sustainability

MDPI

Article

Use of Wearable Devices to Study Physical Activity in Early Childhood Education

Gema Díaz-Quesada [1], Cecilia Bahamonde-Pérez [2], José María Giménez-Egido [3,4,*] and Gema Torres-Luque [1]

[1] Faculty of Humanities and Education Sciences, University of Jaen, 23071 Jaen, Spain; gmdiaz@ujaen.es (G.D.-Q.); gtluque@ujaen.es (G.T.-L.)
[2] Department of Physical Education, Campus Joaquín Cabezas García (DEFDER), Metropolitan University of Educational Sciences, Santiago 2765, Chile; ceciliabahamondep@yahoo.es
[3] Department of Physical Activity and Sport, Faculty of Sport Science, Regional Campus of International Excellence "Campus Mare Nostrum", University of Murcia, 30720 Murcia, Spain
[4] Sport Performance Analysis Association, 30720 Murcia, Spain
* Correspondence: josemaria.gimenez@um.es

Abstract: Physical activity recommendations for early childhood are gradually being met to a lesser extent today. The objectives of the study were: (i) to assess the degree of compliance with physical activity (PA) recommendations by gender; and (ii) to analyze the level of PA and steps in different periods over a week. This study was an observational cross-sectional study. Sixty-three young children (33 boys and 30 girls) aged two years (2.15 ± 0.35) were recruited for this study. Participants wore a "Garmin vivofit® jr." activity tracker for seven days, collecting minutes of moderate-to-vigorous physical activity (MVPA) and step volume (Out-of-School Time and School Time). The results show a 50% compliance of the 120 min/day MVPA and 13,000 steps per day. No gender differences were detected. The findings in the analysis indicated a trend towards higher PA and steps at the Weekend. Moreover, participants reached higher PA and steps values "Out-of-School Time" than "School Time" (MVPA) (min/day). This study can provide strategies and motivational PA guidelines at school to enhance well-being at an early age. These activity trackers could stimulate more sustainable forms of urban mobility, such as walking, as the environment would accompany the child to meet daily PA recommendations.

Keywords: childhood; education; wearable technology; sustainability

Citation: Díaz-Quesada, G.; Bahamonde-Pérez, C.; Giménez-Egido, J.M.; Torres-Luque, G. Use of Wearable Devices to Study Physical Activity in Early Childhood Education. *Sustainability* **2021**, *13*, 13998. https://doi.org/10.3390/su132413998

Academic Editors: Mª Luisa Zagalaz Sánchez, Javier Cachón-Zagalaz, María Sánchez Zafra, Déborah Sanabrias Moreno and Michail Kalogiannakis

Received: 20 November 2021
Accepted: 15 December 2021
Published: 18 December 2021

1. Introduction

The best-known health recommendations are to perform at least 60 min of moderate-to-vigorous physical activity (MVPA) daily, including at least three days of vigorous physical activity (VPA), as established by the Center for Disease Control and Prevention and U.S. Guidelines [1,2], aimed at children aged 6–17. However, U.K. Guidelines and E.U. Physical Activity (PA) Guidelines established that for younger ages under five years, it is recommended that a child perform 60 of MVPA daily [3,4] and 180 min of total PA per day according to World Health Organization (WHO) [5], and the National Association for Sport and Physical Education (NASPE) recommends an increase to 120 min of MVPA per day for ages 2–3 years and older from the time they start walking by [6]. Another option is to consider PA in steps volume, with recommendations of between 10,000 and 14,000 steps for these ages [7,8].

Over the years, PA levels in the world population have declined, as some studies have shown [9,10], especially at an early age [11]. Only a small proportion meet this recommendation [12]. Recent studies reported that over 50% of schoolchildren do not meet with daily PA recommendations in Senegal and in Poland [13,14]. Both studies were conducted during one week of standard routine, and the children carried the portable devices for seven consecutive days. Specifically, only 24% of schoolchildren aged 5–6 years

meet the recommendations of 60 min of MVPA per day [14], and 2-year-olds in China and Chicago do not meet these recommendations [15,16]. MVPA at early ages is beneficial, as children with higher levels of MVPA have lower body fat percentage and higher content of muscle mass, fat-free mass and total body water [14]. Therefore, a higher level of PA and optimal sleep are beneficial for the proper physical, socio-emotional and cognitive development of preschool children [17]. Short aerobic exercise sessions (approximately 10 min) have been shown to decrease impulsivity and improve mood in children [18]. Fitness level has also been associated with cognitive benefits in children, given that VPA is significantly correlated with better executive function [19]. Although several studies show the benefits of PA in children, little research has been conducted on ages below 3 years.

