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Evaluation of problematic cell phone use, smartphone addiction, and internet addiction among students of Gazi University

Smartphone addiction in university students

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Abstract

Aim: We aimed to estimate probable smartphone addiction prevalence among Gazi University undergraduates, examine its relationship with problematic cell phone use and internet addiction, and identify associated sociodemographic and behavioral factors.

Methods: This cross-sectional study surveyed 2,482 undergraduates at Gazi University during the 2015–2016 academic year using a sociodemographic form, the Smartphone Addiction Scale–Short Form (SAS-SF), the Problematic Mobile Phone Use Questionnaire (PMPUQ), and the Internet Addiction Scale (IAS). Analyses used Mann–Whitney U, Kruskal–Wallis, Spearman correlation, and multivariable logistic regression.

Results: Among 2,418 students with complete SAS-SF scores, probable smartphone addiction prevalence was 32.2% using the cut-offs (≥31 for males, ≥33 for females); the crude rate was higher among female students (36.3%) than male students (27.1%; $P < .001$), but sex was no longer independent after adjustment. SAS-SF correlated strongly with PMPUQ ($r = 0.682$, $P < .001$) and weakly with IAS ($r = 0.229$, $P < .001$). In multivariable logistic regression, maternal middle school education (OR=1.47), monthly household income of 3,000–5,000 TL (OR=1.75), each additional hour of daily smartphone use (OR=1.13), each additional hour of weekly internet use (OR=1.01), and having a social networking account (OR=2.50) were independently associated with higher odds of probable smartphone addiction. Pet ownership (OR=0.45) and computer-based internet access (OR=0.43) were associated with lower odds.

Conclusion: Probable smartphone addiction represents a relevant public health concern among university students. The inverse association with pet ownership is a less-explored finding that warrants confirmation in future studies.

Keywords

smartphone addiction, internet addiction, university students, behavioral addiction, public health

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Introduction

Smartphones now serve as the main tool for communication, information access, social contact, and entertainment. Worldwide, smartphone use has grown each year since 2015 — when active users reached approximately 2.2 billion — with the global install base reaching 7.64 billion devices by April 2026.[1] In Türkiye, internet use among people aged 16–74 climbed from 53.8% in 2015 to 88.8% in 2024, paralleling the expansion of smartphones and mobile data services.[2,3] As use has grown, patterns of smartphone use that are excessive, hard to control, and disruptive to daily functioning are now treated as a form of behavioral addiction.[4,5]

DSM-5 recognizes only gambling disorder among non-substance-related addictions; internet gaming disorder appears in Section III as a condition still under study.[6] Young first framed internet addiction as a clinical disorder defined by loss of control, impulsivity, and functional impairment.[7] Smartphone and internet addiction now fall under the broader category of technological or behavioral addictions and share core clinical features with substance addictions: tolerance, withdrawal, loss of control, conflict, and relapse.[8,9]

A systematic review covering 2.1 million participants from 64 countries reported pooled prevalence rates of 26.99% for smartphone addiction and 14.22% for internet addiction.[4] A more recent meta-analysis spanning 2012–2022 put problematic smartphone use at 37.1%, with rates rising significantly across the decade.[5] University students sit in a particularly exposed position: they balance academic pressures and expanding social demands while gaining personal autonomy, and they have continuous access to mobile devices.[10,11]

Studies have linked smartphone and internet addiction to sleep disturbances, depressive and anxiety symptoms, lower academic performance, weaker social functioning, and physical complaints.[8,12] The shift to digital tools during COVID-19 worsened these patterns and brought their public health dimension into sharper focus.[11,13]

Use patterns also differ by sex: female students tend to spend more time on social interaction and messaging, whereas male students lean toward gaming and content consumption.[12,14] Turkish research on these addictions in university populations is still relatively thin; most published work consists of scale-validation studies or modest cross-sectional surveys.[13,14]

Using data obtained from a large, multi-faculty undergraduate sample, this study aimed to estimate the prevalence of probable smartphone addiction in conjunction with problematic cell phone use and internet addiction, and to identify the sociodemographic and behavioral factors associated with these conditions. The findings provide baseline data for future longitudinal studies and serve as a reference point for public health planning.

