A Preliminary Study on the Relationship Between Parental Internet Addiction and Their Children's Body Mass Index

Ebeveyn İnternet Bağımlılığı ile Çocuklarının Vücut Kütle İndeksi Arasındaki İlişki Üzerine Bir Ön Çalışma

Araştırma Research

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DOI: 10.17942/sted.1514049

Geliş/Received: 10.07.2024
Kabul/Accepted: 07.01.2025

Abstract

Objectıve: The complex interrelationship between obesity and digital dependency requires comprehensive research to guide targeted population-level intervention strategies. This study investigates the intricate link between parental internet addiction (IA) and body mass index (BMI) percentiles of children and adolescents. The original research aims to contribute to the academic field on an under-researched topic.

Methods: Research included 109 participants aged 7–20. A sample size of 108 was predetermined for 150 participants at a 95% confidence level. Ethics committee approval was obtained in June 2018. Statistical analysis explored the links between children's BMI percentiles and factors including age, gender, children/adolescents and parents' IA scores, parents' educational status. Descriptive statistics included mean, SD, median, frequency, percentage, min/max values. Kolmogorov-Smirnov and Shapiro-Wilk Tests were used for normality. Comparative tests for quantitative data included Kruskal-Wallis, Independent Samples, Student's t-Test, ANOVA. Qualitative data were analyzed using Pearson's χ^2, Fisher-Freeman-Halton Exact Tests. Spearman correlation analysis was used to assess relationships between the quantitative variables. The significance level was set at $p<0.050$.

Results: The mean±SD age was 13.8±2.8 years. In terms of children and adolescents' IA scores, 2 had IA, 46 were at risk. Percentile categories for BMI showed that 3 were underweight, 62 had normal/healthy weight, 39 were overweight, 5 were obese. Significant correlations were found between children/adolescents' age and BMI percentiles ($p=0.002$), higher in younger children ($p=0.011$). Across children and adolescents' two BMI percentile categories, statistical significance was observed with fathers' IA scores ($p=0.029$).

Conclusion: Despite the limitations of generalizability in research, potential associations were implicated. Additional investigation into the potential role of younger age as a risk factor for childhood obesity may be merited. The study hints at possible transmission of unhealthy behaviors across generations. Health care providers are crucial in educating about healthy lifestyle choices, conducting risk assessments, and implementing, monitoring, evaluating public health interventions. The study was conducted as a pioneering and exploratory investigation. The promising outcomes of the research warrant further investigation to comprehend its full implications, especially in regard to familial influences on health behaviors.

Keywords: pediatric obesity; maternal obezite; parenting; digital technology; internet addiction disorder; public health

Özet

Amaç: Obezite ve dijital bağımlılık arasındaki karmaşık ilişki, hedeflenmiş nüfus düzeyindeki müdahale stratejilerine rehberlik edecek kapsamlı araştırmalar gerektirmektedir. Bu çalışma, ebeveyn internet bağımlılığı ile çocuk/ergen vücut kütle indeksi (VKİ) persentilleri arasındaki karmaşık bağlantıyı araştırmaktadır. Orijinal araştırma, az incelenmiş bir konuda akademik alana katkı sağlamayı amaçlamaktadır.

Yöntem: Araştırmaya 7–20 yaşları arasında 109 katılımcı dahil edilmiştir. Örneklem büyüklüğü, %95 güven aralığında 150 katılımcı üzerinden 108 olarak önceden hesaplanmıştır. Etik kurul onayı Haziran 2018'de alınmıştır. İstatistiksel analiz, çocukların VKİ persentilleri ile yaş, cinsiyet, çocuk/ergen ve ebeveynlerin internet bağımlılığı puanları ile ebeveynlerin eğitim durumu gibi faktörler arasındaki bağlantıları incelemiştir. Tanımlayıcı istatistikler, ortalama, SD, medyan, sıklık, yüzde, min/max değerlerini içermektedir. Normalite için Kolmogorov-Smirnov ve Shapiro-Wilk Testleri kullanılmıştır. Nicel veri için karşılaştırmalı testler arasında Kruskal-Wallis, bağımsız örneklem t-testi ve ANOVA yer almıştır. Nitel veri Pearson χ^2, Fisher-Freeman-Halton Exact Testleri ile analiz edilmiştir. Nicel değişkenler arasındaki ilişkileri değerlendirmek için Spearman korelasyon analizi kullanılmıştır. Anlamlılık seviyesi $p<0,050$ olarak belirlenmiştir.

Bulgular: Ortalama±SD yaş 13,8±2,8 yıl olarak bulunmuştur. Çocuk/ergen İnternet Bağımlılığı Testi puanlarına göre 2 kişi IA, 46 kişi ise risk altındadır. Sınıflandırmalar 3 kişinin zayıf, 62 kişinin normal/sağlıklı kiloda, 39 kişinin fazla kilolu ve 5 kişinin obez VKİ persentil kategorisinde olduğunu göstermiştir. Çocuk/ergenlerin yaşlarıyla VKİ persentilleri arasında anlamlı korelasyon bulunmuştur ($p=0,002$), yaşları küçük olan çocuklarda daha yüksek bulunmuştur ($p=0,011$). Çocuk ve ergenlerin iki VKİ persentil kategorisi kıyaslandığında, babalarının internet bağımlılığı puanlarıyla istatistiksel olarak anlamlı ilişki olduğu saptanmıştır ($p=0,029$).

Sonuç: Sonuçların topluma genellenebilir olması açısından kısıtlamalar bulunmakla birlikte, elde edilen bulgular, potansiyel ilişkiler hakkında önemli ipuçları sunmaktadır. Çocukluk çağı obezitesi için erken yaş risk faktörünün olası rolünün daha fazla araştırılması gerekmektedir. Çalışma, sağlıksız davranışların nesiller arası aktarımına işaret etmektedir. Sağlık hizmet sunucuları, sağlıklı yaşam tarzı seçimleri konusunda eğitim vermek, risk değerlendirmeleri yapmak, halk sağlığı müdahalelerini uygulamak, izlemek ve değerlendirmekte kritik rol oynarlar. Çalışma, öncü nitelikte ve keşif amaçlı olarak yürütülmüştür. Özellikle sağlık davranışlarının ailevi etkilerinin tam olarak anlaşılabilmesi için daha fazla araştırma yapılmasının gerekliliği vurgulayan, ümit verici sonuçlar ortaya konulmuştur.

