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Original Article

Screen time and metabolic syndrome among expatriate adolescents in the United Arab Emirates

Moien AB Khan [a], Syed M. Shah [b], Abdullah Shehab [c], Samit Ghosal [d], Shamma J. Muhairi [a], Rami H. Al-Rifai [b], Fatima Al Maskari [b, e], Juma Alkaabi [c], Javaid Nauman [b, f, *]

[a] Department of Family Medicine, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates
[b] Institute of Public Health, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates
[c] Department of Internal Medicine, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates
[d] Nightingale Hospital, Kolkata, India
[e] Zayed Center for Health Sciences, United Arab Emirates University, United Arab Emirates
[f] Department of Circulation and Medical Imaging, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology, Trondheim, Norway

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ABSTRACT

Background: Both screen time and metabolic syndrome (MetS) are associated with health outcomes. However, limited data exist on the association between screen time and MetS among expatriate adolescents living in United Arab Emirates (UAE).
Methods: We conducted a cross-sectional school-based study on 473 expatriate adolescents (47% girls) aged 12–18 years in Al-Ain district of Abu Dhabi Emirates in the UAE. Data was collected with the expertise of trained nurses & IDF criteria was used to define MetS. Information on screen time (computer, television, and video game use combined) during a regular day was self-reported, and divided into two categories: <2, or ≥2 h per day. Using logistic regression analyses, adjusted odds ratios (OR) and 95% confidence intervals (CI) were estimated for the association between screen time and MetS.
Results: A high proportion of adolescents (75.3%) spent ≥2 h daily on screen. The prevalence of MetS was 8.5% in those with <2 h per day of screen time compared with 13.5% in those who reported ≥2 h per day. There was a graded positive association between screen time and MetS (*P*-trend = 0.01). Each hour increase in screen time was associated with 21% (OR, 1.21; 95% CI, 1.08–1.35) greater likelihood of having MetS. The adjusted OR value associated with ≥2 h of daily screen time was 2.20 (95% CI, 1.04–4.67), compared with adolescents who spent less than 2 h of daily screen time.
Conclusion: Higher screen time by expatriate adolescents was associated with increased likelihood of having MetS.

1. Introduction

Computers, tablets, and mobiles are the key tools used for electronic communication and visualization by the current generation. Today's adolescents have grown up spending a major part of their life on screens. There is growing evidence that screen time is associated with decreased physical activity [1], increased food intake [2], and lower metabolic rates [3], all leading to obesity and its consequences [2,4].

Metabolic syndrome (MetS) is defined as a set of risk factors, consisting of glucose intolerance, central obesity, hypertension, and dyslipidemia, leading to an increased risk of type 2 diabetes and cardiovascular disease [5]. In the last 20 years, the United Arab Emirates (UAE) has transformed due to rapid socioeconomic growth, which has resulted in a lifestyle with increased calorie intake and sedentary behaviors among adolescents [6]. Sedentary behavior is described as any sitting behavior with a minimal energy expenditure, that is, ≤1.5 metabolic equivalents, such as watching television, reading, or playing video games in a sitting or reclining position [7,8].

* Corresponding author.
E-mail address: javaid.nauman@uaeu.ac.ae (J. Nauman).

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Worldwide, obesity and MetS are on the rise amongst adolescents [9,10], and in the UAE, the prevalence of MetS in obese adolescents is around 59% [11]. It has been suggested that childhood MetS has adverse consequences in adult life [12]. At the same time, laptops, smartphones, tablets, and other small screen devices have become readily available over the last decade, with adolescents spending as much as 11 h each day on such electronic gadgets [13]. The findings of a recent meta-analysis in an adolescent population suggested that prolonged screen time is associated with the development of MetS [4].

The UAE, as an emerging economy, has witnessed rapid urbanization with an influx of expatriate workforce [14]. The UAE population comprises approximately 11% nationals, with the rest being expatriates of different nationalities [15]. Expat adolescents mostly go to English curriculum schools, and participate in little physical activity overall [16]. However, data on the amount of time spent on screens by expatriate adolescents and its relationship with MetS in the UAE are limited. Therefore, this study aimed to assess the association between screen time and MetS in a cross-sectional school-based survey in the UAE.