Article 12.2 of the Organic Law 2/2006 of 3 May on Education [20] establishes that the purpose of early childhood education and care (ECEC) is to contribute to children's physical, emotional, social and intellectual development. According to the Decree 149/2009 of 12 May [21], children's schools specify the curricular contents in a specific pedagogical proposal, which implies that each center will work on the contents in a different way, among these contents are motor development and PA [20]. As a result, the school plays a significant role as schoolchildren spend approximately one-third of their day at school, and this makes it the ideal place to measure PA levels and implement PA programs [22]. Therefore, the school is an ideal place to promote PA practice to achieve daily recommendations from an early age [23]. Already, studies analyzing PA behavior at different times of the day suggest that about half of the recommended daily MVPA time should be spent during "School Time" [24]. However, children have a higher level of "PA Out-of-School Time" than in "School Time"; this trend is higher in pre-school age [25]. An effective strategy to improve PA levels during school time would be to commute to and from school via a walking school bus, thereby avoiding polluting transport modes and promoting sustainable urban mobility [26,27].

The usefulness of portable devices to measure children's PA lies in a quick and useful collection of data, hence their widespread use in the scientific literature [28]. Accelerometers are the most common devices used; however, their cost is relatively high and requires complex data processing, so their use in some research may not be practical or easily accessible [29]. On the other hand, smart wristbands with accelerometer-derived technology are smaller, easier to use and more affordable than accelerometers for measuring PA [30]. That is why current studies use different portable devices to monitor PA in schoolchildren [31,32].

After reviewing the literature on the use of smart devices to analyze or determine PA levels at very early ages, a lack of robust studies on this topic can be observed. This study hypothesizes that the PA level and daily steps practiced by children in childhood may be different depending on gender and when they are performed. Therefore, this study aims to analyze compliance with daily PA recommendations in children two years of age about gender; and analyze PA in different periods (Monday to Friday versus Weekend and School-time versus Out-of-School Time).

2. Materials and Methods

2.1. Design

The observational cross-sectional study was conducted to collect information on children's PA at different times of the day. The sampling was carried out according to accessibility criteria. Data were gathered at one given point in time (seven consecutive days of a week's school routine) in the same population (children 2-year-olds).

2.2. Subjects

Sixty-three children ~2-year-olds in kindergarten (age = 2.15 ± 0.35; gender = 33 ♂ and 30 ♀; weight 14.18 ± 1.61 kg ♂and 14.17 ± 2.15 kg ♀; height = 0.90±0.09 m ♂ and 0.90 ± 0.08 m ♀; and IMC = 18.49 ± 9.77 ♂and 17.83 ± 3.91 ♀) were recruited for this study. Inclusion criteria were as follows: children with good general health; and without physical

disability and psychiatric illness. The children belonged to three day-care centers in Jaén (Spain). The Ethics Committee of the local institution approves this work with the code (University of Jaén, Spain (JUN.17/6)).

2.3. Procedure and Measures

Subjects were randomly selected. Only data from subjects who wore the activity tracker every day were used. This research collected PA in steps and minutes of MVPA per day. Participants wore the Garmin vivofit® jr. (Garmin Ltd., Schaffhausen, Switzerland) activity tracker on their right wrist for seven consecutive days of a week's school routine and wore it for 24h/day. The children were very engaged and receptive when wearing activity-tracking wristbands. The teachers introduced the wristbands in class as a game for children's endorsement. This brand wearable device is accurate for assessing PA and steps [33,34]. Specifically, Garmin Vivofit® (Garmin Ltd., Schaffhausen, Switzerland) showed an optimal validity in formal and informal sports with children [35–38] and adults [28]. Schoeppe et al. [39] concluded that these activity trackers are reliable for measuring PA levels in different populations. All measurements were collected in the spring. This activity tracker is portable and tailored for early childhood to assess PA in steps and MVPA in minutes per day. According to the manufacturer, the children-friendly design is comfortable, durable and waterproof. The smart device had to be paired with its app (APP Vivofit jr Ltd., Schaffhausen, Switzerland) on a smartphone or tablet so that parents and children could interact with the device and control the settings. Families and teachers were informed through a standard document on how to pair the activity tracker with their smartphone or tablet app. They also had a diary in which they made notes of steps and minutes of PA. MVPA minutes and steps were recorded in the following periods of the week: Week (Monday to Sunday), Monday to Friday (Midweek), School Time (9:00 to 14:30 h), Out-of-School Time (14:31 to 22:00 h) and Weekend (Saturday and Sunday). Both the MVPA and the steps were averaged as minutes/day (min/day) and steps/day, respectively. For both weekly periods, the 60 min rate of meeting MVPA [4], the 120 min rate of meeting MVPA [6], and the 13,000 steps meeting rate were assessed as reference values for similar-aged children as the study sample [7,8].

