

The relationship between problematic internet use, sleep quality and impulsivity in adolescents with major depressive disorder

Merve ONAT,¹ Gonca ÖZYURT,² Yusuf ÖZTÜRK,³ Aynur PEKCANLAR AKAY⁴

ABSTRACT

Objective: Problematic internet use and poor sleep quality are widespread problems in adolescents. The aim of this study is to investigate the relationship between problematic internet use, sleep quality and impulsivity in adolescents diagnosed with major depressive disorder and to compare the findings with those of healthy controls. **Methods:** The study was planned as a single-disciplinary, three-centered, cross-sectional study with a control group. All participants were assessed using the Kiddie Schedule for Affective Disorders and Schizophrenia Present and Lifetime Version (K-SADS-PL), Beck Depression Inventory (BDI), Barratt Impulsiveness Scale (BIS-11), Pittsburgh Sleep Quality Index (PSQI) and Young's Internet Addiction Test (IAT) were administered to all participants. **Results:** It was determined that the total scores of BIS-11 scale, PSQI and IAT were statistically and significantly higher in the depression group than controls. In addition, a positive correlation was found between IAT and BIS-11 score and between IAT and PSQI. A positive correlation was also found between BIS-11 and PSQI. **Conclusion:** According to the findings of our study, it is suggested that there may be multiple and complex interactions between problematic internet use, low sleep quality, impulsivity and depressive symptoms. (*Anatolian Journal of Psychiatry* 2019; 20(5):491-498)

Keywords: depression, problematic internet use, sleep quality, impulsivity, adolescent

Majör depresif bozukluğu olan ergenlerde problemlerli internet kullanımı, uyku kalitesi ve dürtüsellik arasındaki ilişki

Öz

Amaç: Problemlerli internet kullanımı ve düşük uyku kalitesi ergenlerde sık rastlanan sorunlardır. Bu çalışmanın amacı majör depresif bozukluk tanısı konan ergenlerde problemlerli internet kullanımı, uyku kalitesi ve dürtüsellik arasındaki ilişkiyi araştırmak ve saptanan bulguları sağlıklı kontrol grubunun bulgularıyla karşılaştırmaktır. **Yöntem:** Çalışma, olgu ve kontrol grubu ile üç merkezli, tek disiplinler, kesitsel bir çalışma olarak planlanmıştır. Tüm katılımcılar Okul Çağı Çocukları için Duygulanım Bozuklukları ve Şizofreni Görüşme Çizelgesi - Şimdi ve Yaşam Boyu Versiyonu kullanılarak değerlendirilmeye alınmıştır. Tüm katılımcılar Beck Depresyon Ölçeği (BDÖ), Barratt Dürtüsellik Ölçeği (BIS-11), Pittsburgh Uyku Kalitesi Ölçeği (PUKÖ) ve Young İnternet Bağımlılık Testi (YİBT) ile değerlendirilmiştir. **Bulgular:** BIS-11, PUKÖ ve YİBT ölçeklerinin toplam puanlarının depresyon grubunda kontrol grubuna göre istatistiksel olarak anlamlı düzeyde daha yüksek olduğu saptanmıştır. YİBT ve BIS-11 puanları arasında ve YİBT ve PUKÖ puanları arasında pozitif bir korelasyon bulunmuştur. Ayrıca BIS-11 ve PUKÖ puanları arasında da pozitif bir korelasyon saptanmıştır. **Sonuç:** Çalışmamızın bulguları problemlerli internet kullanımı, düşük uyku kalitesi, dürtüsellik ve depresif belirtiler arasında çok yönlü ve karmaşık etkileşimlerin olabileceğini destekler niteliktedir. (*Anadolu Psikiyatri Derg* 2019; 20(5):491-498)

¹ Child and Adolescent Psychiatrist, Nevşehir State Hospital, Nevşehir, Turkey.

