# Investigation of adolescents diagnosed with exogenous obesity in terms of internet, smartphone usage characteristics and psychopathologies

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**SUMMARY**

**Objective:** In this study, it was aimed to investigate comorbid psychopathologies, internet/smartphone addiction and usage characteristics in adolescents diagnosed with exogenous obesity.

**Method:** 48 obese patients aged 12-18 years, diagnosed with exogenous obesity, and 49 healthy adolescents without obesity were included in the study. Comorbid psychopathologies were screened with the "Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS)". Young Internet Addiction Scale (YIAS), Smartphone Addiction Scale-Short Form (SAS-SF), Addiction Profile Index-Internet Form (API-IF) were administered to the patient and control groups; Atilla Turgay DSM-IV Based Child and Adolescent Distruptive Behaviour Disorders Rating Scale (ATS) was applied to their parents.

**Results:** As a result of our study; In the case group, the presence of mental illness and obesity in the family, the duration of internet and smart phone use, snacking in front of the screen and spending time in virtual games were found to be significantly higher ($p<0.05$). In terms of the scales, it was determined that the YIAS, SAS-SF, API-IF and ATS scores were significantly higher in the case group ($p<0.05$). As a result of K-SADS, it was seen that adolescents with exogenous obesity had more psychiatric diagnoses when compared to the control group.

**Discussion:** Our study shows that besides the biological aspect of obesity, it also progresses with a high rate of mental problems. Considering the difficulty of obesity treatment and the excess of complications, biopsychosocial interventions and multidisciplinary approaches including mental health professionals are important for the prevention and treatment of pediatric obesity.

**Key Words:** Exogenous Obesity, Psychopathology, Internet Addiction, Smartphone Addiction

## INTRODUCTION

Obesity occurs with the combination of many etiological factors. It may occur as a result of the combination of genetic/biological factors, various metabolic/hormonal factors, and psychological and cultural factors in an environment predisposing to obesity (1). Childhood obesity is mostly the result of primary, exogenous causes. Exogenic obesity is defined as a simple type of obesity that occurs due to excessive calorie intake and in which there is no underlying metabolic or endocrinological problem (2). Factors such as personal preferences, including eating behavior, physical activity preference, and income level of the country where the person lives contribute to overweight and obesity (3).

The use of technology has been increasing in recent years, especially during adolescence, and has reshaped individuals' lifestyles. During adolescence, when emotional problems, the search for identity, peer approval, and the need for socialization increase, Internet and smartphone use becomes attractive for adolescents. Intensive digital media use that starts for these reasons leads to impairments in adolescents' functioning in social-academic areas such as school, family, and peer environment (4). Individuals with intensive inter-

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net and smartphone use are likely to face obesity and its complications due to prolonged immobilization (5,6). Some studies in the literature indicate that adolescents who prefer to use the Internet in their free time have higher body mass index (BMI) values and less physical activity (7,8).

Several studies have demonstrated that risk factors associated with obesity in adolescents, including diminished self-esteem, negative body image, peer bullying, reluctance to form relationships, introversion, and social isolation, elevate the likelihood of developing mental health disorders (9,10). As a result of many studies examining the relationship between depressive disorders, anxiety disorders, and obesity, evidence has been obtained that obesity increases the risk of depression and anxiety disorders (9). In addition, in studies examining the relationship between attention deficit hyperactivity disorder (ADHD) and obesity, significant attention problems and impulsivity were found in children with obesity (11-13).

While there are studies investigating the relationship between exogenous obesity and internet addiction in the literature, studies examining the relationship between smartphone addiction (SA) and obesity are limited. It was observed that the studies were mostly conducted in community-based samples and evaluated the relationship between SA and physical activity. In general, it was found that physical activity decreased and related complications increased in people with intense smartphone use (14,15). In addition, studies examining other mental disorders (especially ADHD) and smartphone addiction in the context of obesity were not found in the literature. This study aimed to examine internet and smartphone addiction in adolescents with exogenous obesity and to investigate its relationship with ADHD and other mental disorders.

## METHOD

Approval for the study was obtained from the Dicle University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee with the date 10/12/2020 and number 20.