2.4. Statistical Analysis

A descriptive analysis of the data was first performed as means and standard deviation. Second, the Kolmogorov–Smirnov normality test confirmed a normal distribution. Third, a *t*-test for independent children samples was calculated for gender comparison (boys vs. girls). Fourth, the Student's paired samples *t*-test was used to observe the differences between different moments (Midweek vs. Weekend and School Time vs. Out-of-School Time). Finally, Bayesian inferences were carried out to perform a *t*-test for paired samples and independent samples, in addition to a repeated-measures ANOVA (comparison among the 7 days of the week in the variables steps/day and minutes of MVPA). This methodology based on the quantification of the relative degree of evidence for supporting two rival hypotheses, the null hypothesis (H0) vs. alternative hypothesis (H1), employing the Bayes factor (BF01–BF10) [40,41], has been recently suggested as an alternative more robust than the traditional frequentist statistics (based on confidence intervals and *p* values) for hypothesis testing. Bayesian statistic provides (among others) the following benefits: the BF10 quantifies evidence that the data provide for H0 vs. H1, the BF10 can quantify evidence in favor of H0, and the BF10 is not "violently biased" against H0 [42,43]. The BF10 was interpreted using the evidence categories suggested by [44]: <1/100 = extreme evidence for H0, from 1/100 to <1/30 = very strong evidence for H0, from 1/30 to <1/10 = strong evidence for H0, from 1/10 to <1/3 = moderate evidence for H0, from 1/3 to <1 anecdotal evidence for H0, from 1 to 3 = anecdotal evidence for H1, from >3 to 10 = moderate evidence for H1, from >10 to 30 = strong evidence for H1, from >30 to 100 = very strong evidence for H1, and >100 extreme evidence for H1. The BF01 was read opposite the BF10 (e.g., from >3 to 10 = moderate evidence for H0). The effect size was

interpreted using criteria develop by Hopkins et al. [45]: ≤0.2 = trivial; 0.2–0.6 = small; 0.6–1.2 = moderate; 1.2–2.0 = large; 2.0–4.0 = very large; >4.0 = extremely large. The level of significance for frequentist analysis was set at $p \leq 0.05$ for the different tests. The IBM SPSS Statistics 25.0 software for Windows (IBM Software Group, Chicago, Illinois, United States) and the spreadsheet called Jamovi 1.2.12 base on graphical user interface R were used.

3. Results

The descriptive values, Bayes factor, *p* values and effect size used to compare PA recommendations between genders are displayed in Table 1. Descriptive data, as daily steps and minutes, according to weekdays, can be observed in Figure 1. The Student's paired samples *t*-test (Bayesian and frequentist inferences) used to see PA levels and recommendations differences between "Monday to Friday" and "Weekend" are shown in Table 2. The Student's paired samples *t*-test and Bayesian methodology used to see PA levels and PA meeting recommendations differences between "School Time" and "Out-of-School Time" can be observed in Table 3.

Table 1 indicates that during the "week" (Monday to Friday and the Weekend), 100% met the recommendations of 60 min/day, while around 50% met the recommendations of 120 min/day and 13,000 steps/day. By analyzing the "School Time", around 30% met the recommendation of 60min/day, while around 15% met the recommendations of 120 min/day and 13,000 steps/day. Throughout "Out-of-School Time", around 70% met the recommendations of 60 min/day, while around 35% met the recommendations of 120 min/day and 13,000 steps/day. No gender differences were found.

