

Sleep time, tv/video games and snack consumption in preschool children – a cross-sectional study Tiempo de sueño, televisión / videojuegos y consumo de bocadillos en niños en edad preescolar: un estudio transversal

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Abstract. This study aims to evaluate the sedentary behavior, caloric content of snacks and sleep time of preschool children in two different regions of Portugal (Bragança and Gondomar). Participated in this study 230 healthy preschoolers (103 girls; 127 boys), of which 176 (76.5%) were from Bragança (mean age of 4.5 ± 0.7 years) and 54 (23.5%) were from Gondomar (mean age of 4.3 ± 1.0 years). A questionnaire about sedentary behavior, sleep time and caloric content of snacks (morning and afternoon) were answer by parents of this preschool children. The principal results of our study indicated that the preschool children slept an average of 9.9 ± 0.9 hours, spent time 1.5 ± 0.8 hours in front of television (TV) during the week, and 2.5 ± 1.5 hours during weekend. Regarding the time spent playing video games, they did 0.6 ± 0.6 hours during the week and 0.9 ± 0.9 hours during the weekend. The children morning snack had an average of 232.7 ± 100.8 kcal and the afternoon snack had an average of 350.4 ± 122.4 kcal. According to the WHO guidelines, the results of this study revealed that preschool children spent less hours sleeping, had more caloric content in the morning and afternoon snacks and spent more time in sedentary behaviors, of what is in the recommendations. These results also suggest that the children's slept time is affected by the time they spent watching TV and playing video games.

Keywords: Sedentary behavior; sleep time; preschool children; snacks.

Resumen. Este estudio tiene como objetivo evaluar el comportamiento sedentario, el contenido calórico de los bocadillos y el tiempo de sueño de los niños en edad preescolar en dos regiones diferentes de Portugal (Bragança y Gondomar). Participaron en este estudio 230 preescolares sanos (103 niñas; 127 niños), de los cuales 176 (76,5%) eran de Bragança (edad media de $4,5 \pm 0,7$ años) y 54 (23,5%) eran de Gondomar (media de edad de $4,3 \pm 1,0$ años). Los padres de estos niños en edad preescolar respondieron un cuestionario sobre el comportamiento sedentario, el tiempo de sueño y el contenido calórico de los bocadillos (mañana y tarde). Los principales resultados de nuestro estudio indicaron que los niños en edad preescolar duermen un promedio de $9,9 \pm 0,9$ horas, pasan $1,5 \pm 0,8$ horas frente a la televisión (TV) durante la semana y $2,5 \pm 1,5$ horas durante el fin de semana. En cuanto al tiempo dedicado a los videojuegos, dedicaron $0,6 \pm 0,6$ horas durante la semana y $0,9 \pm 0,9$ horas durante el fin de semana. La merienda de la mañana de los niños tuvo un promedio de $232,7 \pm 100,8$ kcal y la merienda de la tarde tuvo un promedio de $350,4 \pm 122,4$ kcal. Los resultados de este estudio han revelado que los niños en edad preescolar pasaban menos horas durmiendo, consumían más contenido calórico en las meriendas matutinas y vespertinas y pasaban más tiempo en conductas sedentarias, según las directrices. Estos resultados también sugieren que el tiempo de sueño de los niños se ve afectado por el tiempo que pasan viendo televisión y jugando videojuegos.

Palabras Clave: Comportamiento sedentario; hora de dormir; niños de preescolar; meriendas.

Introduction

The worldwide increasing prevalence of overweight and obese preschoolers in recent decades, represents a challenging public health issue (de Onis, Blossner, & Borghi, 2010; Wyszynska et al., 2020). As in other countries, in Portugal more than 30% of the childhood population has overweight (Camarinha, Graca, & Nogueira, 2016; Garrido-Miguel et al., 2019).

The etiology of overweight and obesity at these ages are multivariate, and the causes commonly pointed out are the lack of physical activity (PA) (Camarinha; Tam, Yassa, Parker, O'Connor, & Allman-Farinelli), time spent watching television (TV) and playing videogames, the excess energy intake, as well as parental and environmental

influences. There is a positive association between parental and preschoolers' obesity, normally obese parents have obese children (McLoone & Morrison, 2014), as well parent's PA and sedentary behavior's influence childhood behavior (Goldfield, Harvey, Grattan, & Adamo, 2012). PA participation in preschool children contributes to motor skill and psychosocial development and is vital for establishing lifelong PA (Hoyos-Quintero & Garcia-Perdomo, 2019). On the other hand, snacks are as well important in providing energy and nutrients, as it is reported that snacks afford about 5-10% in the morning snacks and 10-15% in the afternoon snacks of the daily energy of preschool portuguese students (Hoffmann et al., 2019). It is reported that short sleep is associated with an increase snacking and preferences of high energy foods. Mechanism through which inadequate sleeping increases energy intake includes more time and opportunity for eating, psychological distress, more energy

needs to endure long awakening, and increased appetite hormones (Mozaffarian et al., 2020).

