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Internet Addiction and Emotion Regulation Difficulties in Patients Diagnosed With Attention-Deficit/Hyperactivity Disorder

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Objective This study aims to examine the relationship between internet addiction and emotion regulation difficulties in individuals with attention-deficit/hyperactivity disorder (ADHD).

Methods Sixty-three patients diagnosed with ADHD according to DSM-5 and 63 healthy controls were included in our study. Sociodemographic data form, Adult ADHD Self-Report Scale (ASRS), Young Internet Addiction Scale (YIAS), Difficulties in Emotion Regulation Scale (DERS), Barratt Impulsivity Scale–11 (BIS), and Beck Depression Inventory (BDI) were applied to both groups.

Results According to the independent samples t-test, the ADHD group had higher scores on YIAS (t=4.754, p<0.001), ASRS (t=11.832, p<0.001), DERS (t=7.167, p<0.001), lack of emotional awareness (t=2.411, p=0.017), clarity (t=5.976, p<0.001), non-acceptance of emotional reactions (t=3.724, p<0.001), impulsivity (t=5.976, p<0.001), goal (t=8.298, p<0.001), strategy (t=5.210, p<0.001), and means were found to be statistically significantly higher than the control group (CG). According to the Pearson correlation analysis, no statistically significant correlation was found between the YIAS scores and other scale scores in the ADHD group. According to Pearson correlation analysis, a statistically significant positive correlation was found between the YIAS scores in the CG and the ASRS (r=0.474, p<0.01) and inattention (r=0.450, p<0.01) scores. According to the regression analysis, lack of emotional awareness, non-acceptance of emotional reactions, and BDI were found to be significant predictors of risky internet use.

Conclusion It has been determined that risky internet use increases in adults with ADHD and that some emotion regulation difficulties increase the risk.

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Keywords Internet addiction; Risky internet use; Attention deficit hyperactivity disorder; Emotion regulation difficulties; Depression.

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a chronic neurodevelopmental disorder that begins in childhood and often continues into adolescence and adulthood, and can affect individuals' quality of life in many ways. The main components of ADHD are defined as inattention, hyperactivity, and impulsivity. These basic symptoms can cause problems such as decreased academic achievement, difficulty in social relationships, and decreased daily functioning. In recent years, interest in investigating comorbid conditions associated with ADHD has increased, and behavioral and emotional problems, especially internet addiction (IA), are frequently associated with this disorder.[1] When the literature is examined, several studies show that ADHD often co-occurs with other psychiatric disorders, such as anxiety disorders, depression, autism spectrum disorders, behavioral addictions such as IA, and substance use disorder.[2,3]

IA is defined as a condition in which individuals have difficulty controlling their internet use, which results in significant deterioration in social, academic, or occupational functioning.[4] In a recent large-scale study, the rate of IA was found to be 28.4% in the probable ADHD group, while it was 1.9% in the non-ADHD group.[5] A study has shown that ADHD is strongly associated with IA. As the severity of ADHD symptoms increases, the likelihood of developing IA also increases.[6] A comprehensive review of the relationship between ADHD and IA suggested that individuals with ADHD are vulnerable to IA, which may be caused by impaired inhibition leading to a lack of self-control and difficulties with self-regulation. It

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has been noted that uncertainty remains as to whether ADHD is a risk factor or a comorbidity for IA.[7] IA can make it easier for individuals to escape from their offline lives, and this escape can create a cycle that reinforces addiction.

Emotion regulation involves being aware of one's emotions, accepting them, controlling one's behavior when negative emotions arise, acting goal-oriented, and using relevant emotion regulation strategies to achieve goals.[8] The Difficulties in Emotion Regulation Scale (DERS) consists of six subscales: non-acceptance of emotional reactions, difficulties in displaying goal-directed behaviors, impulsivity, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. Lack of emotional awareness, non-acceptance of emotional reactions, and clarity subscales assess emotional processing difficulty, the goals and impulsivity subscales assess emotional response difficulty, and the strategy subscale assesses emotional self-efficacy.[9] In their study, Rosello et al.[10] suggested that emotion regulation difficulties are a core feature of ADHD and are associated with higher illness severity, more frequent psychiatric comorbidity, and reduced functioning. It has been suggested that individuals with emotion regulation difficulties often resort to ineffective methods to cope with stressful situations, and that this can lead to behavioral addictions such as IA.[11] IA can be used as an emotional escape mechanism in individuals with emotion regulation difficulties. For example, individuals may turn to internet use to avoid stressful or disturbing emotions. While this escape provides relief in the short term, it has an effect that reinforces addictive behavior and increases addiction severity in the long term.[12] An Interaction of Person-Affect-Cognition-Execution (I-PACE) model developed by Brand et al.[13] explains IA through the interaction of personal predispositions, affective durations, cognitive control mechanisms, and decision-making processes. Based on this model, it can be argued that having an ADHD diagnosis, through impulsivity and executive function difficulties, may predispose individuals to IA. Furthermore, in the presence of emotion regulation difficulties, the internet may be used as an escape route in the face of negative events. Poor cognitive control may reinforce addictive behavior. ADHD and emotion regulation difficulties may play a role in both the initiation and maintenance of addiction. Understanding this complex relationship between IA and emotion regulation difficulties is of critical importance for the development of intervention programs for individuals diagnosed with ADHD.[14] In particular, the effectiveness of psychoeducation, cognitive behavioral therapy (CBT), and mindfulness-based interventions for these individuals should be investigated. In addition, families and educators need to be made aware of technological addiction in order to recognize it early and bring it under control.

