

ORIGINAL ARTICLE

ASSOCIATION OF ANXIETY AND DEPRESSION IN RELATION TO SMARTPHONE ADDICTION AMONG UNIVERSITY STUDENTS IN INDIA

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ABSTRACT

Smartphone addiction results in mental health disorders especially among youth. Only few studies are done among youth in rural areas. This study was conducted to find the association of anxiety, depression and stress in relation to smart phone addiction in rural undergraduate students. A Cross sectional survey was done among university students in rural part of south India in 2018. 684 students from four different colleges participated in the study, and Depression Anxiety Stress Scale (DASS-21) and Smart phone Addiction Scale - Shorted version questionnaire (SAS-SV) scales were used. Descriptive analysis in terms of mean, standard deviation and categorical analysis as percentage and frequencies were applied. Overall 413 (60.4%) students were using smart phone, and the prevalence of smart phone addiction was around 26.8% and was found to be common among males than females ($p < 0.001$). Depression and stress were progressively greater with increasing usage across the three groups ($p < 0.001$). There was statistically significant weak positive correlation between the total depression ($r = 0.16$; $p < 0.001$), anxiety ($r = 0.10$; $p < 0.05$), and stress scores ($r = 0.24$; $p < 0.001$) with total addiction scores. Simple linear regression showed that with one unit increase in addiction scores there was significant increase in depression ($B = 0.156$, $p = 0.002$), anxiety ($B = 0.098$, $p = 0.046$), and stress scores ($B = 0.236$, $p < 0.001$) and multiple linear regression showed stress was more significantly associated with addiction than depression and anxiety ($B = 0.243$; $p < 0.001$). Alarming higher prevalence of depression, anxiety and stress among rural college students is a serious concern. Life skills education would address these growing public health problems.

Keywords: Smart phone, Prevalence, Depression, Anxiety, Students

INTRODUCTION

Smartphone usage is rapidly increasing globally, with greater advancement in the e-technology and their availability it has become an essential device, which performs functions of a computer with features of touch screen interface, Internet access and an operating system capable of running downloaded applications. This has led to wider social phenomenon in its usage such as social networking, emails, watching videos, listening to music, gaming and Internet browsing¹. Its usage has tremendous scope for enhancing the higher education through its multiple features such as speedy communication, rapid access to information and augmented organization^{2, 3}.

Youths are the most vulnerable population. Nearly 30% of world's population is formed by youth in the age group between 10 years and 24 years old. In India youths constitute around 242 million⁴. The proportion of smart phone usage is highest among 16 -24 years age group, which is around 34% when compared to others age groups showing an exponential growth⁵. Despite having enormous advantages such as networking and social networking various studies done across the globe

indicates impact of excessive phone use on daily life, health and safety among youth population^{6, 7}. Youth who use mobile phones excessively have trouble controlling their time of using mobile phones and are more likely to suffer from depression, anxiety disorder and self-esteem disturbances^{8, 9}.

The World Health Organisation (WHO) defines addiction or dependence, as the continuous use of something for the sake of relief comfort, or stimulation, which often leads to excessive use, use despite harmful impact of self or family, and occurrence of withdrawal symptoms including physical effects and craving when it is absent¹⁰. Kuppam is a town bordering three states in south India, consists of mainly people from rural areas and majority of the University Students studying in different educational institutions are from rural areas. To the best of our knowledge, there have been no studies looking at the usage of Smart phones by the youth particularly from rural area. There was a felt need to study smart phone usage and addiction to smart phone. Hence this study was undertaken to find out the prevalence of smart phone usage & addiction, and also assess their relationship with depression and anxiety.

METHODS

This cross sectional study was conducted in the Kuppam town of Chittoor district of Andhra Pradesh state in Southern part of India, between July 2018 and December 2018. The town has a total of six colleges under the university of which one was run by government and other five were managed by private authorities. Approval from the Institutional Human Ethics Committee, (PESIMSR/IHEC/20) was obtained. Students studying in various colleges under the university were included as study participants after obtaining the informed consent and those who were not using smart phones and not willing to participate were excluded.