Anahtar Sözcükler: pediatrik obezite; maternal obesity; ebeveynlik; dijital teknoloji; internet bağımlılığı bozukluğu; halk sağlığı

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Introduction

Obesity and internet addiction (IA) are two major public health issues that threaten global well-being in modern life.

Obesity is a preventable and treatable, yet often relapsing, condition that has become a major global public health issue. Obesity has become a significant global public health issue, with its prevalence more than tripling worldwide between 1975 and 2022. When defining overweight and obesity in children, age is a crucial factor to consider. This increase is especially alarming among children and adolescents, with the prevalence of overweight and obesity among those aged 5–19 rising from 4% in 1975 to over 18% by 2016. The global age-standardized obesity rate for children and adolescents demonstrated substantial increases, from 0.7% to 5.6% for girls and from 0.9% to 7.8% for boys between 1975 and 2016. In 2020, 39 million children under five were classified as overweight or obese, and by 2024, over one billion people, nearly 880 million adults and 159 million children and adolescents, were living with obesity. While high-income countries have seen a plateau in obesity rates since 2000, low- and middle-income nations continue to experience a rise in obesity, with countries like China, India, and the USA projected to have the highest numbers of affected children by 2030. Childhood obesity is now recognized as one of the most serious health challenges of the 21st century, affecting nearly every country worldwide, with the highest obesity rates observed in Pacific Island nations and regions such as the Middle East, North Africa, and the USA (1-4). A study explored the prevalence of overweight and obesity in preschool children under five in Turkey, using data from the Turkey Demographic and Health Surveys, and investigated the role of maternal, household, individual-level factors on childhood obesity. The study found a significant increase in the prevalence of overweight children over time. The findings highlight the rising trend of childhood obesity in Turkey and emphasize the importance of considering maternal and household factors when addressing this public health issue (5). Another Turkish study aimed to assess the prevalence of childhood obesity and its associated factors among primary school students in Istanbul. Conducted across 39 schools with 5,620 students aged 8–12, it found that 15.7% of the children were obese, with a slightly higher prevalence in boys (17.3%) than girls (14.1%). Factors linked to obesity included excessive screen time, defined in the study as TV and computer use, skipping meals, and irregular eating habits, such as not having breakfast. The study also identified higher obesity rates in younger children and those with less physical activity. The results highlighted that childhood obesity is on the rise in Turkey, mirroring trends in other countries, and that future research should also explore the role of parents in childhood obesity prevention (6).

The Body Mass Index (BMI) is globally recognized as the most commonly used metric for assessing body weight in relation to height. It is a statistical index that categorizes individuals into classifications such as underweight, normal weight, overweight, or obese based on their weight and height. In pediatric populations, BMI is utilized to facilitate comparisons, with values below the 5th percentile indicating underweight status, and values exceeding the 95th percentile indicating obesity. Although ubiquiously used, it has notable limitations, particularly in evaluating abdominal adiposity and in its application across different racial, ethnic, gender groups (7,8).

Problematic computer use, particularly Internet Addiction Disorder (IAD), is a growing global concern. It is typically described as an impulse control disorder characterized by an overwhelming and uncontrollable reliance on the internet, leading to excessive and compulsive online behavior. The widespread use of the internet, smartphones, and other electronic devices has led to health problems from excessive usage, making it a significant public health issue in many countries. As a result, organizations like the World Health Organization (WHO), along with researchers and healthcare professionals, are taking action to address it. In 2020, the WHO formally recognized addiction to digital technology as a global problem, where excessive online activity impairs the ability to manage time, energy, and attention. The widespread use of electronic devices, including smartphones and computers, has become a notable public health concern

due to its association with various physical and mental health issues, particularly among children and adolescents. Studies consistently show that excessive device use leads to musculoskeletal symptoms, such as back and neck pain, and visual disturbances like eye strain. It also negatively affects psychosocial health, contributing to stress, anxiety, and depression, while reducing quality of life. Research from Hong Kong, Bangladesh, and Serbia highlights how increased screen time correlates with these health problems, with adolescents being particularly vulnerable (9-12). Excessive smartphone use has further been linked to cognitive impairments, sleep disorders, and even changes in brain structure, leading to concerns about long-term mental health impacts (13,14). Public health experts emphasize the need for interventions, such as limiting screen time and encouraging outdoor activities, to address these emerging health risks (15,16). According to metabolic and environmental research, global digitalization is linked to reduced sunlight exposure, posing health risks such as obesity (17-19). A study reveals that positive parent-adolescent relationships are negatively associated with mobile phone addiction, highlighting different pathways through which parental interactions influence adolescent, and offers insights for intervention and prevention strategies (20).

The aim of this research is to explore the complex interrelationship between parental IA and the BMI percentiles of children and adolescents. Building upon a preliminary study on the relationship between parental IA and their children's BMI, this original research seeks to provide valuable insights into this intricate link. The ultimate goal is to inform public health policies and family-oriented programs that promote healthier behaviors, improve family dynamics. The long-term vision is to reduce the impact of these interconnected issues at a population level.

Material and Methods

The ethics committee approval was obtained on June 22nd 2018, with decision number 1319, from Istanbul Research and Training Hospital of the Republic of Turkey Ministry of Health (TR MoH), before data collection was initiated and carried out for a period of two months.

