

PHYSICAL ACTIVITY AND SCREEN TIME: A CROSS-SECTIONAL STUDY IN ALIGARH, NORTH INDIA

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ABSTRACT

Children have been exposed to electronic devices. They grow up thinking that these devices are a part of their daily lives. As they get older, their dependency on such devices grows, even during school days. As a result, their physical activity is hardly handled even until they reach adulthood. This study assessed the frequency of physical activity, duration of screen time, and association between these variables amongst school children. This cross-sectional study was conducted among 800 school-based adolescents aged 12 to 14 years at A.M.U. High Schools, Aligarh, in July 2018 to June 2019. Students were asked about their physical activity and screen habits by disseminating a self-reported questionnaire. The data were analyzed in SPSS version 20.0. The study found that most of the students had adequate physical activities (75.51%), while the reported screen time duration was also adequate for most (59.1%). The association between the two variables was not statistically significant ($p > 0.05$). For the students with inadequate frequency of physical activity and enough duration of screen time, interventions should be done both at family and school levels to make them more physically active and better at performing studies and reaping the benefits of good health.

Keywords: physical activity, school children, adolescents, screen time

INTRODUCTION

The benefits of physical activity at all age groups, right from childhood, have been well documented. Adolescence, particularly, is a critical period of development during lifetime in which behavior patterns and lifestyle choices i.e., being physically active are established. There has been ample research that can demonstrate the advantages of being physically active, as well as the health effects of less physical activities and more sedentary behaviour (Kumar, Robinson and Till, 2015). There has been growing evidence about positive impacts of physical activity on child's social and cognitive development carrying forward to adulthood (Organization, 2019). The first ever global trends for adolescents with inadequate physical activity indicate that increment in physical activity between 11 to 17 years

adolescents must be given urgent attention (Guthold, Stevens, Riley *et al.*, 2018).

The trend and frequency of physical activity in children and adolescents in developing countries have been analyzed in depth (McKenzie, Marshall, Sallis *et al.*, 2000; Sallis, Prochaska and Taylor, 2000); however, there is a dearth of documentation for the same in developing countries, particularly Asian. Nowadays, frequency of physical activity in children decreases due to various factors, e.g., changes in lifestyles such as watching television, playing games on computer or mobile phones for long hours, to name a few. It has also been known that excessive exposure of screen time can cause a tendency to overuse of such electronic devices later in the next development phase and interruption of healthy routine, whilst also affecting studies at the same time (Canadian Paediatric Society, 2017).

Besides, children do not compensate for physical activities after school, while chances for doing physical activities are restricted during the school day. Along with decreased frequency of physical activity, longer screen time puts the children at risk of various health issues such as overweight, blood sugar problems, decreased social interaction, and others (Kang, Lee, Shim *et al.*, 2010; Sisson, Broyles, Baker *et al.*, 2010). Additional school-based physical activities may be warranted to engage children even beyond physical education classes (Ronghe, Gotmare and Kawishwar, 2016). In view of this, it was thought that it was important to carry out an assessment of frequency of physical activity, the duration of the screen time, and the association between these variables in school children aged 12 to 14 years. By doing this study, it accounts for preventive measures that could be placed in time to avoid the incidence of overweight later in adulthood.

METHODS

The current study was conducted across high schools of Aligarh Muslim University (AMU), Aligarh, a city in the North India, from July 2018 to June 2019. Selected schools had recess during the working days, along with physical education classes in their curriculum. The AMU currently maintains six high schools, including three male and three female schools.

A cross-sectional design was used as the research approach. The participants were selected using simple random sampling with a table of random numbers which students could choose. The selected students were aged between 12 to 14 years and had to be present on the day of examination and had willingness to participate in the examination. Whereas, the exclusion criteria were children aged less than 12 years and more than 15 years, not willing to participate, absent on the day of examination, uncooperative, and suffering

from chronic illness, endocrinal problems, physical and mental problems.

The study was carried out after getting the approval of the Research Ethical Committee, Faculty of Medicine, Aligarh Muslim University. Written consent was obtained prior to the research from the principals of the relevant schools through the School Education Directorate of AMU. The respondents informed their consent for participation orally. Those who did not give consent were excluded from the research. Students were assured about the confidentiality of the information and their identity during the examination and interview. If a medical problem was diagnosed, the respondent would receive appropriate medical advice. Health education and advice would be provided to all respondents.

