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Intrapersonal and Family Predictors of Internet Addiction in Attention Deficit Hyperactivity Disorder

Armagan Aral[1,3]* Mirac Baris Usta[2,4]

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[1]Department of Child and Adolescent Psychiatry, Mental Health Hospital, Samsun, Turkey
[2]Department of Child and Adolescent Psychiatry, Medical Faculty, University of Ondokuz Mayis, Samsun, Turkey
[3]ORCiD: https://orcid.org/0000-0001-5098-3664
[4]ORCiD: https://orcid.org/0000-0002-1573-3165
*Corresponding author: Armagan Aral: Armiaral0@gmail.com

Abstract: This research examined the influence of intrapersonal and family factors on Internet Addiction (IA) among adolescents with Attention Deficit Hyperactivity Disorder (ADHD). A prospective evaluation was performed in two waves on a total of 250 adolescents in this longitudinal study, with a four-month interval. Demographic data, intrapersonal factors (self-esteem, autistic traits and inattention symptoms), and family factors (socioeconomic status, family functioning, and parenting style) were examined as predictors in a multiple regression analysis. The results of Wave 1 indicated that the family factors (neglectful parenting style and family dysfunction, respectively) were stronger predictors than other variables. In Wave 2, lower self-esteem was found to be an independent predictor of IA symptoms after controlling for depression and anxiety in the mediation analysis, while neglectful parenting style and autistic traits remained significant predictors. These findings identified the importance of family risk factors for IA in adolescents with ADHD.

Keywords: Attention-Deficit/Hyperactivity Disorder, Autistic Traits, Family Factors, Internet Addiction, Self-esteem.

Introduction

The Internet has brought myriad benefits to daily life, but it may also have brought adverse outcomes such as poor academic achievement (Iyitoğlu & Çeliköz, 2017) and psychological problems (Odacı & Çikrici, 2017). Indeed, differing terminology has been used to describe dysfunctional and maladaptive Internet usage, including "Internet Addiction" (Young, 2004), "Pathological Internet Use" (Davis, 2001), and "Internet Gaming Disorder" (Pontes & Griffiths, 2016). Although the DSM-V does not list Internet Addiction (IA) as a formal diagnosis, Internet Gaming Disorder (IGD) is included in "conditions that require further research" (American Psychiatric Association, 2013), characterized as sustained participation in online games that results in impairment.

In May 2019, the World Health Organization (WHO) formally recognized "Gaming Disorder" as a diagnostic category (Stavropoulos et al., 2021). However, because the majority of self-report measures used to assess maladaptive internet usage were developed using Young's criteria for IA (Chen et al., 2003; King et al., 2020), that terminology was used in this manuscript. This criterion was adapted from those used to diagnose compulsive gambling (Young, 1998), and include: (1) preoccupation with the Internet, (2) a need to spend increasing amounts of time on the Internet, (3) unsuccessful attempts to abstain from Internet use, (4) mood change when attempting to stop or cut down Internet usage, (5) staying online longer than intended, (6) significant relationships or chances are jeopardized as a result of excessive Internet usage, (7) lying about Internet use, (8) using the Internet as a means of escapism or seeking to alleviate negative mood states (Young, 2004). Specific properties of the developing brain seem to make adolescents vulnerable to IA (Cerniglia et al., 2017), as they experience the developmental difficulties inherent to this phase of life. Some recent studies of children and adolescents have reported ADHD as one of the most common comorbid psychiatric disorders with IA (Restrepo et al., 2019). The biopsychological mechanisms of IA withADHD may differ from those of the general adolescent population (Chou et al., 2015).

Several models have been proposed to describe the risk factors for developing IA (Stavropoulos et al., 2021). A growing body of literature on the developmental process of IA in adolescents has grouped these factors into two categories: (1) interpersonal-contextual and (2) intrapersonal (Cudo et al., 2016; Fumero et al., 2018).

Interpersonal-contextual factors include those related to family such as parent-child relationships and family support (Ahmadi & Saghafi, 2013; Ko et al., 2007), and social factors like life stressors, social influences, and positive outcome expectancy (Cudo et al., 2016; Fumero et al., 2018). Family is an important social context for adolescents, and its impact on IA has been studied extensively. Previous studies have suggested that over-intrusive and punitive parenting style (Xiuqin et al., 2010), family dysfunction (Ko et al., 2007), parental unemployment (Durkee et al., 2012) and lower parental education

(Ahmadi & Saghafi, 2013) is associated with IA in adolescents. Adolescents with ADHD and their families have encountered a variety of challenges in terms of mutual support, interaction, and communication, and impairments in parenting styles and family functioning in ADHD have been reported at high rates (Chou et al., 2015; Gau, 2007). Thus, there is a need to examine the relationship of these predictors with IA in ADHD, the most common comorbidity of IA, (Bozkurt et al., 2013).

Intrapersonal risk factors for the development of IA such as hostility, autistic traits, self-esteem, anxiety, depression, and ADHD symptoms have been researched extensively in cross-sectional designs, although the longitudinal impact has not been investigated appropriately (Chou et al., 2015; Kahraman & Demirci, 2018; Karaca et al., 2017; Yen et al., 2014). Two studies with nonclinical Asian samples point in different directions regarding the relationship of autistic traits and IA symptoms (Chen et al., 2015; Liu et al., 2017). The first reported that autistic traits and IA symptoms were inversely related in a Taiwanese sample (Chen et al., 2015), while the other conducted with Chinese children found autistic traits to be linked to less emotional regulation, which in turn was linked to less school connectedness, which was associated with more IGD symptoms (Liu et al., 2017).

Regarding mood symptoms, two studies with different measurement tools suggested that IA symptoms were positively correlated with anxiety and depression scores and negatively correlated with self-esteem (Kahraman & Demirci, 2018; Yen et al., 2014). Kahraman and Demirci (2018) also found a strong association between IA and ADHD symptoms in Turkish adolescents that persisted when other variables such as depression and anxiety were controlled for.

Most studies have concentrated on direct effect models, but this approach has not allowed researchers to examine the interactions between the key predictors of IA and other psychosocial factors or mediating variables—thereby obscuring any underlying mechanisms that may be vital to understanding IA. By evaluating the relationship between intrapersonal factors and IA with mediation effects accounted for, this study aimed to provide a better understanding of this issue.

Based on our research, family and intrapersonal predictors of IA in ADHD has not been examined conjointly. This longitudinal study therefore aimed to address this gap by examining the relationship between IA in ADHD and the family factors of socio-economic status (SES), parenting style, and family functioning; as well as the intrapersonal factors of autistic traits, self-esteem, anxiety, depression, and ADHD severity It was conducted in two waves at a four-month interval to determine patterns of independent predictors over time.

Materials and Methods

Participants

The initial sample consisted of 350 adolescents (age 12 to 18) diagnosed with ADHD, recruited from the Child and Adolescent Psychiatry Clinic of Samsun Mental Health Hospital in Turkey between

January and October of 2020 (see Fig. 1 for the study flow chart). Of these, 250 participated in both waves of the study and were analyzed as the final sample. The diagnosis of ADHD was based on multiple pieces of information recorded in the chart at the first visit to the clinic, including the diagnostic interview results with the child psychiatrist and the results of the parent-reported Turgay DSM-IV Disruptive Behavior Disorders Rating Scale (T-DSM-IV-S). Based on clinical observation and information from parents, adolescents with schizophrenia, bipolar disorder, substance abuse, and autistic disorder were excluded from the study. Based on the Internet Addiction Diagnostic Questionnaire (IADQ), ADHD adolescents were assigned to two groups (see Fig. 1 for details). To implement a naturalistic design, it was decided to not match the groups in terms of age and sex.

