



ELSEVIER

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

The impact of sensation seeking on the relationship between attention deficit/hyperactivity symptoms and severity of Internet addiction risk

Ercan Dalbudak^{a,*}, Cuneyt Evren^b, Secil Aldemir^a, Ibrahim Taymur^c, Bilge Evren^d, Merve Topcu^a

^a Department of Psychiatry, Faculty of Medicine, Turgut Ozal University, Ankara, Turkey

^b Bakirkoy Training and Research Hospital for Psychiatry, Neurology and Neurosurgery, Alcohol and Drug Research, Treatment and Training Center (AMATEM), Istanbul, Turkey

^c Department of Psychiatry, Ministry of Health, Sevket Yilmaz Research and Training Hospital, Bursa, Turkey

^d Baltalimani State Hospital for Musculoskeletal Disorders, Department of Psychiatry, Istanbul, Turkey

ARTICLE INFO

Article history:

Received 6 September 2014

Received in revised form

18 January 2015

Accepted 23 April 2015

Keywords:

Attention deficit/hyperactivity

Internet addiction

Online survey

University students

ABSTRACT

The aim of this study was to investigate the relationship of attention deficit/hyperactivity symptoms (ADHS) with severity of Internet addiction risk (SIAR), while controlling the effects of variables such as depression, anxiety, anger, sensation seeking and lack of assertiveness among university students. Cross-sectional online self-report survey was conducted in two universities among a representative sample of 582 Turkish university students. The students were assessed through the Addiction Profile Index Internet Addiction Form Screening Version (BAPINT-SV), the Psychological Screening Test for Adolescents (PSTA) and the Adult Attention deficit/hyperactivity disorder Self-Report Scale (ASRS). The participants were classified into the two groups as those with high risk of Internet addiction (HRIA) (11%) and those with low risk of Internet addiction (IA) (89%). The mean age was lower in the group with HRIA, whereas depression, anxiety, sensation seeking, anger, lack of assertiveness and ADHS scores were higher in this group. Lastly, a hierarchical regression analysis suggested that severity of sensation seeking and ADHS, particularly attention deficiency, predicted SIAR. The severity of sensation seeking and ADHS, particularly attention deficit symptoms, are important for SIAR. Awareness of sensation seeking among those with high ADHS may be important in prevention and management of IA among university students.

© 2015 Published by Elsevier Ireland Ltd.

1. Introduction

Excessive use of the Internet may lead to Internet addiction (IA), which may result as a wide range of dysfunction in daily routine and in taking responsibilities (Yen et al., 2007). The lack of a standardized definition and diagnostic instruments that show adequate reliability and validity across countries are significant limitations in evaluating of IA. Despite this limitation, IA was considered as a new psychiatric disorder in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), although it was not defined in DSM-5. Nevertheless, although the phenomenon has been previously called with different terms (Ko et al., 2012), the literature findings have been started to make consensus on the term IA (Young and Rogers, 1998; Yen et al., 2007; Dalbudak et al., 2013a, 2013b, 2014a; Dalbudak and Evren, 2014b). On the other hand, a number of studies have been

conducted to describe the underlying mechanism of the phenomenon, but further research is still required.

1.1. Internet addiction and sensation seeking

Studies have suggested that individuals who have higher scores on novelty seeking (Dalbudak et al., 2013a) and/or sensation seeking (Lin and Tsai, 2002; Shi et al., 2011) would also be more likely to have IA due to the free nature of the Internet. Zuckerman (1979) defined the concept of sensation seeking as a trait comprised of individuals' need for novel and complex sensations and experiences, and voluntary social and physical risk taking for the sake of the experience. Individuals may seek sensation via drug use, sexuality, aggression, extreme sports, Internet and computer use (Zuckerman, 1979; Lin and Tsai, 2002).

1.2. Internet addiction and psychological symptoms

Although IA has been accepted as a differentiated psychopathology (Fu et al., 2010), it has been reported that IA is also highly

* Correspondence to: Bestepe mah. Meric Sok., Kardes Apt. 25/28 Bestepe, 06330 Yenimahalle, Ankara, Turkey. Tel.: +90 312 2035555; GSM: +90 505 6478616; fax: +90 312 2213670.

E-mail addresses: edalbudak@hotmail.com, dr.dalbudak@gmail.com (E. Dalbudak).

<http://dx.doi.org/10.1016/j.psychres.2015.04.035>

0165-1781/© 2015 Published by Elsevier Ireland Ltd.

comorbid with psychological symptoms (Yang et al., 2005; Ko et al., 2012; Carli et al., 2013; Dalbudak et al., 2013b). Previous studies suggested that IA is associated with attention deficit/hyperactivity symptoms (ADHS) (Yen et al., 2007; Carli et al., 2013; Dalbudak and Evren, 2014b), low self-esteem (Kim and Davis, 2009), shyness (Treuer et al., 2001), anger expression (Hwang et al., 2014), hostility (Yen et al., 2007), depressive symptoms (Young and Rogers, 1998; Treuer et al., 2001), impulsivity (Cao et al., 2007; Dalbudak et al., 2013b) and obsessive–compulsive symptoms (Jang et al., 2008; Carli et al., 2013, Dalbudak et al. 2013b). Finally, according to a meta-analysis (Ho et al., 2014), IA is associated with alcohol abuse, ADHS, depression and anxiety.