2. Methods

This cross-sectional study was conducted in schools enrolling adolescents aged 12–18 years in Al Ain, Abu Dhabi, the largest and wealthiest of the seven emirates of the UAE. A detailed description of the sampling frame, inclusion/exclusion criteria, participants, and measurements is available elsewhere [11]. Briefly, out of 114 schools, eight were randomly selected, and students within schools were sampled proportional to the enrollment size of each school to obtain a self-weighting sample. To assess the association between screen time and MetS, we studied 474 expatriate adolescents (251 males and 223 females, 98% Arabs) with available data on screen time and components of MetS.

Trained nurses using standardized methods conducted anthropometric and clinical measurements of blood pressure, waist circumference, height, weight, plasma glucose, total cholesterol, high-density lipoprotein (HDL), and triglycerides after overnight fasting of the study participants. Information on the attendance of physical education classes, smoking status, parental education, and intake of carbonated drinks, fruits, milk, vegetables, and fast foods was collected through self-administered questionnaires [11].

The institutional ethics committee, the Al Ain Medical District Human Research Ethics Committee approved the study. Informed written consents were obtained either from parents in case of minors/children or adults who were 18 years old at the time of study.

2.1. Screen time

Screen time included computer game use, videos, and television and was self-reported. Participants reported the number of hours per typical day in the past 30 days that they spent watching television (including videos) and/or using a computer (including video games) during their free time.

2.2. Metabolic syndrome

We used the International Diabetes Federation guidelines to define MetS, where the defining criterion for MetS included presence of obesity and at least two of four criteria [17,18]. For this purpose, waist circumference cut points established by Katzmarzyk et al. [19] were used to identify abdominal obesity. The diagnostic criteria of MetS in children and adolescents include a waist circumference ≥90th percentile (for youth <16 years of age) or ≥94th percentile (aged 16 years or older), triglycerides levels ≥150 mg/dL (1.7 mmol/L), HDL-cholesterol <40 mg/dL (1.03 mmol/L) for youth younger than 16 years, or <40 mg/dL for boys and <50 mg/dL (1.29 mmol/L) in girls aged 16 years and older, fasting plasma glucose (FPG) levels of ›100 mg/dL (5.6 mmol/L) or known type 2 diabetes mellitus, and blood pressure ≥130/85 mmHg or treatment of previously diagnosed hypertension [11,17–19].

2.3. Statistical analyses

Descriptive data are presented as means (standard deviations [SD]) for continuous variables, and numbers (percentages) for categorical variables. Characteristics of participants were compared using paired samples t-tests for continuous variables and chi-square tests for categorical variables. We categorized participants into two groups according to their daily screen time: <2 h/day or ≥2 h/day. The cut-off point was chosen "a priori", based on results from previous studies [4,7,20].We then used logistic regression analyses to quantify the magnitude and direction of the association between daily screen time and MetS. The <2 h/day group was used as a reference, and we present both age and sex-adjusted as well as multivariable-adjusted effect estimates with 95% confidence intervals (CI). Multiple adjustments were made for age, sex, physical education classes, smoking status, parental education, and intake of carbonated drinks, fruits, vegetables, milk, and fast foods. In a sensitivity analysis, we also addressed possible within-school clustering of MetS using the school as a random variable in the final multivariable model.

In a separate analysis, we used three groups of different screen times (<2, 2–5, or >5 h/day) to assess a potential dose-response association with MetS. We also tested the interaction between screen time and attendance of physical education classes, and sex as an additional factor for the association between screen time and MetS. All statistical tests were two-sided and $P < 0.05$ was considered significant. Statistical analyses were performed using Stata for Windows (Version 15.1, StataCorp LLC, Texas, USA).

3. Results

The characteristics of the study participants are presented in Table 1. The mean age of study participants was 14.9 (SD, 1.9) years, and 47% of them were females. Three out of four participants (75.3%) reported ≥2 h/day of screen time. The prevalence of MetS was 8.5% in those with <2 h/day of screen time compared with 13.4% in those who reported ≥2 h/day. The prevalence of various components of MetS increased with an increase in screen time, as shown in Fig. 1. Participants who spent ≥2 h/day on screens were more likely to have low HDL levels (27.6%), hypertension (11.9%) or elevated triglyceride levels (4.2%) or to be overweight/obese (38.1%), compared with the participants who spent <2 h/day on screens.

The results of the logistic regression analyses investigating the association between screen time and MetS adjusted for various confounders are presented in Table 2. Compared with the reference group (<2 h/days), participants with ≥2 h/day were 2.2 times (OR, 2.20; 95% CI, 1.04–4.67) more likely to have MetS. There was a positive association between screen time and MetS (Fig. 2). Each hour of increase in screen time was associated with a 21% (OR, 1.21; 95% CI, 1.08–1.35) greater likelihood of having MetS, independent of other covariates (Table 2).