Procedure

After obtaining informed consent from the participants and their legal guardians, a semi-structured interview was conducted with each by the clinician, using the Turkish version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children: Present and Lifetime Version (K-SADS-PL), and a set of questions created by the current authors to establish patterns in their daily internet use. Upon enrollment in the study, each adolescent completed the IADQ, the Family Assessment Device (FAD), the Parenting Style Inventory (PSI), and the Autism Spectrum Quotient-Adolescent Version (AQ-Adolescent). The Coppersmith Self-Esteem Inventory (CSEI), the Children's Depression Inventory (CDI), the Screen for Child Anxiety-Related Emotional Disorders (SCARED), and the T-DSM-IV-S was completed by parents in both waves of the study.

Data Collection and Instruments

Turkish Version of The Schedule for Affective Disorders and Schizophrenia for School-Age Children–Present and Lifetime Version (K-SADS-PL)

According to DSM-III-R and DSM-IV diagnostic criteria, Kaufmann developed t semistructured interview form to determine the past and current psychopathologies of children and adolescents (Kaufman et al., 1997). Clinician makes clinical diagnoses through a combination of these results with clinical observations. In Turkey, the validity and reliability study was established by Gokler et al. (2004).

Patterns of Daily Internet Use

The study interviews included a personal data form developed by the current researchers to record sociodemographic data, amount of time they had spent on the internet in the past month, their preferred device to connect to the Internet (tablet/computer/mobile phone), the purpose of their Internet use in the past month (e.g., online gaming, homework, and social media), and their frequency of internet usage in the past month. The amount of time spent on the Internet was assessed by asking participants the number of hours they spent per week and per day on the Internet in the last month, while the frequency of internet use

was evaluated with the question, “How many days per week and hours per day have you spent on the Internet in the last month?”

Socio-Economic Status Evaluation. Socioeconomic status (SES) was based on the employment status and education level of their parents using the Hollingshead index, as shown in Table 1 (Hollingshead, 1991).

Internet Addiction Diagnostic Questionnaire (IADQ). The scale used to evaluate IA severity in this study was developed by Young and adapted to Turkish by Bayraktar (2001), who showeda Cronbach's alpha internal consistency coefficient of .91. The scale consists of 20 items with six-point Likert-type responses (0 = “does not apply,” 1 = “rarely,” 2 = “occasionally,” 3 = “frequently,” 4 = “often,” 5 = “always”), resulting in a total score between 0 and 100, with higher scores representing a greater tendency to IA. Some example items include: “How often do you find that you stay online longer than you intended?,” “How often do you neglect household chores to spend more time online?,” and “How often do you snap, yell, or act annoyed if someone bothers you while you are online?”

The version of the scale issued at www.netaddiction.com classifies scores between 20 and 49 as “regular Internet user”, 50 to 79 as “Internet user with occasional or frequent problems,” and 80 to 100 as “Internet user experiencing serious problems. Because the current study focused on Young's IA criteria (Young, 2004) rather than Problematic Internet Use (PIU), the ranges of 0–79 and 80–100 were used to separate those with serious addiction problems from all others.

The Family Assessment Device (FAD). This 60-item self-report instrument was developed to assess the seven dimensions of family functioning outlined in the McMaster Model of Family Functioning (Epstein et al., 1983); problem-solving (6 items), affective responsiveness (6 items), roles (11 items), communication (9 items), affective involvement (7 items), behaviour control (9 items) and general functions (12 items). Each item is rated on a 4-point Likert scale and a score of dimensions calculated as the formula: the total score of the items in the dimension/item number for each dimension. Scores for scales range from 1 (healthy) to 4 (nonhealthy) for each dimension. The scale was adapted to Turkish by Bulut (1990), with Cronbach α ranges between .38 and .86, and test-retest reliability ranges between .62 and .90 in seven dimensions (Bulut, 1990).

Parenting Style Inventory (PSI). Developed by Lamborn et al. (1991), the PSI was based on the findings of McCoby (1983), including elements such as the number and type of demands made by parents and the contingency of parental reinforcement. Three dimensions emerged from a factor analysis of the scale scores: (1) acceptance/involvement, (2) strictness/supervision, and (3) psychological autonomy. The acceptance/involvement dimension asks children’s opinions on to what degree their parents are loving, careful, and participative (for example, "When I have any trouble, I am sure that my parents would aid me"). The strictness/supervision dimension asks how much supervision their parents impose (for example, "Do your parents allow you to go out at night during school time with your friends?"). The psychological

autonomy dimension asks how much parents apply democratic attitudes and support their children to exhibit independence (for example, "My parents suggest that I should argue with elder individuals").

There are 9 items in the acceptance/involvement and psychological autonomy dimensions, rated on four-point Likert scales. The first two items of the strictness/supervision dimension are rated with 7-point Likert scales, and the remaining 8 items use 3 points. The scores can be measured in two ways: the different levels of parenting style may be separated from the answers of 3 dimensions, or the four parenting styles (authoritative, authoritarian, indulgent, and neglectful) can be determined by the combination of scores on the acceptance/involvement and strictness/supervision dimensions.

The second measurement method was adopted in the current study. With this method, parents of participants whose scores on the acceptance/involvement and strictness/supervision subscales are both greater than the median point are referred to as “authoritative,” while those with scores less than the median point are referred to as “neglectful.” Parents who score below the median in acceptance/involvement, but above the median in strictness/supervision, are classified as “authoritarian,” while those with scores above the median on the acceptance/involvement subscale but less than the median on the strictness/supervision subscale are considered “permissive.”

The scale was adapted to Turkish Yılmaz (2000), with test-retest reliability coefficients and the internal consistency (Cronbach's alpha) were .82 and .70 respectively for the acceptance/involvement dimension, .88 and .69 for the strictness/supervision dimension, and .76 and .66 for psychological autonomy dimension, (Yılmaz, 2000).

Coppersmith Self-Esteem Inventory (CSEI). Following the introduction of the CSEI by Stanley Coopersmith (1967), two forms were developed in revision studies (Johnson et al., 1983), the adult form and the school form. The school form was used in this study, and includes 25 items rated on four-point Likert-scales (1 to 4), with total scores ranging from 25 to 100. Higher scores on the scale mean higher self-esteem in adolescents, but it does not have any prescribed cut-off points. Validity and reliability studies of the school form were conducted in a Turkish high school sample, finding internal consistency of .76 using the Kuder-Richardson (KR-20) formula (Pişkin, 1997).

The Autism Spectrum Quotient- Adolescent Version (AQ-Adolescent). The AQ was developed to evaluate autistic traits or the broad autism phenotype in adults (Baron-Cohen et al., 2001). The adolescent version study was also conducted by Baron-Cohen et al. (2006). Turkish validity and reliability of the adolescent version found a Cronbach's alpha of .82 (Cetinoglu & Aras, 2021). The AQ includes 50 items rated either 0 or 1. Higher the scores on the AQ-Adolescent indicates more autistic features. According to the Turkish adaptation study, the scale showed four different factor structures, and the most appropriate cut-off value was found to be 24 (Cetinoglu & Aras, 2021). Because we used only 41 of the 50 items—those obtained in the factor analysis of construct validity (Cetinoglu & Aras, 2021), scores ranged from 0 to 41 in this study.

The Children's Depression Inventory. The CDI is a self-report scale developed by Kovacs (1992) to measure depression severity in children and adolescents. There are three different options for each item to be rated between 0 and 2. The participant is asked to mark the statement that best fits their situation for the past two weeks on 27 items, resulting in a total score from 0 to 54 with higher scores indicating more severe depression. The cut-off value was determined to be 19 in the Turkish adaptation of the scale by Öy (1991), and Taysi et al (2015) found the Cronbach's alpha for internal consistency to be .88.