This study was aimed to examine the relationship between IA and emotion regulation difficulties in individuals with ADHD. Considering the gaps in the literature, we planned a study in a clinical sample diagnosed according to Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), controlling for depression and impulsivity accompanying both ADHD and IA, and separately addressing the emotion regulation difficulties and their subscales. Our hypothesis for this study is that IA is positively associated with difficulty regulating emotions in individuals with ADHD. It is thought that the results of the study will contribute to the development of new approaches to the prevention and management of behavioral addictions in individuals with ADHD.

METHODS

Participants

Sixty-three patients who presented to the Psychiatry Outpatient Clinic of Mental Health and Diseases Hospital, between June 2023 and June 2024, were diagnosed with ADHD according to DSM-5 criteria and met the inclusion criteria were included in the study. Additionally, 63 healthy volunteers, matched for sex with the ADHD group, were recruited as controls. Verbal and written informed consent was obtained from all participants. Individuals who met the diagnostic criteria for ADHD according to DSM-5, volunteered to participate in the study, were literate, and were between the ages of 18–65 years were included in our study, while individuals who did not volunteer to participate in the study and had other medical, neurological, or developmental diseases affecting cognitive functions were excluded. For the healthy volunteer control group (CG), individuals who were literate, between the ages of 18–65 years, volunteered to participate in the study, and did not have any psychiatric illness were included in the study, while individuals with other medical, neurological, or developmental illnesses affecting cognitive functions were excluded. The healthy volunteer CG was recruited from hospital staff and relatives of the researchers. A research project was approved by the decision of the Health Sciences University Bursa Yuksek Ihtisas Training and Research Hospital Ethics Committee (Approval number: 2011-KAEK-25 2023/05-04, Date: 17/05/2023). The study was conducted in accordance with the Declaration of Helsinki. Participants were recruited only after providing written informed consent.

Instruments

Sociodemographic data form

This form was prepared by researchers and includes sociodemographic and clinical data such as age, sex, marital status, education status, employment status, whether or not re-

ceiving mental treatment, mental illness in the family, and past suicide history.

Adult ADHD Self-Report Scale

It is one of the scales developed by WHO for screening mental disorders.[15] The scale has two subscales, "attention deficit" and "hyperactivity/impulsivity," each consisting of nine questions. Questions are designed to determine how frequently each symptom has occurred in the last 6 months. Responses are scored from 0 to 4. The Turkish validity and reliability study was conducted by Doğan et al.[16] in 2009, and the Cronbach's alpha value of the scale was 0.88.

Young Internet Addiction Scale

It is a self-report scale created by Young[17] and contains 20 questions. It is evaluated with a 6-point Likert type score between 0 (never) and 5 (continuous). A total score of 80 and above is defined as "internet addiction," a score between 50–79 is defined as "risky internet use," and a score of 49 and below is defined as an "average internet user" who does not have any problems related to internet use. The scale was adapted to Turkish by Bayraktar and Gün[18] and its Cronbach's alpha value is 0.91.

DERS

It is the scale created by Gratz and Roemer.[8] This scale, which is evaluated with a 5-point Likert type score between 1 (almost never) and 5 (almost always), consists of 36 items and six subdimensions. These sub-dimensions are: 1, non-acceptance of emotional reactions; 2, difficulties in displaying goal-directed behaviors; 3, impulsivity; 4, lack of emotional awareness; 5, limited access to emotion regulation strategies; and 6, lack of emotional clarity. The Turkish adaptation, validity, and reliability studies of the scale were conducted by Ruganci and Gençöz[19] and Cronbach's alpha was found to be 0.93 for the total scale.

Barratt Impulsivity Scale–11

A 30-item self-report questionnaire designed by Patton et al.[20] (1995) to measure impulsivity. Factor analysis revealed three components: 1) attentional impulsivity, 2) motor impulsivity, and 3) nonplanning impulsivity. The higher the total Barratt Impulsivity Scale–11 (BIS-11) score, the higher the level of impulsivity. The Cronbach alpha value of the total scale, whose Turkish validity and reliability study was conducted by Güleç et al.,[21] was 0.80.

Beck Depression Inventory

The scale, developed by Beck et al.[22] in 1961, consists of 21 symptom categories. The four options in each symptom category of the scale are scored between 0 and 3. The Cronbach's alpha coefficient of the Turkish form of the scale, whose Turkish validity and reliability study was conducted by Hisli,[23] was found to be 0.80.

Procedure-data analyses

The demographic and clinical characteristics of the participants were analyzed using descriptive statistical methods (e.g., number, percentage, mean, standard deviation). The mean scores of Young Internet Addiction Scale (YIAS), Adult ADHD Self-Report Scale (ASRS), Beck Depression Inventory (BDI), BIS, and DERS between ADHD and CGs were compared using the independent groups t-test. The relationship between YIAS, ASRS, BDI, BIS, and DERS scores in ADHD and CGs was analyzed using Pearson correlation analysis. The false discovery rate (FDR) method was applied to reduce the risk of false significance that may arise from multiple comparisons in the correlation analysis. The significance threshold was set at ($p<0.00042$), and relationships falling below this value were considered significant [$FDR=0.05\times(1/119)=0.00042$]. To test the contribution of interaction terms between variables in the regression model, the ASRS×BIS and DERS×BDI interaction terms were calculated and included in the multiple linear regression model. At this stage, tolerance and variance inflation factor (VIF) values were calculated for all independent variables. Additionally, variables predicting risky internet use were evaluated separately in multiple binary logistic regression models, along with diagnostic group (ADHD/no ADHD). One-way analysis of covariance (ANCOVA) was applied to examine the main and interaction effects of group (ADHD/CG) and education level, controlling for the effects of age, BDI, lack of emotional awareness, and non-acceptance of emotional reactions on YIAS scores. A significance level of $p<0.05$ was set for all analyses. The normality of data distribution was checked using skewness and kurtosis values (±1.5). All analyses were performed using the IBM SPSS 26.0 software (IBM Corp.).