To our knowledge, the relationship between IA and assertiveness has not been studied directly yet. Assertiveness is characterized as “the proper expression of any emotion other than anxiety toward another person” and is commonly conceptualized within social skills (Furnham, 1979). Moreover, previous studies suggested that low extravert personality trait is closely associated with severity of Internet addiction risk (SIAR) (Yan et al., 2014; Dalbudak and Evren, 2014b) and addictive behaviors (Feldman and Eysenck, 1986; Eysenck, 1997). Assertiveness is a manifestation of being extravert (Carver and White, 1994). It is also known that individuals with IA have lower social skills in real world and high comorbidity of social anxiety (Yen et al., 2014). Therefore, directly studying the relationship between IA and assertiveness may have an important role for further understanding of the concepts (Naragon-Gainey et al., 2013).

1.3. Internet addiction and attention deficit/hyperactivity symptoms (ADHS)

Attention deficit/hyperactivity disorder (ADHD) is a chronic neurobiological and childhood-onset disorder persisting into adolescence and adulthood (Ramos-Quiroga et al., 2013). Comorbidity of ADHS with other psychopathologies has been well-established in the literature. ADHS is commonly found in psychopathologies such as depression, anxiety, oppositional defiance, conduct disorder, substance use disorders (Herguner and Herguner, 2012; Klassen et al., 2012; de la Barra et al., 2013) and last but not least IA (Dalbudak and Evren, 2014b). Both IA and ADHS may lead to academic problems, including lower school performance and higher drop-out rates (Fredriksen et al., 2014), risky behaviors (Wolraich et al., 2005) and relational problems (Yen et al., 2014). Recently interest of researchers in studying underlying mechanisms of the relationship between ADHS and IA have increased (Carli et al., 2013; Dalbudak and Evren, 2014b; Ho et al., 2014). It was suggested that Internet serves by instant feedback and reward to the nature of ADHS in which individuals are easily getting bored and “having an aversion for delayed reward” (Ko et al., 2012). In addition, it is known that impaired inhibition is seen among those with ADHS due to abnormal brain activity (Weiss et al., 2011). In this case, impaired inhibition may lead difficulty in controlling the Internet use and increase the vulnerability of IA (Yen et al., 2014). Moreover, it is possible to predict risk of IA two years before the diagnosis of IA by detecting early ADHS (Ko et al., 2009).

Among various forms of psychological problems, depression and anxiety are salient in individuals with IA (Ko et al., 2012). Yen et al. (2014) suggested that prevention and intervention programs for IA in adolescents with ADHS should take anxiety, depression, and self-esteem into consideration. This study revealed that higher physical symptoms, lower harm avoidance and higher somatic discomfort/retarded activity were found to be significantly associated with more severe IA symptoms (Yen et al., 2014). Thus, studies focusing on IA must include depression and anxiety in their analyses.

Beside limited findings accounting for the associations between anxiety, depression, ADHS and sensation-seeking with SIAR, studies evaluating the effect of variables such as lack of assertiveness and anger on IA are also lacking in the literature. Although associations of these variables with IA are not well known, addiction potential can be predicted by aggression and assertiveness among university students (Hajihassani et al., 2014). Since literature findings emphasize the similarities in terms of personality, temperament, and emotion upon IA and alcohol addiction (Dalbudak et al., 2013a; Hwang et al., 2014), studying the relationship between IA and these variables may have importance. So far only one study conducted in Turkey evaluated the association between severity of ADHS and IA, while controlling the effect of personality traits, depression and anxiety symptoms among Turkish university students (Dalbudak and Evren, 2014b). However, this study did not consider variables such as sensation-seeking, lack of assertiveness and anger, and also was not conducted online. To our knowledge, the present study is the first online survey carried out in Turkish university students. After considering the previous literature, the current study hypothesized that even after controlling psychological symptoms, ADHS would predict SIAR and the sensation seeking may mediate this relationship. Therefore, the aim of the present study is to investigate the relationship of SIAR with psychological variables (depression, anxiety, anger, sensation seeking and lack of assertiveness) and ADHS among university students in Ankara/Turkey.

2. Methods

2.1. Participants and procedure

Cross-sectional online self-report survey was conducted in two universities in Ankara. A website was prepared for online participation. Approval from the Ethical Committee of the Turgut Ozal University was taken. The study was carried out between February and July 2013. The students were asked to fill out the form on the website anonymously. Informed consent was approved by students online before continuing with further questions. Exclusion criteria were unfilled forms. Due to exclusion criteria 582 students were included in the study, out of 803 randomly selected students from two universities.