Participants comprised 109 participants, aged 7 to 20 years, who presented to the hospital and met the established inclusion criteria from an initial cohort of 150 potential subjects with informed consent. The researchers defined the population as all children and adolescents who visited the Pediatric Outpatient Clinic of the hospital from Tuesday July 31st, to Friday September 28th, 2018, totaling 1,293 patients. The study population included participants of different ages, genders, clinical conditions, ensuring the sample would be representative. To implement random sampling, a list of all 1,293 patients was compiled using the hospital's database, which included patient ID, age, gender, visit history, diagnosis. Each patient was assigned a unique identifier from 1 to 1,293. Simple random sampling was used, with every patient having an equal chance of being selected. A computational random number generator algorithm was employed to generate a sequence of numbers for statistical sampling, producing 150 unique numbers between 1 and 1,293, thus ensuring an unbiased selection. The corresponding patients were identified and included in the sample. If any duplicates were found, they were replaced through another random selection. After selecting the sample, its accuracy was verified, duplicates were checked for, and it was confirmed that the sample covered a broad demographic spectrum. The unique selection process guaranteed that the chosen sample accurately represented the broader population of clinic visitors. Data collection included both demographic and relevant clinical information, with informed consent obtained. Data analysis involved descriptive statistics and comparisons between subgroups, allowing for generalization to the entire population of the specific research study. The results were compiled with details of the methodology, findings, study limitations, and conclusions, all based on the representative nature of the random sample.

In scientific literature, it's commonly recognized that the power of a study, referred to as 1-β, indicates the probability of not making a type II error. Given the established understanding, it is typically accepted to be around 80% (21).

The current study used the sample size calculation formula proposed by Salant and Dillman in 1994 (22), and considering a 95% confidence interval, $\alpha=0.05$ sampling error, and aiming for 80% power with 150 child participants enrolled over a period of sixty days. Using the Yamane formula to calculate sample sizes in research (23,24), the required sample size for the study was determined to be 108, with a significance level, p-value of 0.50. This refers to the number of child and adolescent participants in the study. To avoid confusion, it's important to briefly mention at this point that, in line with study requirements and research objectives, data was collected from the participants' parents as well. The calculation was done using the formula $n=Nt^2pq/d^2(N-1)+t^2pq$ where N referred to the total population size, n indicated the intended sample size, p represented the probability of the event to occur, while q stood for the converse probability of the event failing to occur, t was the theoretical value derived from the t-distribution table at a specified significance level, and d denoted the observed incidence of the event in question ± acceptable sampling error based on event frequency.

The inclusion criteria for participation were set to include participants aged 7 to 20, requiring signed consent for participation, with minors under 18 needing parental/guardian signed consent. Children and adolescents' involvement in the research was determined by parental discretion, with participants having the final say. The ability to understand the assessment language was a requirement. Researchers carefully considered maturity and comprehension levels of younger individuals before testing. The exclusion criteria were delineated as follows. Participants outside the specified age range, those who didn't provide signed consent, those with medical conditions impacting BMI, diagnosed psychiatric disorders affecting internet use or BMI, those on relevant medications, and those lacking maturity or comprehension were excluded, along with those with incomplete data.

The descriptive study used a self-report survey. In the first section, demographic characteristics of the participants were obtained. Personal information included such as age, gender, height, weight parents' educational levels. The second section of the forms consisted of a standardized questionnaire comprising 20 questions, which evaluated the participants' IA levels. The Internet Addiction Test (IAT) was developed in the United States, where the validity and reliability studies have been conducted (25-27). The validity and reliability of the Turkish version of IAT was calculated for consistency and accuracy (28-30). The IAT is designed to be used at any age. The IAT by Kimberly Young is widely accepted across diverse age cohorts, encompassing children/adolescents and adults alike, with certain considerations which were carefully addressed in cunducting the research. With judicious and meticulous deliberation in its application in the current study, it was used to determine the levels of IA for both participants aged 7–20 and for their parental guardians. In subsequent sections of this article, the limitations are explicated and critically analyzed. The IAT is used to measure whether IA is mild, moderate, or severe. According to the scores obtained from the IAT results, 20–49 represents the average internet user group who can control, 50–79 correlates with the group who has trouble controlling, and 80–100 is associated with the group who has major problems in controlling their internet use (29).

In this study, WHO's child developmental proportions have been used in classifying children and adolescent according to their BMI results. Participants presenting to the hospital, including those under follow-up care, underwent measurements for height and weight, allowing BMI values to be contemporaneously established through direct measurement. Underweight is BMI $<5^{th}$ percentile, normal or healthy weight is BMI $\geq5^{th}$ percentile and $<85^{th}$ percentile, overweight is BMI $\geq85^{th}$ percentile and $<95^{th}$ percentile, obese is BMI $\geq95^{th}$ percentile, for all age, gender, and height categories (31).

The study examined the relationship between children's BMI percentiles and several factors. The dependent variable, or the main focus of the study, is the children's BMI percentiles. This is the outcome or the variable that was analyzed in response to independent variables. The independent variables are factors that

are hypothesized to have an effect on the dependent variable. The study investigated the correlation between children's BMI percentiles and several factors, such as children's age, gender, and IA scores, as well as parents' IA scores and educational status. The dependent variable is children's BMI percentiles, while the independent variables include demographic and behavioral factors of both chldren/adolescents and their parents.

For statistical analysis, the Number Cruncher Statistical Software, developed in Utah, United States, in the year 2007, was used (32). Descriptive statistical methods including mean, standard deviation, median, frequency, percentage, minimum, maximum values were used in the evaluation of the study data. The conformity of quantitative data to the normal distribution was tested with the Kolmogorov-Smirnov Test and graphical examinations. Although the age variable shows a normal distribution due to the number of cases in the subgroups, Kruskal Wallis Test was used for comparisons between more than two groups. Independent Samples Test was used to evaluate children's ages according to the BMI classification of children examined in two groups. The Independent t-Test (Student's t-Test) was used for comparisons of normally distributed quantitative variables between two groups. The Pearson's Chi-squared (x^2) Test and the Fisher-Freeman-Halton Exact Test were used to compare qualitative data. Spearman correlation analysis was used to evaluate the relationships between quantitative variables. The level of significance was set at $p<0.050$.