Sample size was calculated by Leslie Kish formula for cross-sectional study designs¹¹. Based on the 40% prevalence of smart phone dependence found in the Aggarwal Study⁸, 95 % confidence interval & design effect of 1, sample size worked out to be 600 using the following formula:

$$n = \frac{Z_{1-\alpha/2}^2 * p(1-p)}{d^2}$$

An Additional 10% was added to sample to counter non-response from students.

One Government college and three private colleges were selected by simple random sampling, after permission to approach students from the college administration. Each institution was considered as a cluster. A total of 684 university students through cluster sampling participated in the study. All the students who gave informed consent participated in the study.

Data was collected from the study participants using the pre tested semi structured questionnaire containing general information like socio demographic details, supporting family status, Smart phone Addiction Scale - Shortened Version questionnaire (SAS-SV scale) and Depression Anxiety Stress Scale (DASS scale).

SAS-SV scale is a simple tool with 10 questions and it is rated on a dimensional scale 1-6 (1: "Strongly disagree" to 6: "Strongly agree") and with the internal consistency and concurrent validity of SAS were verified with a Cranach's alpha of 0.911⁹. DASS -21 scale is a shortened version of validated 42-item DASS questionnaire which includes three self-reporting scales to measure the Depression, Anxiety, and Stress^{12, 13}. Each of the three scales contains 7 items with a total of 21 questions. In addition, respondents were asked to use the 4-point severity/frequency scales to rate the extent to which they have experienced each state over the past week. Scores higher than 10, 8 and 15 were considered as Depression, Anxiety, and Stress respectively. Based on the scores derived from the interview, the prevalence of Depression Anxiety Stress was generated accordingly.

Statistical Analysis:

The data collected was analysed using Statistical Package for Social Sciences (SPSS) version 25. Categorical data were summarized by percentages and the continuous data by means and standard deviation. Inferential statistical tests like Chi square test, Fischer exact test, T test, spearman correlation tests and linear regression were done to find out relationship between smart phone addiction and factors like depression, anxiety and stress. Preliminary analysis was done to ensure assumption of normality is not violated. Depression, anxiety and stress were the independent variables whereas the smart phone addiction was the dependent variable in the regression analysis and p value of less than 0.05 was considered as statistically significant.

RESULTS

Sample Characteristics

A Shapiro-Wilk's test and a visual inspection of their histograms, normal Q-Q plots and box plots showed that the smart phone addiction scores were approximately normally distributed for depression [extreme (p=0.489), severe (p=0.101 (p=0.30)], anxiety [extreme (p=0.29), severe (p=0.148), moderate (p=0.41)] and for stress [extreme (p=0.292), severe (p=0.146), moderate (p=0.131)]. The skewness and kurtosis of all the independent variables were within the range of -1.96 to 1.96.

A total of 684 college students participated in the study of which 542 (79.3%) were from colleges run by private authority and rest of 142 (20.7%) were from government college. 386 (56.4%) were females and 298 (43.6%) males. The mean age of study participants was 18.57±1.09 years.

More than half (54.3%) of the study participants were below the age of 18 years and 312 (45.7%) were 18 years and above. 680 (99.4%) were unmarried, 637 (93.1%) mentioned their religion as Hindu and 39 reported their religion as Muslim and 8 of them said they belong to Christianity. 669 (97.8%) were living in their house and travelled to college, whereas 15 people stayed in the hostel away from home for their courses. Only four (0.6%) reported that they were smokers and 16 (2.4%) reported drinking alcohol (Table 1).

Smart phone usage

Overall 413 (60.4%) out of total of 684 participants reported using smart phone. The proportion of smart phone usage was more by students from private colleges (64%) when compared to government college students (46.5%) and this was found to be statistically significant (p<0.001). Statistically significant difference was observed with respect to gender wise smart phone usage which was high among males (81.3%) when compared to female students (44.4%).

Similarly smart phone usage was more among those participants who were more than 18 years of age (67%) in comparison to below 18 years of age (54.8%). All those who reported drinking alcohol compared to those not consuming (59.4%). These differences were found to be statistically significant ($p < 0.001$). However marital status and current place of stay were not significant in terms of smart phone usage (Table 1).

Pattern of Use:

Majority of users (66.1%) owned Smart phones for less than a year. The duration of owning a phone, number of calls made in a day, time spent on Smart phone in a day, using for social networking, email, watching videos, and reading news were all more among males than females and these were statistically significant. Self-perception of addiction to Smart phone was also higher among males (38.4%) than females (24%).