Taking prevalence of physical inactivity at 21% (Nawab, Khan, Khan *et al.*, 2016), absolute permissible error at 3% with a confidence level of 95%, and a non-response rate at 10%, the sample size (n) amounted to 709, which were rounded off to 800. Simple random sampling with probability proportionate to size (PPS) was used to draw the sample size.

The study instrument included pre-tested questionnaires regarding details of socio-demographic variables and screen time and physical activity questionnaires for older children (PAQ-C) aged 8-14 years (grades 4-8). It could be used among those children present in the school system which had recess in their daily work schedule. The questionnaires had been tested for reliability and finally obtained a high internal consistency (0.96) for final PAQ-C score. The highest correlation was found in item 9 ($\rho = 0.311$; $p < 0.01$) (Benítez-Porres *et al.*, 2016). Significantly moderate correlation was found in moderate physical activity (MPA) ($r = 0.462$; $p < 0.001$) and moderate to vigorous physical activity (MVPA) ($r = 0.483$; $p < 0.001$); physical activity assessment was done through PAQ-S (Physical Activity Questionnaire for Smaller Children). The validity of PAQ-S

for the estimation of MPA and MVPA was found to be almost similar to the self-reported measures for schoolchildren (Manios *et al.*, 2013).

Screen time was defined as screen viewing, including the use of any electronic devices such as tablets, smartphones, video games, television, wearable technology, or computer. It has been reported that children 11-14 years old, on an average, spend about 9 hours a day in front of screen, while it should not be more than 2 hours per day (Encyclopedia, 2020).

Regarding anthropometric measurements, Body Mass Index (BMI) was measured with an electronic weighing machine, which was kept on a firm horizontal surface. The respondents were asked to stand upright, lean their back against the wall, move the heels closer one another without shoes, and looking at a horizontal plane. Children with BMI of $>+1$ SD (equivalent to BMI 25 kg/m²) are categorized overweight. Similarly, underweight is labelled to children with BMI <-1 SD according to the WHO growth charts (5-19 years) for adolescents (World Health Organization, 2020).

The interview schedule was pre-tested by performing a pilot study on 10% of the sample size to assess the feasibility and appropriateness of the research instruments and methods. Based on the pre-test, the interview schedule was modified as per response elicited, and the words used in the questionnaire were simplified to make them more understandable. Completed schedules were checked weekly for consistency and completeness by the supervisors. Data were analyzed using SPSS version 20.0 (Chicago, IL, United States) for Windows.

The Chi-square test was applied to study the association between physical activity and screen time among children. A statistical significance level (p) was set at < 0.05 . (to ethical clearance number D. No. 1006/FM dated 13.7.2018)

RESULTS

This section explains sociodemographic characteristics of the respondents.

Table 1 shows that the majority (42.6%) of the respondents was in the 12-year age group as new academic session just started at the time of study. The mean age of the respondents was between 12 ± 0.81 years. In the present study, 56.6% of the respondents were males, and 43.4% were females. As many as 92.4% lived in urban areas, while 7.6% students lived in rural areas.

Table 1. Sociodemographic characteristics of the respondents

Characteristics	Frequency (N)	Percentage (%)
Age in years		
12	341	42.6
13	244	30.5
14	215	26.9
Sex		
Male	453	56.6
Female	347	43.4
Address		
Urban	739	92.4
Rural	61	7.6

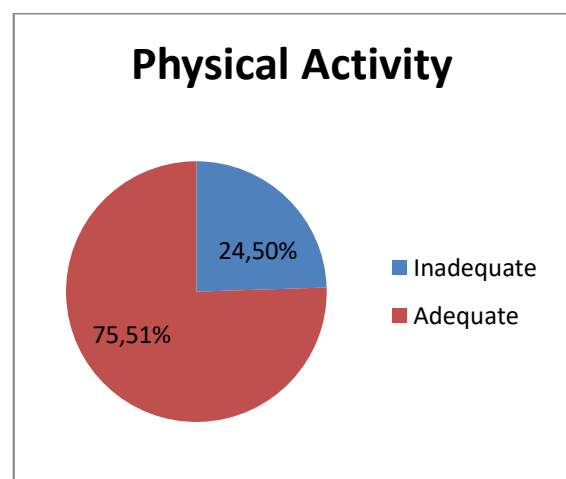


Figure 2. Distribution of students at A.M.U. High Schools by frequency of physical activity

Figure 2 presents the majority of the adolescent respondents had adequate frequency of physical activity (75%). Meanwhile, inadequate frequency of physical activity was reported among a quarter of the students. It can be concluded that students with adequate frequency of physical activity met the minimum required criteria for physical activity, while students with inadequate frequency of physical activity could be at risk of various diseases which arise due to less physical activity.