Materials and Methods

Study Design, Setting, and Sample

This cross-sectional study was conducted among undergraduate students at Gazi University during the 2015–2016 academic year. The source population was 46,846 students enrolled across 22 faculties. The sample size was calculated in Epi Info 6 as 381 (assumed prevalence 50%, 95% confidence level, 5% margin of error). After eight faculties were selected from the 22 faculties using a random numbers table, and after accounting for stratification by health, social, and natural sciences faculty groups, sex distribution, and a 10% non-response margin, the target sample size was set at 2,514 students; ultimately, 2,482 students participated in the study (response rate: 98.7%). Data collection took place during a formative phase of smartphone adoption in Türkiye, and the findings are therefore presented as baseline epidemiological values relevant for comparison with current data.

Data Collection Instruments

Sociodemographic Information Form. The sociodemographic information form included 30 questions assessing age, sex, faculty, year of study, parental education and employment status, monthly household income, housing status, smoking and alcohol use, pet ownership, and mobile phone and internet use habits.

Smartphone Addiction Scale–Short Form (SAS-SF). Smartphone addiction was assessed with the 10-item, 6-point Likert-type SAS-SF developed by Kwon et al.[15,16] Scores run from 10 to 60; cut-offs of ≥31 (males) and ≥33 (females) were established in the original Korean validation.16 Noyan et al. later confirmed the scale's reliability and validity in Turkish university students.[17] Cronbach's alpha in our sample was 0.867.

Problematic Mobile Phone Use Questionnaire (PMPUQ). Problematic cell phone use was measured with the PMPUQ developed by Augner and Hacker in 2012, adapted into Turkish and validated for use in university students by Tekin et al.[18,19] On this 5-point Likert-type scale, higher scores indicate more problematic use; Cronbach's alpha here was 0.854.

Internet Addiction Scale (IAS). Internet use problems were assessed with the 35-item, 5-point Likert-type IAS originally developed in Turkish by Günüç and Kayri.[20] Scores range from 35 to 175. Because no diagnostic cut-off has been established for this scale, we did not calculate an internet addiction prevalence and instead treated the score as a continuous variable. Cronbach's alpha was 0.94.

Data Collection

Data were collected between February and May 2016 using face-to-face questionnaires administered outside class hours; completion took approximately 15–20 minutes.

Ethical Approval

The study was approved by the Gazi University Ethics Committee (Date: 18.09.2015, Decision No: E.109396).

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 22.0. Normality was assessed with the Kolmogorov–Smirnov test, and non-normally distributed variables were reported as median (interquartile range, IQR). Mann–Whitney U and Kruskal–Wallis tests were used for group comparisons, and Spearman correlation analysis was used to assess relationships between scale scores. Probable smartphone addiction prevalence was calculated using only the 2,418 students with complete SAS-SF scores as the denominator, in line with standard epidemiological reporting. Variables were selected for the multivariable logistic regression model based on univariate associations and conceptual relevance to smartphone and internet use behaviors, and were entered using the Enter method. Multicollinearity among the independent variables was assessed using variance inflation factors (VIFs), and all VIF values were below 2. Model fit was assessed using the Hosmer–Lemeshow test and Nagelkerke R^2, and statistical significance was set at $P < .05$.

The study was reported in accordance with the STROBE Statement for cross-sectional studies.

Reporting Guidelines

This study was reported in accordance with the STROBE guideline.

