



The Associations Between Problematic Internet Use, Healthy Lifestyle Behaviors and Health Complaints in Adolescents

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This study aimed to explore relationship between problematic internet use (PIU), healthy lifestyle behaviors and subjective health complaints.

Methods: Participants (396 adolescents, aged 11–18 years) from 34 general education schools across Latvia completed online survey. The PIU was assessed by the Problematic and Risky Internet Use Screening Scale (PRIUSS) collecting data on social impairment, emotional impairment, and risky/impulsive internet use. The subjective health complaints assessed were somatic and psychological symptoms. Healthy lifestyle behaviors assessed were daily physical activities, time spent in using information technologies (IT), eating habits, and duration of sleep.

Results: This study found that 31.00% ($n = 124$) of the participants scored at risk for PIU. Correlates associated with PIU were subjective health complaints, low physical activity, lack of meals together with family and disturbed sleeping regimes on weekends ($P < 0.001$). Stepwise multiple regression analyses showed that 34% of the variance in the PRIUSS scores was explained by psychological health complaints (irritability, depression, and nervousness), screen time use on weekends, physical activity, drinking sweetened soft drinks and unhealthy eating habits.

Conclusion: PIU behaviors among adolescents in Latvia are associated with psychological symptoms and unhealthy lifestyle. Further effective measures and interventions are needed to prevent development of psychosomatic health problems.

Keywords: health, adolescents, problematic internet use, physical activity, education

INTRODUCTION

Adolescence is a period when independent lifestyle behaviours are developed which can significantly impact current and long-term health and education aspects (e.g., body composition, fitness level, academic performance, sleep quality, and psychosocial behaviors) (Biddle et al., 2004; Costigan et al., 2013).

Numerous previous studies involving adolescents have demonstrated associations between lower levels of daily physical activity and greater time engaged in sedentary behaviors such as screen time

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(Hashem et al., 2018; Marques et al., 2019). Several authors have indicated that excessive screen time is associated with adverse effects on irritability, mood disturbances and psychosocial impairments, leading to poor educational performance (Rayner et al., 2017; Bianco et al., 2019). Recently published European statistics demonstrated that in some countries (e.g., Ireland, Portugal, Germany, and Finland) there is greater than 10% prevalence rates for chronic depression for adolescents aged 15 years and over (Eurostat Statistics Explained, 2018). While it is recommended that children and adolescents should spend each day at least 60 min in moderate-to- vigorous activity (World Health Organization, 2020), European national studies reported that majority of adolescent population are not meeting current recommendations of the World Health Organization related to healthy lifestyle (e.g., daily physical activity, nutrition, screen time) (Lowry et al., 2015). Moreover, almost one-third of responders reported multiple health complaints (Marques et al., 2019).

Also, the evidence increases that compulsive and/or problematic internet use behavior can have negative effects on physical and psychological health in adolescents (Lam and Peng, 2010; Derbyshire et al., 2013; Fineberg et al., 2018). The term “Problematic Internet Use” (PIU) was introduced by Beard and Wolf to identify excessive Internet use causing psychological, social, educational, and work problems in people’s lives (Beard and Wolf, 2001). Furthermore, several studies suggests that PIU are associated with and influencing each other instead of existing independently. This raises interest for the probable associations of PIU in relation to their possible associations with other unhealthy behaviors and health outcomes, which has relevance for future health promotion intervention (Eaton et al., 2012; Cliff et al., 2016).

To date, few prospective studies have investigated risk factors for PIU. Cross-sectional adjusted studies have demonstrated different factors associated with PIU, for example, gender and age (Vigna-Taglianti et al., 2017), type of school, academic performance, urban context, socio-economic status (Durkee et al., 2012), family context (e.g., single parent, relationship with parents (Chang et al., 2015), parental communication about the Internet, psychosocial risk factors (Kormas et al., 2011), coping skills, self-esteem, depression (Korczak et al., 2017), amount of hours spent on the internet (Anderson et al., 2016), and screen time media use (Ngantcha et al., 2018).

However, the association between PIU and healthy lifestyle behaviors and subjective health complaints have not been explored so far. Because of the increase Internet use among adolescents, and related multiple adverse health consequences, PIU could become a public health problem in the next years. While subjective health complaints might include symptoms persons experiencing without a medical diagnosis, these complaints represent overall situation of the public health because subjective health feelings are linked to health outcomes (Bombak, 2013). Furthermore, subjective health complaints in adolescents are related to lower level of academic performance leading to dropping out of school (De Ridder et al., 2013), and may become chronic mental or physical health issue in adulthood (Bianco et al., 2019).

