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Original research

Screen time, cardiorespiratory fitness and adiposity among school-age children from Monteria, Colombia

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ABSTRACT

Objectives: To explore the association between electronic media exposure (television viewing time, personal computer/video game use, total screen time), and waist circumference and body mass index, and study whether this association is independent of cardiorespiratory fitness, in a representative sample of adolescents from Montería, Colombia.
Design: Cross-sectional study analyzing data from 546 students aged 11–18 years, from fourteen randomly selected schools. *Z*-scores for WC and BMI were calculated.
Methods: The physical activity module of the Global School Health Survey 2007 was used to determine EME, and the shuttle run test was used to assess CRF. Linear regression models adjusted by age, school location, physical activity level, type of institution (public or private), consumption of sweetened beverages, fast food, and fried food were used.
Results: Among boys, independently of cardiorespiratory fitness, high television viewing time (≥2 h/day) ($\beta = +0.22$; $p < 0.02$), was positively associated with waist circumference. High total screen time (>3 h/day) was positively associated with waist circumference ($\beta = +0.34$; $p < 0.01$), and body mass index ($\beta = +0.39$; $p < 0.01$). Among girls, sedentary behavior was not associated with adiposity, but cardiorespiratory fitness ($\beta = -0.04$; $p < 0.02$) was negatively associated with body mass index.
Conclusions: These findings support the evidence on the negative impact of excessive electronic media exposure and low cardiorespiratory fitness, and highlight the need for interventions and prevention strategies.

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Introduction

Excess adiposity, particularly visceral adipose tissue, is associated with increased risk of chronic diseases.[1] Recent estimates indicate that the prevalence of overweight among adolescents has increased markedly in developing countries.[2] For instance, in Brazil the prevalence of overweight increased from 3.7% in 1974 to 21.7% in 2009, among boys 10–19 years of age, while among girls overweight increased from 7.6% to 19.4%.[3] In Colombia, rates of overweight among adolescents increased from 13.7% in 2005 to 16.7% in 2010, and this growth was higher among boys.[4] Considering the negative health impacts of obesity, the trend toward excess adiposity among school-age children is a public health concern.

Rapid processes of urbanization and globalization have been linked with increased obesity in low and middle income countries.[5] In this context, changing diets, decline in physical activity (PA) levels and increased sedentary behaviors have all contribute to a higher prevalence of obesity.[6] In addition, sitting for prolonged periods of time plays a significant role in the development of obesity,[7] and according to recent evidence, it could be considered, along with poor fitness, a modifiable risk factor for cardiovascular and metabolic disease.[8] Most of the sedentary behavior (SB) is characterized by what is called electronic media exposure (EME), this is the access and use of electronic devices, such as television, computers, cell phones, and video games. Access and use of these devices is growing around the world.[8]

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Previous studies in youth have shown consistent associations between SB and excess adipose tissue, explained through various mechanisms such as increased energy intake,[9] reduced metabolic rate,[10] and lower levels of PA.[11] The mechanism by which sedentary behavior is associated with low cardiorespiratory fitness may be, presumably, due to displacement of time spent in PA.[12] Previous studies have suggested a mechanism by which cardiorespiratory fitness (CRF) attenuates the health risk of obesity, and may even mitigate the effects of sedentary behavior.[12] Studies have also documented that EME patterns are established early in life, and track through adulthood.[13] However, available evidence of associations between SB with adiposity, independently of CRF, are more limited.

Despite acknowledgment of the importance of studying and tracking sedentary behaviors for public health surveillance, few studies have examined associations of EME with central adiposity and BMI among school-age children living in deprived areas of Latin America. Therefore the aim of this study is to explore the association between EME, Total Screen Time (TST), and WC and BMI, and whether this association is independent of CRF, in a representative sample of adolescents from Montería, Colombia.

Methods

The current study was conducted between June and September 2008 in Montería, capital city of Cordoba, located in the Caribbean coast of Colombia which has a population of approximately 382,000 inhabitants. Since 1995, there has been a rapid increase in the population partly explained by the large number of displaced families and individuals that migrate into the city escaping from the violence generated in the countryside as a result of internal conflict.[14] By 2005, there were more than 20,800 displaced individuals in Monteria; many of them face conditions of unemployment and extreme poverty. The city has a significant deficit of public infrastructure for recreation purposes[15] and there is a lack of interventions aimed at promoting PA. According to the 2010 National Nutrition Survey, 13–17 years old adolescents from Cordoba spend an average of 2.9 h per d watching TV or playing video games.[4] This scenario creates an environment conducive to the development of overweight and sedentary behaviors. Because city officials have to address more pressing needs in the population, such as displacement, frequent river floods and related infectious diseases, little attention is given to risk factors for non-communicable disease.

