# The association between body mass index and duration spent on electronic devices in children and adolescents in Western Saudi Arabia

*Abdulmoein E. Al-Agha,* FRCPCH, *F. Sarah Nizar,* MBBS, *Anwar M. Nahhas,* MBBS.

## ABSTRACT

**الأهداف:** تقييم العلاقة بين معدل كتلة الجسم والوقت المستغرق من الأطفال واليافعين على الأجهزة الالكترونية، كجهاز التلفاز، جهاز الكمبيوتر، أجهزة ألعاب الفيديو، والأجهزة اللوحية. وقياس تأثير العلاقة بين عوامل عدة وبين إرتفاع معدل كتلة الجسم لدى الأطفال.

**الطريقة:** شملت هذه الدراسة المقطعية 541 طفل ومراهق بين مارس ويونيو 2015م. تم الحصول على البيانات وقياسات الطول والوزن عن طريق عيادة الأطفال المتنقلة، جدة، المملكة العربية السعودية. تم حساب مؤشر كتلة الجسم وفقاً لمعايير مركز مكافحة الأمراض والوقاية منها (CDC).

**النتائج:** كان متوسط عمر الأطفال 10.1 سنوات. أثبت 68.4% من أفراد العينة ممن أمضوا ساعتين فأكثر على الاجهزة الالكترونية وجود علاقة بين تناول الوجبات أمام شاشة التلفاز، قلة أو عدم ممارسة النشاط البدني، وإرتفاع معدل كتلة الجسم.

**الخاتمة:** وُجدت السمنة بمعدل أعلى بين الأطفال مستخدمي الأجهزة الإلكترونية لمدة أكثر من ساعتين يومياً. ووُجدت علاقة مثبتة بين قلة النشاط البدني، وتناول الطعام أمام شاشة التلفاز.

**Objectives:** To evaluate the relationship between body mass index (BMI) and the duration spent on electronic devices, and to assess the factors that can cause obesity among children.

**Methods:** A cross-sectional study including 541 participants. Data was collected from March to June 2015 via ambulatory pediatric clinics in Jeddah, Kingdom of Saudi Arabia. The BMI standard deviation was calculated based on Center of Disease Control and Prevention (CDC) standards.

**Results:** The mean age of the participants was 10.1 years. Children who spent ≥2 hours daily on electronic devices showed an increased BMI, and made up 68.4% of the sample.

**Conclusion:** An increased BMI was more common among children who spent ≥2 hours daily on electronic devices. The relationship between BMI, reduced physical activity, and eating during television viewing was determined.

***Saudi Med J 2016; Vol. 37 (4): 436-439***
***doi: 10.15537/smj.2016.4.15018***

*From the Department of Pediatrics (Al-Agha), King Abdulaziz University Hospital, and Ibn Sina National College (Nizar, Nahhas), Jeddah, Kingdom of Saudi Arabia.*

*Received 9th December 2015. Accepted 24th February 2016.*

*Address correspondence and reprint request to: Prof. Abdulmoein E. Al-Agha, Department of Pediatrics, King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia. E-mail: aagha@kau.edu.sa*

Obesity mainly occurs as a result of an imbalance between the intake and expenditure of energy. The increasing prevalence of obesity among children and adolescents all over the world is a cause for concern due to the potentially devastating effects a high body mass index (BMI) can have on their health. An important risk factor that has been associated with this problem is the considerable amount of time spent on electronic entertainment and communication devices (EECDs), such as television sets, cell phones, computers, video game consoles, and electronic tablets. Television viewing is undoubtedly the most extensively studied behavior worldwide, and there are certain mechanisms that link it to increased rates of obesity. These mechanisms also apply to the other aforementioned electronic devices and include: the mindless consumption of junk food and sweetened beverages during the use of these devices, the lack of time available for physical activity, and the effect of food and drink advertisements seen through these platforms.[1-4] Although previous studies

**Disclosure**. Authors have no conflict of interest, and the work was not supported or funded by any drug company.

have analyzed the use of EECDs and their contribution toward an increased BMI, they have not covered the use of electronic tablets. This study takes this relatively new piece of technology into account. In the Kingdom of Saudi Arabia (KSA), sedentary behavior is favored these days due to the major lifestyle changes that have taken place over the last few decades as a result of westernization, and due to globalization, which has made these electronic devices available everywhere. This has led to an increased prevalence of obesity (from 6.3-11.3%) among children and adolescents in KSA.[1] The aim of this study was to evaluate the association between BMI and the duration spent on these EECDs in a cross-sectional study of Saudi children in Jeddah.