Table 1. Sociodemographic Characteristics, Mobile Phone And Internet Use Profile, Scale Scores, And Prevalence Of Probable Smartphone Addiction Among Students (*n* = 2.482)

Sociodemographic characteristics	Value
Age, y median (IQR)	20 (19–22)
Female sex, *n* (%)	1.363 (54.9)
Faculty group, *n* (%)	
Health sciences	401 (16.2)
Natural sciences	969 (39.0)
Social sciences	1.112 (44.8)
Monthly household income, *n* (%)	
≤1.000 TL	283 (11.4)
1.001–3.000 TL	1.346 (54.2)
3.001–5.000 TL	601 (24.2)
>5.000 TL	252 (10.2)
Maternal education, *n* (%)	
Primary school or less	1.169 (47.1)
Middle school	432 (17.4)
High school	555 (22.4)
College/University	326 (13.1)
Maternal employment *n* (%)	591 (23.8)
Paternal employment *n* (%)	2.278 (91.8)
Smoking *n* (%)	539 (21.7)
Alcohol use *n* (%)	472 (19.0)
Pet ownership *n* (%)	164 (6.6)
Scale scores and probable smartphone addiction prevalence	
Daily smartphone use, hours/day, median (IQR) (*n* = 2.418)	3 (2–5)
Weekly internet use, hours, median (IQR) (*n* = 2.471)	14 (7–30)
Primary device for internet access (n = 2.471)	
Smartphone	1.935 (78.0)
Computer	503 (20.3)
Tablet or similar device	33 (1.3)
Social networking account ownership, *n* (%)	2.191 (88.3)
Scale scores and probable smartphone addiction prevalence	
SAS-SF, median (IQR)	26 (19–35)
PMPUQ, median (IQR)	31 (23–39)
IAS, median (IQR)	82 (65–101)
Probable smartphone addiction prevalence	
Overall, *n* (%)	778 (32.2)
Female (within female SAS-SF subsample, *n* = 1.331)	483 (36.3)
Male (within male SAS-SF subsample, *n* = 1.087)	295 (27.1)

*SAS-SF, Smartphone Addiction Scale–Short Form; PMPUQ, Problematic Mobile Phone Use Questionnaire; IAS, Internet Addiction Scale; IQR, Interquartile range; %, Column percentage; n, Number of participants. *Prevalence was calculated among 2.418 students with calculable SAS-SF scores using the cut-off values of ≥31 for males and ≥33 for females. Since no diagnostic cut-off score has been established for the IAS, the prevalence of internet addiction was not calculated.*

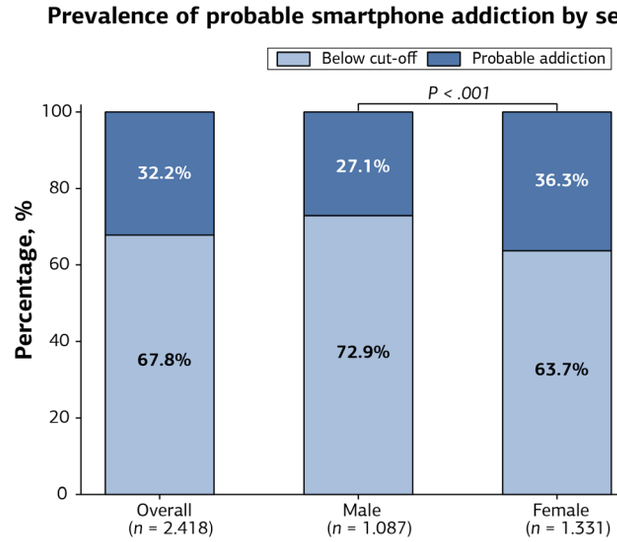


Figure 1. *Prevalence of Probable Smartphone Addiction by Sex*

The prevalence of probable smartphone addiction, calculated using SAS-SF cut-off values (≥31 for males and ≥33 for females), is shown for the total sample and the sex subgroups. The prevalence was significantly higher among female students than male students (p<0.001, chi-square test).