² Assist. Prof., İzmir Katip Çelebi University Faculty of Medicine, Department of Child and Adolescent Psychiatry, İzmir, Turkey

³ Assist. Prof., Abant İzzet Baysal University Faculty of Medicine, Department of Child and Adolescent Psychiatry, Bolu, Turkey

⁴ Prof., Dokuz Eylül University Faculty of Medicine, Department of Child and Adolescent Psychiatry, İzmir, Turkey

Correspondence address / Yazışma adresi:

Merve ONAT, MD, Child and Adolescent Psychiatrist, Nevşehir State Hospital, Nevşehir, Turkey

E-mail: merve_01_10@hotmail.com

Received: November, 11th 2018, Accepted: January, 23rd 2019, doi: 10.5455/apd.17978

Anadolu Psikiyatri Derg 2019; 20(5):491-498

Anahtar sözcükler: Depresyon, problemli internet kullanımı, uyku kalitesi, dürtüsellik, ergen

INTRODUCTION

Major depressive disorder (MDD) is a widespread mental disorder in adolescents. The prevalence of MDD is 2% in children and 4-8% in adolescents.¹ It is observed that the risk of MDD increases 2-4 times after puberty.² The etiology of MDD has been investigated for many years and it is now approved that biological and psychosocial factors play a role together.³

Problematic internet use can be identified as excessive and uncontrollable impulses with regard to internet use and can disrupt academic and familial functioning of the individual and restrict social relations.⁴ The prevalence of problematic internet use has ranged from 1-26%.⁵ In studies conducted in Turkey, the prevalence of problematic internet use in adolescents has been determined in the range of 4.5-16%.^{6,7} In a recent study, a relationship between MDD and problematic internet use was found and MDD has been asserted to be predisposed to development of internet addiction.⁸ In a study carried out in 2013, it has been suggested that problematic internet use may lead to MDD in adolescents due to both direct effect and internet-related sleep problems.⁹ In addition, problematic internet use often paves the way for sleep problems such as insomnia.¹⁰

Sleep is a very important factor in growth and development of children. Poor sleep quality can lead to mood, behavior, memory and attention problems.¹¹ Approximately 25-50% of children and 40% of adolescents have been indicated to have sleep problems.^{11,12} Comorbid psychiatric disorder was detected in 52% of adolescents with sleep problems.¹³ Recent studies have shown the role of sleep quality in the development of depression.^{3,14}

The relationship between impulsivity and MDD in adolescents is rarely examined in the literature. Some studies have reported that no association between MDD and impulsivity.^{15,16} However, in accordance with a review published in 2014, there is a strong relationship between impulsivity and depression even if depression is in remission.¹⁷ Impulsivity is a risk factor that can lead to serious consequences such as suicide attempts in depressed individuals, and it is especially important to analyze in individuals with MDD in the adolescent age group.¹⁸ Furthermore, individuals with poor sleep quality are thought to be

more impulsive than others.¹⁹ A recent study shows that poor sleep quality may give rise to greater risk-taking in adolescents, by increasing the normative imbalance between emotional and cognitive control systems.²⁰ On the other hand, in a recent study, it has been shown that the impulsivity is not predictive of apnea risk score.²¹

In this study, it was hypothesized that problematic internet use, sleep quality and impulsivity would find to be more impaired in patients with major depressive disorder than in healthy control group. It was aimed to search impulsivity, sleep quality and problematic internet use in adolescents with MDD and to compare the findings with those of healthy controls.

METHODS

The study was planned as a single-disciplinary, three-centered, cross-sectional study with a healthy control group. All participants were assessed using the Kiddie Schedule for Affective Disorders and Schizophrenia Present and Lifetime Version (K-SADS-PL). Beck Depression Inventory (BDI), Barratt Impulsiveness Scale (BIS-11), Pittsburgh Sleep Quality Index (PSQI) and Young's Internet Addiction Test (IAT) were administered to all participants.

