

Internet Addiction in South Indian Adolescents: Prevalence and YDQ-IAT Diagnostic Agreement

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ABSTRACT

Background: The Internet has revolutionized global communication while introducing concerning patterns of maladaptive use among adolescents. Internet addiction has emerged as a significant public health concern requiring robust assessment methodologies. This study employs a dual-scale approach to evaluate internet addiction among adolescents, aiming to determine prevalence rates, identify associated risk factors, and assess the concordance between two established assessment instruments.

Methodology: A cross-sectional study was conducted among adolescents in the field practicing area of a tertiary care hospital over three months. Two structured assessment tools were employed: Young's diagnostic criteria and Young's Internet Addiction Test, administered through self-completed questionnaires. Demographic data and internet usage patterns were collected alongside addiction assessments. Kappa statistical analysis evaluated concordance between measurement instruments.

Results: The study comprised of 1138 participants where 363(31.9%) had internet addiction according to Young's diagnostic criteria, while Young's Internet Addiction Test classified 696(61.1%) participants with varying addiction levels (385 (33.8%) mild, 239(21%) moderate, 72(6.3%) severe). Male gender, college attendance, and increased daily internet usage were significantly associated with higher addiction rates ($p < 0.001$). Kappa statistics revealed poor agreement ($\kappa = 0.185$) between the two assessment tools.

Conclusion: Male gender, higher age, college attendance, and increased daily internet usage (particularly exceeding five hours) were significantly associated with internet addiction and also slight agreement between assessment tools were found.

Keywords: Internet addiction, kappa statistics, adolescent, Young's diagnostic criteria and Young's Internet Addiction Test

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INTRODUCTION

The modern era has witnessed revolutionary advancements across multiple domains, particularly in the realm of digital connectivity. The internet has emerged as a transformative force connecting disparate regions worldwide, embodying the concept of a "Global Village." This digital infrastructure serves numerous essential functions including information dissemination, commercial transactions, relationship building, social interaction, educational pursuits, retail activities, and entertainment consumption.¹ While the internet offers unprecedented opportunities and conveniences, its usage requires judicious management. Individual capacities for self-regulation vary considerably, some demonstrate sufficient self-control while others exhibit vulnerability to excessive use, potentially culminating in internet addiction.²

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, defines internet addiction disorder as "A pattern of excessive and prolonged internet gaming that results in a variety of cognitive and behavioural features, including growing loss of control over gaming, tolerance, and withdrawal symptoms that are similar to those of substance use disorders".³ Young has conceptualized the addictive potential of various internet modalities through several distinct classifications: cyber sexual addiction, cyber-relational addiction, net compulsions, information overload, and computer game addiction. These taxonomies reflect the diverse manifestations of problematic internet usage patterns and their potential to develop into clinically significant conditions resembling traditional substance use disorders in their phenomenology and neurobiological mechanisms.^{4,5}

With over 900 million internet users, India is the second-largest internet user behind China.⁶ The average time consumed by people on social media is about 2.4 hours, and for adolescents, it is up to 27 hours per week.⁷ Even before the COVID-19 pandemic, internet usage was prevalent; however, during and after this global health crisis, adolescent internet engagement escalated significantly. This increase was driven by multiple factors including the shift to online education platforms, heightened participation in gaming activities, and expanded utilization of social networking sites (SNS) and various communication tools. These altered patterns of internet consumption potentially contribute to a constellation of adverse outcomes, including sleep disturbances manifesting as insomnia, depressive symptomatology, diminished self-esteem, anxiety disorders, and personality trait disturbances. Additionally, problematic internet usage patterns may emerge alongside concerning interpersonal behaviours such as cyberbullying.⁸⁻¹⁰

Adolescence represents a pivotal developmental transition between childhood and adulthood, charac-

terized by profound physical, intellectual, emotional, and social transformations. During this critical period, individuals actively explore their emerging identities while progressively establishing independence from parental figures. This developmental significance underscores the rationale for focusing this research specifically on adolescents, with particular emphasis on late adolescence (16 - 19 years), as late adolescence involves psychosocial changes like identity formation, making this group particularly susceptible to internet addiction.^{11,12} Although behaviours deemed detrimental to health during adolescence may persist into adulthood, potentially resulting in adverse effects on quality of life.¹³

