



Anger-Related Problems and Sleep Disturbances in Adolescents Playing Massively Multiplayer Online Role-Playing Games

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Abstract

Purpose Publications have shown that playing massively multiplayer online role-playing games (MMORPGs) can increase the risk of depression, social withdrawal, and anxiety. In the current study, we compared adolescents who play MMORPGs to those who do not on anxiety and depression symptoms, sleep disturbances, and anger-related problems.

Methods The participants included 52 adolescents (aged 12–18 years) who play MMORPGs and a control group of age and gender-matched adolescents. Subjects completed the State-Trait Anger Scale (STAXI), Children's Depression Inventory (CDI), Pittsburgh Sleep Quality Index (PSQI), and Screen for Child Anxiety Related Emotional Disorders Child Version (SCARED) questionnaires.

Results Anxiety, depressive symptoms, and anger-related problems were higher in adolescents who played MMORPGs than those who did not. The scores of trait anger, anger in, and anger-out subscales showed a positive correlation with the CDI scores, while the anger control scores showed a negative correlation ($p < 0.05$). Subjective sleep quality, sleep disturbances, sleep functionality subscale, and total PSQI scores of adolescents who played MMORPGs showed a significant relationship with SCARED scores ($p < 0.05$). The sleep latency showed a positive correlation with the scores on CDI scales.

Conclusions Consequently, as anxiety problems increase, subjective sleep quality decreases, frequent sleep disturbances impair adolescents' daily functioning and the risk of sleep disturbances increases in adolescents who play MMORPGs. In addition, an increase in depressive symptoms prolongs sleep latency and decreases total sleep time. When depressive symptoms increase in adolescents who play MMORPGs, they also have more anger problems.

Keywords Adolescents · Massively multiplayer online role-playing games · Anxiety · Depression · Sleep problems

1 Introduction

Compared to other games, massively multiplayer online role-playing games (MMORPGs) have different characteristics. MMORPGs provide an environment in which millions of users interact daily with each other through avatars. MMORPG players can take on different roles, as the games contain fantastical elements, and players can play with their friends; therefore, MMORPGs are highly addictive and appealing to a wide audience [1–3]. The physical and psychological effects of these games allow the games to be used as chatting platforms in which players spend a lot of time; therefore, these issues need to be explored [1, 2].

Some studies show that MMORPG can cause individuals to spend more time on the computer, be more socially isolated, and disrupt daily tasks. Loneliness, introversion, low social self-efficacy, and a hostile attitude toward others are some of the social problems that can occur in individuals with game addiction [4–6]. In addition, it has been shown that MMORPGs users may exhibit symptoms such as tolerance and cravings, and the games may have negative consequences on their quality of life [7].

Moreover, studies have shown that excessive MMORPGs can increase insomnia symptoms and worsen depressive symptoms [6]. When playing these games, young people's perception of time can be altered and sleeping habits can be disturbed. Sleep disorders manifest themselves as insomnia and phase shift [8]. Some researchers have found that playing MMORPGs can cause changes in the brain's circuitry, leading players to depression [8]. Based on clinical observations, increasing the time spent in MMORPGs may increase

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sleep disturbances and cause some psychological effects, such as increased anger control problems and depressed mood [9, 10]. For this reason, sleep problems could be one of the mechanisms that explain anger-related problems in adolescents who play MMORPGs. In addition, depressive mood and anxiety disorders may emerge as increased anger [11, 12].

In this study, we propose two hypotheses. First, adolescents who play MMORPGs exhibit more depressive, anxiety symptoms, sleep disturbances, and anger-related problems compared to those who do not play MMORPGs. Second, sleep disturbances and anger-related problems are related significantly in adolescents who play MMORPGs. Likewise, anxiety and depression have a significant effect on anger-related problems. To examine these hypotheses in the current study, we compared adolescents who play MMORPGs with those who do not, in terms of anxiety, depressive symptoms, sleep disturbances, and anger-related problems.