Participants

Our study was conducted in adolescents aged 12 to 18 years. Ninety-seven adolescents (73 girls and 24 boys; mean age 14.70±1.48) were enrolled into the MDD group and age and sex matched 101 adolescents (mean age 15.02±1.55, 30 boys, 71 girls) were accepted into the healthy control group. Ninety-seven adolescents who were admitted to child psychiatry outpatient clinics of three different hospitals in Turkey during 2017, and who were diagnosed with MDD in reference to the DSM-5 diagnostic criteria and K-SADS-PL which were administered by a child psychiatry specialist, and who had not received any psychotropic drug before, were included into MDD group. One hundred and one adolescents who were admitted to various outpatient clinics of the same hospitals and who did not have any psychiatric or chronic disease and approved to attend the study, were included in the healthy control group. Adolescents with clinically normal intelligence were accepted to our study. Ethics committee approval was received from İzmir Katip Çelebi University

Clinical Research Ethics Committee. The written and verbal approvals of the adolescents and their mothers who admitted in our study were obtained. Comorbidities of the adolescents in the MDD group were evaluated by K-SADS-PL. While the adolescents with MDD and comorbid anxiety disorder (AD) were accepted to the MDD group, the adolescents with psychiatric comorbidity other than AD were excluded from our study. Of the cases with MDD, 35 had comorbid AD and 62 had no comorbidities. Subjects with substance abuse, obsessive compulsive disorder, bipolar disorder, psychotic disorders and central nervous system disorders were excluded from the study. One hundred and seventy-two adolescents admitted to three separate outpatient clinics owing to depressive symptoms were evaluated for the MDD group during 2017. Thirty-three adolescents without MDD and eight adolescents who refused to attend to the study were excluded, thus 131 adolescents with MDD were included in the evaluation. Twenty-one of the adolescents with MDD were excluded because of having comorbidity other than AD. Because seven of them used psychotropic drugs and six of them due to missing data were excluded from the study. As a result, 97 adolescents were included in the study for the MDD group.

Instruments

All participants were assessed using K-SADS-PL by the child and adolescent psychiatric specialist. Beck Depression Inventory (BDI), Barratt Impulsiveness Scale (BIS-11), Pittsburgh Sleep Quality Index (PSQI) and Young's Internet Addiction Test (IAT) were administered to all participants.

Sociodemographic Data Form: It was prepared by authors to obtain information about sociodemographic characteristics of adolescents and their parents.

Schedule for Affective Disorders and Schizophrenia for School Age Children Present and Life-Time (K-SADS-PL): It is a semi-structured interview form prepared by Kauffman et al. to study current and life-long psychopathology in children and adolescents aged between 6 and 18.²² Turkish translation of K-SADS-PL, validity and reliability study were performed by Gökler et al.²³

Beck Depression Inventory (BDI): The purpose of BDI is establish the degree of depressive symptoms. The scale includes four items of each of the 21 symptom categories of depression. Each item in the measurement is between 0 and

3 points. The increase in scale scores indicates that depression level and severity also increase.²⁴ The validity and reliability study of the Turkish version of the BDI were performed by Hisli.²⁵

Barratt Impulsiveness Scale-11 (BIS-11): Barratt developed the first version of the BIS. There are four different points are obtained from BIS-11: total score, motor, attentional and non-planning impulsivity scores. The high total BIS-11 score states the high impulsivity status.²⁶ Turkish validity and reliability study of BIS-11 were conducted by Güleç et al.²⁷

Pittsburgh Sleep Quality Index (PSQI): A self-report test supplies information about sleep quality in last month. PSQI consists of 24 questions and seven subscales including subjective sleep quality, sleep duration, sleep latency, sleep disturbance, sleep efficiency, use of sleep medication and daytime dysfunction.²⁸ The validity and reliability study of the Turkish version of PSQI was performed.²⁹

Young's Internet Addiction Test (IAT): The IAT consists of 20 questions that are scored between 1 and 5 about internet use and the total score from the scale varies between 20 and 100. IAT is used to determine the level of internet addiction.³⁰ The validity and reliability study of the Turkish version of IAT was studied and a four factor model (mood, relationship, responsibilities, duration) was found.^{31,32}

Statistical analysis

SPSS 18.0 (Statistical Package for the Social Sciences) program was utilized for the statistical analysis of the data attained in the study. The sociodemographic and clinical categorical variables of the case and control groups were established by the number and percentage values, and the comparison of categorical variables classified by the cross-chi-square test. Distribution of data was evaluated by the Kolmogorov-Smirnov method. Since the distribution of the data was in accord with normal distribution, paired groups were evaluated by parametric t test. In order to determine correlation between continuous variables, Pearson's correlation analysis was employed. p value < 0.05 was accepted as statistically significant.

