

# Encouragement to be More Physically Active or to Lessen Sedentary Behavior; Are These Two as the Same?

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**Background:** There are a considerable number of published studies that strongly support the benefits of physical activity in children, and to achieve such benefits, guidelines recommend children to participate in at least 60 minutes of physical activity every day. There is a vicious cycle between low physical activity and increased body mass index.

**Objectives:** The aim of this study was to assess daily physical activity and sedentary behavior in overweight and obese children.

**Patients and Methods:** In this descriptive analytical study, 300 overweight and obese children were recruited to assess their daily physical activity, energy expenditure and screen times with standard techniques. Distribution of these variables was examined according to their demographic characteristics. Using Pearson's correlation test and linear regression the predictor effect between these variables was discovered.

**Results:** There was a significant difference between physical activity and screen time according to Relative Body Mass Index (RBMI), gender and grade ( $P \leq 0.001$ ). Pearson's correlation test discovered a positive association between Weekly Screen Time (WST) and Daily Physical Activity (DPA) ( $r \approx 0.37$ ,  $P \leq 0.001$ ). In the regression model, children's screen time explained only about 13% of change in body mass index.

**Conclusions:** Overweight and obese children may consume more energy according to the international recommendations. In parallel with this, they experience more sedentary behavior, as well. In this situation, planning to decrease their sedentary behavior is at greater priority.

**Keywords:** Physical Activity; Child; Obesity; Students

## 1. Background

There are a considerable number of published studies that strongly support the benefits of physical activity in children, including: obesity and overweight prevention, healthy bones and muscles, chronic disease prevention, self-esteem improvement, and anxiety and stress reduction (1-5). Recent studies indicated that physical activity can improve academic performance and increase school achievements, and students may be more efficient learners after physical activity performance (6-10). To achieve such benefits, guidelines recommend children to participate in at least 60 minutes of physical activity every day (11).

Despite the abundance of data supporting the benefits of physical activity enhancement in children, some researchers discovered that children in many countries, especially in developing and underdeveloped nations, have not met the recommended level of physical activity (1, 2, 4, 10, 12).

Lack of adequate physical activity in children may lead to bad consequences during both childhood and adulthood. Increasing Body Mass Index (BMI) is one the obvious consequences of low physical activity. Initiation of a healthy life style in children is more convenient than change of an unhealthy life style in adults, thus health

education and behavior change intervention in children are suitable for researchers. The main theme in such researches was how to increase physical activity in children to result more energy expenditure.

Interventions to increase energy consumptions in children with Relative Body Mass Index (RBMI) above the 85th percentile are in limited consequences; overweight and obese children tend to restrict their physical activity, although some of them like to overestimate the amount of their physical activity (13-16). As shown in Figure 1, in a vicious cycle, low physical activity results increased BMI, and increased BMI results in low physical activity. In this study we proposed that overweight and obese children do more physical activity according to the international Physical Activity (PA) recommendations, and spent more time watching TV or playing computer games.

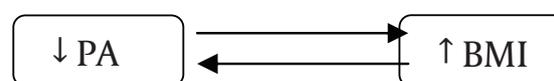


Figure 1. Vicious Cycle Between Physical Activity and Body Mass Index

## 2. Objectives

The primary aim of this study was to assess daily physical activity and sedentary behavior in overweight and obese children. Next, the study aimed to (a) examine correlations between children's screen time (ST) and physical activity, (b) construct a regression model for RBMI and ST in children and (c) compare the children's ST and PA according to standard recommendations.

## 3. Patients and Methods

### 3.1. Sampling and Study Design

This descriptive-analytical study was part of a study in Qazvin university of medical sciences. The six main constructs required to develop an educational intervention were assessed by the entire study; we selected 50 subjects per construct.

First, using the cluster sampling method, seventy elementary schools were selected from two districts of the Qazvin province, and next 300 overweight and obese students of 5<sup>th</sup> and 6<sup>th</sup> grade were recruited in the study. The Human Research Ethics Committee of the Qazvin University approved the study, and written informed parental consents and children assents were obtained prior to their recruitment in the study.

### 3.2. Measurements

#### 3.2.1. Demographic and Relative Body Mass Index Measures

Socio-demographic characteristics of the sample, such as: age, gender, grade and RBMI were gathered by a questionnaire. Relative body mass index of schoolchildren were collected from school health profiles. Based on this profile, students with RBMI of over the 85<sup>th</sup> percentile were selected and then their RBMI were calculated again with a standard method (17).