### Sample

The sample size for the study was calculated with the G*Power software package. It was found that a sample size of at least 40 participants per group was sufficient to obtain an alpha error rate of 0.05, a Cohen effect size of 0.30, and a statistical power of at least 80%. Sixty cases were planned to be included in both groups, considering there might be a 30% data loss. However, the data loss was less than calculated.

Our case group consisted of 48 individuals aged 12-18 with exogenous obesity who were admitted to the Dicle University Pediatric Endocrinology Outpatient Clinic between January and March 2021. A control group was formed with 49 age- and gender-matched healthy subjects without obesity. The control group consisted of individuals who came to the general pediatric outpatient clinic for reasons such as developmental follow-up, vaccination, and health screening. A BMI of 95th percentile and above was accepted as obesity. The presence of clinical or intellectual disability, autism spectrum disorder, history of substance abuse, and chronic medical disease were determined as exclusion criteria. Of the 62 obese subjects screened for our study, 2 had mental retardation, 7 had chronic physical disease, and 5 had previous psychiatric admission and were not included in this study. Among the 61 subjects evaluated for the control group, 3 had chronic physical illness, 2 had previous psychiatric admission, 2 had incomplete completion of the scales, 5 had BMI between 85-95 percentile and were not included in the study.

### Procedure

Patients aged 12-18 years with exogenous obesity diagnosed with exogenous obesity who applied to the Dicle University Pediatric Endocrinology Outpatient Clinic between January and March 2021, the subjects constituting the control group and their families were informed about the study. Their written informed consent was obtained by explaining that participation in the study was voluntary and that they had the right to withdraw from the study whenever they wanted. “Schedule for Affective Disorders and Schizophrenia for School-

Age Children-Present and Lifetime Version (K-SADS) based on DSM-5" was conducted by a previously trained and certified researcher to determine comorbid psychopathologies. Young Internet Addiction Scale (YIAS), Smartphone Addiction Scale-Short Form (SAS-SF), Addiction Profile Index-Internet Form (API-IF) were administered to the patient and control groups, and Atilla Turgay DSM-IV Based Child and Adolescent Distruptive Behaviour Disorders Rating Scale (ATS) was administered to their parents. Internet addiction and smartphone addiction are diagnoses that have not yet been included in DSM-5 and scales with validity for these diagnoses were used.

**Data Collection Tools**

*Sociodemographic and Clinical Data Form:* It is a form prepared by the researchers that questions sociodemographic and clinical characteristics. This form was completed by the clinician after face-to-face interviews with adolescents and their families.

*Young Internet Addiction Scale (YIAS):* It is a 20-question scale adapted from the pathological gambling criteria of DSM-IV by Young (16). It was adapted into Turkish by Bayraktar (17). In this Likert-type scale, the options are "rarely," "sometimes," "frequently," "most of the time," and "always" and scored as 1,2,3,4 and 5, respectively. Scoring 80 and above on the scale indicates a serious impairment in functionality, and people with this score are characterized as internet addicts. Those who score between 50-79 points on the scale are defined as a "borderline symptomatic group" experiencing internet-related problems. On the other hand, those who score 49 or below on the scale are described as ordinary internet users who do not experience any problems related to internet use in their daily lives.

*Addiction Profile Index-Internet Form (API-IF):* This test, developed by Ögel et al., consists of 18 questions. The questions ask about the last three months. APIIF can be used in high school and university students and is valid and reliable in both populations. The items are scored between 0-4. Scoring can be made in 6 areas, including frequency of Internet use, diagnosis, effects on life, severe desire, motivation, and total score (18).

*Smartphone Addiction Scale-Short form (SAS-SF)*: The SAS-SF was developed by Kwon et al. to measure the risk of smartphone addiction in adolescents. It consists of 10 items and is a six-point Likert scale. The validity and reliability study of the Turkish version was conducted by Noyan et al. Scale scores vary between 10-60. According to the study by Kwon et al., the cut-off score on the scale was 33 and above for women and 31 and above for men. As the score obtained from the test increases, the risk for addiction is considered to increase (19,20).