Screen for Child Anxiety-Related Emotional Disorders (SCARED). The SCARED is a 41-item scale developed to screen for DSM-IV anxiety disorders in children (Birmaher et al., 1997). Participants score the items on a 3-point scale (0 = "not true or hardly ever true," 1 = "sometimes true," and 2 = "true or often true"), resuling in a score from 0 to 82, wherehigher scores indicate more general anxiety. The validity and reliability of the SCARED total scores have been found to be satisfactory for a Turkish sample with a Cronbach's α of .88 (Karaceylan, 2005).

The Turgay DSM-IV Disruptive Behavior Disorders Rating Scale (T-DSM-IV-S). The T-DSM-IV-S is a 41-item scale developed by Turgay (1994) based on the DSM-IV criteria for ADHD (18 items), Oppositional Defiant Disorder (ODD; 8 items), and Conduct Disorder (CD; 15 items), administered by parents or teachers. It has been used as an outcome measure in clinical trials to diagnose children with suspected ADHD, ODD, and CD (Ercan et al., 2013). It was translated and adapted into Turkish by Ercan et al. (2001).

Statistical Analysis

Data obtained in the study was analyzed using SPSS version 25. Descriptive statistics were calculated as percentages for categorical variables and as mean and standard deviation for continuous variables. T-tests were performed to determine significant differences between the IA and non-IA groups for continuous dependent variables, including Hollingshead index score, frequency and duration of Internet use, self-esteem, depression severity, anxiety severity, autistic traits, ADHD symptoms, and family functioning. After these univariate analyses, a hierarchical logistic regression of three models was applied to investigate whether demographic, intrapersonal, and family factors were associated with IA in Wave 1. Model 1 included age and sex, Model 2 added only self-esteem, autistic traits, and inattention symptoms due to multicollinearity between other intrapersonal variables. Finally Model 3 added general family functioning and parenting styles (neglectful and other parenting styles as a dummy variable). The same hierarchical system was used in the linear regression analysis with time spent on the Internet as a dependent variable.

The second model was used in Wave 2, and included intrapersonal and family factors together due to less significant results in the univariate analysis than in Wave 1. To investigate the independent effect of self-esteem on IA symptoms in the IA group, mediation analysis using PROCESS Macro was applied (Hayes, 2017). The

percentile method was applied to detect indirect mediating effects based on bias-corrected 5000 bootstrap samples with a 95% CI. The indirect effect was statistically significant if the 95% CI did not include zero. A two-tailed alpha level of .05 was chosen for statistical significance.

Results

Sample Characteristics

The final sample after Wave 2 consisted of 250 participants. Of these, 55 (21%) were evaluated as having IA in Wave 1, with the other 195 (79%) in the non-IA group. Four months later in Wave 2, the IA group reduced to 44 (17.6%), with 206 (82.4%) as non-IA.

There was no significant difference between the IA and non-IA groups in either wave with respect to age or the gender ratio. The descriptive statistics of the sample shown in Tables 2 and 3 demonstrate accurate matching between the groups. Significant decreases in the total T-DSM-IV-S-ADHD score, as well as the inattention and H/I subscales, are shown in Table 4.

Intrapersonal and Interpersonal Factors Correlation with IA Symptoms

Bivariate correlation analyses revealed significant relationships between IADQ score and many of the intrapersonal factors in Wave 1 (Table 5), but most of these did not remain significant in Wave 2 (Table 6). Scores on the IADQ had a moderate positive relationship with CDI and SCARED, strong positive relationships with T-DSM-IV-S inattention and ADHD total subscores, and a moderate negative correlation with CSEI scores. Among the FAD subscales, only general functions had a significant correlation with IADQ score, but it was fairly weak, $r = .26$, $p < .001$ (Table 7). A lower SES was also determined to be significantly correlated with IADQ score in Wave 1 of the IA group, rho = -.36, $p = .006$. After excluding the neglectful parenting style in Wave 1 of the IA group, the relationship between SES level and IADQ score was no longer significant, rho = -.18, $p = .60$.

Binary logistic mediation using PROCESS macro was used (Hayes, 2012) to evaluate the mediating effect of depression severity (M) on the relationship between prior self-esteem (IV) and IA symptoms (DV) in Wave 1 of the IA group. This model indicated that the relationship between self-esteem (CSEI score) and IA symptoms (IADQ score) was mediated by depression severity (CDI) in Wave 1. Significant pathways are shown in Figure 2. The first model (1a) indicated a significant association between self-esteem and IA symptoms before including depression severity as a mediator variable, $b = -2.1$, SE = 0.03, $p < .001$, 95% CI [-0.28, -0.14]. Although the second model (1b) indicated a small decrease in the direct effect of self-esteem after including depression severity as a mediator variable, $b = -1.6$, SE = 0.03, $p < .001$, 95% CI [-0.24, -0.09], the indirect effect through depression severity was small, $b = -0.4$, SE = 0.01, 95% CI [-0.08, -0.01].

This same method was also used to test anxiety severity as the mediator rather than depression severity, using the SCARED. The

model indicated that the relationship between self-esteem and IA symptoms was not mediated by anxiety severity in Wave 1 (see Figure 3). The first model (1a) shows the same significant relationship between self-esteem and IA symptoms as the previous analysis with depression severity. The second model (1b) in thise case indicated no difference in this relationship after including anxiety severity as a mediator, b = -2.1, SE = 0.03, p < .001, 95% CI [-0.29, -0.15]. Anxiety severity therefore had no indirect effect on the relationship between self-esteem and IA symptoms, b = -0.007, SE = 0.02, p = .052, 95% CI [-0.01, -0.06].

Predictors of IA for Waves 1 and 2

According to the IADQ score, 55 (21%) and 44 (17.6%) of the participants were classified as IA in Waves 1 and 2, respectively, with a male to female ratio of 2.33:1 in both. The results of the binary logistic hierarchical regression analysis in Wave 1 (see Table 8) assessed the relationship of IA with demographic factors, significant intrapersonal factors, and family factors in the univariate analysis. Models 2 and 3 indicated a significant overall fit, but not so for model 1. The decrease in the value of -2LL from 261.283 in model 1 to 76.085 in model 2 and 62.082 in model 3, and the increase in the Nagelkerke R^2 value from .013 in model 1 to .81 in model 2 and .849 in model 3, indicated that the inclusion of intrapersonal and family factors significantly improved the fit compared to model 1 (step χ^2 for model 2: 185.198, p < .001—step χ^2 for model 3: 14.003, p < .01). For model 3, the most powerful independent variables were neglectful parenting style and general dysfunction in the family. The odds ratios indicate that for every point of increase in these predictors, the chances of being classified as IA was 9.61 times higher for general dysfunction, and 3.92 times higher for neglectful parenting. The intrapersonal factors autistic traits and inattention symptoms increased the probability by 1.25 to 1.74 times, while self-esteem decreased the probability of IA by 0.91 times.

The results of the binary logistic hierarchical regression analysis in Wave 2 (Table 9) assessed the relationship of IA with demographic, significant intrapersonal, and family factors in the univariate analysis. Model 2 showed a significant overall model fit, after model 1 did not. In Wave 2, neglectful parenting style and autistic traits continued to be significant factors, with odds ratios of 7.06 and 1.24, respectively.