**Methods.** *Participants.* The retrospective cross-sectional study was conducted from March to June, 2015 at a selected number of ambulatory clinics in Jeddah, KSA. Ambulatory clinics are outpatient health care facilities that cater to the primary health care needs of a localized population (local communities). Flyers were distributed to invite families from the general population to participate by bringing their children in for checkups at these clinics. The participants comprised 541 children and adolescents between the ages of 2 and 18 years old, with the mean age being 10.1 ± 3.6. Of these participants, 54.3% were male and 45.7% were female. Children below the age of 2 and above the age of 18 were excluded from this study.

*Instruments.* The participants were weighed to the nearest 0.1 kg using a single scale and their height (without shoes) was measured to the nearest cm using a mechanical beam scale with a height rod. Their waist circumference and hip circumference were measured to the nearest cm using a measuring tape. All the previously mentioned anthropometric measurements were also taken from at least one parent, but are not reported here.

*Data collection.* The BMI is an easy way to screen for weight categories that may lead to health issues. The BMI (weight in kg divided by height in square meters) was calculated and the children were classified as either normal (5-85th), overweight (85-95th), obese (>95th), or severely obese (>99th) using Center for Disease Control and Prevention (CDC) growth charts[5] where the age of the child is also taken in to account. Questionnaires were filled out using tablet devices during face-to-face interviews and parents were asked how long their children spent watching TV, how often they used other electronic devices, such as tablets, cell phones, video game consoles, and computers, if they asked for and consumed more junk food after viewing advertisements, and if they consumed junk food while using these devices. Junk food can be defined as types of food that are high in calories usually due to excessive sugar, fat, salt, and little nutritional value. They include fast food, sweetened beverages, candy, salted crisps, and so forth). Junk food consumption was measured based on whether children did or did not eat them while using these devices. Television and EECD usage were measured based on whether children used these for more than or less than 2 hours on an average day. Parents were also asked regarding their children's daily physical activities, particularly the time they spent exercising (less than or more than 30 minutes per day). An informed verbal consent was acquired from both the parents and children. Some results were excluded from the study as there were missing values for height and weight, and some BMI standard deviation (SD) values were out of range. PubMed was used to find articles on previous similar researches in order to compare them with our findings.

*Statistical analysis.* Data was entered, coded, and analyzed using the Statistical Package for Social Science (SPSS Inc., Chicago, IL, USA) version 16. Cross tabulation was used to find the frequencies and percentages of hours using electronics with relation to BMI categories (obese or non-obese) that depend on BMI SDs. Independent sample t-test was used to test the mean difference of BMI (kg\m$^2$) between the 2 categories and the time spent using electronics. The analysis was carried out on a sample size equal to 541 children between the ages of 2 and 18. Results were considered to be significant with $p<0.05$.

The significance of relations between some nutritional habits (eating in front the television and eating habits being influenced by advertisements seen on TVs) and BMI were analyzed. We also used Spearman correlation for ordinal data to find the relation between exercise duration categories (<30 minutes, 30-60 minutes, and ≥60 minutes) and BMI categories, after assuming that the data followed a normal distribution dependent on a normal curve with the same sample size.

**Results.** *Obesity.* Obesity was found in 86.6% of the study population of which 162 (44.4%) were severely obese and 154 (42.2%) were obese. It was found to be associated with the lack of physical exercise, eating in front of the TV, and prolonged use of other electronic devices. **Table 1** shows that male participants had a slightly higher mean weight and BMI than female participants. **Table 2** illustrates the valid percentage of participants in various BMI categories and different variables.

*Television and other electronic devices.* **Tables 2 & 3** illustrate that although 63.9% of the children in this

study watched at least 2 hours of TV per day, there was no significant association between the time spent watching TV and obesity ($p$=0.138). There was also no significant association between the influence of advertisements on eating habits and obesity ($p$=0.126). There was however, a positive association between obesity and a history of eating while watching TV ($p$=0.028). The amount of time spent on other electronic devices was classified as either less than or at least 2 hours per day with 68.4% of the children using them for 2 hours or more. The results in **Table 3** show a significant difference between BMI (kg\m$^2$) mean among children and adolescents who used these devices for more than 2 hours and increased BMI ($p$=0.004).

***Physical activity.*** Approximately 48% exercised for less than 30 minutes per day and were severely obese. We found a significant relation between the ordinal variables, BMI categories and exercise duration ($p$=0.015, r = -0.147).