RESULTS

In the study, it was found that the mean age of the ADHD diagnosed cases was 25.56±7.35 years, and the mean age of the CG participants was 28.27±6.16 years, and there was a statistically significant difference in the mean ages between the two groups ($t=-2.25$, $p=0.027$). Among the ADHD cases, 32 (50.8%) were male, 13 (20.6%) were married, 18 (28.6%) had completed secondary school, 5 (7.9%) had completed high school, and 40 (54.0%) had graduated from university; 23 (36.5%) were employed, 33 (52.4%) smoked, 33 (52.4%) used alcohol, and 2 (3.2%) used substances; 6 (9.5%) had a history of suicide, 25 (39.7%) had a family history of mental disor-

ders, 5 (7.9%) had a medical illness, and 43 (68.3%) were receiving mental treatment. Among the CG cases, 29 (46.0%) were male, 26 (41.3%) were married, 6 (9.5%) had completed secondary school, 6 (9.5%) had completed high school, and 51 (81.0%) had graduated from university; 53 (84.1%) were employed; 24 (38.1%) smoked, 23 (36.5%) used alcohol; 1 (1.6%) had a history of suicide, 10 (15.9%) had a family history of mental disorders, and 1 (1.6%) had a medical illness. According to the chi-square test, it was found that the marriage rates (χ^2=6.28, p=0.012), education status rates (χ^2=7.42, p=0.024) and employment rates (χ^2=29.84, p<0.001) in ADHD diagnosed cases were statistically significantly lower than the rates in CG cases. According to the chi-square test, it was found that the rates of family history of mental disorders in ADHD cases were statistically significantly higher than the rates in CG cases (χ^2=8.90, p=0.003) (Table 1). In addition, other demographic characteristics were evaluated to be statistically similar between the other groups (p>0.05).

Table 1. Comparison of sociodemographic characteristics between ADHD and CG

	ADHD	CG	Analysis	p
Age (yr)	25.56±7.35	28.27±6.16	t=-2.25	0.027
Education level			χ^2=7.42	0.024
Primary education	18 (28.6)	6 (9.5)		
High school	5 (7.9)	6 (9.5)		
License	40 (63.5)	51 (81.0)		
Marital status			χ^2=6.28	0.012
Single	50 (79.4)	37 (58.7)		
Married	13 (20.6)	26 (41.3)		
Mental illness in the family			χ^2=8.90	0.003
Yes	25 (39.7)	10 (15.9)		
No	38 (60.3)	53 (84.1)		

Values are presented as mean±standard deviation or N (%). ADHD, attention-deficit/hyperactivity disorder; CG, control group; χ^2, chi-square test; t, independent groups t-test.

In the independent groups t-test shown in Table 2, the ADHD group had higher scores on YIAS (t=4.754, p<0.001), ASRS (t=11.832, p<0.001), inattention (t=11.326, p<0.001), hyperactivity impulsivity (t=9.599, p<0.001), DERS (t=7.167, p<0.001), lack of emotional awareness (t=2.411, p=0.017), clarity (t=5.976, p<0.001), non-acceptance of emotional reactions (t=3.724, p<0.001), impulsivity (t=5.976, p<0.001), goal (t=8.298, p<0.001), strategy (t=5.210, p<0.001), BIS (t=11.441, p<0.001), attentional impulsiveness (t=10.045, p<0.001), motor impulsiveness (t=8.341, p<0.001), non-planning impulsiveness (t=10.377, p<0.001), and BDI (t=6.331, p<0.001) means were found to be statistically significantly higher than the CG (Table 2).

According to the Pearson correlation analysis shown in Table 3, no statistically significant correlation was found between the YIAS scores and other scale scores in the ADHD group. According to Pearson correlation analysis, a statistically significant positive correlation was found between the

Table 2. Comparison of YIAS, ASRS, BDI, BIS, and DERS scores between ADHD and CG

	ADHD	CG	t	p
YIAS	41.14±12.91	31.86±8.59	4.754	<0.001
ASRS	47.17±12.73	22.71±10.36	11.832	<0.001
Inattention	25.59±7.02	12.70±5.68	11.326	<0.001
Hyperactivity-impulsivity	21.59±7.27	10.02±6.22	9.599	<0.001
DERS	96.38±22.74	70.24±17.68	7.167	<0.001
Lack of Emotional Awareness	13.29±4.09	11.65±3.48	2.411	0.017
Clarity	14.60±5.11	10.10±3.11	5.976	<0.001
Non-Acceptance of Emotional Reactions	14.41±5.78	10.95±4.58	3.724	<0.001
Impulsivity	13.95±5.02	9.37±3.46	5.976	<0.001
Goal	19.27±4.24	13.17±4.00	8.298	<0.001
Strategy	20.86±6.91	15.05±5.53	5.210	<0.001
BIS	78.27±13.26	54.90±9.32	11.441	<0.001
Attentional impulsiveness	36.79±7.99	24.56±5.45	10.045	<0.001
Motor impulsiveness	15.86±3.48	11.46±2.32	8.341	<0.001
Non-planning impulsiveness	25.62±4.08	18.89±3.14	10.377	<0.001
BDI	15.46±10.76	5.84±5.45	6.331	<0.001

Values are presented as mean±standard deviation. ADHD, attention-deficit/hyperactivity disorder; CG, control group; ASRS, Adult ADHD Self-Report Scale; YIAS, Young Internet Addiction Scale; DERS, Difficulties in Emotion Regulation Scale; BIS, Barratt Impulsivity Scale; BDI, Beck Depression Inventory; t, the independent samples t-test.