2 Methods

2.1 Participants and Procedure

This cross-sectional study includes a sample of 14–18-year-old 52 adolescents who play MMORPGs at least 5 days a week, more than 4 h a day, and age- and gender-matched adolescents who play digital games less than 2 h a day and have at least four days of MMORPG-free days. Adolescents participating in the study were admitted to the pediatric outpatient clinic with a condition other than mental illness or a chronic illness such as muscle aches, colds, post-nasal drip at the state hospital where the study was conducted. Because the reasons for using the health facility may affect the outcome of the study, the study and control groups were included two weeks after the treatment of the reasons for using the health facility. The study was conducted in the child and adolescent polyclinic of the same state hospital by a child psychiatrist through face-to-face interviews with the adolescent. Internet usage durations were learned verbally from adolescents and their parents. If inconsistency was found between the parent and the adolescent, the adolescent was excluded from the study. The ethics committee approved the study with protocol number 2021/226, and informed consent was obtained from all participants and their guardians. Adolescents who did not belong to the specified age group, had a condition that would interfere with the analysis (autism spectrum disorder, neurological, intellectual, or psychotic disorder), or did not wish to participate in the study, were excluded. Interviews were conducted with 73 individuals who were eligible for the study. Eleven of them declined to participate in the study because they feared prolonged hospitalization due to the pandemic while

seven were diagnosed with conditions such as intellectual disorder and epilepsy; hence, they were excluded from the study. Three individuals did not complete their questionnaires, which affected the statistical analysis. The results of these individuals were not included in the statistical analysis.

2.2 Measures

A child psychiatrist conducted face-to-face interviews with the adolescent participants, during which their sociodemographic and family data and their internet usage status were obtained. In addition, the adolescents were presented with four self-report scales.

2.2.1 State-Trait Anger Scale (STAXI)

The State-Trait Anger Scale (STAXI) is a questionnaire designed to identify anger-control problems. The trait anger subsection comprises the first ten questions of the questionnaire. The second part of the scale evaluates expression of anger. There are three sub-headings: anger-in, anger-out, and finally, anger-control [13]. The Turkish validity and reliability study was conducted by Özer et al. [14]. Internal consistency coefficients in the reliability study of the scale were 0.79 for trait anger, 0.84 for anger control, 0.78 for anger-out, and anger-in for anger dimension, which is 0.62.

2.2.2 Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) assesses sleep quality. It consists of seven subcomponents: subjective sleep quality, sleep latency, sleep duration, sleep disturbance, habitual sleep efficiency, use of sleep medication, and disturbance of daily routine. First, each subgroup is scored within itself. Then, sleep quality is determined by the score obtained by summing the scores of all components. Scores of 5 and above indicate poor sleep quality [15, 16]. The Turkish validity and reliability study was conducted by Ağargün et al. [17]. The instrument showed satisfactory internal consistency with an overall Cronbach α of 0.8.

2.2.3 The Children's Depression Inventory (CDI)

The Child Depression Inventory (CDI) is a scale used by mental health professionals to detect signs of depression in young people aged 7–17 years. Different cut-off scores are used in populations where depression is expected in the general population. For example, in societies where depression is expected, a cut-off score of 12 or 13 is recommended, whereas in general population studies, a 19–20 is recommended [18]. The Turkish validity and reliability study was conducted by Oyet et al. [19].

2.2.4 Child Screen Version for Anxiety-Related Emotional Disorders in Children (SCARED)

The Child Screen Version for Anxiety-Related Emotional Disorders in Children (SCARED) is a 41-item questionnaire used to assess anxiety symptoms in children. It measures separation anxiety, generalized anxiety, school phobia, and somatic symptoms. A 3-point Likert scoring procedure is used, ranging from 0 to 2. The cut-off score is 25 points. A high scores mean high more anxiety [20]. The Turkish validity and reliability study was conducted by Karaceylan Cakmakci et al. [21].

2.3 Statistical Methods

Data were analyzed using the Statistics Program for the Social Sciences (IBM SPSS 21.0). The descriptive data were given as mean and standard deviation (SD). Chi square test was used for comparison of categorical data. Distribution of data was assessed by Kolmogorov Simonov test. MANOVA was used to compare the results of the group that played and the group that did not play MMORPGs. Linear regression analysis was conducted to determine which variables were associated with the anger and sleep problems in adolescents who play MMORPGs. p value of 0.05 was considered statistically significant.

3 Results

Of the 52 adolescents who played MMORPGs and participated in the study, 20 (38.5%) were girls and 32 (61.5%) were boys, with a mean age of 15.86 ± 0.96 years. No statistically significant difference was found between the adolescents who played MMORPGs and those who did not, in the age and sex-matched control groups ($p = 0.85$).