Duration and Frequency of Internet Usage

The time spent on the Internet was 4.38±1.54 hours per day for the IA group and 2.09±1.06 hours per day for the non-IA group—significantly higher for the IA group, p < .001. The frequency was 4.91±1.59 times per day for the IA group and 4.58±1.81 times per day for the non-IA group, which was not a significant difference, p = .30. Multiple analysis with hierarchical linear regression was performed with the same model classification as the previous logistic regression (Tables 8 and 9), treating the time spent on the Internet as the dependent variable. Table 10 summarizes the results of this analysis. Model 1 showed that age and sex demographics had no significant effect on time spent on the Internet. In model 2, interpersonal factors such as self-esteem, autistic traits, and inattention symptoms accounted for 28.1% of the variance in

time spent on the Internet. After including all variables in model 3, this increased to 37.4%. Participants exposed to a neglectful parenting style spent significantly more time on the Internet, β = .170, *t* = 3.08, and inattention symptoms were the strongest predictor, β = .333, *t* = 4.75). The other significant predictors were autistic traits, β = .073, *t* = 1.29, and lower self-esteem, β = -.068, *t* = -1.05). The ΔR^2 (improvement in R^2) was .277 in model 2 and .093 in model 3.

Discussion

The results of the study include some major findings. The interpersonal factors of neglectful parenting style (odds ratio = 9.6), and family dysfunction (odds ratio = 3.9) were the strongest predictors of IA in Wave 1. Autistic traits, lower self-esteem, and ADHD inattention symptoms were also independent intrapersonal factors of IA, but with a smaller effect size. Neglectful parenting style and autistic traits (obtained in Wave 1) remained independent predictors of IA in Wave 2, as well. These findings highlight the importance of family factors to the development of IA in ADHD, and suggest that greater parental supervision may protect against IA. However, the evidence in nonclinical populations suggests that over-involved and punitive parents may also induce adolescents to develop IA (Xiuqin et al., 2010). This discrepancy appears to indicate that ADHD adolescents require more strict parental monitoring, at least on the Internet—but not *too* strict. Protective or supervisory parents in general can monitor their children's Internet usage and other risky activities, which is compatible with research on the perception of unprotective families among substance abusers (Becerra & Castillo, 2011). Parents should therefore monitor Internet use, especially for children with ADHD who tend to be risk-taking (Pollak et al., 2017).

Adolescents with IA were also found to have a lower SES, although this was not significant after controlling for neglectful parenting style and thus was not considered an independent predictor. Similar trends have been reported for fathers' educational levels (Ahmadi & Saghafi, 2013) and parental unemployment (Durkee et al., 2012) without considering the interaction effect of parenting style. Low SES may cause IA through lower levels of parental monitoring and more sedentary lifestyles (Li et al., 2018). Moreover, in line with previous research (Habibi et al., 2015), family dysfunction was found to positively correlate with IA severity in ADHD adolescents in this study. As these families suffer difficulties, parents can display negative behaviour, causing the family to be a source of enduring environmental stress. Adolescents with better family functioning are more likely to cope better with stress, so they do not tend to feel the same need to escape to the virtual world of the Internet (Habibi et al., 2015). Implementing family-based preventive programs with the aim of intervening in IA is necessary for the effective management of adolescents with ADHD and a family environment that can cause IA.

The importance of autistic traits in this study’s multivariate analysis is consistent with previous studies of adult samples (Finkenauer et al., 2012; Romano et al., 2013). However, when the relationship

between autistic traits and IA was investigated for the first time in primary and secondary school students diagnosed with ADHD, contradictory findings were reported in the literature (Chen et al., 2015). The present research acknowledged the relatively new question of whether autistic traits are a predisposition that is independent of intrapersonal and family factors for IA in ADHD adolescents. Various mediators of this relationship have been suggested, such as the complexity of face-to-face contact (Burke et al., 2010) and the control of self-presentation on the Internet (Finkenauer et al., 2012), which were not included in the present study. Therefore, it is crucial to research Internet use among adolescents with autistic traits and ADHD to evaluate whether it has a detrimental effect on "offline" contact. In a Chinese follow-up study, it was suggested that the link between autistic traits and IA is mediated by emotion regulation and school connectedness (Liu et al., 2017). Other possible mediators must be examined to clarify the relationship.

Adolescents with ADHD have various difficulties in academic, social, and family contexts, which can lead them to perceive themselves as inferior to their peers (Harpin et al., 2016). Therefore, it is reasonable to hypothesize that by developing another identity in the online virtual world, they may feel more secure and confident (Carli et al., 2013). Previous studies have also shown that low self-esteem is associated with IA symptoms in adolescents with ADHD (Kahraman & Demirci, 2018; Yen et al., 2014). Nevertheless, self-esteem has not been investigated without eliminating the confounding effects of depression and anxiety in these studies, as mentioned above. Consistent with these studies, lower self-esteem in ADHD adolescents was associated with more IA symptoms in the current study. Going further, it was still found to be an independent factor for IA symptoms after controlling depression and anxiety severity.

The findings on autistic traits and self-esteem lead us to think that adolescents with ADHD motivate themselves through social achievement on the Internet. As suggested by social compensation theory, online media users who find it difficult to engage in real-world social interactions may turn to online connections in an attempt to meet their social needs (Valkenburg & Peter, 2007). For instance, if real life is devoid of social stimulation, an individual may feel compelled to go online to interact in an online game or social networking site to seek it out. However, due to the amount of compensation necessary to ease negative feelings, this behaviour can occasionally result in severe consequences and addictive behaviours (Kardefelt-Winther, 2014). Individuals with persistent real-world problems may require compensation on a continuous basis, as Griffiths (2000)'s case study evidence suggests. In milder cases, such as temporary stress related to school or work, a few hours of compensatory Internet use may be sufficient and result in fewer negative effects (Leung, 2006). Thus, adolescents with severe addictive behaviours (defined as IA in the IADQ) compensate for permanent social incompetencies such as autistic traits and low self-esteem through online media where socializing is

afforded. Despite the longitudinal design of this study, cause and effect could not be established between these variables and IA.

The other main findings of this study were that ADHD inattention symptoms were the most important intrapersonal factor of IA in Wave 1 (odds ratio = 1.7) but became insignificant in Wave 2. A possible explanation for this is that ADHD symptoms were attenuated after medical treatment and the correlation of ADHD symptoms with IA symptoms decreased. Similarly, a systematic review by Carli et al. (2013) found that the correlation of ADHD symptoms with IA symptoms was the strongest association among the various comorbid psychopathologies. A similar conclusion was drawn in a two-year follow-up study evaluating high school students, which determined that hostility and ADHD were the most important predictors of IA (Ko et al., 2009). After the separation of ADHD symptoms into the inattentive and hyperactivity/impulsivity types, the correlation was seen to remain for the inattentive type, but not for the hyperactivity/impulsivity type. This could be attributed to lower rates of the hyperactivity/impulsivity type in adolescence, so it is less often encountered (Weiss et al., 2003), as was the case in the current study.

Another novel finding of this research was the causal link between IA and anxiety/depression severity. Anxiety and depression severity were associated with IA symptoms in Wave 1, but in Wave 2 this association was lost as a result of the treatment effect. These results went beyond previous reports, which have shown that anxiety/depression severity is linked with IA in a cross-sectional design (Chou et al., 2015; Yen et al., 2014).

There are some potential explanations regarding the association of anxiety and IA in ADHD. First, academic underachievement and impaired peer relationships in ADHD make adolescents prone to anxiety, which can consequently direct them to the alternative world of the Internet as an escape from the real world (Yen et al., 2014). Second, withdrawal from the Internet can cause anxiety symptoms similar to substance abuse (Yen et al., 2014). In a Finnish cohort study, 26% of adolescents with ADHD were characterized by anxiety symptoms (Smalley et al., 2007), which was directly in agreement with the findings of the current study. Low self-esteem, low motivation, fear of rejection, and the need for approval have been reported to lead depressed adolescents to use the Internet more frequently. Specifically, the interactive functions of the Internet may cause addiction as a compensation for insufficient pleasure in daily life (Tsitsika et al., 2011). In two studies in the same age and same psychopathology group, the IA group showed more depressive symptoms (Yen et al., 2007) and depression severity correlated with IA severity (Kahraman & Demirci, 2018), in alignment with the current study results.