Very few students (8.30%) reported that they did not have enough time to watch television mainly due to their packed study schedule or coaching or tuition classes. A few students (24%) reported that they watched television for more than 2-3 hours, and very few (8.6%) informed having screen time of more than 4 hours, while the majority (59.10%) had screen time of 1-2

hours (see Figure 3). Hence, it can be concluded that screen time duration could mainly depend on the time left after school and coaching classes. The total mean screen time was 2.6 ± 0.94 hours per day.

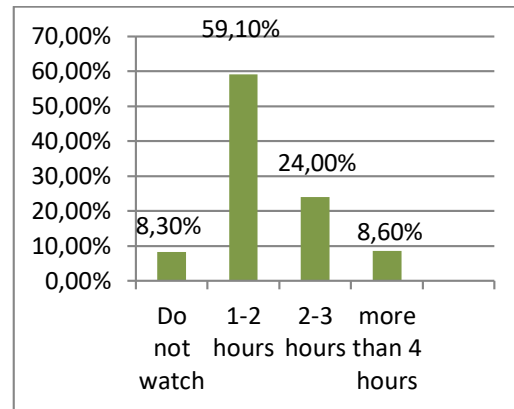


Figure 3. Distribution of students at A.M.U. High Schools by device screen time

Table 2. The average duration of screen time by variables among students at A.M.U. High Schools

Sex	N	Mean screen time duration
Males	453	2.40±1.23 hours
Females	347	2.31±1.16 hours
t= 0.9; p <0.05		
Age	N	Mean screen time duration
12 years	341	2.6±0.90 hours
13 years	244	2.8±1.03 hours
14 years	215	2.6±0.89 hours
ANOVA F = 3.38; p < 0.05		
BMI	N	Mean Screen time Duration
Underweight	415	2.6±0.96 hours
Normal	204	2.6±0.94 hours
Overweight	181	2.6±0.90 hours
ANOVA F = 0.167; p > 0.05		

Table 2 presents that the mean screen time had a statistically significant association with gender as the T-test showed the mean screen time was not much different among males from females (2.40 ± 1.23 and 2.31 ± 1.16 , respectively). Regarding the age groups, the ANOVA test found age was significantly related to screen time duration. The mean screen time was not much different among the three age

groups (2.6 ± 0.90 hours among 12-year-old students, 2.8 ± 1.03 hours among 13-year-old students, and 2.6 ± 0.89 hours among 14-year-old students). While the BMI was not significantly different from the mean screen time (2.6 ± 0.96 hours among underweight students, 2.6 ± 0.94 hours normal students, and 2.6 ± 0.90 hours among overweight students).

Table 3. The association between frequency of physical activity, age, sex, BMI and screen time among students at A.M.U. High Schools

Age	Physical activity level				Σ
	Inadequate		Adequate		
	n	%	n	%	
12 years	53	15.5	288	84.5	341
13 years	69	28.3	175	71.7	244
14 years	74	34.4	141	65.6	215
$\chi^2=28.110, df=2, p<0.05$					
Sex	Physical activity level				Σ
	Inadequate		Adequate		
	n	%	n	%	
Male	76	16.8	377	83.2	453
Female	120	34.6	227	65.4	347
$\chi^2=33.675, df=1, p<0.05$					
BMI	Physical activity level				Σ
	Inadequate		Adequate		
	n	%	n	%	
Underweight	105	25.3	310	74.7	415
Normal	54	26.5	150	73.5	204
Overweight	37	20.4	144	79.6	181
$\chi^2=2.184, df=2, p>0.05, r=0.03$					
Screen time duration	Physical activity level				Σ
	Inadequate		Adequate		
	n	%	n	%	
1-2 hours	109	23.0	364	77	473
2-3 hours	46	24.0	146	76	192
More than 4 hours	16	23.2	53	76.8	69
Do not watch T.V	25	37.9	41	62.1	66
Total	196	24.5	604	75.5	800
$\chi^2=7.023, df=3, p>0.05, r=-.056$					

From the table below, frequency of physical activity progressively decreased across all the age groups as the age increased. The low frequency of physical activity (15.5%) was found among 12-year age group, and more increased frequency (34.4%) was observed among 14-year age group, while adequate frequency of physical activity (84.5%) was found among 12-year age group. It had decreased to a mere 17.2% among 14-year age group. Frequency of physical activity was significantly associated with age groups.