Table 3. Correlation (r) between YIAS, ASRS, BDI, BIS, and DERS scores

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
ADHD															
1-YIAS	-														
2-ASRS	0.297														
3-Inattention	0.268	0.886													
4-Hyperactivity-impulsivity	0.261	0.894	0.585*												
5-DERS	0.304	0.410	0.352	0.378											
6-Lack of emotional awareness	0.120	0.000	0.021	-0.021	0.375										
7-Clarity	0.239	0.400*	0.369	0.344	0.741*	0.295									
8-Non-acceptance of emotional reactions	0.166	0.324	0.286	0.290	0.826*	0.219	0.560*								
9-Impulsivity	0.333	0.348	0.209	0.408*	0.810*	0.147	0.525*	0.559*							
10-Goal	0.330	0.440*	0.462*	0.324	0.697*	0.026	0.394	0.518*	0.586*						
11-Strategy	0.170	0.261	0.198	0.265	0.815*	0.118	0.433*	0.614*	0.637*	0.514*					
12-BIS	0.321	0.631*	0.604*	0.522*	0.476*	0.177	0.425*	0.390	0.365	0.360	0.336				
13-Attentional impulsiveness	0.294	0.510*	0.478*	0.431*	0.435*	0.245	0.432*	0.301	0.380	0.255	0.283	0.924*			
14-Motor impulsiveness	0.277	0.538*	0.477*	0.481*	0.311	0.055	0.285	0.316	0.236	0.195	0.224	0.825*	0.662*		
15-Non-planning impulsiveness	0.230	0.595*	0.618*	0.444*	0.429*	0.048	0.291	0.407	0.242	0.503*	0.345	0.737*	0.480*	0.533*	
16-BDI	0.365	0.343	0.276	0.334	0.613*	0.274	0.448**	0.455*	0.506*	0.311	0.586*	0.295	0.358	0.220	0.070
CG															
1-YIAS	-														
2-ASRS	0.474*														
3-Inattention	0.450*	0.857*													
4-Hyperactivity-impulsivity	0.379	0.882*	0.514*												
5-DERS	0.225	0.494*	0.554*	0.317											
6-Lack of emotional awareness	0.145	0.275	0.260	0.222	0.461*										
7-Clarity	0.260	0.520*	0.514*	0.397*	0.648*	0.392									
8-Non-acceptance of emotional reactions	0.278	0.329	0.354	0.225	0.813*	0.285	0.438*								
9-Impulsivity	0.075	0.544*	0.463*	0.483*	0.778*	0.185	0.451*	0.530*							
10-Goal	0.103	0.279	0.450*	0.053	0.658*	0.076	0.269	0.343	0.463*						
11-Strategy	0.117	0.282	0.397	0.107	0.892*	0.216	0.372	0.743	0.693*	0.590*					
12-BIS	0.358	0.669*	0.592*	0.573*	0.413	0.292	0.368	0.200	0.419*	0.306	0.272				
13-Attentional impulsiveness	0.332	0.677*	0.599*	0.580*	0.361	0.304	0.375	0.190	0.395*	0.169	0.217	0.923*			
14-Motor impulsiveness	0.355	0.460*	0.324	0.470*	0.371	0.181	0.360	0.161	0.439*	0.280	0.241	0.735*	0.532*		
15-Non-planning impulsiveness	0.226	0.472*	0.478*	0.348	0.329	0.206	0.174	0.147	0.234	0.409*	0.254	0.824*	0.612*	0.521*	
16-BDI	0.129	0.276	0.297	0.189	0.531*	0.089	0.416	0.355	0.478*	0.398*	0.511*	0.423*	0.324	0.364	0.425*

According to the multiple comparison correction performed with the false discovery rate method, the significance threshold was determined as p<0.00042. *correlations below this value were considered significant. r, Pearson correlation analysis; ADHD, attention-deficit/hyperactivity disorder; CG, control group; ASRS, Adult ADHD Self-Report Scale; YIAS, Young Internet Addiction Scale; DERS, Difficulties in Emotion Regulation Scale; BIS, Barratt Impulsivity Scale; BDI, Beck Depression Inventory; - not applicable.

YIAS scores in the CG and the ASRS (r=0.474, p<0.001) and inattention (r=0.450, p<0.001) scores (Table 3).

According to the multiple linear regression analyses shown in Table 4, in the first model created for Group 1 (individuals with ADHD), the DERS, BDI, ASRS, and BIS variables did not provide significant explanatory power on the dependent variable (R^2=0.19, F=3.34, p=0.016). When the interaction terms (DERS×BDI, ASRS×BIS) were added to the model (Model 2), no significant increase in explanatory power was observed (R^2=0.19, F=2.15, p=0.061). For this group, no individual effect of any independent variable or interaction term was found to be statistically significant (p>0.05) (Table 4).