There was a graded positive association between screen time and MetS (Fig. 3, P-trend = 0.01). Compared with the reference group (<2 h/day), the OR values associated with 2–5 h and >5 h of daily screen time were 2.09 (95% CI, 1.00–4.43) and 3.27 (95% CI, 1.22–8.77), respectively.

Table 1
Characteristics of study participants.

	Screen time, hours per day			
	Total	<2	≥2	*P*-value[a]
No. of subjects, (%)	474	117 (24.7)	357 (75.3)	
Female sex, No. (%)	223 (47.1)	40 (34.2)	183 (51.3)	<0.01
Age, mean (SD), years	14.9 (1.9)	14.9 (2.0)	14.9 (1.8)	0.99
Metabolic syndrome, No. (%)[b]				
No	416 (87.8)	107 (91.5)	309 (86.5)	
Yes	58 (12.2)	10 (8.5)	48 (13.5)	0.16
PE classes per week, No. (%)				
0	87 (18.3)	23 (19.6)	64 (17.9)	
1	154 (32.5)	34 (29.1)	120 (33.6)	
≥2	233 (49.2)	60 (51.3)	173 (48.5)	0.65
Smoking status, No. (%)				
Never	383 (80.8)	93 (79.5)	290 (81.2)	
Current	25 (5.3)	10 (8.5)	15 (4.2)	
Former	66 (13.9)	14 (12.0)	52 (14.6)	0.16
Parental education, No. (%)[c]				
No with high education	92 (19.4)	22 (18.8)	70 (19.6)	
One with high education	175 (36.9)	49 (41.9)	126 (35.3)	
Both with high education	161 (34.0)	31 (26.5)	130 (36.4)	
Don't know	46 (9.7)	15 (12.8)	31 (8.7)	0.16
Daily carbonated drinks intake, No. (%)				
0	40 (8.4)	15 (12.8)	25 (7.0)	
≤1	316 (66.7)	73 (62.4)	243 (68.1)	
>1	118 (24.9)	29 (24.8)	89 (24.9)	0.14
Daily fruit intake, No. (%)				
≤1	354 (74.7)	87 (74.4)	267 (74.8)	
>1	120 (25.3)	30 (25.6)	90 (25.2)	0.93
Daily milk intake, No. (%)				
≤1	345 (72.8)	84 (71.8)	261 (73.1)	
>1	129 (27.2)	33 (28.2)	96 (26.9)	0.78
Daily vegetable intake, No. (%)				
≤1	334 (70.5)	78 (66.7)	256 (71.7)	
>1	140 (29.5)	39 (33.3)	101 (28.3)	0.30
Fast food intake per week, No. (%)				
≤1	284 (59.9)	65 (55.6)	219 (61.3)	
>1	190 (40.1)	52 (44.4)	138 (38.7)	0.27

PE, physical education.
[a] Group differences were examined by using *t*-test for continuous variables, and χ^2 tests were used for proportions of categorical variables.
[b] According to International Diabetes Federation criteria.
[c] High education was defined as graduating from college or university.

Table 2
Odds ratio of metabolic syndrome according to screen time.

Screen time (hours/day)	Mets[a]					
	No	Yes	OR[b]	(95% CI)	OR[c]	(95% CI)
<2	107	10	1.00	(Reference)	1.00	(Reference)
≥2	309	48	2.25	(1.08–4.70)	2.20	(1.04–4.67)
Per 1 h	416	58	1.19	(1.07–1.32)	1.21	(1.08–1.35)

Mets, metabolic syndrome; OR, odds ratio; CI, confidence interval.
[a] According to International Diabetes Federation criteria.
[b] Adjusted for age and sex.
[c] Adjusted for age, sex, physical education classes, smoking status, parental education, and daily intake of carbonated drinks, fruits, vegetables, milk, and fast food.

