Relationship Between Screen Time and Body Mass Index in Young Adults

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Abstract

Background: This study aimed to find the association between screen time (ST) and body mass index in young adults.

Methods: This was a cross sectional study conducted on 1876 students (aged 18-22yrs) from multiple Colleges of Imam Abdulrahman Bin Faisal University, from January 2021 till June 2021. The main tools of the study were: 1) Body mass index (BMI) and an online questionnaire. The subjects were categorized into 3 main groups based on their ST: 1) Low ST< 2Hours/day, 2) Medium ST= 3 to 5Hours/day, 3) Excessive ST ≥ 6Hours /day. Based on BMI, subjects were categorized into three main groups: Normal and underweight (BMI ≤24.9), over weight (BMI >25-29.9) and obese (BMI > 30).

Results: The mean age (±SD) of participants was 20 ± 2.8 years. Average BMI was 23.5 kg/m^2 . The % of students falling into the categories of normal weight, overweight and obesity was 69.2, 19.05 and 11.7% respectively . Average screen time in study participants was 8.2 ± 3.45 hrs /24 hours. 71.15% participants indicated a ST of ≥ 6 hrs/24 hours and 23.71% reported ST of 3 - 5 hrs/24 hours. Only 3.15 % of students reported ST of ≤ 2 hrs/24 hours. Although a rise in the mean BMI was observed with an increase in the ST, but this difference was not statistically significant (P=0.156). Pair wise comparison also failed to demonstrate any difference in BMI between different categorize of ST. Furthermore no significant positive correlation was found between increased BMI and excessive ST (P=0.37).

Conclusion: A high percentage of young adults (31.2%) were overweight or obese, but excessive ST was not significantly associated with increased BMI in this study population. Further studies are recommended to identify the effects of other factors in causing increased BMI in young adults.

Background

Obesity is a common health risk affecting over 13% of the world's adult population.[1] Kingdom of Saudi Arabia (KSA) was ranked the fourteenth highest country with obesity rate worldwide in 2016.[2] In the same year, the overall percentage of obesity has reached 35% among Saudis. In addition, in the last three decades, the mean body mass index (BMI) of the KSA population has jumped to the overweight category compared to previously being normal.[3] The substantial increase in obesity rates among Saudi population could be explained by various factors, mainly unhealthy eating habits and sedentary behaviors. One of the biggest causes of sedentary behavior nowadays is the increase in screen use which is due to the rise in electronic devices ownership.[4–8]

The prevalence of electronic devices ownership as well as the duration of using them is increasing globally. Women in the United States of America (USA) spend an average of 6 to 20 hours per week watching television (TV).[9] More than 85% of university students across Canada owns it while in South Korea and KSA it is 100%.[10–12] USA college students spent an estimate of nine hours per day using their smartphones.[4] while more than half of university students in Indonesia spend 5 hours or more a day.[13]

In the gulf region, United Arab Emirates (UAE) college students use their smartphones for a mean of 7.5 hours daily.[7] Studies in KSA from universities in Riyadh, Qassim, Jeddah, and Dammam cities have measured the mean time spent on smartphones among college students which were estimated to be 7.5 hours, 3.5 hours, 5 hours, 8.5 hours respectively.[6, 8, 14, 15] The increase in smartphones usage could be explained by its various advantages.

Mobile devices show a positive influence on different aspects of life. Easier access is provided for both consumers and sellers via internet commerce.[16, 17] Many adults spend their screen time for work-related tasks and educational purposes.[6, 10, 13, 18, 19] Laptop classrooms enhance learning by increasing interest, participation, and motivation compared to regular classrooms.[20] To add on, social media is used for sharing information and knowledge among students.[12] Smartphone messages and applications have also shown promising influences on health via promoting preventive behaviours, reducing stress, increasing mindfulness and self-compassion.[21, 22] Moreover, wearable devices connected to a smartphone applications have helped in monitoring the progress and response of patients.[23, 24]

Despite the advantages of screen use, it could have a negative impact on life. Addiction to smartphones is a phenomenon that is significantly increasing especially among young adults[4–8], this has resulted in higher rates of reported low self-esteem, decrease in social behavior[7, 25] and high levels of stress.[8, 26] Moreover, depressive symptoms are more commonly seen in addictive smartphone users. Smartphones could also be a source of distraction during classes.[12, 27] Prolonged screen use is associated with poor academic performance, poor sleep quality, a decrease in sleeping time[6, 14, 15] in addition to greater physical discomfort.[20] Screen usage encourages sedentary behaviors via various mechanisms.[5, 6, 9, 19, 25]