When comparing the days of the week, Bayesian repeated measures ANOVA showed very strong evidence in favor of H1 for minutes of MVPA and steps/day (BF > 100, and percentage error < 0.001). The subsequent post hoc analysis (Figure 1) showed substantial differences for the minutes of MVPA between these pairs of days: (i) Friday vs. Tuesday (BF10 > 100, error percentage < 0.001; δ > 0.791, 95% credible interval (95%CI) = 0.505 to 1.081; (ii) Friday vs. Wednesday (BF10 > 100, error percentage < 0.001; δ > 0.832, 95% CI = 0.540 to 1.128); (iii) Friday vs. Thursday (BF10 > 100, error percentage < 0.001; δ > 0.657, 95% CI = 0.380 to 0.936); and Saturday vs. Wednesday (BF10 from >10 to 30, error percentage < 0.001; δ > 0.456, 95% CI = 0.189 to 0.726). Likewise, the post hoc analysis revealed extreme evidence in favor of H1 for steps/day between these pairs of days: (i) Friday vs. Tuesday (BF10 > 100, error percentage < 0.001; δ > 0.797, 95% CI = 0.510 to 1.087; (ii) Friday vs. Wednesday (BF10 > 100, error percentage < 0.001; δ > 0.885, 95% CI = 0.590 to 1.184); (iii) Friday vs. Thursday (BF10 > 100, error percentage < 0.001; δ > 0.637, 95% CI = 0.363 to 0.915); and Saturday vs. Wednesday (BF10 > 100, error percentage < 0.001; δ > 0.578, 95% CI = 0.304 to 0.855). The general trend in Figure 1 displays that during midweek, there is a decrease in MVPA time, being Wednesday the day with the lowest values of the entire week. However, as the week progresses, the MVPA time increases, with Friday being the day with the entire week's highest values. During the "Weekend", the MVPA time values are initially higher and lower at the end, although the lowest values of the entire week are not reached.

The Student's paired samples *t*-test (Bayesian and frequentist statistic) in Table 2 indicates a trend towards higher mean values in the different variables analyzed in the "Weekend", compared to the "Monday to Friday". However, none shows robust evidence in favor of H_1 (differences between "Weekend" and "Monday to Friday") or statistically significant differences. However, around 50% of the meeting recommendations of steps and MVPA of 120 min/day are fulfilled.

On the other hand, data analysis through Bayesian statistics showed extreme evidence (BF10 > 100) in favor of H_1 in the following variables: MVPA min/day, steps/day, MR 60 min/day (%), MR 10 min/day (%) and MR 13,000 steps/day (%) compared between "School Time" and "Out-of-School Time" in Table 3 (School Time < Out-of-School Time). This data indicates that it was 1.255×10^{15} times more probable to find higher mean values in favor of Out-of-School time than School time. The numerical algorithm used to calcu-

late the results indicated great stability (error% < 0.001). The robustness of Bayes factors was stable (e.g., max BF_{10}: 1.620 × 10^{15} at r = 1.5, user prior: BF_{10} = 1.617 × 10^{15}; wide prior: BF_{10} = 1.497 ×10^{15}; ultra-wide prior: BF_{10} = 1.255 × 10^{15}. The posterior distribution showed a large effect size in all variables (MVPA min/day = δ > 1.2, 95% credible interval (95%CI) = −1.915 to −1.207; steps/day = δ > 1.2, 95%CI = −1.862 to −1.175; MR 60 min/day (%) = δ > 1.2, 95%CI = −1.920 to −1.041; MR 120 min/day (%) = δ > 1.2, 95%CI = −1.918 to −1.207; and MR 13,000 steps/day (%) = δ > 1.2, 95%CI = −1.900 to −0.974). Frequentist analysis showed statistically significant differences in MVPA time and steps/day, recommendations of 60 and 120 min MVPA per day and recommendations of 13,000 steps/day ($p < 0.001$).

Table 1. Participants' characteristics and meeting recommendations by gender.

