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SMARTPHONE USE ADDICTIVE IN NATURE AMONG STUDENTS AND ITS ASSOCIATION WITH LIFESTYLE RELATED HEALTH ISSUES

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ABSTRACT

Background: There is a rising concern regarding the addictive potential of smartphones as seen from research in developed nations around the world. Hence, the supply of smartphones in a large number into the markets in low- and middle-income countries is becoming a matter of concern. **Objectives:** To study the prevalence of Problematic Smartphone Use (PSU), Addictive in nature among students and to study the correlation of PSU with other health and behavioral correlates. **Methodology:** Short version of Smartphone Addiction Scale (SAS-SV) was used to assess the prevalence of PSU through an online Google survey form. Additional questions were included regarding demographic profile, regularity of exercise, frequency of intake of food high in fat, salt and sugar, and sleep disturbances. Also, data regarding regularity of menstrual cycles and features of androgen, which may be suggestive of polycystic ovary syndrome, was collected from female students to study the correlation with PSU. **Results:** Valid data was received from 421 respondents, with male to female ratio of 0.74. SAS-SV score of 31 for males and 29 for female students corresponding to the 75th percentile. Which was used as a cut-off for self-reported PSU. Average duration of smartphone use was 4.79 (+/-2.64) hours. There was significant correlation between PSU and decreased frequency of exercise, increased consumption of HFSS food, and increased sleep disturbance, but the correlation with BMI, menstrual irregularity and PCOS was not significant. **Conclusion:** Prolonged and problematic smartphone use is an emerging public health problem of concern that can be managed by raising awareness among the end-users and by enforcing regulation at parental and institutional levels.

Key Words: *Problematic Smartphone Use, Smartphone Addiction, Sleep Disturbances, Food Addiction*

INTRODUCTION

The easy access and multifunctionality of smartphones have made them a crucial and indispensable part of everyday life. Features of all kinds in numerous varieties such as enhanced communication, calculation, recording day to day activities, access to internet and all the associated activities such as gaming, chatting, reading, and watching all kinds of content are available on the internet. Thorough use of smartphones in practice is seen, for educational as well as entertainment purposes. These two significant features have made smartphones one of the most desired utility objects especially for the younger generation. They are known as excellent sources of communication for those who are located distantly, further they provide ready access to information, and a good alternate source of entertainment.

However, repetitive and excessive use of smartphones is now considered a behavioral addiction (Gutiérrez, et.al. 2016). Such problematic smartphone usage (PSU) can cause physical and psychological maladaptation in the user. PSU has been shown to be harmful over and above the kind of content that the users may be exposed to because of the poorly restricted content that is posted on the internet. (Bisht, 2022).

The ever-increasing number of smartphone users has a potential to escalate PSU into a major public health problem. According to Pew Research Center (2021), in February 2021, 96% of adults aged 18-29 years owned a smartphone in the USA. As per Sangliao (2022), the entry rate of smartphones in India, in the year 2020, reached 54 percent and is likely to reach 96% by the year 2040.

The mental and behavioural issues associated with smartphone use have been studied by several researchers. However, there is dearth of research on this subject in India, especially depicting the association of smartphone use with changing dietary and lifestyle habits in adolescents and young adults. These changes have the potential to cause chronic physical and mental health issues. This survey based research was conducted to explore and to investigate these issues; to ascertain the nature and extent of Physical & Psychological problems as a result of excessive and addictive nature of Smartphone use.

OBJECTIVES

1. To study the association of PSU with regularity of physical exercise, sleep disturbances, and Body Mass

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Index (BMI) of all the respondents,

2. To study the association between PSU and menstrual health of girls and young women,
3. To analyze the association between PSU and consumption of food high in fat, salt, and sugar content (HFSS food or fast food).