Results

The study was conducted with 109 individuals. In terms of the distribution of the child/adolescent participants' descriptive characteristics, 42.2% (n=46) were females and 57.8% (n=63) were males (Figure 1). The ages of the children/adolescent participants ranged from 7 to 20 and the median age was 14. The mean±SD age was 13.8±2.8 years.

The subjects' BMI mean±SD value was 21.3±4.3. The BMI median was 21.0. The minimum and maximum BMI values of the subjects participating in the study ranged from 11.8 to 44.1. Regarding their BMI percentiles,

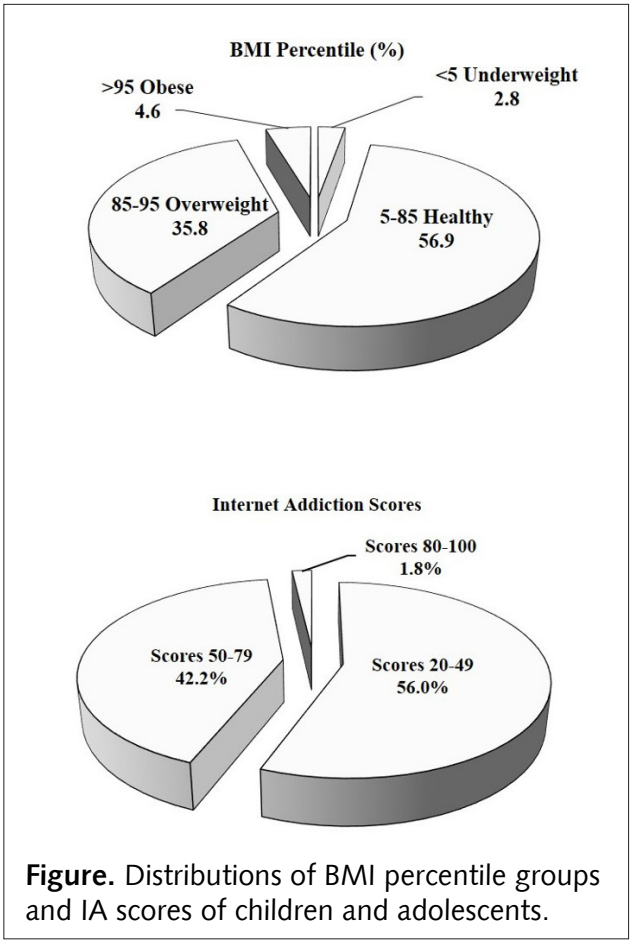

Figure. Distributions of BMI percentile groups and IA scores of children and adolescents.

3 (2.8%) were in the <5 underweight, 62 (56.9%) were in the ≥5 to <85 normal/healthy weight, 39 (35.8%) were in the ≥85 to <95 overweight, and 5 (4.6%) were in the ≥95 obese categories (Table 1).

Regarding the child/adolescent participants' IA scores, 61 (56.0%) were in the 20–49, 46 (42.2%) were in the 50–79, and 2 (1.8%) were in the 80–100 intervals (Figure). The IA score mean±SD was 43.9±16.1 and median (min-max) was 46 (20–87).

Regarding the educational status of the study subjects' mothers, 24 (22.0%) were primary school graduates, 10 (9.2%) were secondary school graduates, 36 (33.0%) were high school graduates, and 39 (35.8%) were university graduates or had higher education. In terms of the educational status of the fathers, 21 (19.3%) were primary school graduates, 12 (11.0%) were secondary school graduates, 34 (31.2%) were high school graduates, and 42 (38.5%) were university graduates or had higher education.

The parents of the children/adolescents were

Table 1. Comparison of the participants' and the parents' descriptive characteristics by the participants' four percentile groups <5, ≥5 to <85, ≥85 to <95, and ≥95.

		Participants' BMI percentile groups				p
		<5 Underweight (n=3)	≥5 to <85 Healthy (n=62)	≥85 to <95 Overweight (n=39)	≥95 Obese (n=5)	
Comparison of the participants' gender, age, internet addiction score by the participants' percentile group						
Gender	Male	1 (33.3%)	35 (56.5%)	24 (61.5%)	3 (60.0%)	[a]**0.827**
	Female	2 (66.7%)	27 (43.5%)	15 (38.5%)	2 (40.0%)	
Age	Mean±SD	11.3±1.1	14.6±2.8	13.0±2.6	11.6±1.8	[b]**0.002****
	Median (min-max)	12 (10-12)	15 (8-20)	13 (7-20)	12 (9-14)	
Internet Addiction Score	20-49	2 (66.7%)	36 (58.1%)	21 (53.8%)	2 (40.0%)	[a]**0.929**
	50-79	1 (33.3%)	25 (40.3%)	17 (43.6%)	3 (60.0%)	
	80-100	0 (0.0%)	1 (1.6%)	1 (2.6%)	0 (0.0%)	
Comparison of the parent's educational status by the participants' percentile group						
Mother's Educational Status, Graduation	Primary school	0 (0.0%)	16 (25.8%)	5 (12.8%)	3 (60.0%)	[a]**0.128**
	Secondary school	0 (0.0%)	6 (9.7%)	3 (7.7%)	1 (20.0%)	
	High school	0 (0.0%)	20 (32.3%)	15 (38.5%)	1 (20.0%)	
	University or higher	3 (100.0%)	20 (32.3%)	16 (41%)	0 (0.0%)	
Father's Educational Status, Graduation	Primary school	0 (0.0%)	12 (19.4%)	8 (20.5%)	1 (20.0%)	[a]**0.436**
	Secondary school	0 (0.0%)	8 (12.9%)	3 (7.7%)	1 (20.0%)	
	High school	2 (66.7%)	15 (24.2%)	14 (35.9%)	3 (60.0%)	
	University or higher	1 (33.3%)	27 (43.5%)	14 (35.9%)	0 (0.0%)	
Comparison of the parent's internet addiction score by the participants' percentile group						
Mother's Internet Addiction Score	20-49	3 (100.0%)	61 (98.4%)	39 (100.0%)	4 (80.0%)	[a]**0.135**
	50-79	0 (0.0%)	1 (1.6%)	0 (0.0%)	1 (20.0%)	
Father's Internet Addiction Score	20-49	3 (100.0%)	59 (95.2%)	32 (82.1%)	4 (80.0%)	[a]**0.179**
	50-79	0 (0.0%)	2 (3.2%)	6 (15.4%)	1 (20.0%)	
	80-100	0 (0.0%)	1 (1.6%)	1 (2.6%)	0 (0.0%)	

[a]Fisher Freeman Halton Test [b]Kruskal Wallis Test
•Insufficient number of observations; not included in the analysis.

also administered the IAT, and scores were obtained from all of them for comparisons following the study protocol. When the mothers' IA scores, 107 (98.2%) were in the 20–49, and 2 (1.8%) were in the 50–79 intervals. In terms of the fathers' IA scores, 98 (89.9%) were in the 20–49, 9 (8.3%) were in the 50–79, and 2 (2.8%) were in the 80–100 intervals.