#### 3.2.2. Physical Activity in Children

Physical activity of children was measured using the previous day physical activity recall (PDPAR) tool. This tool is a standard instrument with 30-minute time blocks, which can assess previous physical activity of children. Some general activities are listed on the form, and the participants enter their main activity during each time period. To help participants select the correct level of intensity, the instrument provides pictorial representations of the four levels of relative intensity. Prior to the application of the PDPAR tool, we educated students on how to mark each block based on their main activities. Finally, based on the PDPAR scoring protocol, the energy consumption for physical activity was calculated according to Metabolic Equivalence (MET) (18).

#### 3.2.3. Screen Time in Children

Screen time explains any time spent on sedentary behaviors such as watching TV, video games and computer games. Screen time in children was assessed based on two methods; self-report and parent-report, with a standard questionnaire. In the self-report method, children estimated their weekly hours and minutes spent on sedentary behaviors. At the same time, in the parent-report, the researcher asked the mothers to estimate their children's screen time.

### 3.3. Analysis

After data coding, all data were entered in the SPSS software for analysis. The significance level was set on two-tailed with  $P \leq 0.05$ . Demographic data of children were analyzed using descriptive analysis methods. Differences between physical activity level according to gender, grade and RBMI were analyzed using the chi-square test. Also, distribution of children's screen time by gender, grade and RBMI was analyzed with the chi-square test. Pearson's correlation test was used to assess the correlation between the two methods of screen time measurement; self-report and mother's report. Finally, by the linear regression model, children's RBMI was regressed to their screen time, to discover the predictor impact of children's screen time on their weight status.

## 4. Results

Children's characteristics are presented in Table 1. They were in the range of 10.2 to 12.3 years old and 55% of them were obese ( $n = 165$ ) with almost equal distributions in gender and grade variables. Measures of Daily Physical Activity (DPA) and Weekly Screen Time (WST) in children according to their gender, grade and RBMI are shown in Table 2. There were significant differences between DPA according to RBMI ( $P \leq 0.001$ ); overweight children had lower DPA than obese cases ( $4.6 \pm 1.1$  ver.  $5.1 \pm 0.9$ ). Also, the t-test revealed a significant difference between mean DPA based on the grade variable, children of the 6<sup>th</sup> grade had lower DPA than children of the 5<sup>th</sup> grade ( $3.5 \pm 0.8$  ver.  $4.1 \pm 0.9$ ) ( $P \leq 0.001$ ). Gender-based distribution of DPA indicated that boys were more physically active than girls ( $5.53 \pm 0.64$  ver.  $4.2 \pm 0.9$ ) ( $P \leq 0.001$ ).

Distribution of WST in children revealed that obese children spent more time watching a screen (computer or TV) than overweight cases ( $23.0 \pm 6.9$  ver.  $17.5 \pm 7.2$ ), and there was a significant difference between the two groups ( $P \leq 0.001$ ). Children at the 5<sup>th</sup> grade spent more time watching a screen ( $13.9 \pm 2.5$  ver.  $12.5 \pm 2.1$ ), also boys had more WST ( $25.3 \pm 5.6$ ) than girls ( $15.8 \pm 6.0$ ), and the t-test showed that this difference was significant ( $P \leq 0.001$ ). Children's RBMI was regressed to WST, and the model was significant ( $F = 45$ ,  $P = 0.001$ ,  $R^2 = 13$ ). In the model, WST explained about only 13% of RBMI.

Pictorial exhibition of correlation between WST and DPA are shown in Figure 2. Pearson's correlation test dis-

covered a positive association between WST and DPA ( $r \approx 0.37, P \leq 0.001$ ).

**Table 1.** Demographic Characteristics of Children

Variables	Values	Range
<b>Children (n = 300)</b>		10.2 - 12.3 y
Age, y <sup>a</sup>	11.2 ± 1.1	
Gender <sup>b</sup>		
Male	145 (48.5)	
Female	155 (51.5)	
School Grade <sup>b</sup>		
5th	152 (50.5)	
6th	148 (49.5)	
RBMI <sup>c</sup>		
85 - 95 percentile	135 (45)	
≥ 95 percentile	165 (55)	

<sup>a</sup> Values are presented as Mean ± SD.