METHODOLOGY

This was a cross-sectional exploratory study. Data was collected through an online survey using convenience sampling. The Short Version of the Smartphone Addiction Scale (SAS-SV) by Kwon, et al. (2013) was used to determine the PSU. The scale consists of 10 questions related to the problems associated with smartphone usage as perceived by the respondent. Each question is scored on a five-point Likert scale with responses ranging from 'strongly disagree' to 'agree'. SAS-SV score is the sum of the score of each of these ten responses. It ranges from a minimum of 10 for those who strongly disagree with any possible problems associated with smartphone use, to a maximum of 50 for individuals agreeing to all the 10 problems associated with smartphone use as per the questionnaire.

This scale has been tested for internal consistency and reliability by the authors and found to have a high Cronbach's alpha correlation coefficient of 0.91. as per the authors, the validity of the scale has been checked by using clinical diagnosis of smartphone addiction as the reference parameter. The questionnaire was administered through Google forms after adding additional questions to study the demographic profile of the respondents as well as questions regarding the consumption of HFSS food (fast food), sleep disturbances, regularity of physical exercise, and questions about menstrual health of the female respondents.

The questionnaire was checked for internal validity and clarity through a pilot survey among 20 respondents before the final circulation of the form. Informed consent of the participants was taken before administering the questionnaire.

RESULTS AND DISCUSSION

In all, there were 450 responses, out of this total number only 421 were noted to be valid complete in all respects and thus deserved inclusion in the study.

Sex distribution of respondents included in the study was 42.3% (n=178) of them were males, 57% (n=240) were females and 0.7% (n=3) preferred not to disclose their gender. Most respondents belonged to the middle (44.4%, n=187) and upper middle (39.4%, n=166) socioeconomic class as per modified Kuppuswamy scale. (Wani, 2019) Table 1 summarizes the distribution of demographic characteristics, average duration of smartphone usage per day and SAS-SV score of the respondents. Normality of distribution of age, height, weight, and BMI was tested on Kolmogorov–Smirnov test and found that the distribution was skewed.

Table 1: The distribution of demographic characteristics, average duration of smartphone usage per day and SAS-SV score of the respondents

		Age	Height	Weight	BMI	hours per day phone?	SAS-SV Score
Mean		20.54	1.6723	64.798	23.138	4.79	24.544
S.D		1.811	.10600	13.7580	4.7099	2.643	8.0688
Minimum		16	1.00	39.0	15.1	1	10.0
Maximum		24	1.98	166.0	78.0	16	50.0
Percent	**25**	19.00	1.6000	55.000	20.420	3.00	18.000
	50	21.00	1.6800	64.000	22.588	4.00	24.000
	75	22.00	1.7500	73.000	24.776	6.00	30.000

The main purpose for using smartphones was entertainment for 60.6% (n=255) respondents, while 33.5% (n=141) and 5.9% (n=25) said that they used them for educational or for professional purposes respectively.

Table 2 shows the comparison of SAS-SV scores and duration of use among male and female respondents. The mean as well as the median SAS-SV scores were significantly lower among females as compared to male respondents (p value<0.02). SAS-SV scores more than 75th percentile in either group were used to define problematic smartphone use (PSU). These were 31.00 and 29.00 for male and female respondents respectively. The mean time spent on the phone per day was 4.77 (+/-2.43) hours for males and 4.78 (+/-2.80) hours for females, but the difference was not significant, p value = 0.431.

Table 2: Comparison of SAS-SV scores and duration of use among male and female respondents

		Males	Females	P value
SAS-SV Score	Mean	25.584	23.729	.020
	Std. Deviation	8.3006	7.8392	
	Median	25.00	23.00	
	75th Percentile	31.00	29.00	
Duration of use (average duration of use per day over the last seven days)	Mean	4.77	4.78	.431
	Std. Deviation	2.432	2.798	
	Median	4.00	4.00	

On applying the Kruskal-Wallis test we found no significant difference in the daily duration of mobile phone use among respondents belonging to different

socioeconomic groups (p< 0.45). Similarly, there was no significant association between duration of phone use and other parameters like the purpose of use – educational/professional/entertainment, or frequent consumption of 'fast food' or sweetened beverages. However, the regularity of exercise was significantly higher among students using smartphones for less than 6.00 hours (75th percentile) compared to those who used them for a longer duration (p<0.03)

We analyzed the data to study the correlation of various parameters of interest in male and female respondents with problematic smartphone use (PSU). As mentioned above, we have used the 75th percentile values of SAS-SV score, which were 31.00 and 29.00 for male and female respondents respectively, to categorize the respondents into those who reported PSU versus those who did not report PSU. Table 3 summarizes these findings.