Numerous studies have linked screen use with an increase in body weight by encouraging sedentary behaviors. Prolonged setting time, decreased physical activity and unhealthy eating habits are the main mechanisms behind weight gain.[5, 6, 8, 9, 19, 25] Increased time spent on viewing TV was significantly associated with increased body weight in adults.[28] There is a 23% increase in obesity risk for each 2 hours per day spent on TV. In addition, women who watched TV for longer hours consumed more calories in the form of red and processed meat, saturated fats, and snacks.[9] About 30% of college students agree that after using a smartphone, they started to eat more junk food and gained more weight.[6]

In contrast, other studies suggest that screen use helps in losing weight. Mobile health (m-health) involves using technology to provide interventions that help in improving the patient's lifestyle via personalized contact. This technique has proven its effectiveness in a meta-analysis by Seong-Hi et al where it showed a significant reduction in both body weight and BMI regardless of the duration of the intervention.[29] In another meta-analysis, Fangchao et al have concluded that when using a smartphone intervention that includes either short message service (SMS), Multimedia materials (MMS) or both combined, a significant reduction in weight and BMI can be achieved.[30] When a smartphone intervention

was used, total daily steps have increased by 15% and it was associated with decreased BMI[31]. Besides that, vigorous physical activity was found to be higher among college students who are using devices connected to a smartphone application. [32]

In conclusion, some studies suggest that smartphones use decreases body weight and hence BMI. This is linked to the use of applications and messages that encourage healthy actions. On the other hand, other studies suggest that screen use increases body weight by encouraging sedentary behavior and unhealthy eating habits. Therefore, the relationship between ST and weight changes is still inconclusive and further evaluation is needed. Therefore we designed this study to “investigate the relationship between ST and BMI in young adults”.

Methods

This was a cross sectional study conducted on 1877 students (aged 18-22yrs) from multiple Colleges of Imam Abdulrahman Bin Faisal University, from from January 2021 till June 2021.

Sample size was calculated by epidemiologic statistics for public health tools software (accessed at: http://epitools.ausvet.com.au/content.php?page=1Proportion&Proportion). The calculation was based on estimated prevalence of overweight and obesity in excessive screen time users in a target population of 4000 students, where desired precision was 0.02 (2%) and confidence interval was 0.95 (95%). The sample size was calculated to be 1800.

The main tools of the study were: 1) Body mass index (BMI) and an online questionnaire. The questionnaire was designed to find the “screen usage time” (ST) in the subjects. It was based on the information from few previous studies. The questionnaire focused on the information about average ST in last one year. The subjects were categorized into 3 main categories based on their ST: 1) Low ST < 2Hours/day, 2) Medium ST = 3 to 5Hours/day, 3) Excessive ST ≥ 6Hours /day. Screens used by the subjects included Television, Laptop, iPad, mobiles and video games (which do not involve physical movement). Test retest technique done on 25 students confirmed the reliability and validity of the questionnaire. ($P = 0.004$; $r = 0.81$).

BMI was calculated by the formula = weight in kg/height in m^2. Measurement of Weight was done in kilograms and height in centimeters. All the anthropometric measurements were done in Physiology lab using standard procedures (light clothing, bare footed, empty bowel and bladder and a minimum 3 hours fasting). Based on BMI, subjects were categorized into three main groups: Normal and underweight (BMI ≤ 24.9), over weight and obese (BMI > 25-29.9), obese (BMI > 30).[33]

Data Collection

Data was collected by convenience sampling technique, and response rate was 47.5%, as 1900 /4000 students volunteered to participate in the study. A ten minutes briefing session was given in various classrooms to explain the rational of study. The willing students were taken to the Physiology lab for

anthropometric measurements and filling of the ST questionnaire. The confidentiality of the personal information was assured to the subjects.

Inclusion criteria

- The students between 16–22 years who were willing to participate in the study.
- The students who used screens(including television, iPads, mobiles Laptops and video games) daily, even if it they use it for a brief moment.
- Not using any prescription medication for at least last 3 months.

Exclusion criteria

The students having:

- Positive family history of obesity
- Any chronic physical or mental illness, affecting their BMI or ST.

Finally, 24 students were excluded, and 1876 were selected.

Ethical approval

of the study was taken by Deanship of Scientific Research, (IAU).

Statistical Analysis

The data analysis was done by Statistical Package for Social Sciences (SPSS) for Windows, Version 20.0. Demographic data was determined by descriptive statistics.