2.2. Measures

The questionnaire administered online in the study, which covered socio-demographic data, was similar with the questionnaire used formerly in Turkey (Ogel et al., 2001, 2003, 2006). The participants also filled the Adult ADHD Self-Report Scale (ASRS); the Psychological Screening Test for Adolescents (PSTA) and the Addiction Profile Index Internet Addiction Form Screening Version (BAPINT-SV) was also used to determine high and low risk addiction groups.

2.2.1. The Addiction Profile Index Internet Addiction Form Screening Version (BAPINT-SV)

BAPINT-SV includes 2 of the 18 questions of BAPINT, which is a self-rating scale that evaluates the risk of IA (Ogel et al., 2012a). Chang and Man Law (2008) categorized Internet use into four macro-areas: compulsive internet use, excessive time spent online and failure to control it; withdrawal symptoms when being restricted from internet use; using the internet for social comfort; and negative social, academic or work consequences related to internet use. Two of these four areas were evaluated with BAPINT-SV with Likert-type answers; 1-Spending time on the Internet within the last 3 months (a-Never, b-1–5 times a week or less, c-up to 3 h 59 min a day, d-4 to 5 h 59 min a day, e- 6 h or more a day) and 2-Does spending time on the Internet effect your life negatively? (a-Never, b-Very little effect, c-Partial effect, d-It effects, e-Too much effect). Correlation of BAPINT-SV with BAPINT is high ($r=0.82$, $p < 0.001$) (Ogel et al., 2012b). BAPINT-SV is validated among adolescents and university students and when point 4 is taken as a cut-off point sensitivity was found as 0.72, whereas specificity as 0.83 (PPV:97.5, NPV:75.7) (Ogel et al., 2012a). Cronbach's α for BAPINT-SV was 0.76 in the present study. Finally, BAPINT-SV is used in a published study (Evren et al., 2014a).

2.2.2. The Psychological Screening Test for Adolescents (PSTA)

The Psychological Screening Test for Adolescents (PSTA) was developed by adaptation of the Examination and Assessment Form for Juvenile Offenders (ARDEF), which

was developed with the purpose of investigating risk of recidivism and needs of children and adolescents who are in conflict with the law (Ogel et al., 2011b). By shortening the number of ARDEF items PSTA questions were formed for screening purposes. The scale has 6 subscales; depression, anxiety, ADHS, anger, lack of assertiveness and sensation seeking. Since we used ASRS to evaluate ADHS, other 5 subscales were used in the present study.

Depression subscale was moderately correlated with the Beck Depression Inventory ($r=0.65$) and depression subscale of the Symptom Checklist-90-R (SCL-90-R) ($r=0.63$). Correlation coefficient of anxiety subscale with the State-Trait Anxiety Inventory (STAI) State anxiety was 0.52, whereas correlation coefficient of anxiety subscale with anxiety subscale of SCL-90 was 0.54. Anger subscale was moderately correlated with Multidimensional Anger Scale (MAS) ($r=0.72$) and anger subscale of SCL-90 ($r=0.54$). Lack of assertiveness subscale and the Rathus Assertiveness Schedule was moderately correlated ($r=0.55$), whereas sensation seeking subscale and sensation subscale of Temperament and Character Inventory (TCI) were mildly correlated ($r=0.39$). All correlations were significant at level of $p < 0.01$ (Ogel et al., 2011a).

The scale has 27 questions with answers "yes" or "no", whereas ADHS subscale with 5 questions has 3 answers "yes", "partially" and "no". The statistical investigations for validation have shown that PSTA has an interrater reliability of $r=0.89$ and a high internal reliability ($\alpha=0.79$) (Ogel et al., 2012b). There is a high level of positive correlation between Youth Self-Report, which is widely used among 6 to 18 years old adolescents for psychological problems, and PSTA total score ($r=0.60$) (Erol et al., 1995). Cronbach's α for depression was 0.72, for anxiety 0.60, for anger 0.75, for lack of assertiveness 0.67 and for sensation seeking 0.70 in the present study. These subscales were previously used in a published study (Evren et al., 2014a, 2014b).

2.2.3. Adult ADHD Self-Report Scale (ASRS-v1.1)

ADHS were measured with the ASRS (Kessler et al., 2005), an 18-item scale based on Diagnostic and Statistical Manual of Mental Disorders: Fourth Edition (DSM-IV-TR) criteria (APA, 2000). The Turkish version of ASRS demonstrated good reliability and validity in university students (Dogan et al., 2009). Reliability analysis showed that the Turkish version of ASRS has a high level of internal consistency (Cronbach's $\alpha=0.88$). Cronbach's α coefficients for 'inattention' ($r=0.82$) and 'hyperactivity/impulsivity' ($r=0.78$) subscales were also high.