According to the multiple linear regression analyses shown in Table 4, in the analysis conducted for Group 2 (CG), the first model (Model 3) was found to be significant (R^2=0.24, F=4.60, p=0.003). In this model, the ASRS variable positively and significantly predicted YIAB (β=0.465, p=0.007). When the interaction terms were added in Model 4, the explanatory power of the model increased (R^2=0.26, F=3.24, p=0.008). In this model, only the effect of the ASRS variable remained significant (β=0.630, p=0.006); the other variables and the interaction terms were not statistically significant (p>0.05) (Table 4). Additionally, tolerance values in all models ranged from 0.215 to 0.699, and VIF values ranged from 1.430 to 4.650. These values indicate that there was no multicollinearity problem in the analysis.

According to YIAS, it was found that 13 of the ADHD diagnosed cases (20.6%) and 4 of the CG cases (6.3%) had risky

Table 4. Effectiveness of DERS, BDI, ASRS, and BIS scores in explaining YIAS scores

Group	Model		Unstandardized coefficients		Standardized coefficients	t	p	95% CI	Collinearity statistics	
			B	SE	Beta				Tolerance	VIF
1	1	(Constant)	36.369	2.184		16.655	<0.001	31.998 to 40.740		
		DERS	0.243	2.237	0.018	0.109	0.914	-4.235 to 4.721	0.527	1.896
		BDI	3.197	1.777	0.273	1.799	0.077	-0.360 to 6.753	0.610	1.639
		ASRS	1.431	2.675	0.084	0.535	0.595	-3.924 to 6.785	0.573	1.746
		BIS	2.847	2.563	0.179	1.111	0.271	-2.283 to 7.977	0.541	1.847
	2	(Constant)	36.441	2.269		16.063	<0.001	31.896 to 40.986		
		DERS	0.354	2.389	0.026	0.148	0.883	-4.432 to 5.139	0.479	2.089
		BDI	3.366	2.177	0.287	1.546	0.128	-0.994 to 7.727	0.421	2.376
		ASRS	1.314	2.933	0.077	0.448	0.656	-4.561 to 7.189	0.493	2.027
		BIS	3.027	3.292	0.190	0.919	0.362	-3.568 to 9.622	0.340	2.945
		DERS×BDI	-0.229	1.541	-0.028	-0.149	0.882	-3.316 to 2.857	0.402	2.488
		ASRS×BIS	-0.061	2.104	-0.005	-0.029	0.977	-4.277 to 4.155	0.417	2.396
2	3	(Constant)	37.242	1.708		21.807	<0.001	33.823 to 40.662		
		DERS	-0.392	1.778	-0.033	-0.221	0.826	-3.953 to 3.169	0.583	1.714
		BDI	0.087	2.210	0.006	0.039	0.969	-4.339 to 4.513	0.644	1.554
		ASRS	6.526	2.346	0.465	2.782	0.007	1.829 to 11.222	0.475	2.104
		BIS	0.927	2.485	0.062	0.373	0.710	-4.049 to 5.903	0.485	2.061
	4	(Constant)	37.759	1.780		21.216	<0.001	34.192 to 41.326		
		DERS	-0.660	1.815	-0.056	-0.364	0.717	-4.298 to 2.977	0.567	1.764
		BDI	0.720	2.304	0.047	0.313	0.756	-3.897 to 5.337	0.600	1.667
		ASRS	8.845	3.119	0.630	2.836	0.006	2.594 to 15.097	0.272	3.676
		BIS	2.696	2.973	0.179	0.907	0.368	-3.262 to 8.654	0.343	2.914
		DERS×BDI	0.431	1.874	0.032	0.230	0.819	-3.324 to 4.185	0.699	1.430
		ASRS×BIS	3.183	2.831	0.281	1.124	0.266	-2.491 to 8.857	0.215	4.650

Dependent variable: YIAS. The values used in the analysis are centralized scores (Z-score). Model 1: R^2=0.19, F=3.34, p=0.016; Model 2: R^2=0.19, F=2.15, p=0.061; Model 3: R^2=0.24, F=4.60, p=0.003; Model 4: R^2=0.26, F=3.24, p=0.008; tolerance values range from 0.215 to 0.699 in all models. VIF values range from 1.430 to 4.650. According to these values, no multicollinearity problem is observed for any independent variables in the models. ASRS, Adult Attention-Deficit/Hyperactivity Disorder Self-Report Scale; YIAS, Young Internet Addiction Scale; DERS, Difficulties in Emotion Regulation Scale; BIS, Barratt Impulsivity Scale; BDI, Beck Depression Inventory; SE, standard error; CI, confidence interval; VIF, variance inflation factor.