One way Anova was used to compare the number of subjects between normal weight, overweight and obese group in all the 3 categories of SUT. Comparison of mean BMI between 3 Categories of SUT was also done by using one way ANOVA. Pair wise comparison was carried out by applying least significant difference (LSD) test. Spearman's correlation was performed to find the association between BMI and SUT. All the statistical tests were conducted at a 95% confidence interval (CI).

Results

The mean age (±SD) of participants was 20 ± 2.8 years. Number of female participants was 1458(77.6%), whereas the number of male participants was 419(22.3%). Average BMI was 23.5 kg/m^2 . The % of students falling into the categories of normal weight, overweight and obesity was 69.2, 19.05 and 11.7% respectively. A statistically significant difference was seen between the BMI of males and females. Males as compared to females had significantly higher BMI. Moreover a significantly higher number of males as compared to females were falling into the category of overweight and obesity. These parameters are compared between male and female subjects is in Table 1.

Table 2 shows that average screen usage time in study participants was 8.2 ± 3.45 hrs /24 hours. 71.15% participants indicated that their SUT was ≥ 6 hrs/24 hrs, 23.71% reported SUT of 3 - 5 hrs/24 hours, whereas only 3.15% of the participants had SUT of ≤ 2 hrs/24 hours. Comparison of SUT between males and females showed no statistically significant difference, Table 2.

Table 3 shows the distribution of the study subjects on the basis of their body mass index into low, medium and excessive SUT groups. Data indicated that most of the subjects (3.2%) who used the mobile for ≤ 2 hrs/24 hours fell into the group of normal weight vs. 2.6% in overweight and 0.6% in obese group, but the difference was not statistically significant (P= 0.06). Moreover, it was analyzed that with an increased SUT of ≥ 6 hrs/24 , the percentage of students falling into the obese group was greater than the % of students in overweight and normal weight group (76.3% vs. 74 and 71.8% respectively). But the difference was not statistically significant.

(P=0.2)

Comparison of mean body mass index between the three categories of SUT is shown in Table 4. A rise in the mean BMI was observed with an increase in the SUT, but this difference was not statistically significant. Therefore, a pairwise comparison was carried out by applying least significant difference (LSD) test Table 5. LSD also failed to show any significant difference in the BMI between various categorize of ST.

Spearman rank correlation coefficient showed a positive correlation between BMI and ST 0.021 (r)* , but the P value was not found to be statistically significant (p = 0.27).

Table 1: Sample Characteristics .

	Male **n = 419**	**Female** **n = 1458**	**P-value**
Mean Age ±SD	20.2 ±3.3	19.8 ±2.3	0.017
Mean BMI	24.6 ±6.1	22.4 ±4.8	< 0.001*
Normal weight	254 (60.6%)	1134 (77.8%)	< 0.0001
Over weight	95 (22.7%)	224 (15.4%)	0.001*
Obese	70 (16.7%)	100 (6.7%)	< 0.0001*

Normal weight = BMI ≤24.9 kg/m^2 , Overweight = BMI 25-29.9 kg/m^2 , Obese = BMI ≥30 kg/m^2

Table 2: Information about screen time (ST).

Screen usage time **(ST)**	**Males** **n = 419**	**Females** **n = 1458**	**P value**
≤ 2 hrs/24 hours	15 (3.6%)	38 (2.6%)	0.3
3 - 5 hrs/24 hours	97 (23.2%)	353 (24.2%)	0.7
≥ 6 hrs/24 hours	304 (72.5%)	1028 (70.5%)	0.4

Table 3: Distribution of the study subjects on the basis of body mass index into low, medium and excessive screen time (ST) groups.

ST	Normal Weight	Overweight	Obese	**P value**
≤ 2 hrs/24 hours	44 (3.2%)	8 (2.6%)	1 (0.6%)	0.060
3 - 5 hrs/24 hours	338 (24.9%)	73 (23.5%)	39 (23.1%)	0.6
≥ 6 hrs/24 hours	973 (71.8%)	230 (74%)	129 (76.3%)	0.2

Normal weight = BMI ≤24.9 kg/m^2 , Overweight = BMI 25-29.9 kg/m^2 , Obese = BMI ≥30 kg/m^2

Table 4: Comparison of mean body mass index between various categories of screen time (ST).