A statistically significant difference was found between different age groups of the participants, according to their BMI percentiles (p=0.004; p<0.010) (Table 1). When comparisons were made between the pairs, in order to determine the source of the difference, the ages of the patients in the ≥5 to <85 normal/healthy weight BMI percentile group were significantly higher than those in the ≥85 to <95 overweight group (p=0.011; p<0.050). Gender and IA scores of the cases according to

Table 2. Comparison of the participants' and the parents' descriptive characteristics by the participants' percentile groups <85 and ≥85.

		Participants' BMI percentile groups		p
		<85 (n=65)	≥85 (n=44)	
Comparison of the participants' gender, age, internet addiction score by the participants' percentile group				
Gender	Male	36 (55.4%)	27 (61.4%)	[d]0.560
	Female	29 (44.6%)	17 (38.6%)	
Age	Mean±SD	14.41±2.80	12.86±2.53	[c]0.004**
	Median (min-max)	15 (8-20)	13 (7-20)	
Internet Addiction Score	20-49	38 (58.5%)	23 (52.3%)	[a]0.783
	50-79	26 (40.0%)	20 (45.5%)	
	80-100	1 (1.5%)	1 (2.3%)	
Comparison of the parent's educational status by the participants' percentile group				
Mother's Educational Status, Graduation	Primary school	16 (24.6%)	8 (18.2%)	[a]0.845
	Secondary school	6 (9.2%)	4 (9.1%)	
	High school	20 (30.8%)	16 (36.4%)	
	University or higher	23 (35.4%)	16 (36.4%)	
Father's Educational Status, Graduation	Primary school	12 (18.5%)	9 (20.5%)	[a]0.489
	Secondary school	8 (12.3%)	4 (9.1%)	
	High school	17 (26.2%)	17 (38.6%)	
	University or higher	28 (43.1%)	14 (31.8%)	
Comparison of the parent's internet addiction score by the participants' percentile group				
Mother's Internet Addiction Score	20-49	64 (98.5%)	43 (97.7%)	[d]1.000
	50-79	1 (1.5%)	1 (2.3%)	
Father's Internet Addiction Score	20-49	62 (95.4%)	36 (81.8%)	[a]0.029*
	50-79	2 (3.1%)	7 (15.9%)	
	80-100	1 (1.5%)	1 (2.3%)	

[a]Fisher Freeman Halton Test [c]Student's t-Test [d]Pearson Chi-Square Test
*p<0.050 **p<0.010

BMI percentile groups did not reveal statistically significant differences (p>0.050).

According to the child/adolescent participants' BMI percentile groups, the educational status, the IA scores of the child/adolescent participants' parents, did not show a statistically significant difference (p>0.050) (Table 1).

The ages of the child/adolescent participants in the <85 BMI percentile group (=underweight & normal/healthy weight) were found to be statistically significantly higher than those in the ≥85 group (=overweight & obese) (p=0.002; p<0.010).

Gender and IA scores of the child/adolescent participants do not differ statistically according to BMI percentile groups (p>0.050).

A statistically significant difference was found between the IA scores of the child/adolescent participants' fathers, according to child/adolescent participants' BMI percentile groups (p=0.029; p<0.050).

Educational status of the mothers, IA scores,

and BMI percent groups of the child/adolescent participants did not show a statistically significant difference, according to BMI percentile groups ($p>0.050$).

Educational status of the fathers and BMI percent groups of the subjects did not show a statistically significant difference, according to BMI percentile groups ($p>0.050$).

Relationship between the child/adolescent participants' BMI percentiles and their parents' IA scores revealed no statistically significant correlation. child/adolescent participants' BMI percentile with child/adolescent participants' IA score ($r=0.176$, $p=0.066$), mother's IA score ($r=0.135$, $p=0.163$), father's IA score ($r=0.051$, $p=0.599$) revealed no statistically significant correlation, by the Spearman Correlation Test. No statistically significant correlation was found between BMI values and IA scores of the cases ($p>0.050$). No statistically significant correlation was found between the BMI values of the cases and the parent IA scores and BMI values ($p>0.050$).

Comparison of child/adolescent participants' BMI values with parents' educational status, by graduation. The BMI valuesof the cases did not show a statistically significant difference according to the educational status of their mothers and fathers ($p>0.050$). Comparison of the child/adolescent participants' BMI percentiles with mothers' educational status ($p=0.443$) and fathers' educational status ($p=0.088$), according to their school of graduation, revealed no statistically significant correlation, by the One-Way ANOVA Test.

Discussion

In this section, the data obtained from the study are evaluated in conjunction with current literature and key sources. The discussion includes the potential influence of age on the BMI percentiles of children and adolescents, as well as the possible impact of a father's internet addiction on the BMI percentiles of their child or adolescent. Additionally, the balance between the advantages and challenges of modern technologies is explored. The limitations of the current research are addressed, and suggestions for future research directions are provided.