Electronic media devices as TV, computers, smartphones, tablets, video game consoles, and others, have become increasingly available for children. The increased exposure to these devices may affect children's sleep time, and the quality of sleep (Brockmann et al., 2016).

To our knowledge, this is the first cross-sectional study with the objectives: (i) to analyze the time watching TV and playing videogames, the caloric content of snacks and the sleep time of preschool children (ii) to analyze the time watching TV and playing videogames, the caloric content of snacks and the sleep time of preschool children between Bragança and Gondomar.

Material and Methods

Study Design and Study Sample

A cross-sectional study was conducted at 6 kindergartens, selected for convenience, in two different cities of Portugal, Bragança and Gondomar. The study included 230 healthy preschoolers, 127 males and 103 females. Participation in the study was voluntary and anonymous. Data were collected when children were attending kindergarten during the months of October and November. The entire investigation team was properly trained in data collection. The parents and guardians of all children that participated in the present study signed an informed consent (Shierka et al, 2018), and the study was approved by the local education authorities and the General Directorate of Education - Ministry of Education.

Anthropometric Measurements

All preschool children were measured without shoes and with the fewest pieces of clothing (t-shirt and shorts). Height was measured with a stadiometer attached to a wall and the result was recorded in meters. Subsequently, the body mass index (BMI) [body mass (kg) / height² (m)] was calculated. Based on the BMI values, the percentile of individual preschool children was calculated. A TANITA scale was used to measure body mass, with the values being recorded in kilograms with approximation to the hectogram. All measurements were carried out in duplicate with subsequent recording of the average value.

Time spent watching TV and playing videogames

It was asked to parent and guardians to answer a questionnaire to categorize the sedentary behaviors and the sleeping hours, with issues related to «time spent watching television» and «playing video games», both during the week and at the weekend, as well as the «number of hours of sleep», adapted from Baecke et al (1982) questionnaire.

Morning and Afternoon Snacks – caloric information

The assessment of the caloric intake and nutritional quality of the snacks in school context was carried out by the photographic record of the snacks, with identification of the child and the mealtime. Subsequently, the energy value of the snacks photographed was calculated based on the nutritional information contained on the labels, for packaged foods, and in the Portuguese Food Composition Table (TJ) for unpackaged foods (15). All this information was inserted in the software Food Processor SQL (ESHA Research Inc. Salem, OR, USA) with proven nutritional information from food composition tables from the United States Department of Agriculture, adapted to typical Portuguese foods and recipes. In these, the type of food and the amount presented were evaluated, proceeding with the calculation of the caloric intake (energy).

Statistical Analysis

Data were analyzed for normal distribution using Kolmogorov–Smirnov test. The mean, standard deviation and 95% confidence interval were calculated as descriptive statistics. Independent samples t-test was used for comparison between groups (between children from Gondomar and Bragança and between sexes). Pearson correlation was used to measure the association between different variables in both regions. Differences were considered significant when p-value <0.05. All statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 23.0 statistical software for Mac (IBM, Armonk, NY, USA).

Results

Participant's characterization

The children anthropometric characterization is presented in Table 1 (n = 230; mean age of 4.5 ± 0.8 years), of which 44.8% were female, and 76.5% of all children were from Bragança and 23.8% from Gondomar.

Table 1. Mean ± standard deviation of anthropometric variables of all preschool children, and those from Bragança and from Gondomar.

	Total (n=230)	Bragança (n=163)	Gondomar (n=54)	p-value
Age (years)	4.5 ± 0.8	4.5 ± 0.7	4.3 ± 1.0	0.163
Sex				
Female	44.8 % (n=103)	47.6% (n=83)	37.0% (n=20)	
Male	55.2 % (n=127)	52.8% (n=93)	63.0% (n=34)	
Weight (kg)	19.1 ± 3.4	19.3 ± 3.6	18.5 ± 2.9	0.139
Height (m)	1.1 ± 0.06	1.08 ± 0.1	1.06 ± 0.07	0.193
BMI (kg/m ²)	16.2 ± 1.6	16.1 ± 1.7	16.3 ± 1.3	0.478
WC (cm)	51.9 ± 4.1	52.0 ± 4.5	51.0 ± 3.0	0.052
%BMF	22.9 ± 3.6	23.1 ± 3.7	22.5 ± 3.4	0.255
Percentil	59.3 ± 28.5	54.8 ± 29.2	70.7 ± 23.2	0.000*

BMI: body mass index; WC: waist circumference; %BMF: percentage of body mass fat. * p-value<0.001, differences between Bragança and Gondomar.