Table 3: Correlation of high versus low SAS-SV Scores* with various parameters

	Males		Females		P value Males	P Value Females
	SAS-SV score ≤31	SAS-SV score >31	SAS-SV score ≤29	SAS-SV score >29		
Socio-economic status					0.210	0.270
Lower	0.7%	0.0%	0.5%	0.0%		
Lower Middle	2.9%	11.9%	2.1%	0.0%		
Middle	48.5%	45.2%	42.6%	40.0%		
Upper Middle	34.6%	33.3%	40.5%	54.0%		
Upper	13.2%	9.5%	14.2%	6.0%		
Main purpose for phone use					0.346	**0.004**
Education	30.9%	31.0%	41.1%	16.0%		
Professional	12.5%	4.8%	2.6%	2.0%		
Entertainment	56.6%	64.3%	56.3%	82.0%		
Consumption of fast food					**0.044**	.051
Occasionally	40.4%	23.8%	45.3%	36.0%		
Once or twice a week	50.0%	54.8%	52.1%	54.0%		
Everyday	9.6%	21.4%	2.6%	10.0%		
Consumption of sweetened beverages					**0.020**	**.004**
Occasionally	48.5%	33.3%	63.2%	42.0%		
Once or twice a week	45.6%	47.6%	32.1%	42.0%		
Everyday	5.9%	19.0%	4.7%	16.0%		
Frequency of exercise					**0.033**	.477
5-7 days a week	40.4%	35.7%	24.7%	20.0%		
1-4 days a week	53.7%	45.2%	60.0%	58.0%		
Almost never	5.9%	19.0%	15.3%	22.0%		
Difficulty in falling asleep					**<0.001**	**.040**
No	67.6%	42.9%	61.6%	44.0%		
Occasionally	26.5%	31.0%	26.3%	32.0%		
Yes	5.9%	26.2%	12.1%	24.0%		
Disturbed sleep [a]					**<0.001**	0.109
No	76.5%	47.6%	70.5%	60.0%		
Occasionally	20.6%	35.7%	18.4%	32.0%		
Yes	2.9%	16.7%	11.1%	8.0%		
Missing menstrual periods					-	.615
Never	61.1%	68.0%				
Occasionally when stressed	7.9%	8.0%				
Two or more times in six months	31.1%	24.0%				
Excessive facial hair [b]					-	.568
No	66.3%	62.0%				
Yes	33.7%	38.0%				

* Based on the value of 75th percentile of SAS-SV scores for males and females which has been used to define PSU in this study

a. Do you wake up frequently during the night after going to sleep (on more than 3 nights/ week for more than 3 months)?

b. Having excessive facial hair/ acne/ dark skin in skin folds

Since the distribution of age, height, weight, and BMI was skewed, hence nonparametric tests for studying the correlation of these parameters with PSU were used. However, the results were not significant.

Further, we categorized BMI into three categories – normal, overweight, and obese using the classification of BMI for Asia Pacific region as provided by the World Health Organization (2000) to apply logistic regression to assess the predictive value of exercise, consumption of fast food and BMI on the presence or absence of PSU. Observations concluded that none of these parameters significantly affected the odds of developing PSU.