Late adolescence is a critical developmental period marked by the transition from school to higher education, and often from parental dependency to increased autonomy. This phase involves significant psychosocial changes, including identity formation, emotional regulation, and decision-making all of which may influence patterns of internet use and susceptibility to addiction.^{14,15} Internet addiction in Adolescence can also negatively impact identity formation, negatively impact cognitive functioning, result in poor academic performance and risky behaviour, and instil unhealthy eating habits.¹⁶ There have been studies conducted among school going students¹⁷⁻²⁰ and also college going students.^{9,21,22}

There are previous literature on internet addiction which has been conducted by using various scales such as BSMAS, SABAS, IGDS9-SF, NMPQ, s-IAT-sex to assess internet related disorders in different settings.^{23,24} In our study both YDC and IAT has been used. The Young's Diagnostic Questionnaire (YDQ) was chosen as it adapts the DSM-IV criteria for pathological gambling to internet use, providing a categorical diagnosis of addiction. In contrast, the Internet Addiction Test (IAT) assesses the graded severity of internet use problems on a continuous scale, allowing for finer distinctions. Both instruments have been used in Indian adolescent populations with acceptable psychometric properties; however, evidence regarding their concordance, particularly among South Indian adolescents, remains limited. This study therefore also explored the level of agreement between the two tools in this context.

Most existing studies examine either school or college students separately using different assessment tools, creating gaps in understanding internet addiction across the complete adolescent period. This scattered approach makes it difficult to compare findings and develop effective interventions that work across different educational settings. Therefore, this study addresses these limitations by including both school and college students and using two commonly used assessment tools - Young's Diagnostic Criteria and Young's Internet Addiction Test. We hypothesize that the poor agreement between YDQ and IAT may be attributable to their differing formats. YDQ employs a binary response structure aligned with categorical diagnosis, whereas the IAT

uses a Likert scale to capture graded severity. This fundamental difference in measurement approach could result in varying sensitivity, with the IAT more likely to detect mild or emerging cases that the YDQ might classify as non-addicted. Such discrepancies highlight the importance of selecting instruments based on the intended purpose whether for screening, prevalence estimation, or clinical diagnosis. By examining both educational groups together and evaluating the agreement between these widely-used instruments, the research provides a more comprehensive understanding of internet addiction patterns among adolescents. The study is aimed at determining the prevalence and associated factors contributing to internet addiction among adolescents, while simultaneously evaluating the concordance between two distinct measurement instruments designed to assess this phenomenon. This research was designed as a cross-sectional study aligned with STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for observational research.

METHODOLOGY

Study design and study duration: An analytical cross-sectional study was conducted for a period of 3 months, from December 2022 to February 2023.

Study Population and study setting: The study comprises a late adolescent age group of 16-19 years from the schools and colleges of the field practicing area of tertiary care hospital, Perambalur district of Tamil Nadu, South India, who have provided consent to participate in the study.

Ethical clearance: Ethics committee approval was taken from the institutional ethics committee of Dhanalakshmi Srinivasan Medical College, Perambalur (IECHS/IRCHS No.320, dated 07/03/2023) before the start of our study. Anonymity was ensured by using coded identifiers instead of personal information, and data were stored securely with restricted access. If the participants with severe internet addiction symptoms were identified, they were appropriately counselled and referred to the institutional counselling and mental health support services.

Sample size and sampling technique: According to Anand N et al²⁵ study, the sample size was calculated with the proportion of subjects with mild internet addiction, and using the formula $n = Z^2_{1-\alpha/2} pq/d^2$ [$Z_{1-\alpha/2} = 1.96$, $p = 27.1\%$, $q = 72.9\%$, $d = \text{absolute precision} = 3\%$], the final sample size came up to 1124 with an 80% response rate [taken into account absenteeism, incomplete forms and prior surveys], the final sample size was approximated to 1200.

In Perambalur district, the study employed a multi-stage random sampling technique to select schools and colleges. In the first stage, a comprehensive list of all secondary schools and undergraduate colleges within the field practice area of the tertiary care hos-

pital was created, identifying 15 eligible institutions (10 schools and 5 colleges). In the second stage, all 15 institutions were approached for participation in the study. After obtaining necessary administrative approvals and considering institutional willingness to participate, 8 institutions (5 schools and 3 colleges) granted permission to conduct the research. This represented a 53.3% institutional participation rate. In the third stage, from these 8 participating institutions, adolescents who met the inclusion criteria from classes 11 and 12 in schools, and first-year undergraduate programs in colleges were recruited. Based on the calculated sample size requirement of 1200 participants, allocated approximately 150 participants per institution. Students were selected using consecutive sampling on scheduled data collection days until the target number from each institution was reached. Through this approach, we successfully recruited 1138 participants (94.8% of the targeted sample size), with non-participation primarily due to absenteeism and incomplete questionnaires. To ensure proper age verification, all participants' ages were confirmed using official school/college identification cards. Prior to data collection, an informed consent was obtained. For those under 18 years of age, informed consent from parents or legal guardians and assent was obtained. Additionally, institutional permission was obtained from the respective heads of the educational institutions.