Time spent watching TV and playing video games

Preschool children slept an average of 9.9 ± 0.9 hours and spent 1.5 ± 0.8 hours in front of television (TV) during the week, and 2.5 ± 1.5 hours during the weekend (Table 2). Regarding the time playing video games, the children spent 0.6 ± 0.6 hours during the week and 0.9 ± 0.9 hours during the weekend. Between cities, the children from Gondomar slept significantly less hours on average, than those from Bragança ($p < 0.05$). Considering the time spent in front of the TV during the week, the children from Bragança spent at least 1.5 ± 0.8 hours per week, as well as those from Gondomar. During the weekend, preschool children from Bragança watched 2.4 ± 1.3 hours of TV per week, and those from Gondomar 2.7 ± 1.8 hours. Regarding the time spent playing video games, preschoolers spent more hours on the weekend in both groups than on the week, but without statistically significant differences.

Table 2.

Mean \pm standard deviation of data from Sedentary Behavior: sleep time (sleep); television during the week (TV_week); television during the weekend (TV_weekend); paying video games/computer during the week (PC_week); paying video games/computer during the weekend (PC_weekend) in total and between groups Bragança and Gondomar.

	Total (n=217)	Bragança (n=163)	Gondomar (n=54)	p-value
Sleep (h)	9.9 ± 0.9	10.2 ± 1.5	9.5 ± 0.8	0.030*
TV_week (h)	1.5 ± 0.8	1.5 ± 0.8	1.5 ± 0.8	0.980
TV_weekend (h)	2.5 ± 1.5	2.4 ± 1.3	2.7 ± 1.8	0.353
PC_week (h)	0.6 ± 0.6	0.5 ± 0.6	0.7 ± 0.9	0.225
PC_weekend (h)	0.9 ± 0.9	0.9 ± 0.9	0.9 ± 0.8	0.841

*p-value < 0.05

Considering the time preschool children spent in front of a screen (watching TV and playing video games) the average value is 2.1 hours during the week and 3.4 hours during the weekend.

Morning and Afternoon Snacks – caloric information

The energy content of the morning and afternoon snacks from all sample, and between Bragança and Gondomar are detailed in Table 3. The children morning snack had an average of 232.7 ± 100.8 kcal and the afternoon snack 350.4 ± 122.4 kcal. The Gondomar preschool children' morning snack had significantly more energy content (250.2 ± 98.8 kcal) than those from Bragança (215.1 ± 102.8 kcal).

Table 3.

Mean \pm standard deviation of data from energy content of the morning and afternoon snacks of preschool children from Bragança and Gondomar.

	Total (n=230)	Bragança (n=163)	Gondomar (n=54)	p-value
Morning Snack (kcal)	232.7 ± 100.8	215.1 ± 102.8	250.2 ± 98.8	0.000*
Afternoon Snack (kcal)	350.4 ± 122.4	354.4 ± 124.6	346.3 ± 100.2	0.478

*p-value < 0.001

Correlation between anthropometric variables, time spent watching TV/playing video games, sleep time and caloric information of morning and afternoon snacks

It was observed a positive correlation between children BMI and the percentage of body fat ($r=0.692$, $p=0.000$) and waist circumference ($r=0.742$, $p=0.000$). On the other hand, BMI negatively correlates with sleep time ($r=-0.104$; $p=0.297$), time watching TV during week ($r=-0.047$; $p=0.637$) and during the weekend ($r=-0.073$; $p=0.462$), as well as time spending playing video games during week ($r=-0.101$; $p=0.308$) and during the weekend ($r=-0.072$; $p=0.468$).

The children that slept more hours, spent less time watching TV during week ($r=-0.044$; $p=0.638$) and during the weekend ($r=-0.157$; $p=0.093$). The same behavior was found on time spent playing video games, where the children that slept more hours, spent less time playing video games during the week ($r=-0.010$; $p=0.914$) and during the weekend ($r=0.075$; $p=0.424$). On the other hand, the children that spent more time watching TV during the week, also spent more time watching TV during the weekend ($r=0.482$; $p=0.000$), as well as spent more time playing video games during the week ($r=0.411$; $p=0.000$) and during the weekend ($r=0.380$; $p=0.000$).

There seems to be a tendency for older children to watch more TV during the weekend ($r=0.59$; $p=0.002$) than younger ones.

Discussion

This study assessed the time sleeping, watching TV and playing video games, as well as snack consumption in preschool children from two cities of Portugal, Bragança and Gondomar. To our knowledge, this is the first study to comprehensively examine these variables in a sample of preschool children from these cities aged from 3 to 5 years.