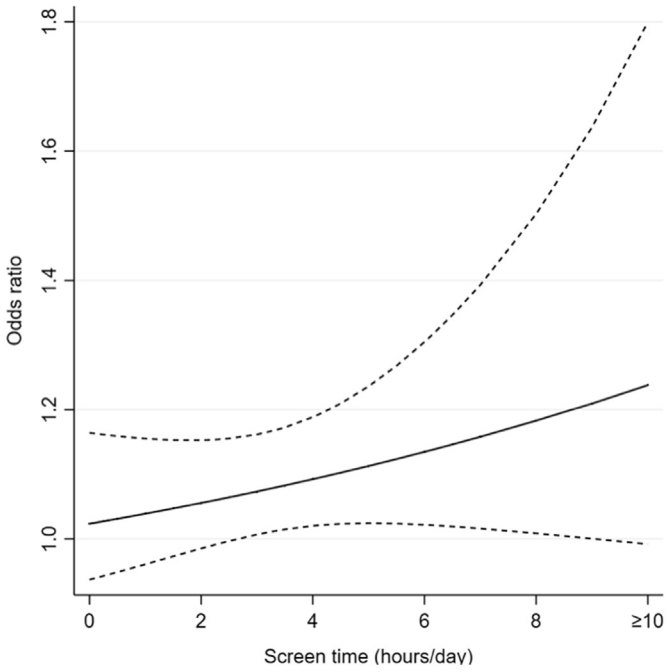

Fig. 2. Screen time and risk of having metabolic syndrome. Solid line represents the odd ratio, and dashed lines represent 95% confidence intervals.

The results of the interaction analyses showed no significant interactions between screen time and attendance of physical education classes (*P*-value for interaction = 0.59), and sex (*P*-value for interaction = 0.22) with the risk of MetS. The results of the sensitivity analysis to determine possible within-school clustering of MetS were not substantially different from the results of the analysis without this adjustment (data not shown).

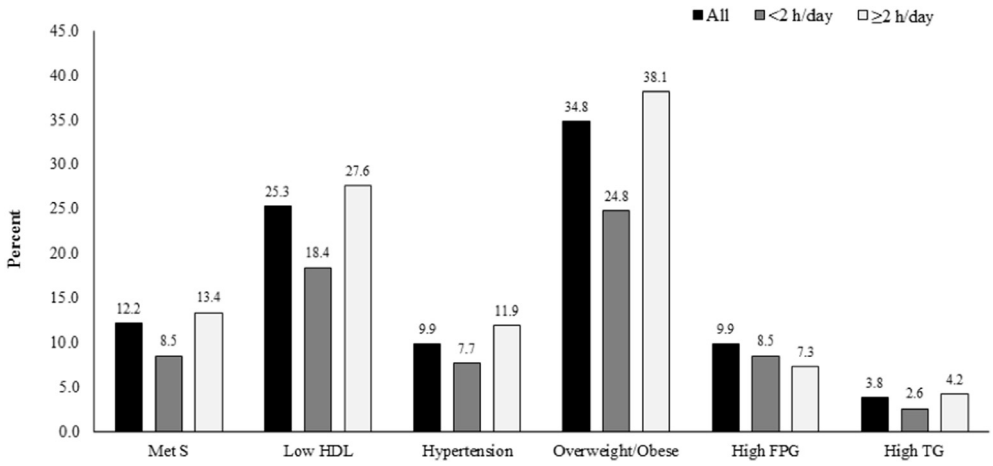

Fig. 1. Screen time and factors associated with metabolic syndrome. MetS, metabolic syndrome; HDL, high-density lipoprotein cholesterol; FPG, fasting plasma glucose; TG, triglycerides.

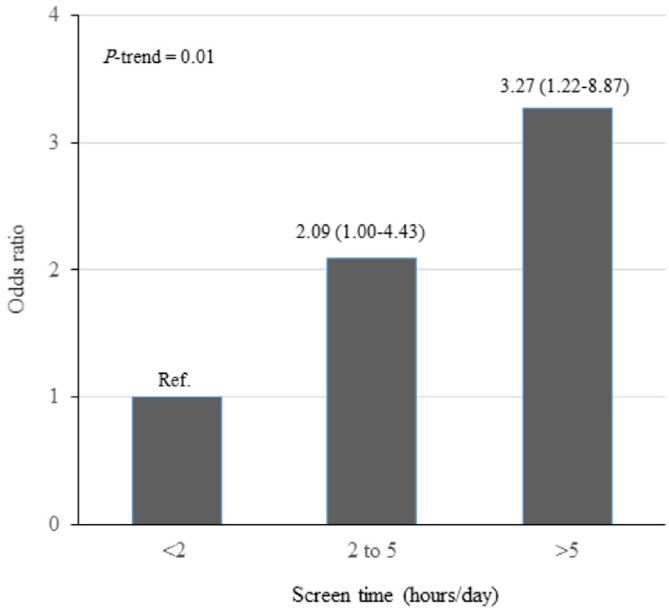

Fig. 3. Odds ratio of metabolic syndrome according to screen time.