Study tool: The research instrument utilized was a structured questionnaire YDQ and IAT was administered by trained investigators through face-to-face interviews. Both tools were pilot-tested among 50 adolescents from the study setting to ensure cultural appropriateness, clarity, and comprehensibility, generating a Cronbach's alpha of 0.92 for IAT and 0.69 for YDQ. These pilot study participants were excluded from the final analysis to maintain data integrity. Responses were digitally recorded in customized Google Forms interface. Data collection was conducted using a structured, self-administered questionnaire consisting of four distinct sections:

Section 1: Sociodemographic Profile This section captured essential demographic information including age, gender, place of residence (urban/rural), type of educational institution (school/college), and specific class/department details.

Section 2: Internet Usage Patterns This component assessed baseline internet usage behaviours, including primary access devices (smartphone, computer, tablet), preferred platforms (social media, gaming, educational sites, entertainment), daily time spent online (weekdays and weekends separately), and predominant location of internet use (home, educational institution, public spaces).

Section 3: Young's Diagnostic Questionnaire (YDQ)⁴ The YDQ consists of eight dichotomous (yes/no) items based on DSM-IV criteria for pathological gambling, adapted for internet use. The crite-

ria assessed were spending more time online than intended; preoccupation with internet activities; withdrawal symptoms when unable to access the internet; unsuccessful attempts to control internet use; craving for internet access; loss of interest in offline activities; continued excessive use despite knowledge of negative consequences; and using the internet to escape negative emotions. Participants meeting five or more criteria were classified as having internet addiction. The internal consistency of the domain questions was assessed by Cronbach's alpha which came to 0.77.

Section 4: Young's Internet Addiction Test (IAT)²⁶

The IAT comprises 20 items rated on a 5-point Likert scale (0 = does not apply, 1 = rarely, 2 = occasionally, 3 = frequently, 4 = often, 5 = always). The questions evaluate three main domains: impact on daily functioning (academic/work performance, sleep patterns, household responsibilities); social and emotional relationships (forming online relationships, defensive behaviours, mood changes when offline); and dependency patterns (loss of control over time spent online, preoccupation with internet use, withdrawal symptoms). Total scores range from 0 to 100, with the following classification: 0-30: Normal internet use; 31-49: Mild internet addiction; 50-79: Moderate internet addiction; 80-100: Severe internet addiction. The IAT demonstrated excellent internal consistency in the study sample (Cronbach's $\alpha = 0.97$), indicating high reliability, and acceptable reliability for the YDQ.

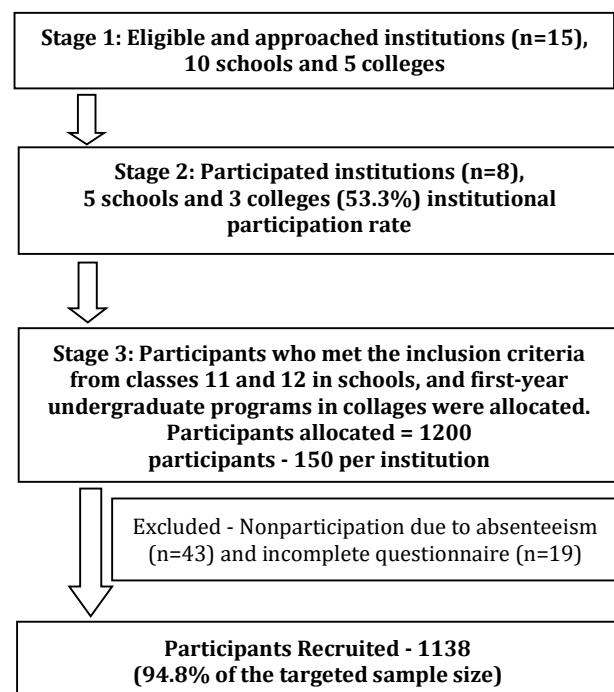


Figure 1: Strobe flowchart of participant recruitment

Statistical analysis: The data was viewed in Microsoft Excel (Microsoft Corporation, Redmond, WA), and analysed using SPSS version 26 (IBM Corp., Ar-

monk, NY). The categorical variables were expressed as tables (frequency, percentage), bars, and pie diagrams. The continuous variables were represented by the mean (SD) and correlation was performed for continuous variables. Association between internet addiction and basic characteristics were analysed by using Chi-square. *Probability (p)* value less than 0.05 was statistically significant. The agreement between the two scales was analysed using kappa statistics. We have also used sensitivity, specificity, YDQ relative to IAT as the reference and McNemar's test.