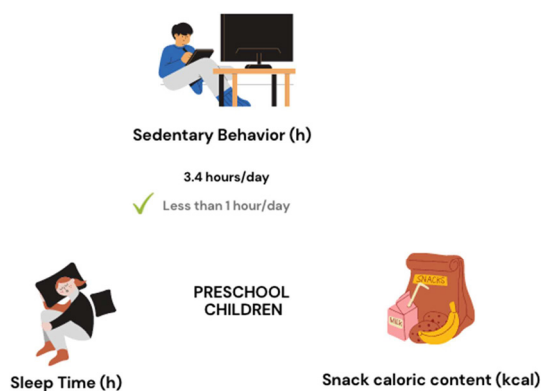
The principal results of our study indicated that the preschool children slept an average of 9.9 ± 0.9 hours, spent time 1.5 ± 0.8 hours in front of the TV during the week, and 2.5 ± 1.5 hours during weekend. Regarding the time spent playing video games, they did 0.6 ± 0.6 hours during the week and 0.9 ± 0.9 hours during the weekend. There were no differences between these two regions according to the body composition and sedentary behavior (spent time watching TV and playing video games). The preschool children from Bragança slept significantly more hours than children from Gondomar. The caloric content of snacks was similar in both regions.

The principal results of our study indicated that the preschool children slept less hours than the recommendations from the World Health Organization

(WHO), spend more time per day watching TV and playing video games and ingest more Calories in morning and afternoon snacks (Hoffmann et al., 2019). The caloric content of snacks was similar in both regions.

There were no clear correlations between body composition among both groups (children from Bragança and Gondomar), according to BMI and percentile values (shown in Table 1). Both groups were normal ponderal, between 50th and 70th percentiles, unlike the latest studies which indicate obesity has been increasing in children at preschool age (Camarinha, 2016; Delfa-de la Morena, 2022; Nader et al., 2006)

Table 4. Principal results of our study, according to snacks caloric content (kcal), sleep time (h/day) and sedentary behavior (h/day) and the recommendations below with a green check (Hoffmann et al., 2019; WHO).



Healthy habits and behaviors, such as caloric content of snacks and sedentary behaviors are typically established during early childhood. Evidence suggests that these behaviors track into later life (al, 2018; Díaz-Quesada, 2021). Children spend up to half of their after-school period with sedentary behaviors, such as screen activities. It has been recommended to limit the time spend by children in these kind of activities to a maximum of two hours daily, and in some countries, a limit of one hour per day was suggested (Hoffmann et al., 2019). According to WHO recommendations, the time in sedentary screen activities should be no more than 1 hour; and less is better. In our results, preschool children from Bragança and Gondomar spent more than 1 hour per day watching TV or paying video games during the week. However, that time was much higher over the weekend. On the other hand, sleep time is a salient feature of health and wellbeing that impacts multiple aspects of early childhood development. Certainly, early preschool children sleep problems are associated with a few poor developmental outcomes across social-emotional, physical health, nutritional intake, healthy development, among others (Mindell & Williamson, 2018). According to the recommendations (Paruthi et al., 2016), preschool children should sleep 10 to 13 hours per 24 hours. In our study, the children slept an average of 9.9 hours per day,

and those from Bragança slept significant more time than those from Gondomar. Rendering to Pearson's correlation, preschool children that slept less, spent more time watching TV and playing video games. In this sense, it seems that these sedentary activities are compromising the sleeping time. Video gaming during nighttime, in fact, is able to delay sleep onset and interfere with sleep duration and efficiency. Interactive computer game consumption prolonged sleep onset latency, more time in stage 2 sleep, and less slow-wave sleep as a percentage of total sleep time (Delfa-de la Morena, 2022; Intelangelo, 2022; Peracchia & Curcio, 2018; Pinillos-Patino, 2022).

Regarding the caloric content of snacks, in average, it was similar in both regions, showing more caloric content in the afternoon snack than in the morning. According to daily caloric intake recommended for a healthy growth in preschool age is 1310 kcal per day for girls and 1390 kcal for boys, which meant that the caloric content in morning and afternoon snacks corresponded to 42,0% of daily total energy intake in Bragança and 44.2% in Gondomar (Pinto, 2016; Robson, Khoury, Kalkwarf, & Copeland, 2015), which was more than recommended (Deming et al., 2017).

Conclusions

The results of this study have revealed that the children that spent less hours sleeping, ingest more caloric content in the morning and afternoon snacks and spent more time in sedentary behaviors, according to the recommendations. The time spent watching TV and playing video games seems to interfere with the total hours that children sleep. In the educational context, in conjunction with parents and guardians, it is essential to find strategies to reduce the time spent by children on screen activities, reduce the caloric content of snacks and increase the levels of physical activity, in order to have healthy children and consequently healthy adults.

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Disclosure Statement

No potential conflict of interest was reported by the authors.

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