ST	**Total**	Mean ±SD BMI	**(Min – Max)**	**P value**
≤ 2 hrs/24 hours	53	21.7 ±3.3	(15.6 - 30.4)	0.156
3 - 5 hrs/24 hours	450	22.8 ±5.4	(14 - 59.8)	
≥ 6 hrs/24 hours	1332	23 ±5.2	(14.5 - 58.2)	

Table 5: Pair wise comparison by LSD Test. (n = 1876)

ST	**P Value**	**95%CI(LL-UL)**
Low ST Versus Medium ST	0.146	- 2.6 – 0.4
Low ST versus Excessive ST	0.087	- 2.7 – 0.2

Discussion

The average ST among young individuals in our study was 8.5 hours/day. This figure is slightly lower than the ST of US college students, who spend an average of 9 hours each day in front of a screen.[4] On the other hand, both Indonesia and UAE college students spend less ST when compared to our results reaching 5 and 7.5 hours respectively.[13, 7] Finally, the ST of this study is the highest compared to

different studies conducted in KSA where the maximum ST (8.5hours/day), was seen in Dammam and reaching lowest in Jeddah with 3.5 hours daily.[15,14]

Although a high percentage of our study population was overweight/obese (31.2%) , but no significant correlation was found between excessive ST and increased BMI in these young adults. Almost similar results have been reported by Chinapaw et.al in their systemic review, indicating that there is insufficient evidence to support the hypothesis that excessive ST is related to higher BMI.[34] Must et al, found that increased BMI was unrelated to excessive ST , but was strongly related to parental body weight. [35] Kalirathinam D et al. were also not able to identify any association between screen time and body mass index among university students. [36]

The possible explanation for these findings may be the fact that there are multifactorial determinants of BMI. Dietary intake, genetic, sleeping habits and physical activity may be the main contributors in controlling BMI, rather than the ST. [37] Moreover, various studies indicate that although the young adults have a significantly increase in their ST , but the young generation is more health conscious and they use various applications in their mobiles that aid weight reduction and maintenance. [29-32] This may be one of the reasons of insignificant association between ST and BMI in our study population.

Our data is contradictory with the findings of some other studies, which provide a positive association between excessive screen time and BMI. [5,6,38,39] These contradictory results can be explained by the difference in subjects' age, study population, sample size and confounding factors. As , the targeted population in the current study focused on young adults between 16-22 years, whereas the participants of Lio et al. were 30-59 years old, and Fable et al. targeted a younger population of 9-15 years. [38, 39] These comparisons may provide an insight into the finding that excessive ST at younger age may have a stronger impact on BMI as compared to the young adults.

The main strength in this study is that we recruited a large sample size. All the students were called to the physiology lab and our study participants were health college students who filled the questionnaire with great interest and accuracy. Moreover the measurement of height and weight was done in the lab with the same machine for all the subjects, which helped to avoid the inaccuracy of self-reported data where the subjects can over or underestimate their height and weight.

Although our study recruited a large sample size to explore a relationship between ST and BMI. However, there are a number of limitations of the present study; for instance, it was a cross sectional study, so it was not possible to conclude a causative relationship between ST and increased BMI. Moreover the effect of other confounding factors on BMI , such as age, family history of obesity, unhealthy eating habits and decreased physical activity were not considered. Moreover, the inclusion and exclusion criteria were only based on the history, no Physical examination/investigations were performed.

As the results of this study indicate that a high percentage of young adults (31.2%) were overweight or obese, but excessive ST was not significantly associated with increased BMI in this study population.

Therefore , we recommend further studies to identify the effects of other factors in causing increased BMI in young adults, in order to reduce the burden of overweight and obesity and its associated future complications.

Conclusion

This study concludes that:

- Average ST in young adults was 8.2 ± 3.45 hrs /24 hours. Most of the young adults (71.5%) used the screen for more than ≥ 6 hrs/24 hours. Only 3.15 % of students used screens for ≤ 2 hrs/24 hours.
- The high % of young adults were overweight/obese (31.2%). But no significant positive correlation was found between excessive Screen time and body mass index.

Declarations

Ethics approval and consent to participate

Ethical approval of the study was taken by Deanship of Scientific Research, (IAU).IRB#= 2021-01-192.

Consent for publication

Not applicable

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

"The authors declare that they have no competing interests" in this section.

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It was a non-funded research.

Authors' contributions

All authors contributed in the conception and design of study, data collection or analysis and interpretation of data; Participated in drafting the article or critically reviewing it for improving its intellectual content. All authors gave final approval for the version being published and agreed to be accountable for every aspect of the work.

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