RESULTS

Sociodemographic and internet usage patterns:

The study included a total of 1,138 adolescents. Participants had a mean age of 18.00 ± 0.19 years. Males constituted a majority of the sample ($n=646$, 56.8%), while females represented 43.2% ($n=492$). The educational distribution showed that most participants were college students ($n=880$, 77.3%), with the remaining 22.7% ($n=258$) enrolled in schools. Regarding residential demographics, slightly more than half of the participants resided in rural areas ($n=601$, 52.8%), while 47.2% ($n=537$) were from urban settings.

Analysis of daily internet usage patterns revealed that nearly half of the participants ($n=537$, 47.2%) spent 1-2 hours online daily, followed by 31.3% ($n=356$) who used the internet for 2-4 hours, 12.1% ($n=138$) for 4-5 hours, and 9.4% ($n=107$) reporting more than 5 hours of daily internet use. (Table 1)

In this study 100% of the participants access the internet. Most of the study participants, or about 97.36%, use mobile phones, whereas only 2.5% of the study participants use laptops for accessing the internet.

The modes of internet usage were assessed by taking most of the multiple options. Among the study participants, about 42.53% use social media for entertainment purposes, followed by OTT at about 29.61%. About 25.92% use the internet for study platforms such as BYJU'S, classrooms, assignments. About 1.93% use the internet for gaming purposes, which is depicted in Table 2.

Internet addiction assessment using Young's Diagnostic Questionnaire (YDQ):

In the study, internet addiction using Young's diagnostic criteria was assessed, where 363 (31.9%) have internet addiction and 775 (68.1%) of the study participants do not have internet addiction. Among the responses to Young's diagnostic criteria, the majority have responded that they are preoccupied with the internet (51.5%) (Table 3).

Internet addiction assessment using Young's internet addiction test:

According to Young's internet addiction test, about 442 (38.8%) study participants do not have internet addiction, whereas about 696 (61.1%) have internet addiction. Among the partici-

pants with internet addiction, about 385 (33.8%) have mild internet addiction, followed by 239 (21%) of the study participants with moderate internet addiction, followed by 72 (6.3%) with severe dependence on the internet. (Table 4)

Figure 2 shows a gradient where the green, yellow indicated the less addiction, grey indicates neutral and red indicates severe addiction. The gradient of red shows the proportion of the response. Among the respondents to Young's internet addiction test, about 12.3% have responded that they prefer the internet to spending time with their friends.

According to Young's diagnostic criteria, a significant proportion of participants showed evidence of internet addiction, though the majority did not meet the diagnostic threshold. Gender showed a strong association with internet addiction prevalence ($p < 0.001$), with males demonstrating substantially higher rates (40.6%, $n=262$) compared to females (20.5%, $n=101$). Educational level also showed a significant relationship with internet addiction ($p=0.010$), as college students exhibited higher prevalence rates (33.9%, $n=298$) than school students (25.2%, $n=65$). However, place of residence showed no significant association with internet addiction ($p=0.702$), with similar rates observed in urban (31.3%, $n=168$) and rural participants (32.4%, $n=195$). The prevalence of internet addiction increased progressively with hours spent online: 26.3% ($n=141$) among those using the internet for 1-2 hours daily, 30.1% ($n=107$) for 2-4 hours, 41.3% ($n=57$) for 4-5 hours, and notably, 54.2% ($n=58$) among those reporting more than 5 hours of daily internet use ($p < 0.001$). A Pearson correlation analysis further revealed a weak but statistically significant positive correlation between participant age and internet addiction ($r=0.081$, $p < 0.001$), indicating that internet addiction tendency marginally increases with age among these adolescents. (Table 5)

Table 1: Daily Internet usage pattern (n =1138)

Hours spent on internet per day	Adolescent (%)
1-2	537(47.2)
2-4	356(31.3)
4-5	138(12.1)
>5	107(9.4)