Table 5. Evaluation of factors affecting the probability of risky internet use

	B	SE	Wald	df	p	Odds ratio	95% CI
Age	-0.066	0.049	1.839	1	0.175	0.936	0.850 to 1.030
Sex (male)	0.127	0.535	0.056	1	0.813	1.135	0.398 to 3.238
Marital status (single)	1.104	0.794	1.932	1	0.165	3.016	0.636 to 14.305
Education (high school and below)	-0.980	0.690	2.016	1	0.156	0.375	0.097 to 1.451
Lack of emotional awareness	0.142	0.069	4.153	1	0.042	1.152	1.005 to 1.320
Clarity	0.080	0.059	1.835	1	0.176	1.083	0.965 to 1.215
Non-acceptance of emotional reactions	0.097	0.046	4.346	1	0.037	1.101	1.006 to 1.206
Impulsivity	0.072	0.057	1.610	1	0.205	1.075	0.961 to 1.202
Goal	0.131	0.072	3.322	1	0.068	1.140	0.990 to 1.312
Strategy	0.039	0.039	1.008	1	0.315	1.040	0.963 to 1.123
BDI	0.056	0.027	4.154	1	0.042	1.057	1.002 to 1.116

Multivariate binary logistic regression analysis. The results obtained for each variable were examined together with the Group (Diagnosis: attention-deficit/hyperactivity disorder present or absent). Tolerance and variance inflation factor values indicate that there is no multicollinearity in the model. Although the number of EPV is below the recommended criterion of ≥10 (EPV=8.5 for this analysis), Vittinghoff & McCulloch (2007) emphasized that this rule does not need to be strictly applied in models for hypothesis testing with small data sets, and that lower EPVs are acceptable when model simplification and other statistical measures are taken. BDI, Beck Depression Inventory; SE, standard error; CI, confidence interval; EPV, variables per event.

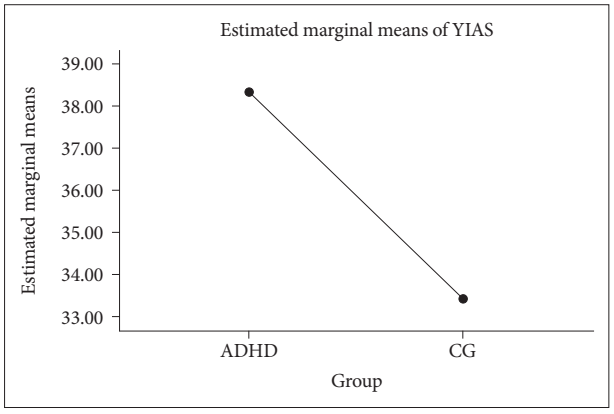

Figure 1. Results of analysis of covariance analysis applied to YIAS scores. YIAS, Young Internet Addiction Scale; ADHD, attention-deficit/hyperactivity disorder; CG, control group.

internet use (≥50 points). In addition, there were no individuals with IA in either group (≥80 points), and according to the chi-square test, the risky internet use rates in ADHD diagnosed cases were statistically significantly higher than the rates in the CG participants (χ^2=5.51, p=0.019).

Each variable was included in separate multivariate binary logistic regression analyses along with diagnostic group (ADHD present/absent). According to the multivariate binary logistic regression analysis shown in Table 5, lack of emotional awareness (B=0.142, standard error [SE]=0.069, Wald=4.15, p=0.042, odds ratio [OR]=1.15, 95% confidence interval [CI] [1.005 to 1.320]), non-acceptance of emotional reactions (B=0.097, SE=0.046, Wald=4.35, p=0.037, OR=1.10, 95% CI [1.006 to 1.206]), and BDI (B=0.056, SE=0.027, Wald=4.15, p=0.042, OR=1.06, 95% CI [1.002 to 1.116]) were found to be significant predictors of risky internet use. Other variables such as age, sex, marital status, and impulse control dimensions were not found to be significant (p>0.05). Including the diagnostic group variable in all models allowed group differences to be controlled. Multicollinearity checks revealed no problems, and all VIF values were calculated as <5 (Table 5).

In the ANCOVA analysis evaluating the factors affecting the YIAS scores, the model was found to be generally significant (F(7,117)=6.218, p<0.001). The model explanatory power was moderate (R^2=0.271). Among the significant covariates, only BDI was included (F=6.923, p=0.010, η^2=0.056). In addition, the effect of the group factor showed borderline significance (F=3.906, p=0.050, η^2=0.032). However, Levene's test indicated that the assumption of homogeneity of variance was violated (F(3,121)=3.041, p=0.032). Therefore, the statistical significance of the group effect should be interpreted cautiously and supported by alternative robustness analyses. In addition, the variables included in the model, age (p=0.101), lack of emotional awareness (p=0.504), non-acceptance of emotional reactions (p=0.419), education (p=0.153), and the group× education interaction (p=0.800), did not have a statistically significant effect on the YIAS scores (Figure 1).

DISCUSSION

In this study, the relationship between IA and emotion regulation difficulties in adults diagnosed with ADHD was examined. Additionally, depression and impulsivity, which were thought to be confounding factors, were also questioned. Our findings indicate that IA was not diagnosed based on YIAS

scores. Adults diagnosed with ADHD had significantly higher rates of risky internet use and emotion regulation difficulties than adults without ADHD. Additionally, in the ADHD group, non-acceptance of emotional reactions and lack of emotional awareness of the DERS subscales increased the risk of problematic internet use.