There are some contrasting views about whether depression is the cause or the outcome of IA. In a general study of Taiwanese adolescents, it was suggested that the Internet provides relief from depression (Tsai & Lin, 2003). In contrast, IA may lead to depression through sleep deprivation in adolescents (Yen et al., 2010). In the current study, depression and IA symptom severity were correlated in Wave 1,

but there was no relationship in Wave 2 due to the effect of the anti-depressive treatment. Some researchers describe Internet use disorders as a problematic way to cope with the stresses of ordinary life and have developed the term "compensatory use" (Kardefelt-Winther, 2014). Although compensatory usage is not synonymous with *problematic* use, it emphasizes that the motive for such use is to avoid real-world issues and responsibilities and/or to avoid negative emotions and affect (Kardefelt-Winther, 2014). In this model, the connection between escapism and negative outcomes should be greater for those who experience more stress (Kardefelt-Winther, 2014). This hypothesis may explain why some people continue to use the Internet while suffering negative consequences, which some researchers refer to as addictive behaviours (Kardefelt-Winther, 2014). Additionally, it could imply that ADHD adolescents fit better into the group of emotionally vulnerable gamblers identified by Blaszczynski and Nower (2002).

The results of this study showed that the time spent on the Internet was positively correlated with the IADQ score, as expected. Common predictors for both the time spent on the Internet and IA were determined in Wave 1. Overall, adolescents with ADHD spent 2.6 hours online per day on average, consistent with a recent similar study (Izmir et al., 2019). In the current study, the device most used for internet access was a mobile phone. This preference is a different topic that is argued through connectedness, social assurance, and multicommunicating in ADHD (Seo et al., 2015). Instant messaging may meet an adolescent's impulse to receive immediate information from friends, and therefore they might tend to stay logged in. Further research is necessary to determine whether instant messaging is a distinct type of internet use in adolescents with ADHD (Rosenbaum & Wong, 2012).

The results suggest that neglectful parenting style, family dysfunction, autistic traits, lower self-esteem, and higher ADHD inattentive symptoms could predict the likelihood of IA in ADHD. The family factors of neglectful parenting and family dysfunction are the most critical considerations for predicting IA. Neglectful parenting and autistic traits remained as significant predictors for IA even after recovery from ADHD symptoms, and lower self-esteem was linked with IA symptoms regardless of the mediation effect of depression and anxiety.

Limitations

There were some limitations to this study that require attention. First, some unpredicted environmental changes between Waves 1 and 2 could have affected the findings, and the four-month interval may not have been sufficient to detect the long-term transition in ADHD and IA symptoms. Second, recall bias in the self-rating scale of IA may have limited the accuracy of symptoms. As there is no Turkish adaptation of the parent version of the scale for IA, only self-reports of adolescents could be used. Third, the properties of the IADQ and heterogeneity in the literature force us to use the umbrella term "Internet Addiction", which has been challenged for its lack of specificity in light of the

diversity of potentially harmful behaviours that may occur online, and the variety of underlying etiological processes (Starcevic & Aboujaoude, 2017). Fourth, the cut-off points for IA and non-IA adolescents are based on those used in the United States, which may not be appropriate for the Turkish population (Young, 2004). For ethical reasons, it was not possible to test the severity of IA symptoms with the dosage/type of medication.

Strengths

The strengths of our work lie in some statistical analytic approaches. First, the longitudinal design allowed the possibility of establishing causality in the predictive relationships of the variables and IA in adolescents with ADHD, However, the causal direction of some factors remain uncertain (e.g., parenting style, self-esteem, and autistic traits). Second, type II errors were minimized by the large sample size. Third, controlling the indirect effect of mediators provided stronger evidence of causality.

Conclusions

In conclusion, this study found that neglectful parenting style, family dysfunction, autistic traits, lower self-esteem, and higher ADHD inattentive symptoms were independent predictors of IA. The main finding was that neglectful parenting is the most important factor in predicting IA. This suggests that the implementation of family education on the subject of IA could be beneficial. There is considerable evidence that unique therapeutic interventions for IA that incorporate family intervention may be beneficial (González-Bueso et al., 2018; Torres-Rodríguez et al., 2018). It is hoped that these findings may be useful in adapting psychoeducational interventions in this population.

The association of self-esteem and autistic traits with IA highlights the importance of communication skills, social skills, and assertiveness. Future research on mediators of the relationship between IA and these permanent intrapersonal factors in the presence of psychiatric disorders other than ADHD could help clarify the underlying mechanism of IA. To analyze within-individual changes and between-individual differences in future work, a two-level multilevel design, with level one repeated measures and level two time-invariant individual characteristics, could garner promising evidence with sufficient statistical power.

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Declaration of conflict of interest
None.

Availability of data and material

The data that shows the results of this research are accessible from the corresponding author through appropriate request.

Author's contributions

AA and MBU contributed to the design of the study and interpretation of the data. AA acquired the data. MBU drafted, revised, critically reviewed, and approved the final submitted draft of the article. AA had full access to all the data in the study and takes responsibility for the integrity of the data.

Ethics and informed consent

The study was reviewed and approved by the Ondokuz Mayıs University Medical Research Ethics Committee (No: OMÜKAEK 2019/847, dated 12.12.2019). (B.30.2.ODM.0.20.08/976).

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Table 1

SES of Both Parents According to the Hollingshead Index

Education level	Score	Occupation	Score
No education	0	No occupation	0
Elementary school	1	Workman	1
Junior school	2	Blue-collar worker	2
High school	3	White-collar worker	3
University	4	Professional	4

Note: SES = Socioeconomic status.

Table 2

Socioeconomic and Psychological Characteristics of the Study Sample in Wave 1

Variables	IA (*n* = 55)	non-IA (*n* = 195)	Statistic	*p*
Demographics				
Age (years)	14.91±1.92	15.11±1.89	$t = 0.678$	.84
Sex			$\chi^2 = 1.84$	.174
Female	17 (30%)	80 (41%)		
Male	38 (70%)	115 (59%)		
Hollingshead Index (mean of both parents' total score)	3.65±1.71	4.05±1.73	$t = 1.50$	.498
Preferred Device			$\chi^2 = 14.89$	.719
Computer	7	31		
Phone	31	113		
Tablet	17	51		
Frequency of IU in the last month	4.91±1.59	4.58±1.81	$t = 1.20$	.30
Time spent on the Internet	4.38±1.54	2.09±1.06	$t = 12.65$	.001***
Comorbidity				
ODD	9 (16.4%)	17 (8.7%)	$\chi^2 = 2.69$	.10
CD	9 (16.4%)	23 (11.8%)	$\chi^2 = 0.80$	.37
Anxiety	40 (72.7%)	98 (50.3%)	$\chi^2 = 8.76$	.03*
Depression	30 (54.5%)	79 (40.5%)	$\chi^2 = 3.43$	.06
Other	23 (41.8%)	97 (49.7%)	$\chi^2 = 1.08$	.29
IADQ score	88.94±5.46	50.84±17.20	$t = 16.17$	.001***
CDI	21.60±9.83	18.47±10.21	$z = 2.30$	.02*
CSEI	64.09±16.44	80.39±6.83	$t = 7.17$	.001***
SCARED	53.38±24.14	49.12±18.66	$t = 1.21$	.048*
AQ	16.58±2.83	11.69±4.85	$t = 9.45$	.001***
T-DSM-IV-S-Inattention	21.36±3.09	13.45±1.10	$t = 18.60$	.001***
T-DSM-IV-S-H/I	3.89±2.59	4.12±2.68	z = -0.54	.58
T-DSM-IV-S-Total ADHD	25.25±3.84	17.57±2.88	$t = 13.78$	.001***
T-DSM-IV-S-ODD	5.02±2.96	5.18±3.07	$z = -0.30$	.75
T-DSM-IV-S-CD	3.92±2.47	3.61±2.24	$z = -0.75$	.44
PSI			$\chi^2 = 39.07$	.001***
Neglectful	45 (81.8%)	67 (34.4%)		
Other than neglectful	10 (18.2%)	128 (65.6%)		
Authoritative	1 (1.8%)	33 (16.9%)		
Authoritarian	3 (5.5%)	46 (23.6%)		
Indulgent	6 (10.9%)	49 (25.1%)		
FAD				
Problem Solving	2.51±0.84	2.48±0.78	$t = 0.196$	.84
Affective Involvement	2.52±0.80	2.57±0.90	$t = 0.358$	.72
Role	2.34±0.81	2.45±0.81	$t = 0.374$	.89
Communication	2.34±0.83	2.41±0.91	$t = 0.358$	.72
Affective Response	2.32±0.84	2.41±0.84	$t = 0.719$	.47
Behaviour Control	2.67±0.83	2.54±0.84	$t = 0.984$	.32
General Functions	2.30±0.74	2.04±0.60	$t = 2.63$	.009**