Variable	Total (n = 63)	Boys (n = 33)	Girls (n = 30)	*p*	error %	Bayes Factor	δ
Weight (kg)	14.18 ± 1.86	14.18 ± 1.61	14.18 ± 2.15	1.000	0.00	BF_{01} = 3.827	−0.006
Height (m)	0.90 ± 0.09	0.90 ± 0.09	0.90 ± 0.08	0.961	0.00	BF_{01} = 3.858	0.010
BMI (kg/m^2)	18.19 ± 7.57	18.50 ± 9.78	17.84 ± 3.91	0.739	0.00	BF_{01} = 3.629	0.071
Week MVPA (min/day)	57.95 ± 20.68	59.91 ± 21.92	55.80 ± 19.35	0.435	8.13 × 10^{-4}	BF_{01} = 2.992	0.166
Week steps/day	5907.39 ± 2244.35	6220.59 ± 2445.65	5562.87 ± 1984.95	0.249	0.00	BF_{01} = 2.193	0.250
AR Week 60 min/day (%)	96.58 ± 34.46	99.85 ± 36.54	92.99 ± 32.25	0.435	8.13 × 10^{-4}	BF_{01} = 2.992	0.161
AR Week 120 min/day (%)	48.29 ± 17.23	49.92 ± 18.27	46.50 ± 16.13	0.435	8.13 × 10^{-4}	BF_{01} = 2.992	0.171
AR Week 13,000 steps/day (%)	45.44 ± 17.26	47.85 ± 18.81	42.79 ± 15.27	0.249	0.00	BF_{01} = 2.193	0.253
Monday to Friday MVPA (min/day)	57.87 ± 18.66	58.98 ± 19.12	56.65 ± 18.38	0.624	0.00	BF_{01} = 3.505	0.101
Monday to Friday steps/day	5878.66 ± 2036.07	6093.30 ± 2087.90	5642.55 ± 1985.59	0.385	5.66 × 10^{-4}	BF_{01} = 2.810	0.187
AR Monday to Friday 60 min/day (%)	96.45 ± 31.10	98.30 ± 31.87	94.41 ± 30.63	0.624	0.00	BF_{01} = 3.505	0.107
AR Monday to Friday 120 min/day (%)	48.22 ± 15.55	49.15 ± 15.94	47.21 ± 15.32	0.624	0.00	BF_{01} = 3.505	0.105
AR Monday to Friday 13,000 steps/day (%)	45.22 ± 15.66	46.87 ± 16.06	43.40 ± 15.27	0.385	5.66 × 10^{-4}	BF_{01} = 2.810	0.176
Weekend MVPA (min/day)	60.06 ± 32.10	64.17 ± 34.81	55.52 ± 28.73	0.297	0.00	BF_{01} = 2.407	0.225
Weekend steps/day	6175.25 ± 3454.78	6743.14 ± 3868.37	5548.62 ± 2869.36	0.180	0.01	BF_{01} = 1.771	0.295
AR Weekend 60 min/day (%)	100.10 ± 53.49	106.95 ± 58.01	92.53 ± 47.89	0.297	0.00	BF_{01} = 2.407	0.224
AR Weekend 120 min/day (%)	50.05 ± 26.75	53.48 ± 29.00	46.26 ± 23.94	0.297	0.00	BF_{01} = 2.407	0.218
AR Weekend 13,000 steps/day (%)	47.50 ± 26.58	51.87 ± 29.76	42.68 ± 22.07	0.180	0.01	BF_{01} = 1.771	0.287
School Time MVPA (min/day)	17.54 ± 6.38	18.57 ± 7.08	16.40 ± 5.40	0.179	0.00	BF_{01} = 1.790	0.284
School Time steps/day	1701.72 ± 646.96	1836.55 ± 725.66	1553.41 ± 519.96	0.083	0.01	BF_{01} = 1.058	0.376
AR School Time 60 min/day (%)	29.23 ± 10.63	30.95 ± 11.79	27.33 ± 9.00	0.179	0.00	BF_{01} = 1.790	0.282
AR School Time 120 min/day (%)	14.61 ± 5.31	15.47 ± 5.90	13.67 ± 4.50	0.179	0.00	BF_{01} = 1.790	0.284
AR School Time 13,000 steps/day (%)	13.09 ± 4.98	14.13 ± 5.58	11.95 ± 4.00	0.083	0.01	BF_{01} = 1.058	0.370
Out-of-School Time MVPA (min/day)	40.33 ± 15.45	40.41 ± 13.79	40.25 ± 17.34	0.967	0.00	BF_{01} = 3.883	0.009
Out-of-School Time steps/day	4166.22 ± 1705.79	4256.75 ± 1538.54	4066.63 ± 1894.52	0.662	0.00	BF_{01} = 3.581	0.090
AR Out-of-School Time 60 min/day (%)	67.22 ± 25.75	67.35 ± 22.99	67.08 ± 28.89	0.967	0.00	BF_{01} = 3.883	0.007
AR Out-of-School Time 120 min/day (%)	33.61 ± 12.88	33.68 ± 11.49	33.54 ± 14.45	0.967	0.00	BF_{01} = 3.883	0.010
AR Out-of-School Time 13,000 steps/day (%)	32.05 ± 13.12	32.74 ± 11.83	31.28 ± 14.57	0.662	0.00	BF_{01} = 3.581	0.093

BMI: Body Mass Index Corporal; A*R:* Accomplishment Recommendations; *MVPA:* Moderate-to-vigorous Physical Activity; M to F*:* Monday to Friday.

Table 2. Differences in young children's PA between "Monday to Friday" and "Weekend" variables.