This original research is a preliminary study that examines the impact of parental IA on children and adolescents' BMI and addresses the significant public health concern of technology dependence. Excessive use of electronic devices, the internet, and gaming platforms is a global issue, with potential serious health implications, especially when it leads to compulsive IA among children. Evidence updates suggest that the global reality constitutes a prevalent problem among youth in Turkey. Research findings presented in a relevant article from Turkey demonstrated that 3.6% of adolescents aged 12–18 had IA, while 21.8% were identified to be risk (33). In a prevalence study conducted with 148 Turkish adolescents aged 12–18, IA frequency was found to be 8.8% (34). In another study group, the percentage of individuals with IA was reported to be 10.1% among 754 individuals, aged 14–20 (35). A different study reported IA prevalence of 10.1% among individuals aged 14–20 (36). Among secondary education students, IA prevalence was 2.3%, with 17.5% at risk (37). Studies also indicate rates such as 7.1% for problematic internet usage among adolescents (38) and 2% IA among teenagers, emphasizing the need for measures against technology dependency (37).

The current study contributes to the emerging body of literature exploring the complex interplay between parental IA and the BMI of children and adolescents. Given the exploratory nature of the study, the significance of the topic deserves further exploration of any statistically significant findings. Within this framework, it represents a pioneering study, making an original contribution to existing knowledge, to be reviewed by international health scholars.

This original research involved 109 individuals aged 7–20, with a gender split of 42.2% females and 57.8% males. It assessed participants' weight status, revealing that 2.8% were underweight, 56.9% were of normal weight, 35.8% were overweight, and 4.6% were obese. In terms of internet usage, 56.0% were average users with good control, 42.2% struggled to control their internet use, while 1.8% encountered major difficulties in doing so (Figure). Internet usage appears to be a prominent issue among youth, potentially linking

these challenges with different weight statuses, and emphasize the necessity for further research on how internet habits may influence broader health behaviors in this demographic.

The educational backgrounds and IA scores of the parents were examined. A significant portion of mothers and fathers had completed high school (mothers: 33.0%; fathers: 31.2%) or higher education (mothers: 35.8%; fathers: 38.5%).

Most of the parents surveyed were average internet users capable of controlling their usage, yet a minority, particularly fathers, encountered challenges in regulating their internet use, with 1.8% of the mothers and 8.3% of the fathers experiencing difficulties, and 2.8% of fathers reporting significant issues in managing their online activities. The study emphasizes that while the majority of parents demonstrate responsible internet use, a significant minority, especially fathers, struggled to control their online conduct. This might suggest potential differences in digital literacy and susceptibility to IA across demographic groups. This research finding potentially indicates that demographic diversity likely influences proficiency in digital technology use, referred to as digital literacy, as well as susceptibility to developing IA. Future research should investigate these factors further and develop specific interventions to promote healthier internet habits among parents.

In the current study, the children and adolescent participants' and their parents' descriptive characteristics were compared, in children and adolescent participants' BMI percentile groups, classified under four categories as <5 underweight, ≥5 to <85 normal/healthy weight, ≥85 to <95 overweight, and ≥95 obese.

While fathers' IA scores showed no significant differences across children and adolescents' four BMI percentile categories ($p>0.050$) (Table 1), there was a notable correlation between children and adolescents' BMI overall percentiles and their fathers' IA scores ($p=0.029$; $p<0.050$) (Table 2). The significant correlation found between paternal IA and the children and adolescents' total BMI percentiles, might suggest a potential influence of parental digital behaviors on childhood obesity. In that context, this observation would be consistent with extant research highlighting that parental behaviors, encompassing screen time habits, exert a significant influence on children's health outcomes (39,40). The results of the current study underscore the need for parents to model healthy digital behaviors, in order to mitigate potential adverse effects on their children's BMI.

Age might be a potential influence on children and adolescents' BMI percentiles

Age emerged as a potential moderator in the relationship between children and adolescents' BMI and parental IA. Younger children exhibited higher BMI percentiles. A statistically significant correlation was found between children and adolescent participants' ages and their BMI percentiles ($p=0.004$, $p=0.002$; $p<0.010$) (Tables 1&2). Specifically, children and adolescent participants in the ≥5 to <85 normal/healthy weight BMI percentile category were older compared to those in the ≥85 to <95 overweight category ($p=0.018$, $p=0.011$; $p<0.050$). Gender and IA scores among children did not yield statistically significant results across BMI percentile groups ($p>0.050$), nor did parental educational status and IA scores ($p>0.050$) (Table 1). Further analysis within two BMI percentile categories (<85 under/normal/healthy weight and ≥85 overweight/obese) also demonstrated a significant correlation between participants' ages and BMI percentiles ($p=0.004$, $p=0.002$; $p<0.010$). Comparisons within these categories did not reveal significant differences in gender or IA scores of children, or educational status of the parents ($p>0.050$) (Table 2). Relevant literature supports the association between IA and obesity among youth, although findings have been variable. For instance, a study with 150 teenage participants found no significant correlation between obesity and IA among 11-18 year-olds. Mothers' education exhibited a significant positive correlation with children's IA scores, with the highest IA scores observed among children of high school graduate mothers, whereas fathers' education did not show a significant correlation (37). The original article presented provides empirical evidence, emphasizing the importance of considering age

as a critical moderator. Future research should further explore these dynamics and investigate potential mechanisms underlying additional associations to inform effective preventive strategies.

Father's internet addiction might be a potential influence on the child or adolescent's BMI percentile

A statistically significant difference was found between the IA scores of the fathers and the children and adolescents' BMI groups. Research findings suggest that children of fathers without IA, characterized by IAT scores of 20–49 compared to 50–79, are less likely to have BMI percentile values ≥85 ($p=0.029$; $p<0.050$). Parents' educational status and mothers' IAT scores did nor reveal any statistically significant differences ($p>0.050$) (Tables 1&2).

These results emphasize the need for additional research focused on fostering healthy digital practices within families, aiming to mitigate potential health risks stemming from parental IA on children and adolescents. Research outcomes might suggest an increased vulnerability to parental IA during crucial developmental phases. This nuanced observation aligns with literature, drawing attention to the influential role of parental behaviors in shaping children's health behaviors, and suggesting a heightened susceptibility to the influence of parental IA during critical developmental stages. The subtle finding resonates with developmental psychology literature, which emphasizes the formative role of parental behaviors in shaping children's health behaviors (41,42).