4. Discussion

The main finding of the present study is that screen time was associated with the likelihood of having MetS in a positive graded manner, independent of various confounders, in our sample of expatriate adolescents in the UAE. Adolescents reporting daily screen times of 2 h or more were twice to three times as likely to have MetS than those with <2 h/day of screen time.

To our knowledge, this is the first study that assessed the association between screen time and MetS in expatriate adolescents in the UAE. Our findings showing an increased likelihood of MetS associated with increasing screen times are in line with previous studies showing positive associations between screen time and several cardio-metabolic risk factors in young adulthood [4,21–25]. In the NHANES study, screen time was associated with an increased likelihood of MetS in a dose-dependent manner [25]. A systematic review of sedentary behavior and health indicators in school-aged children and youth concluded that higher duration and frequency of watching TV was associated with unfavorable body composition, decreased fitness, and higher clustering of cardio-metabolic risk factors [21].

Previous studies have reported the prevalence of screen time in both Emirati and non-Emirati adolescents [26,27]. The recently published UAE 2018 Report Card on physical activity for children and youth reported that 62% of expatriate students did not meet the daily screen time recommendations [27]. A study of 1022 adolescent students (11% expatriates) aged between 12 and 16 years showed that 60% of Emiratis and 50% of expatriate adolescents are not meeting the guidelines of a maximum of 2 h screen time per day [26]. Our results show that approximately 75% of the adolescents in our sample, more than what has been reported earlier, are spending 2 or more hours daily on screens. A plausible explanation for this discrepancy could be the wide age range of our study participants (aged 12–18 years) in comparison with the samples assessed in the UAE 2018 Report Card (aged 13–17 years) [24] and by Haroun et al. (aged 12–16 years) [26]. Indeed, older age has been shown to be positively associated with higher screen times among students in grades 7 to 12 with a mean age of 15.6 years [20], and our results are consistent with the NHANES study reporting that 75% of adolescent spend at least 2 h daily on screens [25].

Recent evidence from adult populations has suggested that high levels of physical activity at moderate intensity may attenuate or effectively eliminate the increased risk of death associated with prolonged sitting times [28,29]. However, there is no data available that would allow to compare these findings to adolescent populations. Our results show no significant interactions between screen time and attendance of physical education classes, suggesting that both increasing screen time and decreasing physical activity may be independent predictors of MetS. Future studies in adolescent populations are warranted to investigate the potential modifying effect of physical activity on the association between screen time and MetS.

4.1. Strengths and limitations

The strengths of our study include a relatively large sample size, standardized methods of anthropometric and clinical measurements, and detailed information on diet and various cardiovascular risk factors. However, several limitations warrant attention. A subjective measure of self-reporting as a means of measuring technology is always fraught with challenges. Using accelerometers and inclinometers and capturing data directly from electronic devices could be more objective and more reliable [7]. However, many studies that have used accelerometers found it difficult to examine patterns of sedentary time and sedentary bouts. In these studies, breaks in sedentary time were not consistently associated with any outcome [30]. Also, accelerometers may not be sensitive enough to capture patterns of sedentary time. Inclinometers, which can accurately capture postures, can objectively capture sedentary time [31] and would allow the direct tracking of screen time to more accurately address the measurement challenge. However, the sharing of devices, passive screen time such as watching television, as well as technical issues can affect the accuracy of such measurements [32,33]. Combining objective measures with subjective measures in future studies will enable context-specific information assessments. Furthermore, the cross-sectional study design does not permit to comment on potential causal associations between screen time and MetS.

To reduce screen time and improve metabolic health, innovative programs should be implemented to maximize participation in physical activities. For instance, parental education is an important determinant of children's sedentary activities [34]. It has been suggested that low parental knowledge of free-time activities leads to increased screen time [35]. Future studies should assess the effect of parental education and training to reinforce screen time regulations and healthy behaviors in order to decrease screen time engagement.

In summary, our study shows that higher screen time in a sample of expatriate adolescents was associated with an increased likelihood of MetS. These findings suggest that public health prevention initiatives for youth focusing on reducing screen time may contribute to better cardio-metabolic health.

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Disclosure

The authors report no conflicts of interest in this work.

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