RESULTS

Sociodemographic results

There was no difference with regard to adoles-

cents' age, gender, maternal age and maternal education level in our study ($p=0.062$, $p=0.281$, $p=0.075$, $p=0.322$, respectively). While school achievement of adolescents was measured by school grades in the last term, peer relationship were evaluated in accordance with their own expressions. Differences in school achievement and peer relationship were detected between the groups ($p<0.001$, $p=0.002$, respectively).

Barratt Impulsiveness Scale-11 (BIS-11) results

Data on BIS-11 scale of case and control groups were analyzed by applying parametric t test. It

was observed that case group acquired statistically significantly higher scores in motor subscale, attentional subscale, non-planning subscale and total scores ($p<0.001$ in all scales) (Table 1). Depressive adolescents with comorbid AD ($n=35$) and depressive adolescents without comorbidity ($n=62$) were compared by applying parametric t test. Motor impulsivity subscale score was found significantly higher in depressive adolescents with comorbid AD ($p=0.047$), but there was no statistically significant difference in total score and other subscales.

Table 1. Comparison of BIS-11 between MDD and control groups

BIS-11	MDD	Control	p*
Attentional	20.2±2.5	16.9±3.2	<0.001
Motor	24.6±3.4	20.5±3.1	<0.001
Nonplanning	29.9±3.5	24.0±4.3	<0.001
Total	74.8±7.1	61.4±6.9	<0.001

* Parametric t test; BIS-11: Barratt Impulsiveness Scale-11, MDD: Major depressive disorder

Pittsburgh Sleep Quality Index (PSQI) results

Data on PSQI scale of case and control groups were analyzed by using parametric t test. The total score of PSQI was found statistically significantly higher in case group compare to controls ($p<0.001$). The results of the subscales of PSQI

are shown in Table 2. Depressive adolescents with comorbid AD ($n=35$) and depressive adolescents without comorbidity ($n=62$) were compared by using parametric t test. Total score of PSQI was found significantly higher in depressive adolescents with comorbid AD ($p=0.006$).

Table 2. Comparison of PSQI between MDD and control groups

PSQI	MDD	Control	p*
Subjective sleep quality	1.8±0.8	0.8±0.7	<0.001
Sleep latency	2.1±0.8	0.7±0.7	<0.001
Sleep duration	1.1±1.3	0.6±0.5	0.001
Sleep efficiency	0.4±0.8	0.0±0.0	<0.001
Sleep disturbance	1.7±0.5	1.0±0.4	<0.001
Use of sleep medication	0.3±0.5	0.1±0.5	0.021
Daytime dysfunction	1.5±0.8	1.3±1.2	0.294
Total	9.2±3.1	4.7±2.3	<0.001

* Parametric t test; PSQI: Pittsburgh Sleep Quality Index, MDD: Major depressive disorder

Young's Internet Addiction Test (IAT) results

Data on IAT scale of case and control groups were examined by using parametric t test. The

total score of IAT was found statistically significantly higher in case group compare to controls ($p<0.001$). The results of the subscales of IAT

Table 3. Comparison of IAT between MDD and control groups

IAT	MDD	Control	p*
Mood	17.5±7.3	17.0±6.6	0.55
Liabilities	10.5±4.6	8.7±3.8	<0.001
Relationships	11.1±4.6	8.7±3.7	<0.001
Duration	8.8±3.0	7.4±3.4	<0.001
Total	47.8±16.6	41.7±13.2	<0.001

* Parametric t test; IAT: Young's Internet Addiction Test, MDD: Major depressive disorder