According to the results, adolescents who played MMORPGs had significantly higher scores on the CDI ($p < 0.001$) and SCARED ($p = 0.001$) scales than adolescents who did not. Scores on trait anger ($p < 0.001$), anger-out ($p < 0.001$), and anger-in ($p < 0.001$) subscales of the STAXI were also higher in the study group as compared to the control group. Anger-control ($p = 0.023$) subscales scores of adolescents playing MMORPGs were significantly lower than those of the control group. In other words, anxiety, depressive symptoms, and anger-related problems were higher in adolescents who played MMORPGs than those who did not ($p < 0.05$) (Table 1).

When the sleep scale was evaluated, it was found that as compared to the control group, total PSQI ($p < 0.001$) scores were higher in the study group; the subscale scores of subjective sleep quality ($p < 0.001$), sleep efficiency ($p = 0.01$), sleep disturbance ($p < 0.001$), and functionality ($p < 0.001$) were also higher in the study group. In other words, sleep

Table 1 Evaluation of scales between adolescents who play MMORPGs and not

Dependent variable	Adolescents who play MMORPGs (52)		Control (52)		df	F	p
	Mean (scores)	SD	Mean (scores)	SD			
CDI	20.00	9.46	9.46	5.95	1	45	<0.001**
SCARED	30.56	14.81	20.69	12.38	1	12.577	0.001**
Trait anger	28.73	7.31	21.63	6.91	1	23.977	<0.001**
Anger-in	20.33	4.68	16.31	4.92	1	19.381	<0.001**
Anger-out	22.10	5.74	15.62	4.85	1	35.232	<0.001**
Anger control	17.04	5.11	19.69	6.50	1	5.308	0.023*
Subjective sleep quality	1.54	0.94	0.85	1.21	1	10.62	<0.001**
Sleep latency	0.73	0.87	0.54	0.98	1	1.13	0.29
Sleep time	0.42	0.82	0.23	0.61	1	1.82	0.18
Sleep efficiency deterioration	0.38	0.57	0.13	0.34	1	7.41	0.01**
Sleep disturbances	1.25	0.74	0.75	0.59	1	14.57	<0.001**
Sleep pill	0.06	0.31	0.15	0.54	1	1.25	0.27
Functionality	1.17	1.02	0.44	0.67	1	18.57	<0.001**
PSQI	5.56	3.32	2.96	2.58	1	20.132	<0.001**

Mean scores from the scales

p values calculated MANOVA

PSQI Pittsburgh Sleep Quality Index, CDI Children's Depression Inventory, SCARED Screen for Child Anxiety Related Emotional Disorders Child Version, MMORPGs multiplayer online role-playing game players

* $p < 0.05$, ** $p < 0.01$

disturbances occurred more frequently in adolescents who played MMORPGs than they did in the control group. Sleep efficiency, quality, fragmentation, and overall functioning ($p < 0.001$) were more problematic in the adolescents who played MMORPGs than in those who did not ($p < 0.05$) (Table 1).

Adolescents in study group spend on average 5.42 h (SD = 0.49) per day on the MMORPGs. 22 (42.3%) engaged in Internet use for 6 or more h per day, 30 (57.7.6%) for 4–6 h per day in study group ($p < 0.001$) (Table 2).

All anger subscales scores of adolescents who played MMORPGs showed a significant relationship with CDI scores ($p < 0.001$) (Table 3). The scores of trait anger, anger-in ($p = 0.012$), and anger-out ($p < 0.001$) subscales showed a positive correlation with the scores of CDI scales, while the anger control subscales scores showed a negative correlation ($p = 0.012$) (Table 3). Only the anger-in scores of adolescents who did not play MMORPGs showed a significant relationship with SCARED scores ($p = 0.027$) (Table 3).

Subjective sleep quality problems ($p = 0.008$), sleep disturbances ($p = 0.008$), sleep functionality subscale ($p < 0.001$), scores of the PSQI, and total PSQI ($p = 0.001$) scores of adolescents who played MMORPGs showed a significant relationship with SCARED scores ($p < 0.05$) (Table 4). The sleep latency ($p = 0.001$) subscale scores of the PSQI, showed a positive correlation with the scores of CDI scales (Table 4). The sleep pill usage subscale ($p = 0.009$) scores of the PSQI showed a positive correlation with the scores of anger control subscales (Table 4).