The existing evidence from the national surveys of the Health Behaviour in School-aged Children (HBSC) in Latvia obtained in 2018 ($n = 4,396$, age 11–15 years old) have revealed that 55.9% of girls and 35.5% of boys have spent by screens more than 3 h during working days. During weekends the screen time increases 42.1% and 61.2%, accordingly (Pudule et al., 2020). In order to better understand associations between unhealthy lifestyle behaviors (e.g., excessive screen time, problematic internet use, limited daily physical activities etc.) and subjective health complaints national studies are required.

Research hypotheses in this study suggested that problematic internet use may be a contributing factor to multiple health complaints because it may replace daily physical activity, increase unhealthy eating habits and sleep problems. This study aimed to explore relationship between problematic internet, healthy lifestyle behaviors and subjective health complaints.

METHODS

Sample Selection

A cross-sectional study design formed the basis of this survey conducted among adolescents representing general education schools from the four cultural regions and the capital of Latvia, Riga. Data for this study were drawn from the national longitudinal research project. The target population was made up of Latvian adolescents from 11 to 18 years of age. Sampling methods included proportional random sampling to select schools from the four cultural regions of Latvia and Riga. The local education departments in each region were contacted for random school selection from their area and Riga. When schools agreed to participate, then class groups of grades from 5th to 11th were randomly selected for participation in the survey. The research team obtained written consent from the school administration priori to ask consent from adolescents’ parents. In total 34 randomly selected schools were involved in this study. The link to a self-completed on-line survey was provided by the researchers to the school administration or directly to adolescents after receiving signed consents. Participants completed 15–10 min online survey by using their smartphones or computers. Of the total 615 participants involved in the project baseline phase, a total of 396 adolescents (64%) completed all survey questions online. Age ranged from 11 to 18 years of age (mean age 14.01 years $SD = 2.23$). Of all participants 230 (58.08%) were girls (mean age 14.14, $SD = 2.21$) and 166 (41.91%) were boys (mean age 13.81, $SD = 2.26$). Participants were recruited from 34 state schools representing rural, town and urban districts of Latvia. According to Cohen (1988) and sample size calculation formula presented in Krejcie and Morgan (1970) this study had adequate sample size ($n = 396$) for data analyses.

The study was approved by the Health Care Ethics Review Committee at the Latvian Academy of Sport Education (Latvia) and has been developed in line with the Declaration of Helsinki (World Medical Association). Data were collected between May–October 2020.

During this time all education settings were open, however, some schools or classes had remote teaching for some weeks because of quarantine condition during COVID 19 pandemic.

VARIABLES AND MEASURES

Problematic Internet Use

Adolescents' problematic internet use (PIU) was assessed by the Problematic and Risky Internet Use Screening Scale (PRIUSS), a validated adolescent screening instrument (Jelenchick et al., 2014). The PRIUSS is an 18-item risk-based screening scale for problematic internet use with questions organized into the three subscales: 1) social impairment (six items), 2) emotional impairment (five items), and 3) risky/impulsive internet use (seven items). The PRIUSS response selections use a Likert scale with scores of 0 through 4 (from "never" = 0 to "very often" = 4). A PRIUSS score ≥ 26 indicates that the adolescent is at high risk for PIU, and score from 15–25 indicates intermediate risk for PIU (Moreno et al., 2011).

For healthy behaviour and subjective health complaints data collection questions derived from the Health Behavior in School-aged Children (HBSC) (Ravens-Sieberer et al., 2008). Since 1990, Latvia has been a member of the Health Behavior in School-Aged Children–HBSC research project.

Subjective Health Complaints

The subjective health complaints were assessed using the HBSC symptom checklist. The HBSC symptom checklist has shown good reliability and validity (Haugland and Wold, 2001). Subjective health complaints questions were related to four somatic and four psychological complaints (headache, stomach-ache, backache, dizziness, feeling depressed, irritability, feeling nervous and difficulties getting to sleep). Participants responded on a 5-point scale ranging from 1 - "rarely or never" to 5 - "about every day". A multiple health complaints variables was identified if the participant reported two or more health complaints observed four or more complaints weekly.