Table 4. Correlations between BDI, BIS-11, PSQI and IAT

	BDI	BIS-11	PSQI	IAT
BDI	r=1	r=0.400 p<0.001	r=-0.128 p=0.211	r=0.001 p=0.989
BIS-11	r=0.400 p<0.001	r=1	r=0.518 p<0.001	r=0.180 p=0.012
PSQI	r=-0.128 p=0.211	r=0.518 p<0.001	r=1	r=0.330 p<0.001
IAT	r=0.001 p=0.989	r=0.180 p=0.012	r=0.330 p<0.001	r=1

BDI: Beck Depression Inventory; BIS-11: Barratt Impulsiveness Scale-11; PSQI: Pittsburgh Sleep Quality Index; IAT: Young's Internet Addiction Test

are given in Table 3. Depressive adolescents with comorbid AD (n=35) and depressive adolescents without comorbidity (n=62) were compared by applying parametric t test. Total score of IAT was found significantly higher in depressive adolescents with comorbid AD (p=0.017).

In our study, a positive correlation was found between IAT and BIS-11 score (p=0.012, r=0.180) and between IAT and PSQI score (p<0.001, r=0.330). Also, there was a positive correlation between BIS-11 and BDI score (p<0.001, r=0.400). In addition, a positive correlation was found between BIS-11 and PSQI score (p<0.001, r=0.518). Correlations between scores of BDI, BIS-11, PSQI and IAT were shown in Table 4.

DISCUSSION

Findings of our study suggest that there may be multiple and complex interactions between problematic internet use, low sleep quality, impulsivity and depressive symptoms in adolescents. In our study, it was determined that problematic internet use was positively correlated with both impulsivity and poor sleep quality. Moreover, there was a positive correlation between poor

sleep quality and impulsivity in our study. These findings suggest that impulsivity, poor sleep quality and problematic internet use in clinical practice are the factors that should allow us to better understand development of MDD in adolescents.

In our study, problematic internet use was higher in adolescents in MDD group when compared to controls and it was found that poor sleep quality and impulsivity were correlated with problematic internet use. Similar to our study, there are several studies displaying the relationship between depression and problematic internet use.^{8,33,34} According to outcomes of a recent meta-analysis, while depression was significantly associated with problematic internet use, social anxiety was not related.³⁵ In addition, there are studies in the literature referring that problematic internet use is also related to poor sleep quality. In a recent study, problematic internet use was significantly associated to depressive symptoms and sleep disturbance in adolescents.³⁶ In a study which problematic internet use is measured by using the internet addiction scale, it has been shown that those with problematic internet use have lower sleep quality and have higher depression scores.³⁷ The findings of our study are

are consistent with the literature. However, in a study using the internet addiction scale, it was demonstrated that problematic internet use was associated with poor sleep quality in non-depressed adolescents, but this relationship was not determined in depressive adolescents.³⁸ Similar to our study, a recent study has shown that impulsivity is correlated with problematic internet use.³⁹

In our study, adolescents in MDD group were found to have poor sleep quality than the healthy control group. The correlation between poor sleep quality and depression in adolescents has been emphasized in previous studies.^{3,14,40} In a recent study of 385 adolescents aged 13-18 years of age, poor sleep quality was shown to be associated with depressive mood.⁴¹ In addition, it has been shown in the literature that sleep restriction influences mood in adolescents in an unfavorable way.^{42,43} This asserts that increasing sleep quality in adolescents may have an important part in the treatment of depression. In a recent three-week follow-up study of adolescents, depressive symptoms were determined to decrease significantly when suggestions gave importance to increase in sleep hygiene and were made to increase sleep duration gradually to improve sleep quality.⁴⁴

Another finding of our study was that impulsivity was higher in MDD group than in controls. There are contradictory results in the literature concerning the relationship between impulsivity and depression.^{16,17} In a study conducted by Sanchez et al., depressive cases were established to have higher scores on the BIS-11 scale when compared to those in the healthy control group.⁴⁵ In a recent study, depressive adolescents were found to score higher on the motor, attention, and planning subscales of BIS-11 scale compared to controls.⁴⁶ Determination of impulsivity in adolescents with depression, which is an important risk factor for suicide attempts, and hindrance of suicide are thought to be crucial in the treatment of depression.