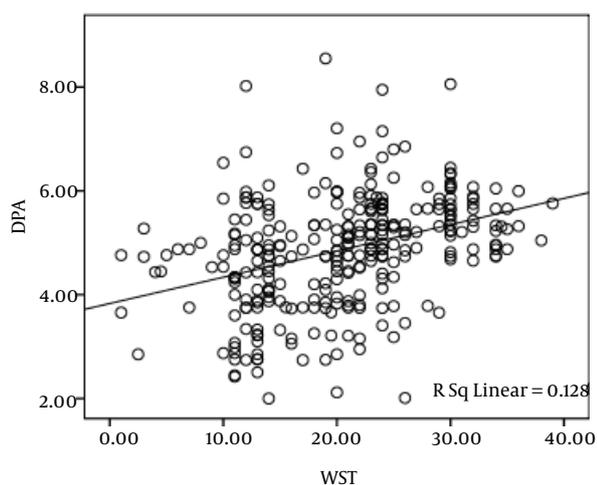
<sup>b</sup> Values are presented as No (%).

<sup>c</sup> RBMI; Relative Body Mass Index.

**Table 2.** Distribution of Physical Activity and Screen Time Based on Gender, Grade and Relative Body Mass Index<sup>a</sup>

Variables	DPA	WST	WST	t-test
<b>Gender</b>				0.000
Male	5.53 ± 0.64	25.3 ± 5.6	23.2 ± 4.4	
Female	4.2 ± 0.9	15.8 ± 6.0	15.2 ± 6.3	
<b>Grade</b>				0.000
5th	4.1 ± 0.9	13.9 ± 2.5	14.8 ± 2.3	
6th	3.5 ± 0.8	12.5 ± 2.1	12.2 ± 2.3	
<b>RBMI</b>				0.000
Over-weight	4.6 ± 1.1	17.5 ± 7.2	16.8 ± 6.9	
Obese	5.1 ± 0.9	23.0 ± 6.9	21.1 ± 5.8	

<sup>a</sup> DPA: Daily Physical Activity. WST: Weekly Screen Time (self-report). WST: Weekly Screen Time (parent-report). DPA was calculated based on daily energy consumption (MET). WST was calculated based on total hours spent per week.



**Figure 2.** Correlation Between Daily Physical Activity and Weekly Screen Time

## 5. Discussion

The primary aim of this study was to investigate the prevalence of PA and ST in children according to their gender, grade and RBMI. Secondary aims were to (a) examine the correlation between children’s screen time and physical activity, (b) construct a regression model for RBMI and ST in children and (c) compare the children’s ST and PA according to standard recommendations.

Our study revealed that obese children, regardless of their gender, had higher DPA than overweight children. Children’s PA was measured by PDPAR and it is possible that obese children overestimated their daily physical activity. Although most studies have demonstrated that increasing RBMI is accompanied by decreasing DPA in children (17, 19-23), yet similar findings have been shown in the study of Manley et al. (17). We suppose that such children like to do an overestimation of their DPA. This is due to our measurement technique, PDPAR, a self-report recall tool for assessment of DPA in children (24, 25). Although, its validity and reliability have been qualified with a pedometer and an accelerometer (18), yet in most studies researchers tend to assess children’s PA with PDPAR at the same time as a pedometer or other validated measure (26-29).

Another finding of this study showed a gender-based difference in DPA; boys had more DPA than girls. We almost found no study in contrast with this finding. Although the recommended level of PA for boys is more than girls (28, 30-33), some social inequalities and social barriers may be the common cause for such differences (34).

Based on our findings, children of the 6<sup>th</sup> grade had less DPA than those of the 5<sup>th</sup> grade. The associations between physical activity and cognitive performance have been assessed in many studies (35-38). Although, in most cases a positive association was found, yet a few studies consider only a specific type of physical activity such as rhythmic ones, and believe that only these lead to cognitive ability enhancement (10). In our study’s context, children at the 6<sup>th</sup> grade were forced to read more to pass exams for sharp-witted governmental schools. We think that this may be the main cause for the decreasing PA at the 6<sup>th</sup> grade. This finding is supported by some other studies (39).

Pearson’s correlation test showed that there was a positive association between DPA and ST; this means that children with high DPA in spite of their high RBMI had more ST. As a result, in addition to the positive association between RBMI and DPA, our study revealed that the association between DPA and ST was positive, as well. This means that children with higher DPA spend more time watching TV or playing games. Regarding physical activity guidelines, children in our study were more physically active than the recommended level, and simultaneously spend time more screen time in spite of their ascending trend in RBMI.

Based on the findings, children in our study were more

physically active than the recommended level, and obese children had more PA than overweight children and along with these results, they experienced more ST. Thus, in such situations, to decline RBMI decreasing ST may be more effective than DPA enhancement.

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## Authors' Contributions

Kazem Hosseinzadeh: study design and data collection. Shamsaddin Niknami: analysis of data and SPSS software application. Alireza Hidarnia: Academic writing and submission.

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