2.3. Statistical methods

The statistical package SPSS 17.0 for Windows (SPSS, 278 Chicago, IL) was used for all analyses. Pearson correlational analyses were used to determine the relationships between ADHS and other subscales. Variables were also assessed both with total mean scores and high/low IA risk groups. A series of analysis including correlation, χ^2 test and t test were run. Lastly, hierarchical linear regression model was used to determine the predictors of SIAR.

3. Results

χ^2 test was run to see the difference in frequency of gender across variables, namely, spending time on the Internet within the last 3 months and effect of spending time on the Internet on persons' life. The results revealed that only the effect of spending time on the Internet on persons' life was significant different across gender. That is, those who reported less significant effect were more likely to be among females, and those who reported partial and more effect were more likely to be among males. Mean score of BAPINT-SV was higher in male participants ($M=1.83$, $S.D.=1.47$) than females ($M=1.47$, $S.D.=1.33$) ($t=-3.10$, $p=0.002$) (Table 1).

The participants were classified into the two groups as those with high risk of Internet addiction (HRIA) (11%) and those with low risk of IA (89%) according to BAPINT-SV. The group with HRIA had higher scores on ASRS total and subscales, depression, anxiety, anger, sensation seeking and lack of assertiveness (Table 2).

Lastly, a hierarchical regression analysis was run with the independent variables of depression, anxiety, sensation seeking, anger and lack of assertiveness, ASRS in order to predict SIAR. In step 1, variables of depression, anxiety, anger, sensation seeking and lack of assertiveness were entered into analysis. Other than anger, four variables predicted the SIAR. In step 2a, ASRS total score was added to the model as an independent variable. ASRS score significantly predicted the SIAR, together with lack of

assertiveness and sensation seeking. Then in step 2b inattention and hyperactivity/impulsivity subscale scores were added to regression model as independent variables instead of ASRS total score. Inattention still significantly predicted the SIAR together with sensation seeking (Table 3).

4. Discussion

In terms of gender differences, consistent with many previous studies (Carli et al., 2013), results revealed that the SIAR was higher in males than females, although the rate of HRIA did not differ between the genders. The rate of HRIA found in the present study (11%) is consistent with previous studies conducted in Turkey, which revealed that the rate of IA was ranging from 7.2 to 12.3 among university students (Kayri and Gunuc, 2009; Dalbudak et al., 2013a). The present study demonstrated that SIAR is associated with anger, sensation seeking, lack of assertiveness, anxiety, depressive symptoms and ADHS. However, the main finding of the present study is that sensation seeking and severity of ADHS were still associated with the SIAR even after controlling other variables. This is consistent with the main findings of the previous studies that associated SIAR with sensation seeking (Lin and Tsai, 2002; Lu, 2008; Shi et al., 2011) and with severity of ADHS (Dalbudak and Evren, 2014b). Although hyperactivity/impulsivity symptoms predicted SIAR together with depression, anxiety, introversion and neuroticism in the previous study (Dalbudak and Evren, 2014b), inattention dimension predicted SIAR together with sensation seeking in the present study. Possible reasons could account for the inconsistency. First, the current study's design is different than the previous study (Dalbudak and Evren, 2014b). Also current study was carried out online, while previous study had a paper-pencil format. Second, the different independent variables were chosen for two studies. That is, previous study did not focus on anger, sensation seeking and lack of assertiveness. Third, variables that match in two studies, such as anxiety, depression and SIAR were assessed with different scales. Nevertheless, consistent with many previous studies (Carli et al., 2013; Dalbudak and Evren, 2014b; Ho et al., 2014), both of these studies suggested that severity of ADHS predicts SIAR even in the presence of other variables.

Previous studies indicated that sensation seeking was positively correlated with risky and addictive behaviors such as smoking, use of alcohol, and use of illicit drugs (Zuckerman et al., 1990; Newcomb and McGee, 1991; Stacy et al., 1993). Up to now, there have been a limited number of studies that evaluated the relationship between sensation seeking and IA (Lu, 2008; Shi et al., 2011), which did not evaluate factors such as depression, anxiety, anger and lack of assertiveness. Nevertheless, consistent with the present study sensation seeking predicted SIAR in these studies (Lin and Tsai, 2002; Lu, 2008; Shi et al., 2011). Also Yen et al. (2009) reported that college students with IA had higher fun-seeking scores. It was suggested that since individuals with higher levels of sensation seeking have lower tolerance to boredom than others (Pizam et al., 2004), external stimuli served by the Internet may make them susceptible to IA (Lin and Tsai, 2002; Shi et al., 2011).

Current findings and findings of the previous studies may shed a light on the relationship between ADHS and SRIA, and the role of sensation seeking on this relationship. Internet is characterized by rapid response, immediate reward and multiple windows with different activities which may reduce the feelings of boredom or aversion to delayed reward among individuals with higher ADHS. Students with high SIAR and greater levels of sensation seeking are likely to be fascinated by the Internet and suffer the adverse effects of its use (Lin and Tsai, 2002). Thus, high sensation seeking

Table 1
Gender differences according to spending time on the Internet within the last 3 months, effect of spending time on the Internet on persons' life, the Addiction Profile Index Internet Addiction Form Screening Version (BAPINT-SV) score and high risk of Internet addiction.