In our study, we found a positive correlation between poor sleep quality and impulsivity. In a study carried out in 96 forensic psychiatric in-

patients, the relationship between sleep quality and impulsivity was analyzed using PSQI and BIS-11 scales and poor sleep quality was found to be significantly related to impulsivity.¹⁹ In a recent study, it was reported that individual differences in sleep quality in adolescents yielded significant differences in functional connectivity between prefrontal cortex and default mode network. In this study, poor sleep quality was identified to be linked to impulsivity in adolescents with low neuronal connectivity. Thus, neuronal functioning was considered to be related to individual differences linking sleep quality and impulsivity.⁴⁷ In a recent study, it was found that adolescents had a significant relationship between sleep patterns and impulse control, and that adolescents who go to bed after midnight have more difficulty in impulse control.⁴⁸ The findings of our study are consistent with the literature.

The present study had several limitations. First, one of the limitations of our study is that the rate of female sex is higher. It is thought that adolescent depression is more likely to occur in the female gender, leading to this limitation. This makes it difficult for the determined findings to be generalized for male gender. The fact that the adolescents participating in our study are adolescents admitted to the hospital for treatment makes it difficult to generalize the data obtained from our study to the nonclinical population. Therefore, this study should be replicated with larger samples. However, another limitation of our study is the use of self-report scales to measure problematic internet use, impulsivity and sleep quality. On the other hand, these data were obtained before the treatment of the adolescents in the study. Depressive adolescents may be followed; the changes could be examined by treatment. Also, adolescents' mental capacity could be evaluated with objective intelligence tests. Findings of our study support that problematic internet use, impulsivity and poor sleep quality are factors may be related to depression and each other. It is of utmost importance to understand the factors leading to the depressive symptom in order to prevent and treat depression developing during adolescence.

Authors' contributions: All authors contributed to design of the study, literature review, data collection, manuscript writing. Y. Öztürk and G. Özyurt contributed to statistical analysis.