Subjective sleep quality problems subscale scores of the PSQI of the adolescents who did not play MMORPGs

Table 2 Evaluation of digital game using time between adolescents who play MMORPGs and not

	Adolescents who play MMORPGs (52)	Control (52)	X^2	df	p
Number of h internet use per day					
0–2 h					
n	0	52	104.00	2	<0.001**
%	0.0%	100.0%			
4–6 h					
n	30	0			
%	57.7%	0.0%			
6 or more					
n	22	0			
%	42.3%	0.0%			

n number of people

p values calculated Pearson chi-square

MMORPGs multiplayer online role-playing game players

* $p < 0.05$, ** $p < 0.01$

Table 3 Linear regression of anger problems with other variables

		Beta	t	p
Adolescents who play MMORPGs (52)				
Trait anger	CDI	0.551	4.668	<0.001**
Anger-in	CDI	0.345	2.598	0.012*
Anger-out	CDI	0.555	4.712	<0.001**
Anger control	CDI	-0.327	-2.608	0.012*
	Sleep Pill	0.327	2.609	0.012*
Control (52)				
Anger-in	SCARED	0.306	2.275	0.027*

Linear regression of scores from anger problems scale with scores from other scales

CDI Children's Depression Inventory, SCARED Screen for Child Anxiety Related Emotional Disorders Child Version, MMORPGs multiplayer online role-playing game players

* $p < 0.05$, ** $p < 0.01$

showed a positive relationship with anger-in scores ($p = 0.048$) (Table 4). Sleep time subscale scores of the PSQI of the adolescents who did not play MMORPGs showed a negative relationship with CDI ($p = 0.039$) (Table 4). The effects of digital game using time on sleep problems and aggression were not found among adolescents who play MMORPGs ($p = 0.269$).

4 Discussion

This study compared adolescents who play MMORPGs and those who do not, on anxiety, depressive symptoms, aggression, and sleep disturbances. It then examined whether there

Table 4 Linear regression of sleep problems with other variables

		Beta	t	p
Adolescents who play MMORPGs (52)				
Subjective sleep quality	SCARED	0.364	2.767	0.008**
Sleep latency	CDI	0.452	3.587	0.001**
Sleep disturbances	SCARED	0.73	5.88	<0.001**
Sleep pill	Anger control	0.36	2.73	0.009**
Functionality	SCARED	0.36	2.76	0.008**
PSQI	SCARED	0.54	4.49	0.001**
Control (52)				
Subjective sleep quality	Anger-in	0.28	2.02	0.048*
Sleep time	CDI	0.29	2.12	0.039*

Linear regression of scores from PSQI scale scores with scores from other scales

PSQI Pittsburgh Sleep Quality Index, CDI Children's Depression Inventory, SCARED Screen for Child Anxiety Related Emotional Disorders Child Version, MMORPGs multiplayer online role-playing game players

* $p < 0.05$, ** $p < 0.01$

were any gender differences between girls and boys who play MMORPGs in terms of anxiety, depression, aggression, and the presence and type of sleep disturbances.

Numerous studies on behavioral problems have shown that digital games can promote the development of aggressive behaviors related to anger and impulsivity [22, 23]. Digital games can have positive or negative consequences depending on the game's content, when it is played, and how often it is played. As time spent playing digital games increases, symptoms include loneliness, decreased enjoyment of life, increased anger, and depressed mood have been also increased [24, 25]. Our results show that adolescents who play MMORPGs have higher depressive and anxiety symptoms, more frequent sleep disturbances and anger-related problems, and lower control over their anger than adolescents who do not play MMORPGs. Balhara et al. showed that excessive internet use is associated with depressive symptoms and being prone to mental illness [26].

The impact of anxiety disorders in adolescents who play MMORPGs is noteworthy in assessing the relationship between adolescent sleep problems and symptoms of depression, anxiety, and anger. As anxiety problems increase, subjective sleep quality decreases, frequent sleep disturbances affect adolescents' daily functioning and the risk of sleep disturbances increases in adolescents who play MMORPGs. The effects of anxiety disorders on sleep problems were not pronounced among adolescents in the control group. An increase in depressive symptoms lengthens the time it takes to fall asleep, known as sleep latency, in adolescents who play MMORPGs and affects total sleep time in adolescents who do not play MMORPGs. Evaluating the relationship between anger and sleep problems found that taking sleeping pills was associated with anger control in adolescents who play MMORPGs. When examining the content of the medications taken by the adolescents and whether or not they were prescribed, it was found that a psychiatrist examined these children and a physician prescribed their medications. Psychiatric treatment could explain the positive correlation in anger control. The effects of digital game using time on sleep problems and aggression were not found among adolescents who play MMORPGs.