Healthy Lifestyle Behaviors

Healthy lifestyle behaviors were related to: 1) free time physical activity (four items); 2) time spent using information technologies (two item), and 3) eating habits (five items). To assess free-time daily physical activity, adolescents were asked to indicate the number of days and hours over the past week during which they were doing moderate-vigorous physical activities out of school. Responses were dichotomized into seven times/hours per week and daily, according to the physical activity guidelines (World Health Organization, 2020). Furthermore, responders were asked to report how many hours per day they spent using information technologies (IT) (e.g., watching TV, playing games, chatting, emailing, messaging on Internet etc.) during the weekday and weekend, according to the guidelines of the scoring system used in the Health Behaviour in School-aged Children (HBSC) (Ravens-

Sieberer et al., 2008). A cut off of 3 h per day was used to allow for time spent reporting various ITs, and to keep the results comparable to a recent international comparison study (Hoare et al., 2016).

Finally, adolescents were asked to respond on five questions related to their eating habits. The frequency of the eating habits was assessed by questions: "How often do you usually have breakfast (in school, or at home)?", "How many times a week do you consume fruit/vegetables/sweetened soft drinks/sweets?", "How often do you eat with your family?", "How often do you eat while being at the screen?", and "How often do you drink sweetened soft drinks such as Coca-Cola, Fanta etc.?" Sleep duration was assessed by asking questions about the time when adolescents went to sleep and woke up on weekdays and weekends.

Statistical Analyses

Data analyses included descriptive statistics calculating means and standard deviations for all study outcomes. Differences between boys and girls were analyzed using ANOVA. Spearman correlation between variables was calculated. Stepwise multiple linear regression analyses to determine the variables to predict variance in PRIUSS total scores. A statistical significance level of at least $p < 0.05$ was used for all analyses. Statistical analyses were performed using IBM SPSS 22.

RESULTS

The characteristics of the obtained results are presented in **Table 1**. The mean PRIUSS score was 21.13 (SD = 10.44), however, for 124 (31.00%) responders' results were >26 points indicating high psychosocial health risks related to PIU. In this study adolescents presented very low daily physical activity time per week (2.33 h/week, SD = 2.12).

Although boys reported average participation in physical activities in significantly more days per week than girls (4.19 days/w and 3.87 days/w, respectively, $p < 0.05$), they did not present daily participation as recommended by the World Health Organization (WHO). The mean of screen time use on weekends was higher than during weekdays (4.30, SD = 1.94 and 3.92, SD = 2.03 respectively), The prevalence of psychological health complaints was significantly higher than somatic health complaints ($p < 0.05$). Moreover, a significantly higher proportion of girls reported experiencing all health complaints than boys in both categories, somatic and psychological domain ($p < 0.05$).

The analyses of relationship between PRIUSS total scores and subjective health complaints and healthy lifestyle behaviors are summarized in **Table 2**.

There was significant negative correlation between PRIUSS total scores and physical activity, having meals together with family and sleeping regimes on weekends ($p < 0.05$). Furthermore, significant positive association was between PRIUSS total score and each of somatic and psychological health complaints, unhealthy eating habits and screen time use ($p < 0.05$). However, no clear correlations

TABLE 1 | Descriptive data of the study participants, by gender.

Variables	Overall, mean ± SD, n = 396	Girls, mean ± SD, n = 230	Boys, mean ± SD, n = 166	p-values
PRIUSS total	21.13 ± 10.44	21.76 ± 11.61	20.27 ± 8.57	0.361
Healthy lifestyle behaviors				
Physical activities (days/per week)	4.00 ± 1.40	3.87 ± 1.38	4.19 ± 1.42	0.011
Physical activities (hours per week)	2.33 ± 2.12	2.12 ± 1.97	2.66 ± 2.3	0.051
Screen time use on weekdays	3.92 ± 2.03	4.12 ± 2.06	3.66 ± 1.98	0.027
Screen time use on weekends	4.30 ± 1.94	4.43 ± 2.02	4.14 ± 1.85	0.097
Sleep duration on weekdays	8.21 ± 1.19	8.22 ± 1.17	8.21 ± 1.24	0.994
Sleep duration on weekends	9.56 ± 1.50	9.63 ± 1.44	9.49 ± 1.6	0.590
Eat breakfast	2.10 ± 0.98	2.00 ± 1.07	2.26 ± 0.84	0.034
Eat with family members	1.81 ± 0.89	1.76 ± 0.92	1.9 ± 0.87	0.130
Eat at the screen	1.58 ± 0.92	1.65 ± 0.94	1.49 ± 0.92	0.078
Eat fruits and vegetables	1.97 ± 0.72	2.00 ± 0.73	1.96 ± 0.73	0.546
Drink carbonated or sweetened drinks	1.17 ± 0.78	1.12 ± 0.77	1.25 ± 0.82	0.122
Eat ready-to-use packaging	0.77 ± 0.75	0.74 ± 0.74	0.83 ± 0.78	0.110
Subjective health complaints				
Somatic health complaints				
Headache	0.92 ± 1.20	1.16 ± 1.31	0.62 ± 0.97	0.000
Abdominal pain	0.71 ± 0.93	0.82 ± 1.01	0.57 ± 0.88	0.006
Back pain	0.99 ± 1.33	1.26 ± 1.44	0.64 ± 1.11	0.000
Dizziness	0.64 ± 1.05	0.79 ± 1.17	0.46 ± 0.85	0.004
Psychological health complaints				
Depression	1.17 ± 1.27	1.29 ± 1.41	1.02 ± 1.31	0.043
Irritability or bad mood	1.92 ± 1.35	2.07 ± 1.35	1.73 ± 1.35	0.015
Nervousness	1.71 ± 1.45	1.91 ± 1.46	1.44 ± 1.42	0.001
Difficulty falling asleep	1.38 ± 1.46	1.51 ± 1.51	1.22 ± 1.41	0.046