REFERENCES

1. Birmaher B, Brent D, Bernet W, Bukstein O, Walter H, Benson RS, et al. Practice parameter for the assessment and treatment of children and adolescents with depressive disorders. *J Am Acad Child Adolesc Psychiatry* 2007; 46:1503-1526.
2. Birmaher B, Ryan ND, Williamson DE, Brent DA, Kaufman J, Dahl RE, et al. Childhood and adolescent depression: a review of the past 10 years. Part I. *J Am Acad Child Adolesc Psychiatry* 1996; 35:1427-1439.
3. Rao U. Biomarkers in pediatric depression. *Depress Anxiety* 2013; 30:787-791.
4. Yau YHC, Yip SW, Potenza MN. Understanding "behavioral addictions": insights from research. RK Ries, DA Fiellin, SC Miller, R Saitz (Eds.), *The ASAM Principles of Addiction Medicine, fifth ed., China: Wolters Kluwer Health-ASAM, 2014, pp.45-63.*
5. Li W, O'Brien JE, Snyder SM, Howard MO. Characteristics of internet addiction/pathological internet use in U.S. university students: a qualitative-method investigation. *PLoS One* 2015; 10:1-19.
6. Cömert İT, Ögel K. İstanbul örneğinde internet ve bilgisayar bağımlılığı yaygınlığı ve farklı etkenlerle ilişkisi. *Türkiye Klinikleri J Foren Med* 2009; 6:9-16.
7. Yılmaz E, Şahin YL, Haseski Hİ, Erol O. Lise öğrencilerinin internet bağımlılık düzeylerinin çeşitli değişkenlere göre incelenmesi: Balıkesir ili örneği. *Journal of Educational Sciences Research* 2014; 4:133-144.
8. Yen JY, Ko CH, Yen CF, Wu HY, Yang MJ. The comorbid psychiatric symptoms of Internet addiction: attention deficit and hyperactivity disorder (ADHD), depression, social phobia, and hostility. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine* 2007; 41:93-98.
9. Do YK, Shin E, Bautista MA, Foo K. The associations between self-reported sleep duration and adolescent health outcomes: what is the role of time spent on Internet use? *Sleep Medicine* 2013; 14:195-200.
10. Engelhardt CR, Mazurek MO, Sohl K. Media use and sleep among boys with autism spectrum disorder, ADHD, or typical development. *Pediatrics* 2013; 132:1081-1089.
11. Bhargava S. Diagnosis and management of common sleep problems in children. *Pediatr Rev* 2011; 32:91-99.
12. Reiter J, Rosen D. The diagnosis and management of common sleep disorders in adolescents. *Curr Opin Pediatr* 2014; 26:407-412.
13. Johnson EO, Roth T, Schultz L, Breslau N. Epidemiology of DSM-IV insomnia in adolescence: lifetime prevalence, chronicity, and an emergent gender difference. *Pediatrics* 2006; 117:247-256.
14. Li YI, Starr LR, Wray-Lake L. Insomnia mediates the longitudinal relationship between anxiety and depressive symptoms in a nationally representative sample of adolescents. *Depress Anxiety* 2018; 35:583-591.
15. Baca-Garcia E, Diaz-Sastre C, Garcia Resa E, Blasco H, Braquehais Conesa D, Oquendo MA, et al. Suicide attempts and impulsivity. *Eur Arch Psychiatry Clin Neurosci* 2005; 255:152-156.
16. Lester D. Functional and dysfunctional impulsivity and depression and suicidal ideation in a sub-clinical population. *J Gen Psychol* 1993; 120:187-188.
17. Saddichha S, Schuetz C. Impulsivity in remitted depression: a meta-analytical review. *Asian Journal of Psychiatry* 2014; 9:13-16.
18. Kingsbury S, Hawton K, Steinhardt K, James A. Do adolescents who take overdoses have specific psychological characteristics? A comparative study with psychiatric and community controls. *J Am Acad Child Adolesc Psychiatry* 1999; 38:1125-1131.
19. Kamphuis J, Dijk DJ, Spreen M, Lancel M. The relation between poor sleep, impulsivity and aggression in forensic psychiatric patients. *Physiology & Behavior* 2014; 123:168-173.
20. Telzer EH, Fuligni AJ, Lieberman MD, Galvan A. The effects of poor quality sleep on brain function and risk taking in adolescence. *Neuroimage* 2013; 71:275-283.
21. Ireland JL, Culpin V. The relationship between sleeping problems and aggression, anger, and impulsivity in a population of juvenile and young offenders. *The Journal of Adolescent Health: Official Publication of the Society for Adolescent Medicine* 2006; 38:649-655.
22. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, et al. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): initial reliability and validity data. *J Am Acad Child Adolesc Psychiatry* 1997; 36:980-988.
23. Gökler B, Ünal F, Pehlivan Türk B, Çengel Kültür E, Akdemir D, Taner Y. Okul çağı çocukları için duygulanım bozuklukları ve şizofreni görüşme çizelgesi-şimdi ve yaşam boyu şekli-Türkçe uyarlaması'nın geçerlik ve güvenilirliği. *Çocuk ve Gençlik Ruh Sağlığı Dergisi* 2004; 11:109-116.
24. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4:561-571.