*Atilla Turgay DSM-IV Based Child and Adolescent Distruptive Behaviour Disorders Rating Scale (ATS):* It is a scale prepared by Turgay for evaluating behavioral disorders in children and adolescents, considering DSM-IV diagnostic criteria (21). With this scale, attention deficit hyperactivity disorder, oppositional defiant disorder, and conduct disorder are screened and evaluated. The scale consists of 41 questions: nine questions investigate attention deficit, nine questions investigate hyperactivity and impulsivity, eight questions investigate oppositional defiant disorder, and 15 questions investigate conduct disorder (22).

*Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS):* It was developed by Kaufman et al. in 1997 from DSM-III-R and DSM-IV diagnostic criteria and is a semi-structured form including interviews with parents and children/adolescents designed to detect both past and present mental disorders. The K-SADS was revised in November 2016 by Kaufman et al. following DSM-V diagnoses (23). The Turkish validity and reliability study of the revised interview version was conducted by Ünal et al. in 2019 (24).

**Statistical analysis**

The data obtained from the study were recorded in IBM SPSS 22.0 for Windows program. The Shapiro-Wilk normality test was performed to evaluate the normal distribution. Mean and standard deviation values were given for numerical vari-

ables. Number (n) and percentage (%) values were written for categorical variables. The chi-square test was used to compare categorical data, and the independent sample t-test was used for numerical data. $p<0.05$ was considered significant.

## RESULTS

Among the case group, 47.9% (n=23) were female and 52.1% (n=25) were male adolescents diagnosed with primary obesity. In the control group, 49% (n=24) were female and 51% (n=25) were male. The case and control groups were similar in terms of gender (p=0.917). The mean age of the case group was 14.20 ± 1.85 years, and the mean age of the control group was 14.51 ± 1.87 years. The mean age of the whole sample was 14.36 ± 1.86 (n=98). The case and control groups were similar in terms of age (p=0.427). A comparison of the groups in terms of sociodemographic data is given in Table 1.

The physical characteristics of the groups (height, body weight, body mass index, and percentile ratio of body mass index) are presented in Table 2.

When the digital media use of the cases was analyzed, it was learned that all adolescents in the case and control groups had smartphone use and internet access (n=97). The mean age of the adolescents in the case group was 9.65 ± 2.54 years (min:4-max:15 years), while the mean age of the control group was 9.41 ± 2.76 years (min:4-max:15 years), and the groups were similar in this respect (p=0.660). The comparison of the groups in terms of internet usage characteristics is given in Table 3.

When the internet usage purposes of the groups other than games were examined (more than one option was allowed), 77.1% (n=37) of the case group stated that they used the Internet for watching movies, videos, and listening to music, 50% for communication (n=24), 68.8% (n=33) for education, 54.2% (n=26) for social media, and 12.5% (n=6) for shopping. In the control group, 65.3% (n=32) watched movies videos and listened to music, 55.1% (n=27) used the Internet for communication, 75.5% (n=37) used it for education, 46.9% (n=23) used it for social media, and 26.5% (n=13) used it for shopping. The groups are similar in these respects (p>0.05)

The comparison of the case and control groups in terms of scale scores and cut-off scores of the scales is given in Table 4.

After the K-SADS, 87.5% (n=42) and 77% (n=37) of adolescents diagnosed with obesity had at least one lifetime psychiatric diagnosis. In the control group, this rate was 44.9% (n=22) for lifetime psychiatric diagnoses and 48.9% (n=24) for current psychiatric diagnoses. The lifetime and current psychiatric diagnoses rate was significantly higher in obese adolescents (p<0.001 and p=0.004).

The comparison of the groups in terms of comorbid mental diagnoses is given in Table 5.

Adolescents diagnosed with obesity showed higher rates of all psychopathologies compared to normal-weight adolescents, and the difference between the groups was statistically significantly higher in terms of depressive disorder, anxiety disorders, and ADHD. When anxiety disorders were evaluated

**Table 1.** Comparison of sociodemographic data of case and control groups

| | | Case | | Control | | |
|---|---|---|---|---|---|---|
| | | n (%) | Mean (SD) | n (%) | Mean (SD) | p |
| Age | | 48 | 14,2 (–1.85) | 49 | 14.5 (–1.87) | 0.422* |
| Gender | Female | 23 (47.9) | | 24 (49) | | 0.917** |
| | Male | 25 (52.1) | | 25 (51) | | |
| SES | Under 3,000 | 20 (41.7) | | 13 (26.5) | | |
| | between 3,000-6,000 | 14(29.2) | | 12 (24.5) | | 0.119** |
| | 6,000 and above | 14 (29.2) | | 24 (49) | | |
| Parental mental illness | Yes | 10 (20.8) | | 1(2) | | **0.004**** |
| | No | 38 (79.2) | | 48 (98) | | |
| Parental obesity | Yes | 20 (41.7) | | 7 (14.3) | | **0.003**** |
| Age | No | 28 (58.3) | | 42 (85.7) | | |