Table 4: Distribution of responses to the SAS-SV questionnaire

	Strongly Disagree	Disagree	Weakly Disagree	Weakly Agree	Agree
Missing planned work due to smartphone use	95 (22.6%)	104 (24.7%)	103 (24.5%)	84 (20.0%)	35 (8.3%)
Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use	82 (19.5%)	117 (27.8%)	101 (24.0%)	77 (18.3%)	44 (10.5%)
Feeling pain in the wrists or at the back of the neck while using a smartphone	164 (39.0%)	112 (26.6%)	61 (14.5%)	48 (11.4%)	36 (8.6%)
Won't be able to stand not having a smartphone	131 (31.1%)	80 (19.0%)	97 (23.0%)	64 (15.2%)	49 (11.6%)
Feeling impatient and fretful when I am not holding my smartphone	154 (36.6%)	111 (26.4%)	81 (19.2%)	48 (11.4%)	27 (6.4%)
Having my smartphone in my mind even when I am not using it	176 (41.8%)	125 (29.7%)	68 (16.2%)	30 (7.1%)	22 (5.2%)
I will never give up using my smartphone even when my daily life is already greatly affected by it.	180 (42.8%)	123 (29.2%)	69 (16.4%)	29 (6.9%)	20 (4.8%)
Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook	155 (42.8%)	115 (29.2%)	74 (16.4%)	48 (6.9%)	29 (4.8%)

Using my smartphone longer than I had intended	37 (8.8%)	58 (13.8%)	111 (26.4%)	132 (31.4%)	83 (19.7%)
The people around me tell me that I use my smartphone too much.	137 (32.5%)	112 (26.6%)	80 (19.0%)	52 (12.4%)	40 (9.5%)

We also studied the distribution of responses to the questions on SAS-SV scale. As depicted in Table 4, nearly 25% of students agreed or weakly agreed that they often missed planned work due to smartphone use; had a hard time concentrating in class or while doing assignments due to smartphone use; felt pain in the wrists or at the back of the neck while using a smartphone; and said that they won't be able to stand not having a smartphone. Further, more than 50% of respondents agreed that they often ended up using them longer than they had intended.

DISCUSSION

A review of recent researches in this area suggests that excessive usage of the smartphone may mimic behavioral addiction with progressive exclusion of other activities, causing physical, mental, and social harm.[8]

Our study, conducted among 421 students, 92% of whom were pursuing a professional medical degree course, aimed to evaluate the prevalence of PSU among these students. Using the SAS-SV scale proposed by **Kwon et al (2013)**, we found that SAS-SV scores for female respondents were significantly lower as compared to male respondents. [5] The 75th percentile of SAS-SV value in males corresponded to the cut-off value of 31.00 that was proposed by **Kwon et al (2013)** in their study. However, it was observed that the 75th percentile score for female respondents was 29.00, which was significantly less than the proposed cut-off value of 33.00 for females. However, since there was no significant difference between the mean duration of use of smartphones for male and female respondents, then the 75th percentile of SAS-SV score was applied for male as well as female respondents to define PSU. Also, the previously suggested SAS-SV cut-off scores of >31 and >33 for males and females respectively were established for Korean adolescents by receiver-operating characteristic analyses. Therefore, these may be less applicable in the Indian context.

Using the cut-off values defined above, The data was analyzed to compute the correlation of PSU with behavioral factors outlined above. Observations noted that a significantly higher number of respondents who reported PSU, were females as compared to males, who used smartphones mainly for entertainment purposes instead of educational or professional purposes. **Gutiérrez et al (2016)** reported that this may relate to their greater sociability and heightened emotional sensitivity, resulting in increased engagement with social media.