25. Hisli N. Beck Depresyon Envanteri'nin üniversite öğrencileri için geçerliliği, güvenilirliği. *Psikoloji Dergisi* 1989; 7:3-13.
26. Barratt ES. Anxiety and Impulsiveness Related to Psychomotor Efficiency. *Percept Mot Skills* 1959; 9:191-198.
27. Güleç H, Tamam L, Yazici M, Turhan M, Karakuş G, Zengin M, et al. Psychometric Properties of the Turkish Version of the Barratt Impulsiveness Scale-11. *Klinik Psikofarmakoloji Bülteni* 2008; 18:251-258.
28. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989; 28:193-213.
29. Ağargün MY, Kara H, Anlar Ö. Pittsburgh Uyku Kalitesi İndeksi'nin geçerliliği ve güvenilirliği. *Türk Psikiyatri Derg* 1996; 7:107-115.
30. Young KS. Caught in the Net: How to Recognize the Signs of Internet Addiction – and a Winning Strategy for Recovery. New York: Wiley, 1998.
31. Kaya F, Delen E, Young KS. Psychometric properties of the Internet Addiction Test in Turkish. *Journal of Behavioral Addictions* 2016; 5:130-134.
32. Çakır O, Horzum MB. Internet addiction test. *Edu Sci Pract* 2008; 7:87-102.
33. Lau JTF, Walden DL, Wu AMS, Cheng KM, Lau MCM, Mo PKH. Bidirectional predictions between Internet addiction and probable depression among Chinese adolescents. *Journal of Behavioral Addictions* 2018; 7:633-643.
34. 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* 2014; 55:1377-1384.
35. Tokunaga RS, Rains SA. An evaluation of two characterizations of the relationships between problematic internet use, time spent using the internet, and psychosocial problems. *Human Communication Research* 2010; 36:512-545.
36. Tan Y, Chen Y, Lu Y, Li L. Exploring associations between problematic internet use, depressive symptoms and sleep disturbance among Southern Chinese adolescents. *International Journal of Environmental Research and Public Health* 2016; 13:313.
37. Kitazawa M, Yoshimura M, Murata M, Sato-Fujimoto Y, Hitokoto H, Mimura M, et al. Associations between problematic internet use and psychiatric symptoms among university students in Japan. *Psychiatry Clin Neurosci* 2018; 72:531-539.
38. Park MH, Park S, Jung KI, Kim JI, Cho SC, Kim BN. Moderating effects of depressive symptoms on the relationship between problematic use of the Internet and sleep problems in Korean adolescents. *BMC Psychiatry* 2018; 18:280.
39. de Vries HT, Nakamae T, Fukui K, Denys D, Narumoto J. Problematic internet use and psychiatric comorbidity in a population of Japanese adult psychiatric patients. *BMC Psychiatry* 2018; 18:9.
40. Harvey AG. Sleep and circadian functioning: critical mechanisms in the mood disorders? *Annual Review of Clinical Psychology* 2011; 7:297-319.
41. Short MA, Gradisar M, Lack LC, Wright HR. The impact of sleep on adolescent depressed mood, alertness and academic performance. *J Adolesc* 2013; 36:1025-1033.
42. Baum KT, Desai A, Field J, Miller LE, Rausch J, Beebe DW. Sleep restriction worsens mood and emotion regulation in adolescents. *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 2014; 55:180-190.
43. Talbot LS, McGlinchey EL, Kaplan KA, Dahl RE, Harvey AG. Sleep deprivation in adolescents and adults: changes in affect. *Emotion* 2010; 10:831-841.
44. Dewald-Kaufmann JF, Oort FJ, Meijer AM. The effects of sleep extension and sleep hygiene advice on sleep and depressive symptoms in adolescents: a randomized controlled trial. *Journal of Child Psychology and Psychiatry, and Allied Disciplines* 2014; 55:273-283.
45. Sanches M, Scott-Gurnell K, Patel A, Caetano SC, Zunta-Soares GB, Hatch JP, et al. Impulsivity in children and adolescents with mood disorders and unaffected offspring of bipolar parents. *Compr Psychiatry* 2014; 55:1337-1341.
46. Khemakhem K, Boudabous J, Cherif L, Ayadi H, Walha A, Moalla Y, et al. Impulsivity in adolescents with major depressive disorder: A comparative tunisian study. *Asian Journal of Psychiatry* 2017; 28:183-185.
47. Tashjian SM, Goldenberg D, Galvan A. Neural connectivity moderates the association between sleep and impulsivity in adolescents. *Developmental Cognitive Neuroscience* 2017; 27:35-44.
48. Abe T, Hagihara A, Nobutomo K. Sleep patterns and impulse control among Japanese junior high school students. *J Adolesc* 2010; 33:633-641.