A significant association was found between sex and frequency of physical

activity ($p < 0.05$). It can be seen that more male respondents had more adequate frequency of physical activity (83.2%) than female ones (65.4%). Also, females as compared to males had more inadequate frequency of physical activity (34.6%).

The study demonstrated a large number of underweight students had adequate frequency of physical activity (74.7%), while only a small number of overweight students had inadequate frequency of physical activity (20.4%). Weight was not significantly related to frequency of physical activity ($p > 0.05$).

However, a weak positive correlation existed between these variables.

Along with this, the majority of the students with adequate physical activity had recommended screen time duration, i.e., between 1-2 hours. Meanwhile, the students with good screen time duration (23.3%) had inadequate frequency of physical activity. Most of the students (76.8%) with good screen time duration could do physical activity adequately. The association between frequency of physical activity and screen time duration was not significant ($p > 0.05$) and negative ($r = -.056$).

DISCUSSION

Research conducted in Canada among children between 8- 13 years old ($n= 401$; 194 boys and 207 girls) reported that a significant decrease in frequency of physical activity was found along older ages (Sherar *et al.*, 2007). A review study on diet, physical activity, and inactivity in children and adolescents (5-18 years of age) found that frequency of physical activity decreased as ages got older (Leech, McNaughton and Timperio, 2014). In India, a similar study among children around 5-18 years old showed also support the current results (Swaminathan *et al.*, 2011). There was an increase in the academic burden that caused students not able to have sufficient time for being physically active. The increase in academic burden also leads to decrease in time for physical activities; in turn, it could be the reason that worsens the situation.

With regards to physical activity and sex, among students aged 12 to 14 years in China, a larger number of males had higher frequency of physical activity (Shi *et al.*, 2006). Another study in Saskatchewan reported a significant association between increasing age and decreasing physical activity among school children (Sherar *et al.*, 2007). Along with this, a study in Spain concluded that among students aged 12-18 years, 26.2% of the whole boys and 46% of the total girls could not meet adequate

frequency of physical activity (Serrano-Sanchez *et al.*, 2011). Studies done in Nigeria and India are consistent with the facts that the patterns and frequency of physical activity among schoolboy adolescents varied by sex. The frequency of physical activity in males was marginally higher compared to females (Oyeyemi, Ishaku, Oyekola *et al.*, 2016; Swaminathan *et al.*, 2011). The findings are also consistent with the current study, in which boys were more physically active compared to girls. Similarly, in another study regarding patterns of physical activity behavior, higher numbers of male students engaged in high frequency of physical activity compared to girls who did not show any such trend (Smith *et al.*, 2016). In another cross-sectional study on 456 college students aged 18-28 years in Saudi Arabia, almost half of the female students reported physical inactivity (Alzamil *et al.*, 2019).

In the same way as the current study, research among urban children aged 8-15 years in South Indian reported that moderate to vigorous frequency of physical activity was higher in boys than in girls (Swaminathan *et al.*, 2011). A study among school children aged 10-19 years ($n= 1714$; 55% males and 45% females) in Ambala, Haryana, reported that the frequency of physical activity remained consistently less than 60 minutes per day in both sexes. Around 40% adolescents reported > 1680 METs/week, and 11% adolescents spent > 2520 METs/week, respectively (Pathak *et al.*, 2017).

As whether physical activity was related to BMI was concerned, some studies showed similar results while some had discordant results. A study in Seychells stated frequency of physical activity and weight had a significantly inverse relationship (Bovet, Auguste and Burdette, 2007). Another study in Iran reported that physical activity and weight had a significantly inverse association as well (Kelishadi *et al.*, 2007). However, this study is not in line with the present study. In

Ghana, children who had more weight were less physically active than children with normal weight (AOR = 1.44; 95% CI = 1.07, 1.94) (Aryeetey, Lartey, Marquis *et al.*, 2017). A study among school students in Bhubaneswar city, India mentioned low frequency of physical activity was significantly associated with overweight, while the current study showed different results (Hota *et al.*, 2015). In contrast, research reported that BMI was not significantly associated with frequency of physical activity, and so did the present study (Goyal *et al.*, 2011).