**Table 1 -** The realtion between BMI and gender among children and adolescent participants.

| Variables | BMI (kg/m$^2$) (Mean) | BMI (SD) | Weight in kg (Mean) | Weight (SD) |
|---|---|---|---|---|
| *Gender* | | | | |
| Male | 27.0 | 2.7 | 53.3 | 4.7 |
| Female | 26.7 | 2.6 | 52.9 | 4.5 |

BMI - body mass index, SD - standard deviation

**Table 2 -** Valid percentage of participants in various BMI categories and different variables.

| Variables | Valid % |
|---|---|
| *BMI categories* | |
| Normal weight | 3.6 |
| Overweight | 9.9 |
| Obese | 42.2 |
| Severely obese | 44.4 |
| **Total** | **100.0** |
| *Time spent watching TV* | |
| <2 hours | 36.1 |
| ≥2 hours | 63.9 |
| *Time spent on electronic devices* | |
| <2 hours | 31.6 |
| ≥2 hours | 68.4 |
| *Eating in front of TV habit* | |
| No | 26.3 |
| Yes | 73.7 |
| *Exercise duration daily* | |
| <30 minutes | 40.4 |
| 30-60 minutes | 45.7 |
| >60 minutes | 13.9 |
| *Exercise ≥30 minutes/day* | |
| No | 49 |
| Yes | 51 |

BMI - body mass index

**Discussion.** Previous studies have confirmed the rising prevalence of obesity among the children of KSA,[6] while several other international studies have shown a causal link between television viewing and childhood obesity.[6-9] This study revealed Jeddah's alarmingly high prevalence of childhood obesity compared not only with the rest of KSA but with other countries as well. It also evaluated the relation between BMI and the time spent on various electronic entertainment and communication devices in children. A positive association was found between obesity and the use of electronic devices (except televisions). Some of the possible explanations for this association that have been hypothesized in previous studies were rapid modernization in Middle Eastern countries, poor knowledge on health and food choices, lack of physical activity, and the consumption of junk food during TV viewing. Hancox and Poulton[10] reported a significant association between BMI and television viewing in girls but the current study found no difference among the 2 genders.[5]

Five studies[6,8,9,11,12] evaluated the association between childhood obesity and long hours of TV viewing. Of

**Table 3 -** The relation between BMI and different TV/EECD variables among studied children and adolescents in Western Saudi Arabia

| Variables | Obese | Non-obese | Total | Mean of BMI (kg/m$^2$) | *P*-value |
|---|---|---|---|---|---|
| | n (%) | | | | |
| *Time spent watching TV per day* | | | | | 0.138 |
| <2 hours | 109 (85.2) | 19 (14.8) | 128 | 27.4 | |
| ≥2 hours | 193 (87.3) | 28 (12.7) | 221 | 26.8 | |
| *Time spent on EECDs per day* | | | | | 0.004 |
| <2 hours | 89 (88.1) | 12 (11.9) | 101 | 26.1 | |
| ≥2 hours | 206 (85.8) | 34 (14.2) | 240 | 27.4 | |
| *History of eating while watching TV* | | | | | 0.028 |
| Yes | 191 (86.8) | 29 (13.2) | 220 | | |
| No | 60 (82.2) | 13 (17.8) | 73 | | |
| *Eating habits influenced by advertisements* | | | | | 0.126 |
| Yes | 47 (83.9) | 9 (16.1) | 56 | | |
| No | 35 (92.1) | 3 (7.9) | 38 | | |

BMI - body mass index, EECD - electronic entertainment and communication devices, TV - television

these 5 studies, 4 found a positive relation between the 2 factors,[6,8,9,11] whereas one only showed a strong relation between high BMI and electronic game use.[12] In this study, watching TV for more than 2 hours per day was significantly associated with childhood obesity. Television viewing has now been surpassed by the usage of other relatively new electronic devices, such as computers and video games. In the current study, computer and internet use was associated with a significant increase in childhood obesity.

Our results supported the mechanism of "unconscious eating" of energy-dense foods, such as savory snacks and sweetened beverages, in front of TV sets. This type of eating was seen less with the use of other electronic devices, such as computers, video games, and so forth, due to the fact that physical interaction was needed to use these devices.[13-15] As opposed to other international studies, our data did not show a significant relation suggesting the influence of advertisements on the consumption of junk food.