Table 2: Platforms for internet access (n =1138)

Platforms for internet usage	Adolescent (%)
Social media	485(42.62)
OTT	336(29.53)
Study platforms (BYJU'S, classrooms, assignments)	295(25.92)
Gaming	22(1.93)

Table 3: Distribution of responses in Young's diagnostic criteria (n=1138)

Variables	Yes (%)
Felt preoccupied with internet	586 (51.5)
Increased use of internet for more time to achieve satisfaction	489 (43)
Repeatedly made unsuccessful efforts to control, cutback or stop internet use	495 (43.5)
On attempting to cut down or stop internet usage felt restless, moody, depressed, irritable	409 (35.9)
Staying online than originally intended	421 (37)
Lied to family members, therapist or others to conceal the extent of involvement in the internet	345 (30.3)
Using internet as a way of escaping problem or relieving a dysphoric mood	572 (50.3)

Table 4: Assessment of internet addiction by Young's internet addiction test (n=1138)

Internet usage	Adolescent (%)
Mean $\pm$ SD	41.32 $\pm$ 20.24
Normal	442 (38.8)
Mild internet addiction	385 (33.8)
Moderate internet addiction	239 (21)
Severe dependence on internet	72 (6.4)

Variables	Rarely	Occasionally	Frequently	Often	Always
Stay online longer than you intended	47.8	24	13.2	5.3	9.8
Neglect household chores to spend more time on - line	46	27.2	11.7	7.6	7.6
Prefer the excitement of the internet to spending time with friends	41.7	22.5	16.4	7	12.3
Form new relationship with fellow online users	58.3	19.7	9.4	5.8	6.8
Others complaining about the amount of time spent on line	49.4	22.8	12.1	6.7	9
Decrease in academic performance due to increased amount of tie spent online	44.6	24.4	11.5	8	11.4
Check social media before something else that you need to do	39.2	27	15.3	8.2	10.4
Productivity of school / college suffers due to internet	46	23.1	12.8	8	10
Becomes defensive or secretive when anyone asks their work online	54.2	21.3	10.7	6.2	7.6
Block out disturbing thoughts about life with soothing thoughts of the internet	45.5	26.9	12.2	7.7	7.6
Find yourself anticipating when you will go online again	49.5	25.2	9.8	7.4	8.2
Fears that life without the internet would be boring, empty, and joyless	45.2	23.7	12.7	7.8	10.6
Snap, yell or act annoyed if someone bothers you when you are on - line	53.3	21.3	11.5	6.9	7.1
Lose sleeps due to late night log - ins	47.6	24.9	11	8.2	8.3
Felt preoccupied with internet when offline, or fantasize about being on - line	50.7	22.1	12	7.4	7.9
Find yourself "just a few more minutes" when online	39.4	27.4	14.4	8	10.8
Try to cut down the amount of time spend online and fail	45.6	23.3	12.9	8.2	10
Hidden the time of being online	49.9	22.8	11.6	6.9	8.8
Choose to spend more time online over going out with others	49.6	21.5	13.1	7.1	8.6
Felt depressed, moody, or nervous when you are offline, which goes away once you are back online	48.2	23.6	11.7	7.2	9.4

Figure 2: Distribution of responses in Young's internet addiction test (n=1138)

Table 5: Association between basic characteristics and internet addiction by using Young's diagnostic criteria

Variables	Addicted (%)	Not Addicted (%)	OR (95%CI)	P value
Gender				
Male	262(40.6%)	384(59.4%)	2.64(2.01 - 3.46)	<0.001*
Female	101(20.5%)	391(79.5%)	Ref	
Class				
School	65(25.2%)	193(74.8%)	Ref	0.010*
College	298(33.9%)	582(66.1%)	1.52(1.11 - 2.08)	
Place of residence				
Urban	168(31.3%)	369(68.7%)	Ref	0.702
Rural	195(32.4%)	406(67.6%)	1.05(0.82 - 1.35)	
Hours spent per day on internet				
1 - 2	141(26.3%)	396(73.7%)	Ref	<0.001*
2 - 4	107(30.1%)	249(69.9%)	0.30(0.19 - 0.46)	
4-5	57(41.3%)	81(58.7%)	0.36(0.23 - 0.56)	
>5	58(54.2%)	49(45.8%)	0.59(0.35 - 0.98)	

Variables such as gender, class, place of residence, hours spent on the internet - Chi-square test [represented as frequency (%)], *p value - <0.05 considered significant.