Due to work, study, or social obligations, digital gaming is more prominent at night. Reduced sleep duration may have various negative cognitive consequences for individuals [27]. Besides, digital games may impact sleep characteristics such as quality, quantity, delay of sleep onset, and nighttime awakenings [28]. A study conducted on middle school students found that children who play online games and have a computer in their room, spend less time in bed, go to bed later at night, and are more tired during the day [29]. In a study conducted on the 5th grade students aged 10–12 years, the relationships between sedentary screen

activity (computers, video games, TV), off-screen activity (talking on the phone, doing homework, reading), and sleep were examined. The effects of video games on sleep showed that using video games for more than two hours per day was associated with decreased sleep duration [30]. Dworak and colleagues found that online video games caused a longer delay in falling asleep, a longer time in stage 2 sleep, and a lower proportion of slow-wave sleep in total sleep time [31]. Higuchi et al. studied seven male volunteers in a sleep laboratory. The volunteers played a shooting game on a computer with a light or dark screen and performed simple tasks with low mental load to obtain control data. After the computer game and the control measurement, the participants' EEG theta power and subjective sleepiness were measured. The results showed that playing computer games before bedtime increased sleep latency, which was construed as a probable effect of physiological stimulation of the central nervous system (CNS) [32]. In our study, assessing the time between going to bed and getting up, adolescents who played MMORPGs had lower subjective sleep quality, more significant sleep fragmentation, lower wakefulness functionality, and higher problem scores on the sleep efficiency subscale. Consistent with the literature, adolescents who play digital games, such as MMORPGs, display problematic sleep quality and activity as well as a shortened sleep duration.

Linear regression analysis showed a significant relationship between the subscales, trait and external and internal anger, and the CDI score. In other words, when depressive symptoms increase in adolescents who play MMORPGs, they have more anger problems. Thus, increased anger in children who play MMORPGs may stimulate depressive symptoms. The result of our study is consistent with the extensive literature data showing a significant association between depressive symptoms and anger [11, 12]. In the control group, high anger-in was associated with high subjective sleep quality problem. Researchers studying the relationship between anger and sleep hypothesized that individuals who are more prone to anger have poor sleep quality because they are more likely to perceive and think about the provocation, react with anger, and fail to adequately regulate these perceptions and reactions. It is believed that the calmness required to fall asleep and sleep through the night decreases with anger and the person becomes agitated. While feeling angry before sleep increases physiological arousal both before and during sleep, cognitive reflection on an event triggering the anger may further increase angry feelings, thoughts, and physiological arousal. The association between anger and delayed sleep onset, poor sleep integrity, and insomnia can be explained by increased agitation and arousal when the person is angry [33–36].

4.1 Conclusions

Consequently, as anxiety problems increase, subjective sleep quality decreases, frequent sleep disturbances impair adolescents' daily functioning and the risk of sleep disturbances increases in adolescents who play MMORPGs. In addition, an increase in depressive symptoms prolongs sleep latency and decreases total sleep time. When depressive symptoms increase in adolescents who play MMORPGs, they also have more anger problems. Therefore, it should be considered that adolescents who play MMORPGs are more likely to seek clinics for their anger and sleep problems; these may be related to anxiety and depressive symptoms.

4.2 Limitations

Although our study adds some insights to the literature on this subject, it has significant limitations. Because of the study's cross-sectional design, causal and temporal associations cannot be established. Studies with a larger sample of MMORPG players may enhance the generalizability of the findings. As opposed to the self-reporting scales used in this study, objective measurement instruments will increase the reliability of future studies.

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Data availability The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants.

Declarations

Conflict of interest The author above certifies that she has NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

Ethical Approval Research procedures complied with universal ethical standards and the tenets of the Helsinki Declaration of 1975, as revised in 2000. Ethics Committee of the Bolu Izzet Baysal Training and Research Hospital, Bolu, Turkey approved the study by the protocol number 2021/226. Written informed consent were obtained from adolescents and their parents or guardians.

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