A recent population-based study found a significant correlation between ASRS and YIAS scores, suggesting that IA may develop through the interaction of ADHD symptoms and executive function impairments.[24] A community-based study with the participation of 468 students found a significant relationship between problematic internet use in adolescents and the presence of symptoms of depression, anxiety, and ADHD.[25] In their study evaluating behavioral addictions in the adult ADHD group, Grassi et al.[3] found that IA was the most common comorbidity at 33%. The same study also found higher ASRS scores, greater impulsivity, more emotional and anxiety symptoms, and greater functional impairment in ADHD patients with behavioral addiction comorbidity. Additionally, a meta-analysis suggests that ADHD-related symptoms are associated with PIU. Although the same study could not establish cause-and-effect relationships, it was suggested that inattention, hyperactivity, and impulsivity constitute a predisposition to PIU.[26] In our study, although significantly higher YIAS scores were found in the ADHD group compared to healthy controls, no patients in the ADHD group were found to qualify for IA based on their YIAS scores. Risky internet use was detected in 20.6% of the ADHD group, with YIAS scores ranging from 50 to 79. Factors such as screening for IA using a self-report scale rather than clinically assessing it, conducting the study with a relatively small sample size of patients from a single center, and the fact that 68.3% of patients with ADHD were under treatment may have contributed to this finding. In a study conducted with 37 adult ADHD participants, ADHD and IA symptoms were assessed after one year of methylphenidate (flexible dose) treatment. At the end of the study, pre-treatment IA test scores were found to be significantly higher than post-treatment scores.[27] These factors should be taken into account in future research. Although not at the level of IA, assessing risky internet use in patients with ADHD and, if identified, incorporating therapeutic interventions for behavioral addictions into treatment is crucial for the prognosis of ADHD.

A recent study found that total and all subscale scores of the DERS were higher in adult ADHD patients than in healthy controls. The same study also noted that childhood trauma in adult ADHD patients was significantly associated with difficulty regulating emotions.[28] Additionally, a comprehensive review suggested that emotional and sensory dysregulation may contribute to the classic symptoms of ADHD: impulsivity, inattention, and hyperactivity. The same study suggested that identifying emotional and sensory dysregulation and implementing therapeutic interventions could positively impact the course of ADHD.[29] Beheshti et al.[30] reported that emotion dysregulation is a core feature of adult ADHD. It notes that negative emotional responses correlate closely with ADHD symptom severity. In the study conducted by Soler-Gutiérrez et al.,[31] it was reported that difficulties in emotion regulation become more evident as the severity of ADHD symptoms increases. In the process model of emotion regulation developed by Gross,[32] five regulatory processes are identified, discussed under two main headings: before and after the onset of an emotional response. The first of these is antecedent-focused emotion regulation, which involves four emotion regulation processes: situation selection, situation modification, attentional deployment, and cognitive change. response-focused emotion regulation, which occurs after the onset of an emotional response, involves response regulation, which involves regulating the physiological, experiential, and behavioral elements of the emotional response. Shaw et al.[33] reported that response-focused emotion regulation strategies such as suppression were used more frequently in the ADHD group than in antecedent-focused emotion regulation strategies such as cognitive reappraisal. Our findings indicate that the total DERS score and all its subscales were significantly higher in the ADHD group than in the CG, supporting the literature. According to the gross process model, cognitive behavioral or dialectical behavioral therapies should be prioritized in ADHD treatment, focusing on strengthening antecedent-focused processes such as situation selection, attentional deployment, and cognitive change, while reducing response-focused processes such as suppression and impulsivity.

There are various studies in the literature examining the relationship between ADHD, IA, and emotional dysregulation. Saatçioğlu et al.[34] stated that adolescents diagnosed with ADHD have an increased risk of IA and that emotion regulation skills are negatively affected in these individuals. Similarly, a study conducted by El Archi et al.[14] on university students, it was suggested that the risk of PIU increased in participants with ADHD symptoms, and that impulsivity, emotion regulation strategies, anxiety, and depressive symptoms could be mediators. In addition, Altıok and Kahraman[35] examined the effects of digital game addiction on emotion regulation difficulties and social anxiety levels in their study on university students. In this study, a significant relationship was found between digital game addiction and emotion regulation difficulties on university students. Gostoli et al.[36] found that adult ADHD symptoms are significantly associated with PIU. It also identified that certain facets of impulsivity and emotion regulation strategies, such as expressive suppression, play a role in

this relationship. However, the study did not extensively dissect the sub-dimensions of emotion regulation. A comprehensive review by Ghiaccio et al.[37] highlighted that impulsivity and emotional dysregulation in ADHD contribute to internet gaming disorder. It has been suggested that time spent online may be a maladaptive coping strategy resulting from social and family difficulties. Contrary to our expectations, in our study, no significant correlation was found between YIAS scores and ASRS, DERS, BDI, and BIS scores in the ADHD group according to correlation analysis. This suggests that risky internet use in individuals with ADHD may be influenced by factors other than ADHD symptom severity or mood regulation difficulties, such as environmental factors, comorbid conditions, and neurobiological factors, which we did not assess in our study. One reason for this may be that the possible relationship was not reflected in statistical measurement tools due to insufficient sample size.

In our study, it was found that subthreshold ADHD symptoms were associated with DERS in the CG. This situation shows that problems related to attention deficit and hyperactivity can affect emotional regulation in individuals who are not diagnosed with ADHD. It has been previously reported in the literature that subthreshold ADHD symptoms are associated with emotional and behavioral problems. Staff et al.[38] found that children with subthreshold ADHD symptoms exhibited impairments in facial emotion recognition, which predicted social and emotional problems. The findings suggest that even subthreshold ADHD symptoms can be associated with challenges in emotion processing and regulation. Albesisi and Overton[39] indicated that ADHD-like traits were significantly correlated with all subscales of the DERS. This suggests that individuals with subthreshold ADHD symptoms may experience various facets of emotion dysregulation. The fact that subthreshold ADHD symptoms in the CG were associated with difficulties in emotion regulation, in particular, reveals that these individuals generally do not recognize and do not receive intervention. This finding points to the importance of evaluating subthreshold ADHD symptoms. Evaluation of subthreshold ADHD symptoms in individuals in the CG may provide early intervention opportunities that will increase both academic and social functioning.