(SES: Socioeconomic Status, Mean: Mean, SD: Standard deviation, *Independent sample T-test, p<0.05
**Chi Square test, p<0.05)

**Table 2.** Comparison of physical characteristics of the case group and control group

| | Case group (n=48) | | Control group (n=49) | | P |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Height (cm) | 163.04 | 9.82 | 163.32 | 10.83 | 0.892 |
| Weight (kg) | 81.37 | 15.4 | 54.3 | 11.04 | **0.001** |
| BMI | 30.40 | 3.70 | 20.23 | 1.91 | **0.001** |
| BMI/persentile | 98.1 | 1.67 | 40.86 | 24.11 | **0.001** |

(BMI: Body mass index, cm: Centimeter, kg: Kilogram, mean: Average, SD: Standard deviation, *Independent sample T-test, p<0.05)

individually, it was found that separation anxiety disorder was significantly higher than healthy controls.

## DISCUSSION

This study aimed to investigate adolescents with exogenous obesity and normal weight regarding sociodemographic characteristics, Internet and smartphone addiction, ADHD, and other psychopathologies. As a result of our study, the presence of parental mental illness and obesity, duration of internet and smartphone use, snacking in front of the screen, and spending time in virtual games were significantly higher in the case group compared to the control group. YIAS, SAS-SF, API-IF, and ATS scores were significantly higher in the case group. In addition, according to the K-SADS interview, it was observed that adolescents with exogenous obesity had more psychiatric diagnoses throughout life and now had depressive disorder, anxiety disorder, and ADHD diagnoses more than the control group.

There are studies showing that obesity is observed more in children and adolescents whose parents have chronic diseases such as DM, obesity, and depression (25,26). It is thought that familial psychopathology may combine with other factors (such as low socioeconomic level, maternal obesity, and broken family) and lead to childhood obesity. It is suggested that a child growing up in a non-ideal environment may not be guided correctly in healthy life choices, such as appropriate food selection and regular physical activity, which may result in obesity (27).

Some authors have reported that genetic predisposition is 25-80% effective in developing obesity and that obesity in the family is the strongest risk source for childhood obesity (28). In addition to increasing the frequency of obesity with genetic predisposition, it is thought that the presence of obesity in the family may increase the frequency of obesity due to parents' dietary habits such as food preference and meal frequency, sedentary lifestyles including lack of physical activity, spending too much time in front of the screen and children modeling parents with obesity (29,30). Our study results seem to be compatible with the literature in this respect.

Studies investigating the effects of eating in front of television and screens suggest that more snacking occurs with the screen and that it affects the

**Table 3.** Comparison of case group and control group in terms of Internet usage characteristics

| | | Case n (%) | Mean (SD) | Control n (%) | Mean (SD) | p |
|---|---|---|---|---|---|---|
| Snacking in front of the screen | Yes | 28 (58.3) | | 12 (24.5) | | **0.001**** |
| | No | 20 (41.7) | | 37 (75.5) | | |
| Internet usage time | By family | | 4.19 (–2.23) | | 2.59 (–1.44) | **0.001*** |
| | According to the child | | 3.05 (–1.76) | | 1.93 (–1.42) | **0.001*** |
| | By family | | 3.66 (–2.43) | | 2.13 (–1.48) | **0.001*** |
| Smartphone usage time | According to the child | | 2.61(–1.89) | | 1.46 (–1.27) | **0.001*** |
| | Yes | 1 (2.3) | | 8 (18.2) | | **0.030*** |
| Internet quota | No | 42 (97.7) | | 36 (81.8) | | |
| | Game | 31 (64.6) | | 20 (40.8) | | **0.036**** |
| Internet usage pattern | Out of game | 17 (35.4) | | 29 (59.2) | | |
| | Film, video, music | 37 (77.1) | | 32 (65.3) | | **0.048**** |
| | Communication | 24 (50) | | 27 (55.1) | | |
| | Education | 26 (54.2) | | 37 (75.5) | | |
| | Social media | 26 (54.2) | | 23 (46.9) | | |
| | Shopping | 6 (12.5) | | 13 (26.5) | | |