Notes: IA = Internet Addiction. IADQ = Internet Addiction Diagnostic Questionnaire. CDI = Childhood Depression Inventory. CSEI = Coppersmith Self-Esteem Inventory. SCARED = Screen for Child Anxiety-Related Emotional Disorders. AQ-Adolescent = The Autism Spectrum Quotient- Adolescent Version. T-DSM-IV-S = The Turgay DSM-IV Disruptive Behavior Disorders Rating Scale-H/I Hyperactive/Impulsive. ADHD = Attention Deficit Hyperactivity Disorder ODD = Oppositional Defiant Disorder.CD = Conduct Disorder. PSI = Parenting Style Inventory. FAD = Family Assessment Device. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 3

Psychological Characteristics of the Study Sample in Wave 2

Variables	**IA (*n* = 44)**	**non-IA (*n* = 206)**	**Statistic**	***p***
Demographics				
Age (years)	14.84±1.99	15.11±1.87	$t = 0.868$	.386
Sex			$\chi^2 = 1.60$	.205
Female	13 (30.2%)	84 (40.6%)		
Male	30 (69.8%)	123 (59.4%)		
Hollingshead Index (mean of both parents' total score)	3.65±1.71	4.05±1.73	$t = 4.36$	.001***
IADQ score	92.50±5.34	40.14±11.90		
CDI	13.67±6.53	12.95±6.17	$t = 0.69$	.49
CSEI	75.30±7.40	73.75±8.22	$t = 1.14$	.25
SCARED	27.35±16.36	27.76±13.78	$t = 0.155$	.877
T-DSM-IV-S-Inattention	6.50±4.16	6.34±3.76	$z = -0.30$	.76
T-DSM-IV-S-H/I	2.95±1.89	3.17±1.98	$z = -0.66$	.50
T-DSM-IV-S-Total ADHD	9.45±4.69	9.51±4.39	$z = -0.09$	.99
T-DSM-IV-S-ODD	13.21±3.15	12.90±3.05	$z = -1.13$	.25
T-DSM-IV-S-CD	19.62±3.06	20.37±3.12	$z = -0.59$	.55
PSI			$\chi^2 = 31.81$	.001***
Neglectful	36 (83.7%)	76 (36.7%)		
Other than neglectful	7 (16.3%)	131 (63.3%)		
Authoritative	0 (0%)	34 (16.4%)		
Authoritarian	2 (4.7%)	47 (22.7%)		
Indulgent	5(11.6%)	50 (24.2%)		
FAD				
Problem Solving	2.40±0.86	2.50±0.78	$t = 0.770$	.44
Affective Involvement	2.46±0.73	2.58±0.90	$t = 0.90$	.36
Role	2.39±0.84	2.43±0.80	$t = 0.246$	.80
Communication	2.33±0.83	2.41±0.90	$t = 0.548$	.58
Affective Response	2.33±0.85	2.40±0.84	$t = 0.526$	.59
Behaviour Control	2.69±0.82	2.55±0.84	$t = 1.02$	.30
General Functions	2.34±0.80	2.05±0.59	$t = 2.22$	.03*

Notes: IA = Internet Addiction. IADQ = Internet Addiction Diagnostic Questionnaire. CDI = Childhood Depression Inventory. CSEI = Coppersmith Self-Esteem Inventory. SCARED = Screen for Child Anxiety-Related Emotional Disorders. T-DSM-IV-S = The Turgay DSM-IV Disruptive Behavior Disorders Rating Scale-H/I Hyperactive/Impulsive. ADHD = Attention Deficit Hyperactivity Disorder. ODD = Oppositional Defiant Disorder. CD = Conduct Disorder. PSI = Parenting Style Inventory. FAD = Family Assessment Device. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 4

Comparison of the T-DSM-IV Scores for the Total Sample in Waves 1 and 2

	Wave 1	Wave 2	Statistics	*p*
T-DSM-IV-S-Inattention	15.19±3.71	6.37±3.83	$t = 26.20$	.001***
T-DSM-IV-S-H/I	4.07±2.65	3.14±1.96	$t = 4.35$	.001***
T-DSM-IV-S-total ADHD	19.26±4.45	9.50±4.43	$t = 23.07$	.001***
T-DSM-IV-S-ODD	5.14±3.04	2.57±1.73	$t = 11.50$	.001***
T-DSM-IV-S-CD	3.68±2.29	1.59±1.09	$t = 12.99$	.001***

Notes: T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale-H/I Hyperactive/Impulsive. ADHD = Attention Deficit Hyperactivity Disorder ODD = Oppositional Defiant Disorder. CD = Conduct Disorder. ***$p < .001$.

Table 5

Bivariate Correlations Between Intrapersonal Factors in Wave 1

	CDI	CSEI	SCARED	T-DSM-IV-S				
				Inattn.	H/I	Total	ODD	CD
IADQ	.255**	-.398**	.239**	.636**	-.067	.533**	-.084	-.122
CDI	-	.065	.272**	.097	.050	.113	.428	.272
CSEI		-	.074	-.548**	.056	-.460**	.115	.100
SCARED			-	.025	-.015	.015	.033	-.161*
T-DSM-IV-S-Inattn.				-	-.075	.853**	-.081	-.136*
T-DSM-IV-S-H/I					-	.455**	-.029	.021
T-DSM-IV-S-Total						-	-.088	-.111
T-DSM-IV-S-ODD							-	-.037
T-DSM-IV-S-CD								-

Notes: IADQ = Internet Addiction Diagnostic Questionnaire. CDI = Childhood Depression Inventory. SCARED = Screen for Child Anxiety-Related Emotional Disorders. CSEI = Coppersmith Self-Esteem Inventory. AQ-Adolescent = The Autism Spectrum Quotient-Adolescent Version. T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale-H/I = Hyperactive/Impulsive ODD = Oppositional Defiant Disorder. CD = Conduct Disorder. OR = odds ratio.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 6

Bivariate Correlations Between Intrapersonal Factors in Wave 2

	CDI	CSEI	SCARED	T-DSM-IV-S				
				Inattn.	H/I	Total	ODD	CD
IADQ score	.108	.079	-.012	-.029	-.005	-.022	.071	-.002
CDI	-	-.072	.091	-.052	.086	.038	.393**	.004
CSEI		-	-.089	.027	-.039	-.015	-.085	.051
SCARED			-	-.041	.146*	.094	.030	-.139*
T-DSM-IV-S-Inattn.				-	-.052	.576**	-.004	-.032
T-DSM-IV-S-H/I					-	.787**	.050	-.050
T-DSM-IV-S-Total						-	.039	-.022
T-DSM-IV-S-ODD							-	.031
T-DSM-IV-S-CD								-