Participants were adolescents ages 11–18 years who resided in Monteria. Fourteen schools (10 from urban and 4 from rural areas) were randomly selected as primary sampling units from a sampling frame of 73 schools. More details on study design, selection criteria, and sample calculations can be found elsewhere.[16] A total of 578 students were randomly selected according to enrollment size of each school. This analysis uses data from 546 adolescents who had complete information.

Study protocols were approved by the Central Research Committee of Universidad de Córdoba. Study was conducted according to appropriate ethical regulations specified in the resolution N° 008430 of the Ministry of Health of Colombia.[17] Informed consent from selected students and their parents was obtained prior to data collection.

Weight, height, and waist circumference were measured by trained staff using standardized measuring equipment and protocols. Weight was measured to the nearest 0.1 kg with participants wearing light clothing and without shoes; using a calibrated beam scale (Health-O-Meter). Height was measured to the nearest millimeter in bare feet with a portable stadiometer (SECA). Body mass index (BMI) was calculated as weight in kilograms divided by height squared in meters. *Z*-scores for BMI were calculated according to the World Health Organization (WHO).[18]

Waist circumference (WC) was measured after a relaxed expiration, using a measuring tape, at the midpoint between the iliac crest and the rib cage, in direct contact with the skin. Due to the lack of reference values for the Colombian population of adolescents, *Z*-scores for WC were constructed, using the study population's mean and standard deviation WC values according to gender and age.

Children were asked to complete the modules of PA and dietary behaviors from the Global School-based Student Health Survey (GSHS-2006). The GSHS is a self-report questionnaire developed by the WHO largely based on the Youth Risk Behavior Survey from CDC (YBRS).[19] The GSHS measures physical activity, eating, and electronic media exposure (EME). The Spanish version of the GSHS survey has been used in Colombia, Venezuela, Peru, Ecuador, Chile and Argentina.[20] Students were asked to report in two separate questions, how much time they spent watching television and using a personal computer (PC) or playing video games (VG) during a typical or usual school day. A checklist of seven options was provided (I do not watch TV/I do not use the PC or play VG during school days, less than 1 h per day, 1 h/day, 2 h/day, 3 h/day, 4 h/day, 5 or more h/day). Based on the recommendation of the American Academy of Pediatrics of less than 2 h of TV viewing per day,[21] two categories for TV viewing time and PC/VG use were created: low TV viewing time or PC/VG use (<2 h/day), and high TV viewing time or PC/VG use (≥2 h/day). Lastly, a composite variable of total screen time (TST) was created, based on the total number of hours of TV viewing time, and PC/VG use. This variable was categorized in two groups, low TST (≤3 h/day), and high TST (>3 h/day). This criterion was used considering that less than 2 h is the suggested cutoff point, separately for television and computer use.

CRF was assessed using the 20-m shuttle run test. This test involves running back and forth between two lines, 20 m apart. The running pace is given by an audio source. Participants must run the 20 m between the lines in time to mark the audio. The test begins at a slow pace, and each minute the pace increases. The test was stopped when the child was unable to reach each 20 m line at the moment of the audio signal, after two consecutive times. This test has shown high reliability and validity to estimate CRF.[22] The equations of Leger et al.[23] were used to estimate VO_{2max}.

Participants provided information on their age and gender. Type of school (private or public) was used as socioeconomic position indicator.

We measured consumption of carbonated soft drinks with the question: During the past 30 days, how many times per day did you usually drink sodas, such as Coca-Cola (Coke), Pepsi or other local sweetened beverage brands? Consumption of high fat foods was measured with the question: During the past 30 days, how many times per day did you usually eat high fat foods, such as fried meats or French fries? For both questions, response options included: I did not drink/eat sodas or high fat foods during the past 30 days, less than one time per day, 1 time per day, 2 times per day, 3 times per day, 4 times per day, and 5 or more times per day. Finally, eating in fast food restaurants was measured with the question: During the past 7 days, on how many days did you eat at fast food restaurants such as McDonalds, Presto, Corral, or at a pizzeria or hamburgueseria? Response options were: 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, and 7 days. All dietary behavior variables were included in the models as continuous variables.

PA was measured through the following question: *During the past 7 days, on how many days were you physically active for at least 60 min per day?* (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe harder for at least part of the time.); response options were: 0 days, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, and 7 days. Participants were categorized as active if they reported 5 days or more. All other responses were categorized as inactive.

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