Table 1. Socio-demographic factors of College students in relation to smart phone usage (n=684)

Factor	Smart phone Usage		Total	χ^2 value	p-value
	Present (413)	Absent (271)			
Type of college				14.47	<0.001*
Government	66 (46.5%)	76 (53.5%)	142(20.7%)		
Private	347 (64%)	195 (36%)	542(79.3%)		
Gender				95.75	<0.001*
Male	242 (81.3%)	56 (18.7%)	298(43.6%)		
Female	171 (44.4%)	215 (55.6%)	386(56.4%)		
Age group				10.46	0.001*
<18years	204 (54.8%)	168 (45.2%)	372(54.3%)		
18years & above	209 (67.0%)	103 (33.0%)	312(45.7%)		
Religion				5.54	0.019*
Hindu	377 (59.2%)	260 (40.8%)	637(93.1%)		
Others	36 (76.6%)	11 (23.4%)	47(6.9%)		
Smoking habit					0.104
Present	4 (100.0%)	0 (0.0%)	4(0.6%)	2.64	
Absent	409 (60.1%)	271 (39.9%)	680(99.4%)		
Alcohol habit				10.75	0.001*
Present	16 (100.0%)	0 (0.0%)	16(2.4%)		
Absent	397 (59.4%)	271 (40.6%)	668(97.6%)		
Marital Status				0.35	0.549
Married	3(75%)	1(25%)	4(0.6%)		
Unmarried	410(60.3%)	270(39.7%)	680(99.4%)		
Current place ore				0.25	0.615
Hostel	10(66.6%)	5(33.4%)	15(2.2%)		
Home	403(60.3%)	266(39.7%)	669(97.8%)		

(*p-value <0.05 is statistically significant)

Smart phone Addiction pattern:

Out of 413 smart phone users 183 (44.4%) were addicted to smart phone by SAS-SV scale. The mean SAS-SV score was 30.72 with SD of 9.80 (range 10 - 58). Overall 26.8% of the study population was addicted to smart phone. The mean SAS-SV score for males was 31.69 with SD of 9.6 and for the females it was 29.34 with SD of 9.85. SAS-SV scores ≥ 31 for males and ≥ 33 for females was considered as addiction.

Among the smart phone users gender wise comparison shows that the proportion of addiction to smart phone was more among males (58.6%) than females (41.4%) and this was statistically

significant (Table 2). Those using smart phones for more than 1 hour per day were addicted than using for less than 1 hour per day.

Depression, Anxiety and Stress:

In the present study the mean scores of depression, anxiety and stress were (24.51 $\pm$ 2.2), (24.31 $\pm$ 6.7) and (26.37 $\pm$ 6.9) respectively. The proportion of extreme, severe and moderate for depression (32% vs30.6% vs37.4%), anxiety (77.9% vs16.7% vs 5.4%) and stress (18% vs36.1% vs31.7%) were noticed.

Relationship of Smartphone usage, addiction to Depression, Anxiety and Stress:

The three group comparison between user with addiction, user without addiction and non-users showed that depression and stress sub-scores on DASS-21 had statistically significance between all the three groups. This suggests that scores on depression and stress increased with use compared with non-users and further increase in scores with developing addiction. In case of Anxiety, although there was no difference in the two groups who were users, but both the user groups had significantly higher anxiety compared with the non-users. (Table 3).

There was a significant positive correlation of SAS - SV scores and depression, anxiety and stress scores. There was a statistically significant weak positive correlation between the total depression ($r=0.16$; $p<0.001$), anxiety ($r=0.10$; $p<0.05$), and stress scores ($r=0.24$; $p<0.001$) with total addiction scores.

Simple linear regression with addiction scores as dependent variable showed that with one unit increase in addiction scores there was significant increase in depression ($B = 0.156$, $p = 0.002$),

anxiety ($B=0.098$, $p=0.046$), and stress scores ($B=0.236$, $p<0.001$). Whereas multiple linear regression with addiction scores as dependent variable showed only stress scores to be highly significantly related to addiction scores ($B= 0.243$; $p<0.001$). Stress was more significantly associated with addiction than depression and anxiety (Table 4).