p values are based on analysis of variance of gender differences.

between the PRIUSS scores and other study parameters were noted.

Results of stepwise multiple regression analyses with PRIUSS scores as dependent variable are presented in **Table 3**.

These outcomes revealed that 34% of the variance in the PRIUSS scores was explained by the three out of the four psychological health complaints (irritability, depression, and nervousness), hours of screen time use on weekend, physical activity days during week, drinking sweetened soft drinks and eating habits such as fast-food meals and frequently having snacks while being at the screen.

DISCUSSION

This study examined the association between problematic internet use (PIU) related psychosocial behaviors, subjective health complaints (somatic and psychological) and healthy lifestyle habits in adolescents (11–18 years of age).

The prevalence of PIU in our study sample of adolescents was 31.00% which is higher than reported in other studies (Durkee et al., 2012; Gámez-Guadix, 2014; Jelenchick et al., 2014).

The main findings in obtained subjective health complaints outcomes demonstrated that psychological health complaints were prevalent. Moreover, girls reported significantly higher rate of the eight symptoms than boys (*p* < 0.05) that was in line with recent study outcomes in Lithuania (Vaičunas and Smigelskas, 2019), Latvia (Pudule et al., 2020) and other

international cross-sectional studies (Gobina et al., 2011). There are a number of possible explanations for this. Data were collected when some schools across country had temporary closings because of quarantine situation related to COVID 19 pandemic. During Spring – Summer 2020 in

TABLE 2 | Correlation of PRIUSS total scores with subjective health complaints and healthy lifestyle behaviors.

Variables	PRIUSS	
	Correlation coefficient	p- values
Physical activities (times during week)	-0.238	0.000
Physical activities (hours per week)	-0.122	0.008
Headache	0.254	0.000
Abdominal pain	0.228	0.000
Back pain	0.307	0.000
Depression	0.407	0.000
Irritability or bad mood	0.435	0.000
Nervousness	0.430	0.000
Difficulty falling asleep	0.258	0.000
Dizziness	0.236	0.000
Eat breakfast	-0.061	0.115
Eat with family members	-0.261	0.000
Eat at the screen	0.348	0.000
Eat fruits and vegetables	-0.060	0.115
Drink carbonated or sweetened drinks	0.205	0.000
Use ready-to-use packaging	0.194	0.000
Screen time use on week days	0.222	0.000
Screen time use on holidays	0.364	0.000
Sleep duration on weekdays	-0.206	0.000
Sleep duration on holidays	-0.067	0.090

TABLE 3 | Stepwise multiple linear regression model examining associations with the PRIUSS.

Variables	Unstandardized Coefficients		Standardized coefficients	95% CI	Sig.
	B	Std.Error	Beta	B	p-value
Irritability or bad mood	1.068	0.455	0.139	0.174–1.963	0.019
Screen time use on weekend days	0.84	0.256	0.157	0.336–1.343	0.001
Depression	1.367	0.384	0.18	0.612–2.122	0.001
Drink carbonated or sweetened drinks	1.512	0.555	0.114	0.421–2.603	0.007
Eat fast food	1.28	0.583	0.093	0.133–2.426	0.029
Nervousness	1.049	0.41	0.146	0.244–1.854	0.011
Eat at the screen	1.396	0.534	0.124	0.346–2.446	0.009
Physical activities (times during week)	–0.71	0.32	–0.095	–1.339–0.08	0.027

$F(8, 387) = 27.273$. $P < 0.0001$. R^2 (Adjusted R^2) = 0.361 (0.347).
Dependent variable: PRIUSS total.