	Female		Male		χ^2	p
	n=331	%	n=251	%		
Spending time on the Internet within the last 3 months					6.45	0.168
Never	13	3.9	4	1.6		
1–5 times a week or less	88	26.6	60	23.9		
Up to 3 h 59 min a day	149	45.0	115	45.8		
4 h to 5 h 59 min a day	61	18.4	46	18.3		
6 h or more a day	20	6.0	26	10.4		
Does spending time on the Internet negatively affect your life?					14.15	0.007
Never	119	36.0	69	27.5		
Very little effect	103	31.1	63	25.1		
Partial effect	67	20.2	73	29.1		
It effects	37	11.2	36	14.3		
Too much effect	5	1.5	10	4.0		
Internet addiction score (mean \pm S.D.)	1.47	1.33	1.83	1.47	$t = -3.10$	0.002
High risk of Internet addiction (11%)	31	9.4	33	13.1	2.09	0.149

Table 2
Comparing scale scores according to Internet addiction risk.

	Low risk of Internet addiction n=518, 89.0%		High risk of Internet addiction n=64, 11.0%		t	p
	Mean	S.D.	Mean	S.D.		
Age	21.05	2.76	20.50	1.97	1.99	0.049
ASRS	25.65	9.13	33.19	9.04	-6.23	<0.001
Attention deficiency	12.49	5.35	16.50	5.32	-5.66	<0.001
Hyperactivity	13.16	4.94	16.69	5.02	-5.37	<0.001
PSTA						
Depression	2.68	1.61	3.86	1.82	-5.45	<0.001
Anxiety	1.83	1.26	2.67	1.52	-4.23	<0.001
Anger	2.39	1.28	3.08	1.34	-4.07	<0.001
Sensation seeking	2.54	1.58	3.25	1.56	-3.42	0.001
Lack of assertiveness	4.21	1.99	5.38	2.27	-4.34	<0.001

PSTA: Psychological Screening Test for Adolescents, ASRS: Adult ADHD Self-Report Scale.

may make it difficult for individuals to control their Internet use, making them vulnerable to IA. This result may be reasonable since the Internet provides a constantly novel environment with a plenitude of opportunities for adventure. Furthermore, according to a new meta-analysis (Ho et al., 2014), ADHD is more prevalent in young adults between 19 and 39 years of age and clinical observations point to predominance of inattention over and above hyperactivity in this age group. Young adults with ADHS may use the internet excessively to control their inattention and in this way, excessive internet usage may be self-treatment for ADHS (Ho et al., 2014). Thus, if university students with inattention symptoms are also high sensation seekers, they may also have high SIAR.

Although this is not the first study to evaluate the relationship of SIAR with severity of ADHS, it is the first study to evaluate this relationship while controlling other variables such as depression, anxiety, anger, lack of assertiveness and sensation seeking. Nevertheless, the current study has some limitations. The sample did not reflect whole university students, it was a non-clinical sample, all the scales were self-rated and last but not least the present study conducted online. Finally, since this study is cross-sectional the findings of this study cannot address the causal relationships among the primary constructs of interest.

Table 3
Predictors of severity of Internet addiction risk in hierarchical linear regression analysis.

Model		Unstandardized coefficients		Standardized coefficients		t	p
		B	Std. error	Beta			
Step 1	Depression	0.119	0.045	0.141		2.644	0.008*
	Sensation seeking	0.129	0.036	0.146		3.591	<0.001*
	Lack of assertiveness	0.080	0.029	0.117		2.750	0.006*
Step 2a	Anxiety	0.126	0.057	0.119		2.214	0.027*
	Depression	0.083	0.045	0.099		1.842	0.066
	Sensation seeking	0.091	0.036	0.104		2.517	0.012*
Step 2b	Lack of assertiveness	0.059	0.029	0.086		2.038	0.042*
	Anxiety	0.083	0.057	0.078		1.461	0.145
	ASRS	0.030	0.007	0.203		4.430	<0.001*
	Depression	0.077	0.045	0.092		1.721	0.086
	Sensation seeking	0.104	0.036	0.118		2.930	0.004*
	Lack of assertiveness	0.049	0.029	0.072		1.684	0.093
	Anxiety	0.101	0.056	0.095		1.802	0.072
	Inattention	0.052	0.011	0.204		4.615	<0.001*

Depression, anxiety, sensation seeking, lack of assertivity and anger were independent variables in Step 1. In Step 2a ASRS score was added as an independent variable, whereas in Step 2b inattention and hyperactivity subscales were added as independent variable.

Step 1: $F=23.49$, d.f.=4, 577, $p < 0.001$ Adjusted $R^2=0.134$, Step 2a: $F=23.33$, d.f.=5, 576, $p < 0.001$ Adjusted $R^2=0.161$, R^2 Change=0.028, Step 2b: $F=23.71$, d.f.=5, 576, $p < 0.001$ Adjusted $R^2=0.164$, R^2 Change=0.031.