Factors related to Depression, Anxiety and Stress:

Among the study participants severity of depression was significantly influenced by owning a smart phone, male gender and age above 18 years while factors like female gender, students studying in private colleges had significant influence on severity of anxiety symptoms. Variables like owning a smart phone, male gender and college run by private management had significant influence on severity of stress among the study participants. Statistically highly significant difference was observed between the means scores of depression and stress among males and females ($p<0.001$) in contrast to anxiety scores.

Table 2. Prevalence of Smart phone Addiction in relation to Gender (Based on SAS-SV Scores)* (n=413)

Gender	Smart phone Addiction		Total	χ^2 value	p-value**
	Present	Absent			
Male	128 (52.9%)	114(47.1%)	242(58.6%)	17.4474	<0.001
Female	55 (32.2%)	116(67.8%)	171(41.4%)		
Total	183(44.4%)	230(55.6%)	413(100%)		

Table 3; Multiple Comparison between User + (User+ Addiction), User- (User - Addiction) & Non-User

	User with addiction N = 183 Mean (SD)	User without addiction N = 230 Mean (SD)	Non-User group N = 271 Mean (SD)	Total score N = 684 Mean (SD)	ANOVA F (df); p value
Depression	26.94 (8.52)	24.57 (7.22)	22.81 (5.38)	24.51 (7.25)	18.63; <0.001
Anxiety	26.26 (7.17)	24.94 (7.11)	22.63 (5.53)	24.38 (6.71)	18.04; <0.001
Stress	29.52 (7.57)	26.08 (6.55)	24.51 (6.18)	26.37 (6.99)	30.73; <0.001

Table 4: Linear Regression Models with Addiction scores as Dependant Variable

Simple Linear Regression						
Variable Scores	B	SE	Beta	t value	p	95% CI
Depression	0.193	0.060	0.156	3.196	0.002*	0.074 to 0.312
Anxiety	0.135	0.067	0.098	2.005	0.046*	-0.003 to 0.267
Stress	0.320	0.065	0.236	4.922	<0.001*	0.192 to 0.448
Multiple Linear Regression						
Variable Scores	B	SE	Beta	t value	p	95% CI
Constant	22.241	2.062		10.784	<0.001	18.186-26.295
Depression	0.064	0.076	0.052	-0.849	0.396	-0.085-0.213
Anxiety	-0.089	0.083	-0.065	-1.074	0.283	-0.253-0.074
Stress	0.330	0.085	0.243	3.865	<0.001*	0.162-0.498

*statistical Significance

DISCUSSION

Our study is unique in terms of study participants of who majority were from rural part of India. It is interesting to note that most of the study participants were females. It was found that 60.4% of the participating university students were using smart phones and our finding was in concordance with studies by Soni R et al (87.1%)¹⁴ and Aggarwal M et al⁸ despite in rural area. This could be due to growing trend of owning and usage of smart phones in rural areas as well.

In our study the prevalence of smart phone addiction 32.5% which is higher than the previous studies done across India by Aggarwal M et al⁸ (23.4%), Nikhita CS et al¹⁵(31.3%). Similar findings were reported by the studies done in China by Chen et al⁶ wherein the prevalence was around 29.8%, in Belgium (21.5%) by Lopez-Fernandez O¹⁶ in Swiss study by Haug S¹⁷of 16.9% smart phone addiction in young and Young-Sook Kwon et al¹⁸ study of 14.7%.

However it was lower than those reported in Saudi Arabia (51%) by Alageel AA et al¹⁹ ,MatarBoumosleh J²⁰ in Lebanese students (49%) and by Alosaimi FD et al²¹ who reported a prevalence as high as 61%. These differences could be due to variations in sociocultural and economic factors across the world.

The Mean SAS-SV score in our study was 30.72 and Soni R et al¹⁴ reported higher SAS-SV scores being 85.66 among smart phone users. Similarly higher SAS-SV scores were reported by Demirci K²² in Turkeese university students (75.68).