(*Independent sample T test, p<0.05 **Chi Square test, p<0.05)

**Table 4.** Comparison of case and control groups in terms of scale scores

| | | Case | | Control | | |
|---|---|---|---|---|---|---|
| | | Mean (SD) | N (%) | Mean (SD) | N(%) | p |
| YIAS | | 36.6 (–14.2) | 48 | 28.7 (–6.54) | 49 | **0.001*** |
| YIAS-CS | ?50 points | | 8 (16.7) | | 0 | **0.001**** |
| | <50 points | | 40 (83.3) | | 49 | |
| API-IF | | 1.97 (–0.60) | | 1.41 (–0.49) | | **0.001*** |
| API-IF-SS | IUF | 3.52 (–0.85) | | 2.38 (–0.81) | | **0.001*** |
| | Diagnosis | 10.43 (–4.04) | | 7.04 (–4.20) | | **0.001*** |
| | IOL | 8.95 (–5.54) | | 5.48 (–3.39) | | **0.001*** |
| | SC | 3.72(–2.29) | | 2.20 (–1.81) | | **0.001*** |
| | Motivation | 2.89(–2.03) | | 3.24 (–2.37) | | 0.439* |
| APIIF-CS | ? 2 points | | 23 (49.9) | | 5 (10.2) | **0.001**** |
| | < 2 points | | 25 (52.1) | | 44 (89.8) | |
| SAS-SF | | 26.6 (–11.7) | | 18.6 (–6.93) | | **0.001*** |
| ATS | | 17.9 (–11.6) | | 11.4 (–10.3) | | **0.005*** |

(YIAS: Young Internet Addiction Scale, CS: Cut-off Score, API-IF: Addiction Profile Index Internet Form, SS: Subscale, IUF: Internet Use Frequency, IOL: Impact on Life, SC: Severe Craving, SAS-SF: Smartphone Addiction Scale Short Form, ATS: Atilla Turgay DSM-IV Based Child and Adolescent Distruptive Behaviour Disorders Rating Scale, *Independent sample T-test, p<0.05 **Chi-Square test, p<0.05)

amount and content of the diet in an unhealthy way. There are comments that one of the reasons for this may be advertisements (31,32). Data suggest that eating with family reduces the risk of obesity (33). From this point of view, it can be said that obese adolescents who participated in our study have unhealthy eating habits following the literature. A study examining snacking habits and screen time found that adolescents with unhealthy snack consumption had more screen time (34). Many studies in the literature report a positive relationship between internet addiction and obesity risk. It has been reported that individuals with IA are likely to encounter obesity and related complications because they remain in a sedentary position in front of the computer for a long time (5,6). In a study conducted with 584 high school students in our country, internet addiction, and disordered eating attitudes were examined, and it was reported that the BMI values of the group with IB (10.1% of all cases) were statistically significantly higher than the non-IB group (35). A school-based cross-sectional study conducted with 10287 adolescents aged 14-17 years in seven European countries showed a relationship between internet use scores and overweight/obesity (36).

It has been reported that easy access to technology and the increasingly widespread use of smartphones and computers reduce physical activity in children (37). Many studies have shown that increased time spent with devices such as TV, computers, tablets, and phones is associated with obesity and overweight in children. A study involving 811 children found that obese children had more screen time than children with normal weight (38). In a study conducted with 230 female and 220 male Portuguese adolescents, computer use for 4 hours or more on weekdays was found to be associated with overweight/obesity (7). In another study conducted with 2467 students, obesity and internet usage time were investigated, and it was concluded that the majority of children with BMI values above normal spent more than 3 hours on the Internet (39). Similarly, the average daily internet and smartphone usage time of obese adolescents who participated in our study was 3 hours or more.