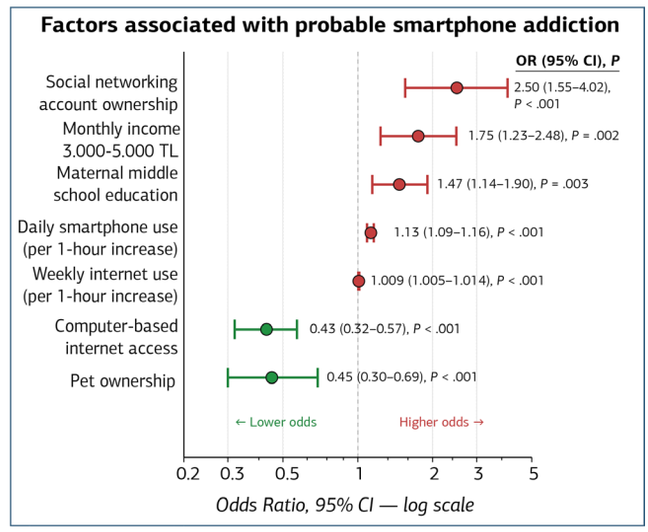


Figure 2. *Forest Plot of Factors Associated with and Inversely Associated with Probable Smartphone Addiction*

Odds ratios (ORs) and 95% confidence intervals obtained from multivariable logistic regression analysis are presented on a logarithmic scale. Values to the right of the OR=1 reference line represent factors associated with higher odds, whereas values to the left represent factors associated with lower odds.

Results

Descriptive Findings

The median age was 20 years (IQR 19–22), and 54.9% (*n*=1,363) were female. About half of mothers (47.1%) had primary school or less education and 17.4% had middle school; 91.8% of fathers were employed. Smoking, alcohol use, and pet ownership were reported by 21.7%, 19.0%, and 6.6% of students, respectively. Detailed characteristics appear in Table 1. Of the 2,482 participants, 98.6% (*n*=2,447) owned a mobile phone, 97.4% (*n*=2,418) owned a smartphone, and 99.6% (*n*=2,471) used the internet regularly.

Mobile Phone and Internet Use Profile

Among smartphone users, median daily use was 3 hours (IQR 2–5) and median weekly internet use was 14 hours (IQR 7–30). The smartphone served as the primary internet access device for 78.0% of students, while 20.3% relied mainly on a computer. Most students (88.3%) maintained at least one social networking account.

Table 2. Multivariable Logistic Regression Analysis Of Factors Associated With Probable Smartphone Addiction

Variable	OR	95% CI	*P* value
Sex			
Male		Reference	
Female	1.124	0.925–1.366	.239
Faculty group			
Health sciences		Reference	
Natural sciences	0.766	0.582–1.009	.058
Social sciences	0.944	0.730–1.220	.658
Maternal education			
Primary school or less		Reference	
Middle school	1.471	1.142–1.895	.003*
High school	0.839	0.650–1.081	.174
College/University	1.131	0.817–1.567	.458
Monthly household income			
≤1000 TL		Reference	
1.001–3.000 TL	1.147	0.843–1.561	.383
3.001–5.000 TL	1.747	1.232–2.478	.002*
>5.000 TL	1.535	0.991–2.375	.055
Pet ownership	0.452	0.298–0.685	<0.001*
Daily smartphone use, ho	1.125	1.090–1.162	<0.001*
Social networking account ownership	2.496	1.552–4.016	<0.001*
Weekly internet use, ho	1.009	1.005–1.014	<0.001*
Primary device for internet access			
Smartphone		Reference	
Computer	0.431	0.324–0.572	<0.001*
Tablet or similar device	0.434	0.178–1.056	.066

*OR, odds ratio; CI, confidence interval. Multivariable logistic regression analysis (Enter method). Hosmer–Lemeshow test P = .326; Nagelkerke R^2=0.140. *P < .05*

Scale Scores and Prevalence of Probable Smartphone Addiction

Median scale scores were 26 (IQR 19–35) for SAS-SF, 31 (IQR 23–39) for PMPUQ, and 82 (IQR 65–101) for IAS. Applying the SAS-SF cut-offs to the 2,418 students with complete scores, probable smartphone addiction reached 32.2% overall (*n* = 778). The rate was substantially higher among female students (36.3%, 483/1,331) than male students (27.1%, 295/1,087), with the difference reaching statistical significance (*P* < *.001*). Figure 1 displays the distribution by sex.