In clear terms, the outcomes of the current study should be interpreted cautiously due to its exploratory nature.

Balancing advantages and challenges modern technologies

It is important to acknowledge both the drawbacks and benefits of technology. Digital devices play a crucial role in modern life, offering speed, ease, and effectiveness; however, excessive internet use raises significant public health concerns, including reduced sunlight exposure leading to health risks, and issues like physical inactivity, poor diets, and various associated health problems (9,19,38,43-48). Despite these concerns, the internet undeniably provides extensive opportunities, especially for youth who are digital natives. Researchers have conducted studies to develop interventions aimed at creating supportive environments for students and resilient communities. These efforts include randomized controlled trials to evaluate online therapies against standard care, contributing to the field of internet-delivered interventions (49). For scholars and health professionals, critical thinking is essential in examining theories and practices that shape public health policies and youth development programs. Despite the advantages of the digital age and the Third Industrial Revolution, a balanced approach is crucial. This necessitates acknowledging the benefits while also addressing the challenges and potential risks of digitalization. Embracing these changes will enable effective navigation of the complexities arising from the digital revolution. A comprehensive approach that considers both positives and negatives will ultimately foster improved outcomes and sustainable solutions in health research and interventions. To advance public health in the digital era, researchers and practitioners must adopt innovative perspectives and methodologies.

Implications for public health include the critical need for monitoring IA and childhood/adolescent obesity in health care services, as well as addressing the challenges in public health interventions to improve overall health outcomes. Primary health care and family medicine are especially crucial in combating IA and childhood/adolescence obesity by offering interventions like screening, education, counseling, and parental guidance. The integration of health care services, including nutritional counseling, physical activity promotion, and behavioral interventions, is essential in addressing these issues and fostering healthier lifestyles in families. The significant challenges faced by health care providers, including heavy workloads, resource limitations, and regional disparities, must be acknowledged. These adversities and barriers can otherwise hinder the effective management of IA and childhood/adolescence obesity unless addressed through supportive policies, training, and interdisciplinary collaboration.

Limitations and future directions

Despite its contributions, this study has several limitations that warrant consideration. The sample size, though sufficient for a preliminary analysis, limits the generalizability of findings to broader populations. Additionally, the cross-sectional nature of the study precludes establishing causality between parental IA and children's BMI percentiles. Future research employing longitudinal designs could elucidate the temporal dynamics and causal pathways involved.

While the IAT is generally considered suitable for individuals of various ages, including children/adolescents and adults, researchers were exceedingly careful in considering the maturity levels and comprehension abilities of younger individuals before administering the test. The questions are designed to assess problematic internet use across different age groups, some questions may be more relevant or understandable for adults compared to younger children/adolescents. Younger individuals may additionally require guidance or explanation from a trusted adult to accurately interpret and respond to the questions. While the IAT can be used with individuals of various ages, it is important to evaluate the appropriateness of the test for each individual and provide support as needed during the assessment process.

The IAT is not an in depth screening survey. Suggestions for further analysis might include qualitative interviews or focus groups, longitudinal studies, neuroscientific studies, cross-cultural studies, ecological momentary assessment, mixed-methods approaches, and intervention studies. To comprehensively analyze IA beyond the IAT, a multifaceted research approach is necessary.

The need for targeted research to inform public health policy to address the escalation of internet addiction and pediatric obesity

In this study, the research was completed prior to the declaration of the first COVID-19 case in Turkey and globally in 2020. Targeted research should leverage the valuable data collected prior to the pandemic, as it highlights the pre-existing escalation of internet addiction and pediatric obesity, trends that were further exacerbated by the COVID-19 pandemic. The COVID-19 pandemic significantly intensified concerns about IAD, especially among teenagers, due to the increased reliance on technology. As global disruptions in daily activities forced individuals to turn to the internet for both personal and professional purposes, the prevalence of IAD escalated. A study conducted a year into the pandemic with 1,305 US participants found that over half of adults were at risk or severely addicted to the internet (47). In adolescents, internet usage surged during the pandemic, leading to an increase in IAD prevalence, which was highlighted in a study of 1,060 junior high school students in Taiwan. This research emphasized the importance of improving family dynamics, promoting physical activity, and addressing mental health issues to mitigate IAD risk (50). A review examining studies from 2000 to 2024 highlighted the significant impact of IAD on social interactions, physical health, and academic performance among adolescents and young adults. The review called for standardized diagnostic criteria, effective interventions, and greater awareness to address these issues (51). These findings draw attention to the growing public health concern surrounding IAD, exacerbated by the pandemic, and the urgent need for targeted interventions.

Public health perspectives, initiatives, resources by the Turkish Ministry of Health

The primary focus is on public health, achieved through various initiatives and resources, with an emphasis on accountability in the implementation and evaluation of its programs. Its ongoing efforts address major concerns, including the rising trends of internet addiction and pediatric obesity, which have been significant issues both in Türkiye and globally and are expected to persist without interventional research. These efforts reflect a structured approach to managing the challenges, aligned with future health management plans.