Variable	Monday to Friday	Weekend	*p*	Error %	Bayes Factor	δ
MVPA (min/day)	58.37 ± 18.72	60.06 ± 32.10	0.604	3.85 × 10^{-5}	BF_{01} = 6.264	−0.063
Steps/day	5940.67 ± 2036.16	6175.25 ± 3454.78	0.501	3.52 × 10^{-5}	BF_{01} = 5.733	−0.082
Recommendations 60 min/day (%)	97.29 ± 31.20	100.10 ± 53.49	0.604	3.85 × 10^{-5}	BF_{01} = 6.264	−0.062
Recommendations 120 min/day (%)	48.64 ± 15.60	50.05 ± 26.75	0.604	3.85 × 10^{-5}	BF_{01} = 6.264	−0.062
Recommendations 13,000 steps/day (%)	45.70 ± 15.66	47.50 ± 26.58	0.501	3.52 × 10^{-5}	BF_{01} = 5.733	−0.081

MVPA*:* Moderate-to-vigorous Physical Activity.

Table 3. Differences in young children's PA between "School Time" and "Out-of-School Time" variables.

Variable	School Time	Out-of-School Time	*p*	Error %	Bayes Factor	δ
MVPA (min/day)	17.54 ± 6.38	40.33 ± 15.45	0.001	3.15 × 10^{-21}	BF_{10} = 3.568 × 10^{15}	−1.537
Steps/day	1701.72 ± 646.96	4166.22 ± 1705.79	0.001	6.21 × 10^{-21}	BF_{10} = 1.255 × 10^{15}	−1.502
Recommendations 60 min/day (%)	29.23 ± 10.63	67.22 ± 25.75	0.001	3.15 × 10^{-21}	BF_{10} = 3.568 × 10^{15}	−1.543
Recommendations 120 min/day (%)	14.61 ± 5.31	33.61 ± 12.88	0.001	3.15 × 10^{-21}	BF_{10} = 3.568 × 10^{15}	−1.533
Recommendations 13,000 steps/day (%)	13.09 ± 4.98	32.05 ± 13.12	0.001	6.21 × 10^{-21}	BF_{10} = 1.255 × 10^{15}	−1.467

MVPA*:* Moderate-to-vigorous Physical Activity.