Relationships Between Scale Scores

Spearman correlations were strong between SAS-SF and PMPUQ (*r* = 0.682, *P* < *.001*), weak between SAS-SF and IAS (*r* = 0.229, *P* < *.001*), and moderate between PMPUQ and IAS (*r* = 0.277, *P* < *.001*). Among female students, the SAS-SF–IAS correlation was somewhat stronger (*r* = 0.301) than among male students (*r* = 0.209).

Factors Associated with Probable Smartphone Addiction

In univariate analysis, female sex was clearly associated with probable smartphone addiction (36.3% vs. 27.1%; *P* < *.001*). However, after adjustment for other sociodemographic and behavioral factors, sex was no longer independently associated with probable smartphone addiction in the multivariable model.

In the multivariable analysis, maternal middle school education, monthly household income of 3,000–5,000 TL, daily smartphone use duration, weekly internet use duration, and having a social networking account were independently associated with higher odds of probable smartphone addiction. In contrast, pet ownership and using a computer rather than a smartphone to access the internet were associated with lower odds. The model showed acceptable calibration according to the Hosmer–Lemeshow test (*P* = *.326*), with a Nagelkerke R^2 of 0.140. Full model results are presented in Table 2 and Figure 2.

Discussion

Smartphone addiction was evaluated together with problematic cell phone use and internet addiction among 2,482 undergraduate students included in the study. Because the data were collected approximately a decade ago, the findings should not be interpreted as current prevalence estimates, but rather as baseline data from the period of rapid smartphone diffusion. In this respect, the study provides an epidemiological reference point for contemporary comparisons.

Our prevalence estimate of 32.2% falls within the middle-to-upper range of global estimates. Meng et al.'s pooled estimate stood at 26.99%, while Lu et al.'s 2012–2022 update reached 37.1%.[4,5] For comparison, the Korean scale developers reported 27.9% in females and 23.8% in males, and Noyan et al.'s Turkish validation gave 28.0% and 26.7% with the same cut-offs.[16,17] A 2024 survey of 1,212 medical students at Selçuk University found similarly elevated rates, indicating that the 32.2% we observed reflects a wider pattern in Türkiye rather than an institutional outlier. Comparable rates in 2,337 Jordanian undergraduates point to the same pattern in nearby regions.[12,21]

Female students had a higher addiction prevalence than male students (36.3% vs 27.1%), in line with prior reports.[11,14] Once we adjusted for daily use duration, social media account ownership, and socioeconomic variables, however, sex was no longer independently associated with probable smartphone addiction. The pattern fits an interpretation centered on how — rather than how much — students of each sex use their phones: female students engage more with social media and messaging, while male students lean toward gaming and content consumption.[14] Lu et al. noted that the initial female-predominant prevalence has been drifting toward males, a shift likely tied to the spread of mobile gaming and always-on apps.[5]

Students whose mothers had middle school education had 1.47-fold higher odds of addiction, in line with literature linking parental education to technology habits and supervision. Notably, the association was confined to the middle school stratum, with no significant difference at higher education levels — a non-monotonic pattern possibly reflecting a transitional group with greater technology access but weaker supervision. Çelik and Ataş found a similar pattern in 600 Turkish university students, where daily use duration and check frequency were the strongest behavioral markers of mobile phone addiction.[14]

A noteworthy finding was the higher odds of probable smartphone addiction among students reporting a monthly household income of 3,000–5,000 TL compared with the lowest income group (≤1,000 TL). This should not be interpreted as a linear income gradient, since the highest income group (>5,000 TL) did not differ significantly from the reference group. In the 2015–2016 context, this middle-income band may have reflected sufficient access to smartphones and mobile data, whereas the lowest income group may have faced economic constraints limiting intensive use. Household income should therefore be interpreted as a contextual socioeconomic indicator rather than a direct determinant of

smartphone addiction.

A less-explored finding was the inverse link between pet ownership and smartphone addiction (OR=0.45). The literature offers convergent evidence: Kretzler et al.'s synthesis of 24 studies showed that pet ownership reduces social isolation in adults, and Haynes and Phillips found lower depression, stress, and loneliness among 391 pet-owning undergraduates.[22,23] Caring for a pet imposes structure on daily life, encourages time outside the home, and provides emotional companionship; any of these may displace compulsive phone checking. Replication in different samples and mechanistic study would be informative.