* Statistically significant.

The severity of ADHS, particularly inattention dimension, has predicted the SIAR together with sensation seeking even after controlling the effect of other variables among Turkish university students. If we consider the findings of the present study together with the findings of our previous study (Dalbudak and Evren, 2014b) it may suggest that to better understand the association between SIAR and ADHS among university students, clinicians must evaluate both inattention and hyperactivity/impulsivity factors of ADHS dimensionally as these constructs present together in an individual although in different degrees. According to the balance between these constructs and the variables that are

included in the analyses, particular construct to predict SIAR may differ. Moreover, consistent with previous studies (Carli et al., 2013; Dalbudak and Evren, 2014b), ADHS has stronger relationship with SIAR than depressive and anxiety symptoms. Finally, awareness of sensation seeking among those with high ADHS may be important in prevention and management of IA among university students.

Conflict of interest

None to declare.

Acknowledgments

This study was part of a Project called as Youth Observation Study (GENCIZ) in Turkey, which through its web site allows surveys for high school and university students from different cities.

References

- American Psychiatric Association, 2000. Diagnostic and Statistical Manual of Mental Disorders, 4th ed. American Psychiatric Press, Washington, DC (DSM-IV-TR).
- Cao, F., Su, L., Liu, T., Gao, X., 2007. The relationship between impulsivity and internet addiction in a sample of Chinese adolescents. *European Psychiatry* 22, 466–471.
- Carli, V., Durkee, T., Wasserman, D., Hadlaczky, G., Despalins, R., Kramarz, E., Wasserman, C., Sarchiapone, M., Hoven, C.W., Brunner, R., Kaess, M., 2013. The association between pathological Internet use and comorbid psychopathology: a systematic review. *Psychopathology* 46, 1–13.
- Carver, C.S., White, T.L., 1994. Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: the BIS/BAS scales. *Journal of Personality and Social Psychology* 67, 319–333.
- Chang, M.K., Man Law, S.P., 2008. Factor structure for Young's Internet addiction test: a confirmatory study. *Computers in Human Behavior* 24, 2597–2619.
- Dalbudak, E., Evren, C., Aldemir, S., Coskun, K.S., Ugurlu, H., Yildirim, F.G., 2013a. Relationship of Internet addiction severity with depression, anxiety, and alexithymia, temperament and character in university students. *Cyberpsychology, Behavior, and Social Networking* 16, 272–278.
- Dalbudak, E., Evren, C., Topcu, M., Aldemir, S., Coskun, K.S., Bozkurt, M., Evren, B., Canbal, M., 2013b. Relationship of Internet addiction with impulsivity and severity of psychopathology among Turkish university students. *Psychiatry Research* 210, 1086–1091.
- Dalbudak, E., Evren, C., Aldemir, S., Evren, B., 2014a. The severity of Internet addiction risk and its relationship with severity of borderline personality features, childhood traumas, dissociative experiences, depression and anxiety symptoms among Turkish university students. *Psychiatry Research* 219, 577–582.
- Dalbudak, E., Evren, C., 2014b. The relationship of internet addiction severity with attention deficit hyperactivity disorder symptoms in Turkish university students; impact of personality traits, depression and anxiety. *Comprehensive Psychiatry* 55, 497–503.
- de la Barra, F.E., Vicente, B., Saldivia, S., Melipillan, R., 2013. Epidemiology of ADHD in Chilean children and adolescents. *Attention Deficit and Hyperactivity Disorders* 5, 1–8.
- Dogan, S., Oncu, B., Varol-Saracoglu, G., Kucukgoncu, S., 2009. Validity and reliability of the Turkish version of the Adult ADHD Self-Report Scale (ASRS-v1.1). *Anatolian Journal of Psychiatry* 10, 77–87 (Turkish).
- Erol, N., Arslan, B.L., Akçakin, M., 1995. The adaptation and standardization of the child behavior checklist among 6–18 years-old Turkish children. In: Sergeant, J (Ed.), *Eunethydis: European Approaches to Hyperkinetic Disorder*. Fotoratar, Zurich, pp. 97–113.
- Evren, C., Dalbudak, E., Evren, B., 2014a. High risk of Internet addiction and its relationship with lifetime substance use, psychological and behavioral problems among 10th grade adolescents in Istanbul. *Psychiatria Danubina* 26, 330–339.
- Evren, C., Dalbudak, E., Evren, B., Can, Y., Umur, G., 2014b. The severity of attention deficit hyperactivity symptoms and its relationship with lifetime substance use and psychological variables among 10th grade students in Istanbul. *Comprehensive Psychiatry* 55, 1665–1670.
- Eysenck, H.J., 1997. Addiction, personality and motivation. *Human Psychopharmacology-Clinical and Experimental* 12, 79–87.
- Feldman, J., Eysenck, S., 1986. Addictive personality traits in bulimic patients. *Personality and Individual Differences* 7, 923–926.
- Fredriksen, M., Dahl, A.A., Martinsen, E.W., Klungsoyr, O., Faraone, S.V., Peleikis, D. E., 2014. Childhood and persistent ADHD symptoms associated with educational failure and long-term occupational disability in adult ADHD. *Attention Deficit and Hyperactivity Disorders* 6, 87–99.
- Furnham, A., 1979. Assertiveness in three cultures: multidimensionality and cultural differences. *Journal of Clinical Psychology* 36, 522–527.
- Fu, K.W., Chan, W.S., Wong, P.W., Yip, P.S., 2010. Internet addiction: prevalence, discriminant validity and correlates among adolescents in Hong Kong. *The British Journal of Psychiatry* 196, 486–492.