Gender wise SAS-SV scores in our study showed significantly higher in males than females. However study by Demirci K²² reported significantly higher scores among female students rather than males (80.50vs 66.59 p < 0.001). And studies by Olatz-Lopez-Fernandez²³, Alosaimi F D et al²¹ and by Bhutia et al¹⁶ showed no statistical difference in SAS-SV score based on gender. This

difference might be due to pattern of smart phone usage, such as use of social networks.

Our study reported higher prevalence of smart phone addiction among males (52.9%) than females (32.2%) which was in concordance with the studies done by Lei et al², Chen B⁶ and Choi SW et al²⁵. However other studies done by Demirci K²² in Turkey, Tao S et al²⁶ in China reported higher prevalence among females. Chen B et al⁶ explained that these differences could be due to that the fact that likelihood of male students using the phone to watch videos, to listen to music and for playing games in contrast to female students who likely use it for communication and social networking.

The present study reported higher prevalence and severity of depression, anxiety, and stress compared to study by Kumar KS et al who reported a lower prevalence of depression (19.5%), anxiety (24.4%), and stress (21.1%) among secondary school students²⁷.Males had higher depression and stress scores which is similar findings by Soni R et al¹⁴ reporting significant higher depression, stress as well as anxiety scores.

Association between smart phone addiction and depression:

Our study reported significant fair positive correlation between depression (r=0.16; p<0.001) and smart phone addiction. Studies done by Ithnain et al²⁹ in university students of Malaysia, Alhassan AA et al³⁰ in Saudi Arabia reported similar findings suggesting a positive correlation between smart phone addiction and depression.

Simple linear regression analysis showed increase in smart phone addiction scores in relation to increase in depression scores which is in concordance with studies by Lei LY et al², Ithnain et al²⁹ suggesting it as an independent predictor for depression which is having negative health effects on students. This might indicate that students are ready to compromise their health with respect to addiction to smart phone.

Association between smart phone addiction and anxiety:

The present study showed weak positive correlation between smart phone addiction and anxiety ($r=0.10, p=0.046$) which corresponds to study findings by Alhassan AA et al³⁰, Demirci K²² suggesting increase of smart phone addictions with anxiety levels. Simple linear regression analysis depicted significant increase in scores of smart phone addiction with anxiety scores. Previous studies by Demirci K²² and by Ithnain et al²⁹. This is probably due to students checking the smart phones in anticipation of reassurance messages by their friends which reduce the anxiety³⁰.

Association between smart phone addiction and anxiety:

The results of our study indicated a significant fair positive relation between stress ($r=0.24; p<0.001$) and smart phone addiction and our findings are in line with study by Alhassan AA et al³⁰. Significant increase in stress scores in relation to high smart phone scores was observed in simple linear regression analysis. Study by Chiu S-I³² among Taiwanese students reported similar findings indicating stressful academic activities which might lower the self control leading to smart phone addiction³⁰.

From the multiple linear regression models, it was found that stress was more significant factor that possibly predicted the development of addiction ($B = 0.243, p<0.001$). The total SAS-SV scores increased by 0.3 units for each unit increase in stress scores. This is in contrast to study done in Lebanon by Matar Boumosleh J¹ who reported the most powerful independent predictors of smart phone addiction as depression followed by anxiety. However Kim M et al³³ and Bian M³⁴ reported that only depression as independent predictor of smart phone addiction college going students in Korea and China respectively. This could be due to differences in study designs and sample size.

Since it is a cross sectional study, whether addiction lead to these symptoms or vice versa cannot be inferred. The confounding variables could not be studied and cause effect relationship could not be established through this study. However this study adds to the limited literature available on smart phone addiction among the students especially belonging rural India.

CONCLUSION

The study is unique done in rural young student population, in comparison to numerous studies that were focussed on the city dwelling youths. Strength of this study is that power calculation was done prior to undertaking the study and the sample size was as per the power calculation.

The main findings from this study was that Smart phone usage rates were 60.4% among the study population, of which 44.4% were found to have dependence to smart phones. In other words, 26.8% of the total study population were addicted to using smart phones. Alarming higher prevalence of depression, anxiety and stress among college students is a serious concern and is a cause for public health concern. Depression, anxiety and stress are the factors associated with the higher usage and addiction. Programs in colleges such workshops or training in life skills development in rural area are need of the hour, to tackle the growing stress among university students.

Conflict of interest

The authors declare no potential conflict of interest.

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