Further, results demonstrated that the frequency of exercise was significantly less among male respondents with PSU ($p<0.03$). Within the spectrum of addictive behaviors, this is explainable through the disproportionate allocation of time to smartphones. **Luk et al (2018)** and **Demirbilek, & Minaz (2020)** also reported similar findings. However, the same observations were not true for females. In fact, the proportion of female students, with or without PSU, engaging in regular physical exercise was much lower as compared to male students, 44.7% versus 76.1% respectively. This gender-related differential attitude towards exercise has also been reported by **Hallal et al (2012).** Significantly higher frequency of intake of 'fast food' (HFSS foods) and sweetened beverages among respondents with self-reported PSU was noted. This association has also been observed by Kim et al in their study of Korean adolescents suggesting that food addictions and PSU may share common neuro-biological pathways (**Kim et al. 2021).** Further, **Gordon et al (2018)** studied the evidence for food addiction and observed that foods high in fat, salt, and sugar (HFSS foods) may provoke addictive-like eating through neurobiological pathways in comparison to diets rich in fresh fruits and vegetables. In addition, researchers also reported an association of PSU with narcissism, anxiety, and other personality variables, such as extraversion, neuroticism, self-esteem, impulsivity, self-identity, and self-image (**Gutiérrez et al, 2016 & Hussain et al. 2017).** These personality variables have also been linked to sleep disturbances and seem to form a part of the spectrum. This was confirmed by our observations of significant sleep disturbances in respondents who reported PSU. Other researchers have also concluded that that there is an association between excessive screen time and problems in sleep onset, insufficient sleep, and insomnia. **(Spagnoli, et al, 2019 & Hong et al, 2020).**

A significant correlation between PSU and other psychological variables such as food addiction and sleep disturbances was evident. However a significant correlation between PSU and increased BMI was not seen. To explore further nonparametric tests and logistic regression after categorizing respondents into three categories – normal, overweight, and obese, were computed, but they were not reported to be significant Less degree of association between BMI and PSU has also been reported by **Luk et al (2018)** in their study of Chinese adults. However, **Ma et al. (2021)** have reported a correlation between PSU and increased BMI (OR, 1.046; 95% CI, 1.018–1.075).

Further, further an attempt was made to analyze the correlation between PSU and symptoms related to polycystic ovary syndrome (PCOS) in female respondents. PCOS is a condition characterized by an imbalance of hormones resulting in irregular menstrual cycles and symptoms related to increased production of androgenic hormones in the body such as excessive facial hair, acne, and darkening of skin in skin folds which has also been seen to be associated with a sedentary lifestyle, intake of HFSS foods, and sleep disturbances **(Tay et al., 2020)**. However, a significant correlation with PSU was not reported, probably because the mechanism behind the occurrence of PCOS is complex and it is believed to be a product of gene-environment interaction **(Ajmal et al., 2019).**

An important observation of the present study was that the average duration of reported smartphone use per day was very high and skewed towards right – median was 4 hours while mean was 4.79 (+/- 2.64) hours or 287.4 +/-158.4 minutes. This was much higher than what has been reported by other researchers **(Montag et al., 2015).** Since this study was conducted after the lockdown due to COVID-19 pandemic in this region, researches presume that more or less hours of the time spent on the smartphone by the students was voluntary.

Limitations

One major limitation of this study was that the collection of data was done through an anonymous survey; therefore this data may be prone to response bias and potential underreporting which was likely to reduce the strength of associations observed in this study. At the same time, there was no control over random or invalid responses from respondents which can skew the distribution of data. Further, due to the cross-sectional nature of the study, longitudinal associations between PSU and various other health factors related to diet/ physical exercise and sleep could not be studied. As most of the respondents were pursuing a professional degree course, these findings may not be generalized to other populations.

CONCLUSIONS

Prolonged and problematic use of smartphones by students is a matter of serious concern. Further, it is associated with a significant increase in the frequency of consumption of HFSS foods, decreased infrequency of exercise, and an increase in incidence of disturbed sleep among respondents who reported PSU. However, these factors were not able to predict PSU. Hence, despite the correlation, there may not be a causal relationship. As suggested by other researchers, all these factors may coexist in a person because of the inherent personality traits. But at the same time, most of these factors that have strong implications for physical health and mental well-being can be regulated through awareness and self-control.

Recommendations for practice

There is a need for a multipronged approach to address the growing prevalence of smartphone addiction. With the marked increase in the number of smartphones into the Indian market, greater awareness needs to be created at the end user level regarding the harmful effects of smartphones. Strict regulations regarding access to various internet sites can reduce exposure to harmful content. Enhanced parental control and institutional restrictions may also help in decreasing the prevalence of PSU.

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