Notes: IADQ = Internet Addiction Diagnostic Questionnaire. CDI = Childhood Depression Inventory. SCARED = Screen for Child Anxiety-Related Emotional Disorders. CSEI = Coppersmith Self-Esteem Inventory. AQ-Adolescent = The Autism Spectrum Quotient-Adolescent Version. T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale-H/I Hyperactive/Impulsive. ODD = Oppositional Defiant Disorder. CD = Conduct Disorder. OR = odds ratio.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 7

Bivariate Correlations Between FAD Subscales and IADQ Scores

	1	2	3	4	5	6	7	8
1. IADQ score	-	.067	-.013	-.047	-.093	-.019	.108	.269***
2. Problem Solving		-	.023	-.057	.111	-.006	.004	.001
3. Affective Involvement			-	-.036	.010	.079	.050	-.001
4. Role				-	-.012	-.104	-.034	.048
5. Communication					-	.017	.142*	-.068
6. Affective Response						-	-.026	.028
7. Behaviour Control							-	.037
8. General Functions								-

Notes: FAD = Family Assessment Device. IADQ = Internet Addiction Diagnostic Questionnaire.

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 8

Results of the Hierarchical Logistic Regression Analyzes of Adolescents with ADHD with IA in Wave 1 as a Dependent Variable

	Model 1			Model 2			Model 3		
Independent Variables	*B*	Wald	*OR*	B	Wald	*OR*	*B*	Wald	*OR*
Demographics									
Age	-0.043	0.280	0.958	-0.027	0.031	0.973	0.019	0.011	1.019
Sex	-0.423	1.660	0.655	-0.190	0.073	0.827	-0.486	0.348	0.615
Intrapersonal factors									
CSEI				-0.076	5.795	0.927*	-0.090	5.211	0.914*
AQ-Adolescent				0.290	9.823	1.336**	0.220	4.758	1.246*
T-DSM-IV-S-Inattention				0.524	40.195	1.689***	0.552	34.367	1.738***
Family factors									
FAD-General Functions							1.366	4.389	3.919*
PSI (Neglectful vs. other)							2.263	7.338	9.614**
Statistics of the model									
-2LL	261.283			76.085			62.082		
Model χ^2	2.171 (df = 2)			187.369 (df = 5)***			201.372 (df = 7)***		
Step χ^2	2.171 (df = 2)			185.198 (df = 3)***			14.003 (df = 2)**		
Nagelkerke $\boldsymbol{R}^2$	.013			.810			.849		
Classification accuracy	78%			96%			96.4%		

Notes: CSEI = Coppersmith Self-Esteem Inventory. AQ-Adolescent = The Autism Spectrum Quotient- Adolescent Version. T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale. FAD = The Family Assessment Device. PSI = Parenting Style Inventory.OR = odds ratio. *p < .05, **p < .01, ***p < .001.

Table 9

Results of the Hierarchical Logistic Regression Analyzes of Adolescents with ADHD with IA in Wave 2 as a Dependent Variable

Independent Variables	Model 1			Model 2		
	B	Wald	*OR*	*B*	Wald	*OR*
Demographics						
Age	-0.065	0.531	0.937	-0.034	0.113	0.967
Sex	0.426	1.378	1.532	0.320	0.602	1.377
Intrapersonal/family factors						
AQ-Adolescent				0.217	15.935	1.242***
PSI (Neglectful vs. other)				1.956	18.484	7.069***
Statistics of the model						
-2LL	227.340			171.275		
Model χ^2	2.181 (df = 2)			58.247 (df = 4)***		
Step χ^2	2.181 (df = 2)			56.065 (df = 2)***		
Nagelkerke $\boldsymbol{R}^2$	.014			.346		
Classification accuracy	82.8%			82.8%		

Notes: CSEI = Coppersmith Self-Esteem Inventory. AQ-Adolescent = The Autism Spectrum Quotient-Adolescent Version. T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale. FAD = The Family Assessment Device. PSI = Parenting Style Inventory OR = odds ratio.

*p < .05, **p < .01, ***p < .001.

Table 10

Results of Hierarchical Linear Regression Analyses of the Time Spent on Internet of Adolescents with ADHD

	Model 1			Model 2***			Model 3***		
Independent Variables	β	*SE*	*t*	β	*SE*	*t*	β	*SE*	*t*
Demographics									
Age	0.13	0.05	0.21	-0.025	0.04	0.45	0.013	0.04	0.25
Sex	-0.65	0.19	-1.01	-0.008	0.17	-0.15	-0.043	0.16	-0.82
Intrapersonal factors									
CSEI				-0.018	0.009	-0.26	-0.068	0.008	-1.05
AQ-Adolescent				0.131	0.18	2.21	0.073	0.01	1.29
T-DSM-IV-S-Inattention					0.02	6.38	0.333	0.02	4.75
				0.452					
Family factors									
FAD-General Functions							0.285	0.12	5.38
PSI (Neglectful vs.other)							0.170	0.16	3.08
Model Statistics									
Model	Adj. R^2 = -.004, $F(2,247) = 0.52$, $p = .59$			Adj. R^2 = -.266 $F(5,244) = 19.06$, $p < .001$			Adj. R^2 = -.356 $F(7,242) = 20.68$, $p < .001$		
Nagelkerke $\boldsymbol{R}^2$	.004			.281			.374		
Δ $\boldsymbol{R}^2$				.277			.093		

Notes: CSEI = Coppersmith Self-Esteem Inventory. AQ-Adolescent = The Autism Spectrum Quotient-Adolescent Version. T-DSM-IV-S = Turgay DSM-IV Disruptive Behavior Disorders Rating Scale. FAD = The Family Assessment Device. PSI = Parenting Style Inventory. OR = odds ratio. ***$p < .001$.