Table 6: Association between basic characteristics and internet addiction by using Young's internet addiction test

Variables	Normal (%)	Mild (%)	Moderate (%)	Severe (%)	P value
Gender					
Male	217(33.6)	222(34.4)	152(23.5)	55(8.5)	<0.001*
Female	225(45.7)	163(33.1)	87(17.7)	17(3.5)	
Class					
School	123(47.7)	74(28.7)	51(19.8)	10(3.9)	0.005*
College	319(36.3)	311(35.3)	188(21.4)	62(7)	
Place of Residence					
Urban	204(38)	181(33.7)	111(20.7)	41(7.6)	0.392
Rural	238(39.6)	204(33.9)	128(21.3)	31(5.2)	
Hours spent per day on internet					
1 - 2	271(50.5)	163(30.4)	80(14.9)	23(4.3)	<0.001*
2 - 4	120(33.7)	147(41.3)	76(21.3)	13(3.7)	
4-5	35(25.4)	51(37)	43(31.2)	9(6.5)	
>5	16(15)	24(22.4)	40(37.4)	27(25.2)	

Variables such as gender, class, place of residence, hours spent on the internet - Chi-square test [represented as frequency (%)], *p value - <0.05 considered significant.

Table 7: Odds ratio of association between basic characteristics and Young's internet addiction

Variables	Normal	Mild	Moderate	Severe
Gender				
Male	Ref			
Female	Ref	0.70 (0.53 - 0.93)	0.55(0.40 - 0.76)	0.29(0.16 - 0.53)
Class				
School	Ref			
College	Ref	1.62(1.16 - 2.24)	1.42(0.97 - 2.06)	2.39(1.18 - 4.81)
Place of Residence				
Urban	Ref			
Rural	Ref	0.96(0.73 - 1.27)	0.98(0.72 - 1.35)	0.64(0.39 - 1.07)
Hours spent per day on internet				
1 - 2 hours	Ref	0.40(0.20 - 0.77)	0.11(0.06 - 0.22)	0.05(0.02 - 0.10)
2 - 4 hours		0.81(0.41 - 1.60)	0.25(0.13 - 0.48)	0.06(0.02 - 0.14)
4-5 hours		0.97(0.45 - 2.08)	0.49(0.23 - 1.02)	0.15(0.05 - 0.39)
>5 hours		Ref		

The severity of internet addiction, as measured by Young's Internet Addiction Test, demonstrated significant variation across several demographic factors. Gender was strongly associated with addiction severity levels ($p<0.001$). Males exhibited higher rates of moderate (23.5%, $n=152$) and severe (8.5%, $n=55$) internet addiction compared to females, who showed predominantly normal (45.7%, $n=225$) or

mild (33.1%, $n=163$) internet usage patterns. Only 3.5% ($n=17$) of females displayed severe internet addiction compared to 8.5% of males. Educational level also showed significant differences in addiction severity ($p=0.005$). College students demonstrated higher rates of severe internet addiction (7.0%, $n=62$) compared to school students (3.9%, $n=10$). The proportion of normal internet users was notably

higher among school students (47.7%, n=123) than college students (36.3%, n=319). Place of residence, however, did not significantly influence addiction severity ($p=0.392$), with similar distributions observed across urban and rural participants. Among participants using the internet for 1-2 hours daily, 50.5% (n=271) exhibited normal usage patterns, with only 4.3% (n=23) showing severe addiction. In comparison, among those spending more than 5 hours daily online, only 15.0% (n=16) maintained normal usage patterns, while 25.2% (n=27) demonstrated severe addiction and 37.4% (n=40) showed moderate addiction ($p<0.001$). (Table 6) The odds ratio and the confidence interval of the associations are depicted in Table 7.

Among the participants 279(76.9%) were diagnosed to have internet addiction by both YDQ and IAT, 358(46.2%) were diagnosed normal by both YDQ and IAT. The 279(76.9%) were classified as mild, moderate, severe which is depicted in Table 8. The kappa coefficient was calculated at 0.185, with a

highly significant p-value (<0.001). According to standard interpretation of kappa values, this represents a "slight" agreement between the two assessment tools (kappa values between 0.01-0.20 are typically considered to indicate slight agreement). McNemar's test revealed a statistically significant difference between YDQ and IAT ($p<0.001$). The majority of discordant cases were adolescents classified as addicted by IAT but not by YDQ, suggesting that YDQ has lower sensitivity and tends to miss milder cases of internet addiction compared to IAT (Table 9). The Sensitivity of YDQ relative to IAT was 40.1% (95% CI: 35.1% - 45.1%) and specificity was 81% (95% CI: 78.2% - 83.8%). A Spearman's rank correlation analysis was conducted to examine the relationship between Young's Internet Addiction Test scores and Young's Diagnostic Questionnaire scores. Results revealed a moderate positive correlation ($r_s = 0.411$, $p<0.001$, $n = 1138$), indicating a statistically significant association between the two measurement instruments despite their limited agreement on categorical classification of internet addiction severity.