The official page of the TR MoH General Directorate of Public Health's Department Healthy Eating and Active Life offers a variety of public resources, including posters, brochures, guides, videos, and publications in English. Key documents include the Turkey Nutrition and Physical Activity Pyramid aimed at the 12–18 age group, which emphasizes

avoiding unhealthy habits and suggests daily moderate-intensity activity, high-intensity activity every other day, and muscle-strengthening exercises three times a week. The site also shares guides for preschool teachers, food safety in schools, and promoting healthy habits in students, along with specialized resources for schools, including meal plans and nutrition recommendations. Further resources are available for managing health conditions such as autism spectrum disorder, chronic diseases, obesity, diabetes, celiac disease, and sugar consumption. The website also supports health care professionals with clinical guidance for managing these conditions. Notable government programs include the Turkey Healthy Eating and Active Life Program 2014–2017, aimed at promoting healthy eating and physical activity, and the Turkey Program for Reducing Excessive Salt Consumption 2017–2021. Other prominent initiatives are the Turkey Diabetes Program and the Turkey Healthy Eating and Active Life Program: Action Plan for the Prevention of Obesity and Physical Activity 2019–2023, which focus on obesity prevention and physical activity promotion across all age groups (52). The TR MoH General Directorate of Public Health concentrates on promoting healthy environments in schools and early childhood settings, empowering families, and ensuring that healthy choices are the easiest options. Their programs aim to reduce marketing pressures targeting children and supports the development of children and adolescents. Key initiatives focus on improving health during pregnancy, early childhood, and school years through policy development, educational programs, and community-based efforts. Major actions include raising awareness about the importance of physical activity, creating exercise programs, and promoting healthy lifestyles. These efforts are coordinated by various ministries, local governments, and institutions such as the TR MoH, the Ministry of Education, and universities. The objectives include increasing access to physical activity spaces, improving school environments, and encouraging physical activity both in and outside of school. Ongoing evaluations and reports track the progress of these initiatives, which are set to continue through 2023 and beyond (53). The TR MoH Healthy Life Centers, with 277 locations across Türkiye, are multi-functional facilities aimed at reducing health risks, promoting healthy lifestyles, and strengthening primary healthcare services. These centers offer a broad range of services, including nutrition counseling, psychosocial support, chronic disease management, smoking cessation programs, and cancer screening. Nutrition counseling at these centers focuses on specific guidelines, including obesity treatment, diabetes management, adolescent weight management, pregnancy follow-up, and elderly weight management. They also provide nonmedical services, one of which is child development support. Each individual receiving services is assigned a coordinator to streamline care, improve service delivery, and enhance patient engagement. These centers are vital in improving public health outcomes, promoting healthier lifestyles, and boosting health literacy within communities (54). The TR MoH General Directorate of Public Health provides resources on mental health and safe digital technology use. These include the National Mental Health Action Plan 2021–2023, which aimed to improve mental health services, as well as materials promoting secure technology use. The resources offer guides for parents, families, and children on safe internet use, social media, and the impact of technology on children, particularly those aged 0–3. Presentations and videos raise awareness of the risks and benefits of internet use, focusing on the biopsychosocial development of children and adolescents. The TR MoH also seeks to strengthen preventive and primary-level care, with an emphasis on the prevention of behavioral addictions and the provision of counseling. Each year, 50 additional professionals were targeted for training, building on the 400 already trained individuals in 2021. The TR MoH further aimed to increase digital security training for professionals, targeting an annual 10% increase in the 300,000 health workers, teachers, parents, and other key figures already trained. Evidence-based psychosocial intervention programs are also being developed for primary healthcare settings, with similar annual increases in training for behavioral addiction counseling and safe internet use. These efforts involve collaboration with institutions such as the Ministry of National Education, the Ministry of Family,

Labor, and Social Services, and the Migrant Health Center (55).

The public health perspectives, initiatives, resources, and comprehensive efforts of the TR MoH demonstrate its focus on public health and well-being. The Ministry emphasizes its commitment to accountability in the implementation and evaluation of its programs, suggesting an organized approach to managing public health issues. The Ministry of Health's ongoing programs, activities, and initiatives reflect a sustained approach to addressing public health concerns, with a structured emphasis on accountability in the implementation and evaluation of its efforts. This process is aligned with future plans and continued engagement in public health management.

Conclusion

Translating research findings into practice is vital for addressing health challenges and promoting the well-being of children and adolescents. The study concludes that age correlates with BMI percentiles, with younger children showing higher percentiles than older adolescents. A significant link was found between BMI percentiles and fathers' IAT scores when categorized into two groups, but not four. The research highlights the need for further study on the role of age, gender, parental education, and internet addiction in childhood obesity. This study is a preliminary exploration of how children's internet use and weight patterns relate to parental characteristics and calls for further investigation, particularly through multisite studies with larger samples for more precision.

Public health programs should focus on educating families and youth about responsible internet use to prevent technology addiction and obesity. It is essential to translate scientific knowledge into effective health strategies and prioritize health promotion in national policies, empowering individuals to improve their habits, health, and overall well-being.

Health care systems, including that of Türkiye, encounter numerous challenges, such as excessive workloads, inadequate resources, bureaucratic inefficiencies, and systemic disparities. In addressing critical health concerns, such as insulin resistance and obesity in childhood and adolescence, it is imperative that policymakers implement measures to standardize treatment protocols, seamlessly integrate specialized services within existing health care frameworks, and prioritize the continuous professional development of health care providers. Fostering dynamic interdisciplinary collaboration that is both effective in achieving desired outcomes and efficient in utilizing resources is advantageous for optimizing care and addressing complex health challenges. These strategies hold the potential to enhance the quality of care delivered and optimize health outcomes across health care systems.

Credit Author Statement

First & Corresponding Author: Conceptualization, Methodology, Software, Formal analysis, Investigation, Resources, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision. Second & Senior Author: Conceptualization, Methodology, Investigation, Resources, Data Curation, Writing - Review & Editing, Supervision, Project administration, Funding acquisition.

Acknowledgements

Authors appreciate participants' collaboration in this scientific research.

The entirety of the research study, including the literature review, research idea conceptualization, methodology development, scientific analysis, results interpretation, critical discussion, and conclusion formulation were conducted solely by the authors. This work utilized the free OpenAI GPT-4o technology in a nearly negligible capacity. Its application was confined to minor tasks such as paragraphing, section partitioning, standardizing the reference list, finding synonyms for no more than ten words, and correcting inadvertent typographical errors.

Conflict of Interest Statement

Authors hereby declare that they have no competing or personal financial interests, funding, employment benefits that may inappropriately influence or affect the integrity of this work. They certify that they have no affiliations with or involvement in any institution or entity with any financial or nonfinancial interest in the subject matter or scientific content discussed in this original article.

Financial Disclosure Statement
This research received no specific grant or financial support from any funding agency in the public, commercial, or nonprofit sectors.

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