Having at least one social media account multiplied the odds of addiction by 2.50 and emerged as one of the strongest behavioral determinants in our model. This points to constant social media access as a central driver.[8,11] Each additional hour of daily smartphone use raised the odds by about 13% (OR=1.13), with each weekly internet-use hour contributing further (OR=1.01) — a dose-response pattern that flags use duration as a modifiable target for intervention. Students who reached the internet mainly through a computer had around 57% lower odds than those who used a phone (OR=0.43); the contrast shows how portability and always-available access shape addiction in ways that desktop use does not.[9]

The strong SAS-SF–PMPUQ correlation (r = 0.682) suggests these two instruments capture overlapping ground, with smartphone addiction reading more like an advanced form of problematic mobile phone use. The weaker SAS-SF–IAS correlation (r = 0.229) supports treating smartphone and internet addiction as partially separate constructs. Paterna et al.'s meta-analysis tied problematic smartphone use to lower academic achievement, Şan et al. identified daily internet use duration as a leading predictor of internet addiction in Turkish students during COVID-19, and Crowhurst and Hosseinzadeh's review of longitudinal studies named mental health problems, academic stress, and family dysfunction as the most consistent predictors.[10,13,24] Read together, these findings argue for treating smartphone and internet addiction not just as individual behavioral issues but as public health concerns that universities can address.

Limitations

This study has several limitations. The cross-sectional design precludes causal inference; therefore, the reported relationships should be interpreted as associations. All measures were self-reported and may be affected by social desirability bias. The sample was drawn from a single public university, limiting the generalizability of the findings to other university populations in Türkiye. The SAS-SF cut-off values used in this study were derived from a Korean sample, and Turkish population-specific cut-off values are not yet available, which limits the precision of prevalence estimation. Psychological variables such as depression, anxiety, sleep quality, and personality traits were not measured; therefore, the multidimensional nature of smartphone addiction could not be fully examined. Finally, the data were collected in 2015–2016, and the mobile technology ecosystem has changed substantially since then. Although the Hosmer–Lemeshow test indicated acceptable model calibration (P = .326), the modest Nagelkerke R^2 value of 0.140 suggests that further determinants — particularly psychological correlates — remain to be characterized. Some reference categories were small (students without social media accounts and pet owners), which may limit the precision of the corresponding odds ratios.

Conclusion

Among Gazi University undergraduates surveyed during Türkiye's 2015–2016 transition to mass smartphone ownership, the prevalence of probable smartphone addiction was 32.2%. Higher odds were carried by students whose mothers had middle school education, who fell in the middle income band, who used their phones longer each day, who spent more time online each week, and who held social media accounts; lower odds were carried by students who owned a pet and who reached the internet mainly through a computer. The crude sex difference was no longer evident in the adjusted model, pointing to behavioral and socioeconomic mediators rather than a direct effect of sex. The inverse pet ownership association deserves further investigation in future studies. Going forward, three steps look worthwhile: awareness programs for university students, campus environments that support face-to-face social interaction, and longitudinal studies to anchor Turkish population-specific cut-off values.

Declarations

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent

Written informed consent was obtained from all participating students.

Data Availability

The data supporting the findings of this study are available from the corresponding author on reasonable request.

Conflict of Interest

The authors declare no conflict of interest.

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Author Contributions (CRediT Taxonomy)

Conceptualization: Ö.A., F.N.B.A.
Methodology: Ö.A., F.N.B.A.
Investigation: Ö.A.
Data Curation: Ö.A.
Formal Analysis: Ö.A.
Writing – Original Draft: Ö.A.
Writing – Review & Editing: Ö.A., F.N.B.A.
Supervision: F.N.B.A.

AI Usage Disclosure

The authors declare that no AI-assisted technologies were used.

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Abbreviations

IAS: Internet addiction scale
IQR: Interquartile range
PMPUQ: Problematic mobile phone use questionnaire
SAS-SF: Smartphone addiction scale–short form
VIF: Variance inflation factor

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