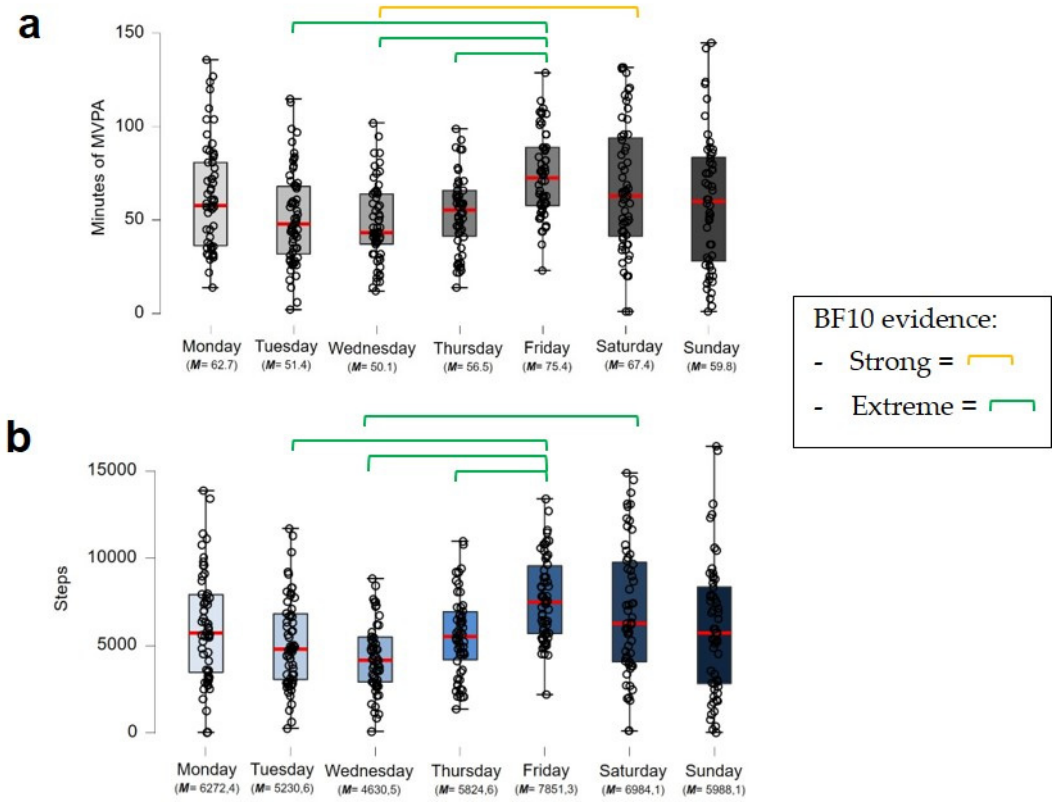

Figure 1. Bayesian post hoc analysis to reveal differences between children's daily minutes of MVPA (**a**) and steps/day (**b**) performed over one week. MVPA = moderate-to-vigorous physical activity, M = mean.

4. Discussion

The current study evaluated meeting recommendations of healthy PA about gender and analyzed different periods over one week using smart devices in 2-year-old Spanish children. The main findings of this study show that meeting recommendations of 60 min/day was 100%. Similar results were found in other studies, given that toddlers reached 102.2% [46] or 125.7% [47] of the daily PA recommendations. On the other hand, pre-school children reached 93–96% of the daily PA recommendations [48,49]. There are also studies in this same population that do not reach the meeting recommendations, finding compliance values of approximately 65% [15,50] and 75% [16] in toddlers and 25% in preschoolers [14,51]. Anecdotally, schoolchildren in Cyprus only comply with the recommendations by 11% [52], which confirms how the country of residence can influence PA levels [53]. Some countries even do not include guidelines for PA recommendations for children under 5 years of age [54].

The results showed a 50% compliance of 120 min/day [6,55]; however, scientific literature from some countries shows a 20–30% compliance rate [56,57]. As noted above, the country of residence can influence the level of PA at early ages due to the design of undemanding PA programs [53]. Several authors highlight that a few children's groups with specific characteristics meet the 60 min daily MVPA recommendations [51]. Therefore, if the degree of compliance were raised to 120 min, as some studies indicate, the rate of compliance would be even lower. Logically, factors such as the socioeconomic or educational level of the parents can have a significant influence on the level of the children's PA. It has been observed that parents with a low level of education have children with low levels of PA [58]. These facts could imply that at these ages, educational establishments and organizations are not focusing on PA's assessment or are not taking specific educational measures to promote PA, resulting in low levels of PA in this population. That is why

intercultural research is essential to know the different cultural contexts and even to identify the time slot in which PA occurs [59].

Using intelligent devices to measure PA has led to the consideration of steps as a measurement variable. The results showed that the children performed around 6.000 steps/day, representing 50% of the recommendations for these ages [8]. Even at 50% of the meeting recommendations are reached, these data are considered low, although several investigations indicate significantly lower compliance values (approximately 10–15%) [14,60]. Moreover, the few studies that measure daily steps through activity trackers do not make a guideline of healthy recommendations using this unit of measurement [2]. Hence, comparing the results obtained with the literature is complicated because most studies analyze MVPA in minutes, omitting the number of steps.

Contrary to the results found when comparing genders (Table 1), several studies showed that boys have higher PA values than girls [13,61]. However, these studies were conducted with older children. Therefore, two-year-old children show non-compliance with the PA values considered healthy for both genders. Further study of the PA profile of these ages is needed, as there is evidence that as subjects grow, these compliance rates continue to decline [62].

These results suggested that if at an early age, the recommendations of MVPA are barely met, they will be met less so as they grow up. These findings are interesting for creating different strategies that involve increasing PA levels at early ages to ensure that these recommendations continue to be fulfilled at later ages. Therefore, it is important to promote programs, such as the walking school bus, as it helps to maintain good PA levels during school years [63,64], and it also has a positive effect on several social aspects: (i) enhanced walkability and neighborhood safety, classroom behavior and sustainable urban mobility; and (ii) reduced school tardiness and bullying [24]. This study shows that the participants practice more MVPA time during the "Weekend" than from "Monday to Friday", coinciding with the results of other studies with similar individuals [65,66]. Although the average values are higher on "Weekends", it should be considered that these differences do not show robust evidence in favor of H1 or statistically significant differences. These results differ from those found in studies with older children, given that children practice more MVPA time from Monday to Friday than during the Weekend [67,68]. Schedules during the midweek are less flexible than weekend days due to the following causes: does not have sufficient autonomy yet; children must follow a very structured daily family and school. The educational system and family environment do not help increase PA ratios; for example, parents, due to their work and lack of free time during the week, are unable to take their children to the park or do PA with them [69].