- Hajihassani, M., Shafiabadi, A., Pirsaghi, F., Bashirpour, M., 2014. Prediction of addiction potential on the basis of aggression and assertiveness in university students. *Journal of Research & Education Office* 5, 41–54.
- Herguner, S., Herguner, A., 2012. Psychiatric comorbidity in children and adolescents with attention deficit hyperactivity disorder. *Archives of Neuropsychiatry* 49, 114–118 (Turkish).
- Ho, R.C., Zhang, M.W., Tsang, T.Y., Toh, A.H., Pan, F., Lu, Y., Cheng, C., Yip, P.S., Lam, L. T., Lai, C.M., Watanabe, H., Mak, K.K., 2014. The association between Internet addiction and psychiatric co-morbidity: a meta-analysis. *BMC Psychiatry* 14, 183.
- Hwang, J.Y., Choi, J.S., Gwak, A.R., Jung, D., Choi, S.W., Lee, J., Lee, J.Y., Jung, H.Y., Kim, D.J., 2014. Shared psychological characteristics that are linked to aggression between patients with Internet addiction and those with alcohol dependence. *Annals of General Psychiatry* 13, 1–6.
- Jang, K.S., Hwang, S.Y., Choi, J.Y., 2008. Internet addiction and psychiatric symptoms among Korean adolescents. *Journal of School Health* 78, 165–171.
- Kayri, M., Gunuc, S., 2009. The adaptation of Internet Addiction Scale into Turkish: the study of validity and reliability. *Ankara University Journal of Faculty of Educational Sciences* 42, 157–175.
- Kessler, R.C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M.J., Jin, R., Secnik, K., Spencer, T., Ustun, T.B., Walters, E.E., 2005. The World Health Organization adult ADHD self-report scale (ASRS): a short screening scale for use in the general population. *Psychological Medicine* 35, 245–256.
- Kim, H.K., Davis, K.E., 2009. Toward a comprehensive theory of problematic Internet use: evaluating the role of self-esteem, anxiety, flow and the self-rated importance of Internet activities. *Computers in Human Behavior* 25, 490–500.
- Klassen, L.J., Bilkey, T.S., Katzman, M.A., Chokka, P., 2012. Comorbid attention deficit/hyperactivity disorder and substance use disorder: treatment considerations. *Current Drug Abuse Reviews* 5, 190–198.
- Ko, C.H., Yen, J.Y., Chen, C.S., Yeh, Y.C., Yen, C.F., 2009. Predictive values of psychiatric symptoms for Internet addiction in adolescents: a 2-year prospective study. *Archives of Pediatrics Adolescent Medicine* 163, 937–943.
- Ko, C.H., Yen, J.-Y., Yen, C.F., Chen, C.S., Chen, C.C., 2012. The association between Internet addiction and psychiatric disorder: a review of the literature. *European Psychiatry* 27, 1–8.
- Lin, S.S.J., Tsai, C.C., 2002. Sensation seeking and Internet dependence of Taiwanese high school adolescents. *Computers in Human Studies* 18, 411–426.
- Lu, H.Y., 2008. Sensation-seeking, Internet dependency and online interpersonal deception. *Cyber Psychology & Behavior* 11, 227–231.
- Naragon-Gainey, K., Gallagher, M.W., Brown, T.A., 2013. Stable “trait” variance of temperament as a predictor of the temporal course of depression and social phobia. *Journal of Abnormal Psychology* 122, 611–623.
- Newcomb, M.D., McGee, L., 1991. Influence of sensation seeking on general deviance and specific problem behaviors from adolescence to young adulthood. *Journal of Personality & Social Psychology* 61, 614–628.
- Ogel, K., Tamar, D., Evren, C., Cakmak, D., 2001. Prevalence of tobacco, alcohol and drug use in high school students. *Turkish Journal of Psychiatry* 12, 47–52.
- Ogel, K., Corapçoglu, A., Tamar, M., Tot, S., Doğan, O., Uğuz, S., Yenilmez, C., Bilici, M., Tamar, D., Liman, O., 2003. Tobacco, alcohol and substance use prevalence among elementary and secondary school students in nine cities of Turkey. *Turkish Journal of Psychiatry* 15, 112–118.
- Ogel, K., Taner, S., Eke, C.Y., 2006. Tobacco, alcohol and substance use prevalence among tenth grade students: Istanbul sample. *Journal of Dependence* 7, 18–23.
- Ogel, K., Basabak, A., Koc, C., Aksoy, A., Karadayi, G., 2011a. Psychometric properties of different forms of the addiction profile index (BAP). *Bulletin of Clinical Psychopharmacology* 21 (Suppl. 2), P151.
- Ogel, K., Karadayi, G., Senyuva, G., Topsakal, E.O., 2011b. Assessment of risks and needs of juvenile offenders: development and standardization of examination and assessment form of juvenile offenders (ARDEF). *Anatolian Journal of Psychiatry* 12, 143–150.
- Ogel, K., Karadag, F., Satgan, D., 2012a. Psychometric properties of the addiction profile index internet addiction form (BAPINT). *Bulletin of Clinical Psychopharmacology* 22 (Suppl. 1), S110.
- Ogel, K., Karadayi, G., Senyuva, G., Kanoglu, H., 2012b. The reliability and validity study of psychological screening test for adolescents. *Dusunen Adam Journal of Psychiatry and Neurological Science* 25, 8–16.
- Pizam, A., Jeong, G.H., Reichel, A., van Boemmel, H., Lussion, J.M., Steynberg, L., State-Costache, O., Volo, S., Kroesbacher, C., Kucerova, C., Montmany, N., 2004. The relationship between risk-taking, sensation seeking, and tourist behavior of young adults: a cross-cultural study. *Journal of Travel Research* 42, 251–260.
- Ramos-Quiroga, J.A., Montoya, A., Kutzelnigg, A., Deberdt, W., Sobanski, E., 2013. Attention deficit hyperactivity disorder in the European adult population: prevalence, disease awareness, and treatment guidelines. *Current Medical Research & Opinion* 29, 1093–1104.
- Shi, J., Chen, Z., Tian, M., 2011. Internet self-efficacy, the need for cognition, and sensation seeking as predictors of problematic use of the Internet. *Cyberpsychology, Behavior, and Social Networking* 14, 231–234.