Unlike a previous study carried out by Al-Ghamdi,[6] this study showed a slight positive relationship between BMI and exercise duration, where there was an increase in BMI with a decrease in the amount of time spent on different types of physical activity. A significant proportion of children who did not exercise or exercised for <30 minutes were either obese or severely obese.

***Study limitations.*** The main limitation of this study is its cross-sectional design, which does not allow confident causal inferences. Prospective studies are needed to confirm our findings. Other limitations include the limited area covered, the size of the study sample, the fact that some results were not used due to being incomplete, the lack of information on the content of media use, the focus of exercise as the sole form of physical activity, and the fact that all the information was obtained from the parents rather than the children themselves. It could also be noted that obese children are more likely to be brought to ambulatory clinics by their parents due to their weight. This could be a possible reason why our study showed such a high percentage of obesity among the participants. In addition, several of the variables were based on self-reports, therefore, making the information gathered questionable. The major strength of our study was the fact that the data is very recent and reflects the use of new communication technology such as tablets.

In conclusion, this study shows that there is an association between the BMI of children and adolescents in KSA and various factors. An increased BMI was found among children who spent ≥2 hours per day on electronic devices. However, there was no association between the duration spent (specifically) watching TV and BMI. A relationship between BMI, reduced physical activity and eating during TV viewing were also determined. Our findings are similar to those of other researches which had examined the association between the duration spent on electronic devices and BMI. We strongly emphasize on the fact that children and adolescents should not use electronic devices for more than 2 hours, minimize the habit of eating junk food in front of TVs, and make an effort to becoming more physically active.

## References


1. Al Shehri A, Al Fattani A, Al Alwan I. Obesity among Saudi children. ***Saudi J Obesity*** 2013; 1: 3-9.
2. Strasburger VC. Children, adolescents, obesity, and the media. ***Pediatrics*** 2011; 128: 201-208.
3. Bickham DS, Blood EA, Walls CE, Shrier LA, Rich M. Characteristics of screen media use associated with higher BMI in young adolescents. ***Pediatrics*** 2013; 131: 935-941.
4. Chaput JP, Klingenberg L, Astrup A, Sjödin AM. ***Obes Rev*** 2011; 12: e12-e20.
5. Centers for Disease Control and Prevention. National Center for Health Statistics: Individual Growth Charts. Available from: http://www.cdc.gov/growthcharts/charts.htm
6. Al-Ghamdi SH. The association between watching television and obesity in children of school-age in Saudi Arabia. ***J Family Community Med*** 2013; 20: 83-89.
7. Fulton JE, Wang X, Yore MM, Carlson SA, Galuska DA, Caspersen CJ. Television Viewing, Computer Use, and BMI among U.S. Children and Adolescents. ***J Phys Act Health*** 2009; 6: S28-S35.
8. Liang T, Kuhle S, Veugelers PJ. Nutrition and body weights of Canadian children watching television and eating while watching television. ***Pub Health Nutr*** 2009; 12: 2457-2463.
9. Mistry SK, Puthussery S. Risk factors of overweight and obesity in childhood and adolescence in South Asian countries: a systematic review of the evidence. ***Public Health*** 2015; 129: 200-209.
10. Hancox RJ, Poulton R. Watching television is associated with childhood obesity: but is it clinically important? ***Int J Obes (Lond)*** 2006; 30: 171-175.
11. Santaliestra-Pasías AM, Mouratidou T, Verbestel V, Huybrechts I, Gottrand F, Le Donne C, et al. Food consumption and screen-based sedentary behaviors in European adolescents. ***Arch Pediatr Adolesc Med*** 2012; 166: 1010-1020.
12. Cox R, Skouteris H, Rutherford L, Fuller-Tyszkiewicz M, Dell' Aquila D, Hardy LL. Television viewing, television content, food intake, physical activity and body mass index: a cross-sectional study of preschool children aged 2-6 years. ***Health Promot J Austr*** 2012; 23: 58-62.
13. Vandewater EA, Shim M, Caplovitz AG. Linking obesity and activity level with children's television and video game use. ***J Adolesc*** 2004; 27: 71-85.
14. Matheson DM, Killen JD, Wang Y, Varady A, Robinson TN. Children's food consumption during television viewing. ***Am J Clin Nutr*** 2004; 79: 1088-1094.
15. Yen CF, Hsiao RC, Ko CH, Yen JY, Huang CF, Liu SC, et al. The relationships between body mass index and television viewing, internet use and cellular phone use: the moderating effects of socio-demographic characteristics and exercise. ***Int J Eat Disord*** 2010; 43: 565-571.