Although more studies examine IA, SA, and internet/smartphone use patterns, studies investigating

**Table 5.** Comparison of case group and control group in terms of current psychiatric diagnoses

| K-SADS | | Case | | Control | | |
|---|---|---|---|---|---|---|
| | | N | % | N | % | P |
| Depressive Disorder | Yes | 8 | 16.7 | 0 | 0 | 0.003* |
| | No | 40 | 83.3 | 49 | 100 | |
| SeAD | Yes | 5 | 10.4 | 0 | 0 | 0.027* |
| | No | 43 | 89.6 | 49 | 100 | |
| SoAD | Yes | 12 | 25.0 | 5 | 10.2 | 0.055* |
| | No | 36 | 75.0 | 44 | 89.8 | |
| SP | Yes | 21 | 43.8 | 17 | 34.7 | 0.361* |
| | No | 27 | 56.3 | 32 | 65.3 | |
| GAD | Yes | 9 | 18.8 | 3 | 6.1 | 0.059* |
| | No | 39 | 81.3 | 46 | 93.9 | |
| Anxiety Disorders (total) | Yes | 30 | 62.5 | 20 | 40.8 | 0.033* |
| | No | 18 | 37.5 | 29 | 59.1 | |
| OCD | Yes | 3 | 6.3 | 0 | 0 | 0.117* |
| | No | 45 | 93.8 | 49 | 100 | |
| ED | Yes | 1 | 2.1 | 0 | 0 | 0.495** |
| | No | 47 | 97.9 | 49 | 100 | |
| ADHD | Yes | 18 | 37.5 | 7 | 14.3 | 0.009* |
| | No | 30 | 62.5 | 42 | 85.7 | |
| ODD | Yes | 7 | 14.6 | 2 | 4.1 | 0.091* |
| | No | 41 | 85.4 | 47 | 95.9 | |
| CD | Yes | 0 | 0 | 0 | 0 | |
| | No | 48 | 100 | 49 | 100 | |
| Tic Disorder | Yes | 3 | 6.3 | 0 | 0 | 0.117* |
| | No | 45 | 93.8 | 49 | 100 | |
| PTSD | Yes | 4 | 8.3 | 0 | 0 | 0.056* |
| | No | 44 | 91.7 | 49 | 100 | |
| ExD | Yes | 3 | 6.3 | 0 | 0 | 0.117* |
| | No | 45 | 93.8 | 49 | 100 | |
| Psychiatric Diagnosis | Yes | 37 | 77 | 24 | 48.9 | 0.004 |
| | No | 11 | 23 | 25 | 51.1 | |

(SeAD: Separation Anxiety Disorder, SoAD: Social Anxiety Disorder, SP: Specific Phobia, GAD: Generalized Anxiety Disorder, OCD: Obsessive Compulsive Disorder, ED: Eating Disorder, ADHD: Attention Deficit Hyperactivity Disorder, ODD: Oppositional Defiant Disorder, CD: Conduct Disorder, PTSD: Post Traumatic Stress Disorder, ExD: Externalizing Disorder *Chi Square test p<0.05)

the purposes of internet use in obese children and adolescents are limited. In a study conducted in our country, it was found that while the use of smartphones for functions such as social media, gaming, online messaging, and video watching was positively associated with SA, the use of smartphones for phone calls, e-mail, and news reading was negatively associated with SA (40). According to a study conducted with high school students in Mersin province, participants who did not use the Internet to obtain information had 2.06 times more IA than those who did (41). In a study conducted with obese children and adolescents, children and adolescents diagnosed with obesity were divided into two groups, IA and non-IA, and it was found that obese people with IA spent more time on social networking sites and playing online games. In contrast, obese people without IA used the Internet mostly for information searches and homework (42). The use of the Internet and smartphones for playing games may increase the potential for addiction by increasing the pleasure felt during this action and leading to longer periods of use, whereas in use for purposes such as obtaining information and reading news, both the duration of use is less and the pleasure similar to playing games may not be felt (43). Our study observed that adolescents diagnosed with obesity had a higher duration of Internet and smartphone use and mostly used the Internet/smartphone to play games, which is consistent with the literature. The fact that internet and smartphone addiction scale scores were higher than in the control group and internet/smartphone use for news reading and general information search was lower supports these findings.

