /j.1524-4733.2007.00291.xs

Shu M, Y., Ivan Jacob, A. P., Meng Xuan, Z., & Anise MS, W. (2019). Psychometric validation of the Internet Gaming Disorder-20 Test among Chinese middle school and university students. *Journal of Behavioral Addictions, 8*(2), 295-305. doi:10.1556/2006.8.2019.18

Sublette, V. A., & Mullan, B. (2012). Consequences of play: A systematic review of the effects of online gaming. *International Journal of Mental Health and Addiction, 10*(1), 3-23. doi:10.1007/s11469-010-9304-3

Vahidi, M., Zamanzadeh, V., Musavi, S., Janani, R., & Namdar, A. H. (2019). Validation of the Persian version of the internet gaming disorder-20 Test among the students of Tabriz University of Medical Sciences. *Journal of Torbat Heydariyeh University of Medical Sciences, 7*(1), 15-26.

van Holst, R. J., Lemmens, J. S., Valkenburg, P. M., Peter, J., Veltman, D. J., & Goudriaan, A. E. (2012). Attentional bias and disinhibition toward gaming cues are related to problem gaming in male adolescents. *Journal of Adolescent Health, 50*(6), 541-546. doi:10.1016/j.jadohealth.2011.07.006

Wartberg, L., Kriston, L., & Kammerl, R. (2017). Associations of Social Support, Friends Only Known Through the Internet, and Health-Related Quality of Life with Internet Gaming Disorder in Adolescence. *Cyberpsychol Behav Soc Netw, 20*(7), 436-441. doi:10.1089/cyber.2016.0535

Wen, S., Larsen, H., Boffo, M., Grasman, R. P. P. P., Pronk, T., van Wijngaarden, J. B. G., & Wiers, R. W. (2020). Combining Web-Based Attentional Bias Modification and Approach Bias Modification as a Self-Help Smoking Intervention for Adult Smokers Seeking Online Help: Double-Blind Randomized Controlled Trial. *JMIR Ment Health, 7*(5), e16342. doi:10.2196/16342

Wilms, I. L., Petersen, A., & Vangkilde, S. (2013). Intensive video gaming improves encoding speed to visual short-term memory in young male adults. *Acta psychologica, 142*(1), 108-118. doi:10.1016/j. actpsy.2012.11.003

Wittekind, C. E., Bierbrodt, J., Lüdecke, D., Feist, A., Hand, I., & Moritz, S. (2019). Cognitive bias modification in problem and pathological gambling using a web-based approach-avoidance task: A pilot trial. *Psychiatry research, 272*, 171-181. doi:10.1016/j.psychres.2018.12.075

Yau, M. Y. H., & Potenza, M. N. (2015). Gambling disorder and other behavioral addictions: recognition and treatment. *Harvard review of psychiatry, 23*(2), 134. doi:10.1097/HRP.0000000000000051

Ziaee, S. S., Fadardi, J. S., Cox, W. M., & Yazdi, S. A. A. (2016). Effects of attention control training on drug abusers' attentional bias and treatment outcome. *Journal of Consulting and Clinical Psychology, 84*(10), 861. doi:10.1037/a0040290