Table 8: Association between Youngs Diagnostic criteria and Youngs internet addiction test

Young's diagnostic criteria	Young Internet addiction test				P value
	Normal (%)	Mild (%)	Moderate (%)	Severe (%)	
Internet addiction present	84 (23.1)	116 (32)	117 (32.2)	46 (12.7)	<0.001*
Internet addiction absent	358 (46.2)	269 (34.7)	122 (15.7)	26 (3.4)	

Chi-square test [represented as frequency (%)], *p value - <0.05 considered significant.

Table 9: Kappa statistics between young's diagnostic criteria & Young internet addiction test

Young's diagnostic criteria- internet addiction	Young Internet addiction test		Kappa statistics [95% CI]	Mc Nemar	P value
	Present	Absent			
Present	279(76.9%)	84(23.1%)	0.185[0.145-0.225]	<0.001	<0.001
Absent	417(53.8%)	358(46.2)			

DISCUSSION

In the study, internet addiction was found to be in 363 (31.9%) according to Young's diagnostic criteria, and about 696 (61.1%) have internet addiction according to Young's internet addiction test. Among them, 385 (33.8%) had mild internet addiction, 239 (21%), had moderate internet addiction, and 72 (6.3%) had severe internet addiction. In another study by George M et al²⁷ in Kerala among medical students shows that adults [mild 107 (54%) and moderate 34 (17%)] had internet addiction. In both the studies, more than 50% of the study participants have internet addiction, and mild internet addiction is more than moderate addiction. This may be due to the age group in both studies, which is the adolescent group, where they have more internet usage for educational and gaming purposes. The findings also align with the study by Anand N et al²⁵ where 27.1% had mild internet addiction, 9.7% had moderate internet addiction and 0.4% had severe internet addiction. Whereas a study conducted by Jaiswal A et al¹⁹ Jodhpur district among undergraduates has showcased though the prevalence of internet addiction is more than 50% the moderate internet addiction is higher than the mild internet addiction. This difference may

result from varying study settings and the exclusive inclusion of undergraduates, who typically have greater internet access and autonomy compared to school-going adolescents. In all the studies which used IAT, overestimation of the internet addiction was present. A meta-analytic work of Indian samples reports pooled prevalences for any level of IA (as per IAT) in the range of ~36%-58% depending on severity thresholds, with wide confidence intervals reflecting heterogeneity between studies. The higher prevalence observed with IAT in our sample likely reflects its dimensional (Likert) format and greater sensitivity to mild and moderate internet-related problems, whereas YDQ (binary items, categorical threshold) identifies fewer, more clear-cut cases.²⁸ This is in contrast to a meta-analysis done by Li L et al²⁹ where the IAT showed a prevalence of 11.2% among 39,354 samples, which is attributable to our post-COVID data collection period capturing elevated internet usage patterns and our specific focus on late adolescents in educational settings who demonstrate characteristically higher internet engagement compared to the diverse populations included in their broader analysis.

The participants spend majority of their time in so-

cial media and least in Games in the study whereas a study conducted in Turkey by Kaya A et al³⁰ among adolescent (school going) majority of the study participants have spent time in social media but on the other hand, gaming was the second highest mode of spending on internet. This variation may be attributed to differences in study settings and population demographics, as school-going students typically demonstrate higher engagement in online gaming compared to their college-going counterparts.

The males were found to have more internet addiction than the females by using both Young's diagnostic criteria and Young's internet addiction test in the study. Similarly, a study conducted in Taiwan by Tsai HF et al³¹ showed positive relationships between Internet addiction and male gender. The reason may be due to the fact that males may be more involved in gaming than the females which could have led to more internet addiction of males than females. Whereas a study conducted by Kuss DJ et al¹⁶ concluded that females have more internet addiction than males by using AICA-S scores. The disparity may be because more than two third of the participants were females and the study population consist of not only adolescent females but also the females of reproductive and elderly population.