When the literature is examined, it is seen that the number of studies examining the relationship between SA and obesity is less than the number of studies examining the relationship between IA and obesity. Studies examining the relationship between SA and physical activity are predominant among these studies. In a study conducted with 325 university students, the relationship between SA and overweight was examined, and the SA scale scores of the participants were found to be significantly different between overweight and normal weight groups. In a study investigating the relationship between eating disorders and SA and IA in university students, a positive relationship was found between SA and IA test scores and BMI values of individuals (14). In a study published in 2021 investigating the relationship between problematic smartphone use and obesity in school-age children and adolescents, similar to our study, problematic smartphone use was associated with obesity (15). In addition, in our research, no study involving a clinical sample in which smartphone addiction was evaluated in obese adolescents was found.

When the literature is examined, the recent increase in publications on the relationship between ADHD and obesity draws attention. In studies conducted on children and adolescents, more attention deficit and impulsivity have been reported in obese individuals (44,45). A diagnosis of ADHD was found in a large proportion (58%) of children treated for obesity, and the BMI of children with ADHD was higher than the control group (13). In another study conducted with adolescents in our country, the ADHD level of the obese group was found to be significantly higher than the non-obese group (46). In parallel with the literature, our study shows that adolescents with obesity were diagnosed with more ADHD.

It was observed that adolescents diagnosed with obesity showed more psychopathologies than normal-weight adolescents, and the difference between the groups was statistically significantly higher regarding depressive disorders and anxiety disorders. When anxiety disorders were analyzed individually, it was found that separation anxiety disorder was higher in the case group than the control group. Obesity itself may lead to psychiatric problems, and some psychiatric disorders may lead to obesity. Despite many studies conducted in recent years, the question of whether psychiatric disorders and mental problems are the cause or consequence of pediatric obesity has still not been clearly answered (47). In the literature, there are studies examining the relationship between obesity and self-esteem, emotion regulation, peer bullying, avoidance of establishing relationships, introversion and social isolation, stigmatization, depression, anxiety, night snacking, and food addiction. In a study conducted by Erermiş et al. with obese adolescents, a significantly higher rate of DSM-IV diagnosis (most commonly major depressive disor-

der) was found in more than half of the participants compared to non-obese adolescents (9). In a study conducted by Vila et al. using K-SADS with 155 obese subjects aged 5-17, 88 children received at least one DSM-IV diagnosis. The most commonly diagnosed mental disorder in this study was anxiety disorder (48). It has been reported that overweight and obese adolescents have higher levels of depressive symptoms; the risk of depression increases in individuals with BMI>40, the duration of depression is longer, and the prognosis is worse (49,50). In a study conducted with obese individuals, it was reported that the frequency of anxiety disorders and phobias increased, social phobia was observed more frequently in women, and being overweight increased the risk of social phobia and specific phobia in women (49). In the study conducted by Vila et al. using K-SADS in 2004, at least one anxiety disorder was found in 63 of 155 children. Of these 63 children, 34 were diagnosed with social phobia, 14 with generalized anxiety disorder, 11 with separation anxiety disorder, 2 with agoraphobia, and 2 with posttraumatic stress disorder. A study by the same authors reported that separation anxiety disorder and social phobia were the most frequently observed psychopathology in obese children and adolescents (48).

Since our cross-sectional study showed a positive association between obesity and IA, SA, and mental disorders, but it cannot explain the causal relationship between these pathologies. Longitudinal studies are needed to evaluate the causal relationship. Since the sample size is limited, community-based studies with large samples are needed. Self-report scales were used because there are no universal criteria for internet and smartphone addiction diagnoses. Determining universal criteria for these diagnoses will enable the use of more standardized criteria for studies.

Our study shows that obesity is associated with a high rate of mental problems in addition to its biological aspects. Considering the difficulty of obesity treatment and the high rate of complications, biopsychosocial interventions and multidisciplinary approaches involving mental health professionals are important for preventing and treating pediatric obesity. Considering the increasing prevalence of obesity in children and adolescents, young people diagnosed with obesity should be evaluated in terms of comorbid IA, SA, ADHD, and other psychopathologies, and clinicians should be careful in this respect.

In this regard, there is a need for community-based and longitudinal studies with larger samples to understand the causality between obesity and psychopathologies.

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