- Stacy, A.W., Newcomb, M.D., Bentler, P.M., 1993. Cognitive motivations and sensation seeking as long-term predictors of drinking problems. *Journal of Social & Clinical Psychology* 12, 1–24.
- Treuer, T., Fabian, Z., Furedi, J., 2001. Internet addiction associated with features of impulse control disorder: is it a real psychiatric disorder? *Journal of Affective Disorders* 66, 266–283.
- Weiss, M.D., Baer, S., Allan, B.A., Saran, K., Schibuk, H., 2011. The screens culture: impact on ADHD. *Attention Deficit and Hyperactivity Disorders* 3, 327–334.
- Wolraich, M.L., Wibbelsman, C.J., Brown, T.E., Evans, S.W., Gotlieb, E.M., Knight, J.R., Ross, E.C., Shubiner, H.H., Wender, E.H., Wilens, T., 2005. Attention-deficit/hyperactivity disorder among adolescents: a review of the diagnosis, treatment, and clinical implications. *Pediatrics* 115, 1734–1746.
- Yan, W., Li, Y., Sui, N., 2014. The relationship between recent stressful life events, personality traits, perceived family functioning and Internet addiction among college students. *Stress and Health* 30, 3–11.
- Yang, C.K., Choe, B.M., Baity, M., Lee, J.H., Cho, J.S., 2005. SCL-90-R and 16PF profiles of senior high school students with excessive internet use. *Canadian Journal of Psychiatry* 50, 407–414.
- Yen, J.Y., Ko, C.H., Yen, C.F., Wu, H.Y., Yang, M.J., 2007. The comorbid psychiatric symptoms of Internet addiction: attention deficit and hyperactivity disorder (ADHD), depression, social phobia and hostility. *Journal of Adolescent Health* 41, 93–98.
- Yen, J.Y., Ko, C.H., Yen, C.F., Chen, C.S., Chen, C.C., 2009. The association between harmful alcohol use and Internet addiction among college students: comparison of personality. *Psychiatry and Clinical Neurosciences* 63, 218–224.
- Yen, C.F., Chou, W.J., Liu, T.L., Yang, P., Hu, H.F., 2014. The association of Internet addiction symptoms with anxiety, depression and self-esteem among adolescents with attention-deficit/hyperactivity disorder. *Comprehensive Psychiatry* 55, 1601–1608.
- Young, K.S., Rogers, R.C., 1998. The relationship between depression and Internet addiction. *CyberPsychology and Behavior* 1, 25–28.
- Zuckerman, M., Ball, S., Black, J., 1990. Influences of sensation, gender, risk appraisal, and situational motivation on smoking. *Addictive Behaviors* 15, 209–220.
- Zuckerman, M., 1979. *Sensation seeking: beyond the optimal level of arousal*. LEA, Hillsdale, NJ.