In the study, college-going students have more internet addiction than school-going students in both the tools used for internet addiction. Similarly, a study conducted in Iran by Alavi SS et al³² concluded that undergraduates and bachelors have internet addiction. Also, a study conducted by Orsal O et al³³ has concluded that 1st year students in various departments have internet addiction. This may be due to the reason that school-going students have more restrictions on using mobile phones than college-going students and hence the school going students have less usage and hence less internet addiction.

Based on the study conducted by Dhawan V³⁴, urban populations have increased usage of the internet compared to rural populations. Similarly, in this study, internet addiction is higher among the urban population than among the rural population. This could be due to the high internet access of urban dwellers.

The increase in hours spent a day on the internet has led to an increase in internet addiction in either of the tools. Similarly, a study conducted among African adolescent by Zewde EA³⁵ shows that the participants who reported more than 4 hour/day of internet usage has two times odds of addiction than the participants with less time spent on internet. A study conducted in Maharashtra³⁶ has also concluded that an increase in staying online for a longer time has led to internet addiction. Similarly, a study conducted by Tonioni F et al³⁷ among patients with complaints of problematic internet usage concluded that the number of weekly hours spent online has a positive correlation with internet addiction disorders. Thus, as increase in the hours of exposure to internet there is

an increase in the addictiveness to the internet.

This study also compares the agreement between the two diagnostic tests for internet addiction. Kappa statistics show that there is only slight agreement ($\kappa = 0.185$), and hence the two diagnostic tests have less agreement. This may be due to the subjective answering of responses and can also be due to the reason where YDQ applies a strict binary cutoff, overlooking subclinical cases that are captured by IAT's graded scale. In practice, this means that many adolescents categorized as "mild" or "moderate" by IAT were classified as "non-addicted" by YDQ. Such differential classification reduces concordance despite both tools aiming to assess internet addiction.

STRENGTH AND RECOMMENDATIONS

This study benefits from a large sample size exceeding the calculated requirement, enhancing statistical power and representativeness. Also, dual-scale methodology allowed comparison between established assessment tools, while comprehensive assessment of internet usage patterns provided contextual understanding of addiction behaviours. The inclusion of both rural and urban adolescents enhanced generalizability across different settings within South India.

The poor agreement between the two assessment tools underscores the need for development of a hybrid tool combining YDQ's simplicity with IAT's severity grading and implementation of school-based screening using IAT for its sensitivity in mild cases. Implementation of targeted screening programs for high-risk groups, particularly male adolescents, college students, and heavy internet users, is warranted. Educational interventions promoting healthy internet use should be incorporated into school and college curricula, with special attention to social media and entertainment platforms. Future research should employ longitudinal designs to better understand the development and progression of internet addiction over time, while exploring relationships with academic performance, mental health outcomes, and social functioning. Collaboration between educational institutions, healthcare providers, and technology companies is essential to create comprehensive prevention and intervention strategies tailored to the needs of South Indian adolescents.

LIMITATIONS

The cross-sectional design limits causal inferences between identified risk factors and internet addiction. Self-reported data may be subject to recall and social desirability biases, potentially affecting response accuracy. There can be also reporting bias and inflated prevalence. The missing data on comorbidities such as depression, anxiety, stress limits the causal inference. Longitudinal follow-up is needed to assess addiction progression. The limited agreement

between assessment tools raises questions about the validity of current diagnostic approaches, while the focus on a specific geographical region and age group may restrict broader applicability.

CONCLUSION

This cross-sectional study examined internet addiction among South Indian adolescents using dual assessment tools and revealed several important findings. The prevalence of internet addiction varied substantially between measurements instruments, with Young's Internet Addiction Test identifying a higher proportion of affected adolescents (61.1%) compared to Young's Diagnostic Criteria (31.9%). Male adolescents showed significantly higher rates of internet addiction than females across both measurement instruments. Similarly, college students exhibited higher rates compared to school students, and there was a clear dose-response relationship between daily internet usage and addiction severity. Beyond prevalence, the poor scale agreement highlights diagnostic challenges; recommend validating tools in diverse Indian populations. Future research should employ advanced metrics like intraclass correlation for continuous scores and explore AI-based tools for addiction assessment.

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Availability of Data: The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Non-use of Generative AI: The authors affirm that no generative artificial intelligence tools were utilized in the design, analysis, interpretation of data, or preparation of this manuscript. All content is the result of the authors' original work.

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