In our study, subthreshold ADHD symptoms in the CG were found to correlate with YIAS scores. This suggests that problems with attention deficit and hyperactivity may influence risky internet use even in individuals without ADHD. A recent study of adolescents found that more severe ADHD symptoms were associated with more internet use problems. This association was also seen in the subclinical ADHD group.[40] Our study may have included a group with subthreshold ADHD symptoms, indicating the importance of screening for ADHD symptoms in non-clinical groups and implementing appropriate interventions. This should be supported by studies with larger samples.

According to Hierarchical Linear Regression Analysis, in the ADHD group, BIS, BDI, ASRS, and DERS did not explain YIAS scores at a significant level separately, while all of them together increased the risk of IA. In the CG, only ASRS was significantly effective in explaining YIAS scores. This suggests that symptoms of attention deficit and hyperactivity are directly linked to Risky internet use. Additionally, the role of emotion regulation difficulties and depression symptoms highlights the complexity of IA mechanisms. Soler-Gutiérrez et al.[31] found that as ADHD symptom severity increases, emotion regulation difficulties also increase, which may contribute to IA. Our findings extend this knowledge by illustrating that both impulsivity and depressive symptoms interact with ADHD in predicting IA risk.

In our study, the logistic regression analysis revealed that an increase in lack of emotional awareness scores statistically significantly increases the likelihood of risky internet use by 1.152 times, and non-acceptance of emotional reactions scores statistically significantly increases the likelihood of risky internet use by 1.101 times. Scores obtained from the lack of emotional awareness subscale, which consists of items reflecting the tendency to pay attention to and accept emotions, reflect a lack of attention to and awareness of emotional reactions. The non-acceptance of emotional reactions subscale consists of items reflecting the tendency to have negative secondary emotional reactions to one's negative emotions or non-acceptance reactions to one's distress.[8] In a study conducted in our country, a significant correlation was found between IA and clarity, strategy, and impulsivity subscale scores in the adolescent group.[41] A study of 500 students showed that the Impulse control difficulties subscale of the DERS predicted the incidence of IA over a 1-year follow-up period in male participants.[42] Evren et al.[43] indicated that both inattentiveness and hyperactivity/impulsivity dimensions of ADHD are related to the severity of IA symptoms. Additionally, it highlights that those difficulties in emotion regulation, particularly the "non-acceptance" dimension, are associated with IA. A recent review suggested that emotional dysregulation plays a role in problematic video game use, particularly through strategies such as emotional suppression and a lack of ability to understand and control emotions.[44] The contradictory results in the literature may be due to the heterogeneous groups included in the study, such as adolescents, adults, community samples, or clinical samples. High BDI scores and other comorbid conditions, such as anxiety disorders and personality traits that we did not assess, may be confounders. Psychotherapeutic interventions such as mindfulness-based cognitive therapy and

emotional awareness exercises for the lack of awareness, and acceptance and commitment therapy for the "non-acceptance" subscale, along with creating space for emotions, could be added to prevent risky internet use.

These results collectively highlight the necessity of incorporating emotion regulation-focused approaches in ADHD management strategies, particularly for populations with varying symptom severity. Furthermore, depression should be considered a crucial factor influencing both emotion regulation difficulties and risky internet use in adults diagnosed with ADHD. Additionally, interventions targeting depression, lack of emotional awareness, and non-acceptance of emotional reactions could be key in developing preventive strategies for reducing the risk of problematic internet use among individuals with ADHD.

There are some limitations to this study. First of all, the results obtained from a limited number of participants were evaluated and the generalizability of the results may be limited. Another limitation is that the CG was not matched with the ADHD group in terms of age and education status. Another limitation, the effects of medication use and comorbidities in the ADHD group were not examined in detail and may have been confounding factors. In addition, since our study has a cross-sectional design, it is not possible to make definitive judgments about causal relationships. In future studies, longitudinal studies with larger samples and different demographic characteristics are recommended.

Despite all the limitations, our study is different from community-based studies conducted in the clinically diagnosed adult ADHD group. All scales, including ASRS, were applied not only to the clinically diagnosed ADHD group but also to the CG. Moreover, subthreshold ADHD symptoms were found to be associated with YIAS scores and DERS scores in the CG. In addition to IA, emotion regulation difficulties and their subdimensions, depression, and impulsivity were also evaluated in adults diagnosed with ADHD, which strengthened our study. The high validity and reliability of the scales used in our study increase the reliability of our findings.

In conclusion, it was determined that the risky internet use is increased in adults diagnosed with ADHD and that emotion regulation difficulties are more pronounced in these individuals. These findings emphasize the importance of evaluating the internet usage habits and emotion regulation skills of adults diagnosed with ADHD. With early diagnosis and intervention, it may be possible to reduce the risk of IA in these individuals and improve their emotion regulation skills.

Availability of Data and Material

The datasets generated or analyzed during the study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: all authors. Data curation: all authors. Formal analysis: Rukiye Ay, Oguzhan Kilincel. Investigation: Rukiye Ay. Methodology: Rukiye Ay, Oguzhan Kilincel, Alparslan Hafif. Project administration: Rukiye Ay. Resources: all authors. Software: all authors. Supervision: all authors. Validation: Rukiye Ay, Oguzhan Kilincel. Visualization: Rukiye Ay, Oguzhan Kilincel. Writing—original draft: Rukiye Ay. Writing—review & editing: all authors.

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