Latvia there were very small numbers of new infections and lockdowns were not enforced. However, many restrictions regarding public events, travelling and social distancing were applied. Therefore, adolescents still experienced increased stress because of uncertainty threats and insecurity about future. According to Zhu et al. (2020), specifically, societal regulations that restricts personal freedom might undermine adolescents' sense of control (for example, limited possibilities to attend public events such as concerts, sport competitions, summer festivals etc.).

In this study majority of participants did not meet WHO guidelines (2020) of daily physical activities for adolescents (at least 60 min of moderate to- vigorous activity each day). Also, a large proportion of participants did not meet international recommendations of less than 3 h per day of screen time (Hoare et al., 2016). With the increasing use of information technologies in adolescents' lives and the greater role of digital tools in education and social activities, it may be challenging to increase the proportion of adolescents meeting the recommendations and guidelines of healthy lifestyle (Marques et al., 2019).

The study outcomes indicated consistent positive association between PIU and subjective health complaints. Although some of these relationships presented small magnitude, the consistency of results across the eight health complaints presents strong link between problematic internet use related psychosocial behaviors and health. These findings are in line with previous studies describing relationship between PIU and mental health in adolescents (Gámez-Guadix, 2014; Ciarrochi et al., 2016). With regard to negative relations, the findings for PIU indicated that adolescents with limited daily physical activities, less sleep duration on weekends and those who had fewer mealtimes with their family members had higher PIU scores. Other research studies have identified problems associated with problematic use of internet and sleep deprivation and lack of exercise (Morahan-Martin and Schumacker, 2000; Moreno et al., 2011). The significant relations between PIU and eating behaviours (for example, having less meals together with family members, consuming more fast-food and carbonated or sweetened drinks) was more complex to explain since eating

habits in a family can be related to parental education, culture and socioeconomic variables (Hanson and Chen, 2007).

The outcomes of multiple regression demonstrated that psychological health complaints, such as irritability, depression, and nervousness were significant predictors of the PIU scores. As indicated above, previous studies conceptualized PIU in relation to psychological dependence and lack of control over the time spent online. Specifically, the links between PIU and anxiety, depression and general psychological distress have been examined mainly as predictors in adolescents (van Rooij et al., 2010; Gámez-Guadix et al., 2013; Gámez-Guadix, 2014; Kowert et al., 2015). Similar to our study, risk factors that have been implicated in the development of PIU have encompassed lifestyle such as limited physical activities, sedentary behaviors including excessive screen time and consuming unhealthy food (Zboralski et al., 2009; Li et al., 2014).

There are a number of limitations to interpretation of this study findings. The sample included in this study does not necessarily represent the entire population of that age. The results are based on self-reported survey outcomes. Therefore, any errors introduced due to self-report of subjective health complaints, healthy behaviors and PRIUSS might tend to mitigate the statistical associations, suggesting that the actual associations might be stronger. Furthermore, the part of data were collected during COVID 19 pandemic when some schools had remote education because of temporary quarantine situation. Therefore, screen time measures can be increased because of online education mode. However, observations and anecdotal notes during this study demonstrated that screen time during leisure was also prolonged, indicating that many adolescents engaged in long screen time for leisure.

CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

The reported data presented relationship between PIU, subjective health complaints and lifestyle factors in adolescents. The results of the present study should also be considered as an indicator to public health policies to be acknowledged and strengthened in the future

targeting health, education and healthy lifestyle early in adolescence. Further effective measures and interventions are needed to prevent development of psychosomatic health problems. Evidence indicates that individual health behaviors of children and adolescents are influenced by social networks (Asch and Rosin, 2016). The innovative technological approaches could be designed to motivate adolescents engage in healthy lifestyle behaviors (e.g., physical activities) and to deploy interventions based on their social connections. Social incentives motivate adolescents to adjust their behaviors based on social links, are comprehensive and could incorporate gamification interventions to provide a measurable, achievement directed and sustainable approach to increase engagement in healthy lifestyle behaviors.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

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ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the Latvian Academy of Sport Education (approval date 28.02.2020.). Written informed consent to participate in this study was provided by the participants legal guardian.

AUTHOR CONTRIBUTIONS

AK devised the structure of the paper, drafted the manuscript. LF, AR, and AA contacted participants and collected data. VV analyzed the data and JP commented on the final version.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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