Figure 1

Flowchart of the Sample Recruitment

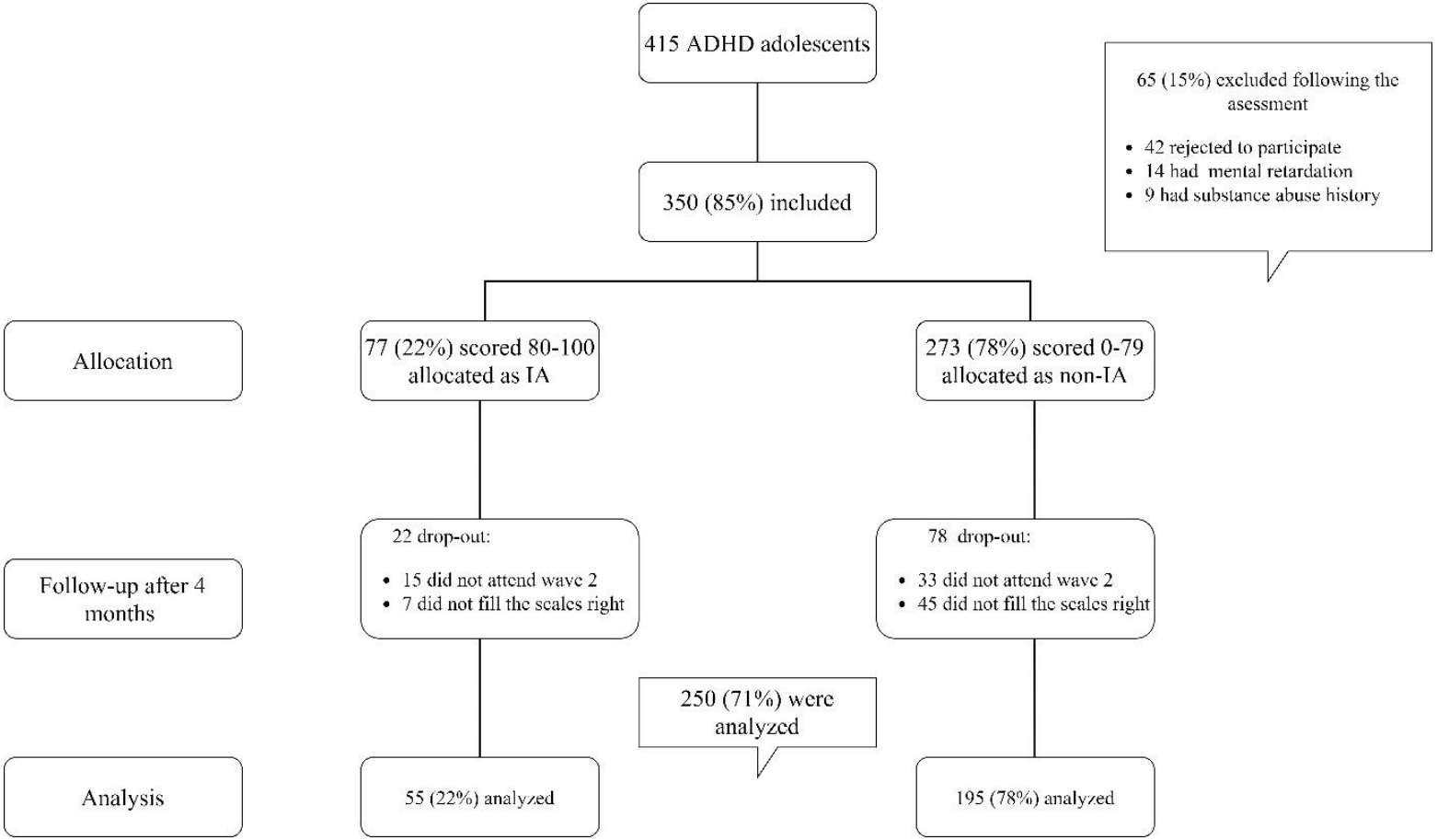
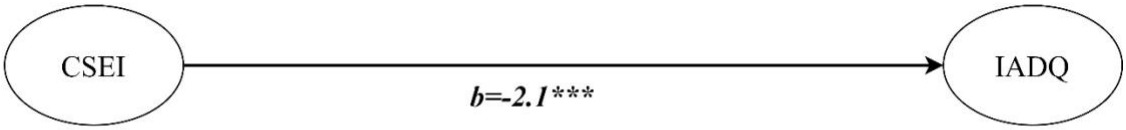


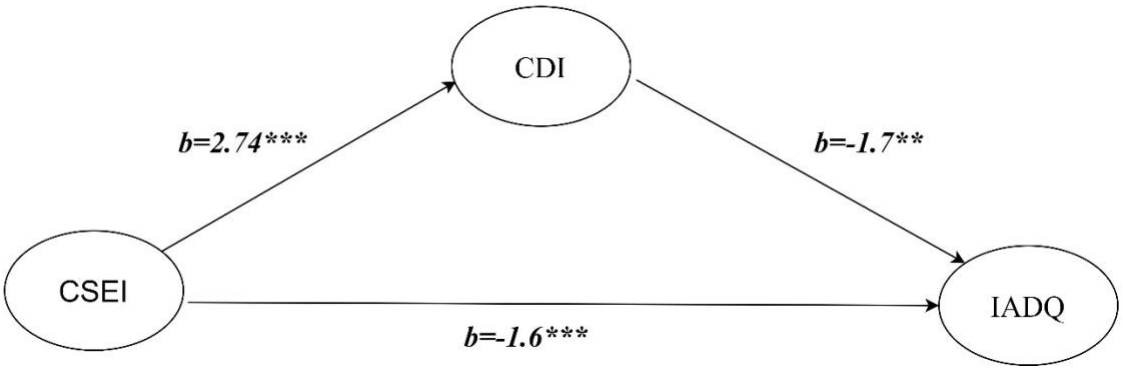
Figure 2

Logistic Mediation Model Revealed the Association Between Self-Esteem and IA Symptoms Mediated by Depression Severity

(1a)



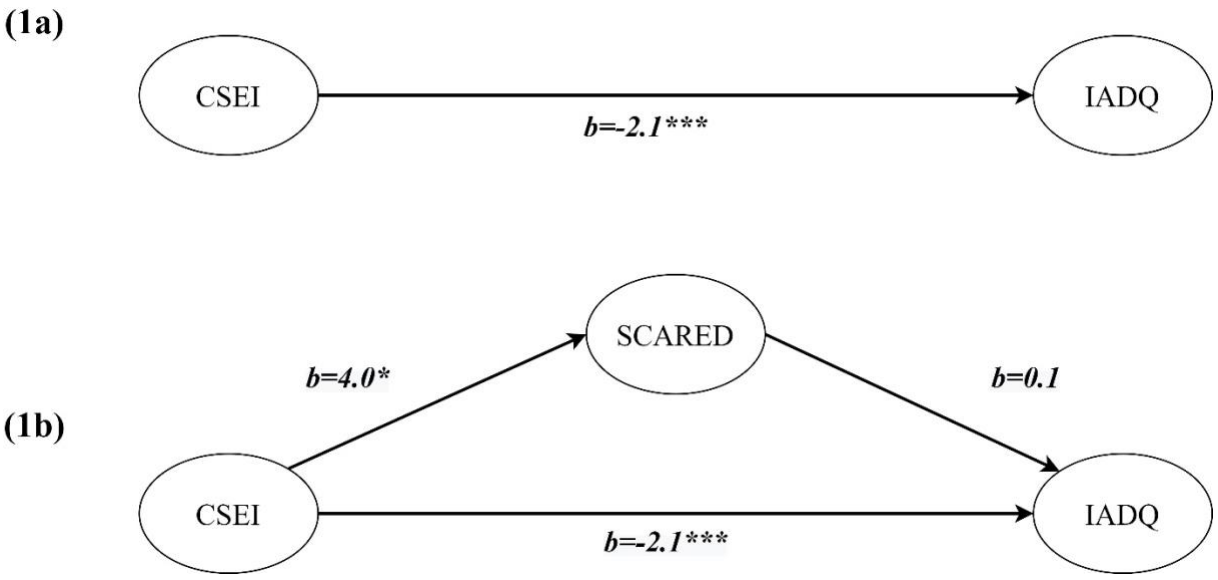
(1b)



Notes: IADQ = Internet Addiction Diagnostic Questionnaire. CDI = Childhood Depression Inventory. CSEI = Coppersmith Self-Esteem Inventory. *$p < .05$, **$p < .01$, ***$p < .001$.

Figure 3

Logistic Mediation Model Revealed that the Association Between Self-Esteem and IA Symptoms was not Mediated by Anxiety Severity



Notes: IADQ = Internet Addiction Diagnostic Questionnaire. SCARED = Screen for Child Anxiety-Related Emotional Disorders. CSEI = Coppersmith Self-Esteem Inventory.
*$p < .05$, **$p < .01$, ***$p < .001$.

Figure Captions

- Figure 1. Flowchart of the sample recruitment
- Figure 2. Logistic mediation model revealed the association between self-esteem and IA symptoms mediated by depression severity
- Figure 3. Logistic mediation model revealed that the association between self-esteem and IA symptoms was not mediated by anxiety severity