The major current findings conveyed that most of the students had adequate frequency of physical activity and good screen time duration as recommended by the guidelines (Encyclopedia, 2020).

With regard to physical activity, a study in Dakar reported that 57% of the students were involved in moderate physical activity, while 43% had low PAL (Diouf *et al.*, 2016). Another study in Greece reported similar results to the present study that school children conducted adequate frequency of physical activity (Diouf *et al.*, 2016; Tsioufis *et al.*, 2011). The PAQ-C questionnaire in the current study tends to overestimate moderate frequency of physical activity and screen time duration compared to the measured intensity of physical activity (Peters *et al.*, 2010). By contrast, the 2016 India Report on physical activity in children and youth stated that only about 38% of children between 13-15 years old met the recommended PAL (Katapally *et al.*, 2016). Similar results have been found in a few other studies conducted in West Bengal and Nagpur, India (Lahiri *et al.*, 2019; Ronghe *et al.*, 2016).

Various studies from Mexico and India have reported that school adolescents did not adhere to the recommended screen time limit. Most of them had average screen duration of 3 hours per day and used mobile phones for the entertainment purposes (Dubey *et al.*, 2018; Lahiri *et al.*, 2019; Morales-Ruán *et al.*, 2009). Another study

in Australia reported about 63% adolescents used electronic devices for more than 2 hours per day (Hysing *et al.*, 2015). These results are in line with the current study where 24% of the students had screen time duration of more than 2 hours per day, and 8.6% had screen time duration of more than 4 hours per day.

The mean screen time duration was more than 2 hours per day in both male and female students. However, it was higher in males than females probably due to easy availability and accessibility to devices and lack of recreational facilities in residential areas, leading children to be compelled with using electronic devices for recreational purposes (Shah, Fahey, Soni *et al.*, 2019). In rural areas of Western India, the average screen time duration was 2.7 hours (SD = 1.7). This finding accords with the present study.

As for BMI status and time duration, in Ireland, a longitudinal study reported longer screen time in overweight children than normal children (O'Brien, Issartel and Belton, 2018). Consistent with the current study, a similar study conducted in Tamil Nadu, India conveyed no significant association between BMI and screen time (S. Santha Kumar, 2019). Regardless of BMI, students had an average screen time of 2.6 hours per day (Nawab *et al.*, 2016).

A study among school adolescents in the United States showed that less exposure to screen and more adequate frequency of physical activity were associated with lower obesity (Boone *et al.*, 2007). In contrast, this current study showed screen time was not associated with frequency of physical activity. Similarly, various other studies among school adolescents in Spain, the United Kingdom, and the United States confirmed children having less screen time were more physically active (Marshall *et al.*, 2004; Sandercock, Ogunleye and Voss, 2012; Serrano-Sanchez *et al.*, 2011). However, in Ireland, research found that screen time duration was far unrelated to frequency of physical activity (O'Brien *et al.*, 2018). In

India, some studies contrastingly showed screen time was correlated with frequency of physical activities (Boone *et al.*, 2007; Dubey *et al.*, 2018).

CONCLUSION

Almost a quarter of the students had inadequate frequency of physical activity, while almost more than half of the respondents followed the recommended screen time limit. Screen time was not significantly correlated with frequency of physical activity.

For children having inadequate frequency of physical activity, interventions can be introduced at family, school, and community levels, along with strong political commitment from the government. Parents can be role models, teaching them the benefits of being physically active. Increasing the duration and frequency of physical education classes at schools, provision of proper infrastructure and safe environment in residential areas are some ways to ensure children's physical activity. Teachers should educate the students about the importance of taking proper diet as well as limiting screen time on electronic devices. Besides, they need to motivate them to perform more physical activity (CDC, 2011). Despite the results, the present study may have some limitations due to a short period of data collection using the PAQ-C questionnaire, thus leading to bias. Apart from this, since the study was conducted only on adolescents enrolled to schools, the previous results might not be generated to the entire adolescent population of the same age group.

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