These data show that the child population practices more MVPA during the weekend than "Monday to Friday". Probably because centers currently do not provide an optimal amount of PA. Part of this lack of PA could be due to the lesson structure and educational approach since there is only one 45-min session dedicated to developing motor skills in early childhood education. The children between lessons have little freedom of movement, as everything is so planned and organized that hardly any free time is left for unguided play. Another reason may be the scarcity of extracurricular activities offered that involve movement at these ages, only focusing the offer on children of higher grades.

This study highlights that younger children practice more MVPA during out-of-school hours than during school hours, coinciding with other research in pre-school [25,70] and older children [71]. An explanation could be that the classroom's specific characteristics, the methodology of work, the size and characteristics of the playground and teacher education can negatively influence the students' PA levels [72]. These data indicate that the school does not promote an optimal MVPA time during its schedule to help meet daily PA recommendations (even MVPA ratios are higher outside of school time; see Table 3). Thereby, educational programs should be designed to improve daily PA levels from the early school ages. Because the practice of MVPA during physical education lessons has a positive effect on the daily MVPA practice during the week [73]. Despite the short duration

of the break, its total contribution of MVPA is high [74]. Active breaks can be instrumental if teachers are encouraged to undertake educational initiatives based on substantial scientific evidence to improve PA levels [75].

The school provides a workable environment for increasing daily PA [22]. This research has shown that including short periods of PA during school hours is an excellent strategy to improve pre-school PA levels of preschool-age children [76]. We can find several studies that show examples of practical applications that could be implemented at school to encourage the practice of PA [77]:

Active breaks: Consisting of PA periods (usually 5–10 min) between class sessions, i.e., every 45–60 min. They involve children performing movement activities after a long period of sitting, contributing to physical and cognitive improvements. Children can play short games or do activities such as standing on one leg, doing a little dance, and so on [78].

Physically Active Lessons: This kind of lesson comprises adapting the subjects to introduce PA with academic content and not in an isolated way, obtaining educational and physical benefits [79].

Standing desks: These are elevated desks that allow children to stand or sit on stools during lessons. These desks can break sedentary patterns without interfering with their school schedule. Besides all the cognitive and academic benefits of using these types of desks, they also increase PA levels [80].

Annual projects: These projects should be developed during the year with at least one session per week. Thus, PA is worked on during the year and does not appear at a specific moment, thus avoiding the risk of abandoning PA [81].

Walking school bus: Programs to promote optimal PA levels when walking to and from school by favoring sustainable urban mobility [26,27]. The main limitation is the small sample size due to the difficulty of accessing at such an early age. The result should be interpreted with caution because of the small sample size and characteristics of context (Spain). Even so, this study provides the first approach to young children's physical profile in order to establish possible intervention strategies. Future studies are needed to know in-depth the effect of PA at these ages for correct development.

5. Conclusions

Two-year-old schoolchildren do not meet the MVPA and steps/day recommendation. There are no gender differences in PA levels and steps per day; it seems that at this age, these differences have not appeared yet. Regarding the different periods, there is a tendency to perform more PA and steps in the "Weekend" regarding the "Midweek", without these values showing robust evidence in favor of H1 or statistically significant differences. However, there is "extreme evidence" and a highly significant difference in the PA and steps made in favor of "Out-of-School Time", as compared to "School Time". These results can contribute to designing educational strategies and programs to improve PA levels in the school context.

Author Contributions: Conceptualization, G.D.-Q. and G.T.-L.; methodology, G.T.-L. and C.B.-P.; formal analysis, G.D.-Q. and J.M.G.-E.; investigation, G.D-Q. and C.B.-P.; data curation, J.M.G.-E.; writing—original draft preparation, G.D.-Q. and C.B.-P.; writing—review and editing, G.T.-L. and J.M.G.-E. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the University of Jaén, Spain (JUN.17/6).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Acknowledgments: The authors would like to thank the teachers, parents and children.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Center for Disease Control and Prevention. How Much Physical Activity Do Children Need? 2011. Available online: https://www.cdc.gov/physicalactivity/basics/pdfs/FrameworkGraphicV9.pdf (accessed on 15 December 2021).
2. U.S. Department of Health and Human Services. *Physical Activity Guidelines for Americans*, 2nd ed.; U.S. Department of Health and Human Services: Washington, DC, USA, 2018. Available online: https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf (accessed on 15 December 2021).
3. Department of Health, Physical Activity, Health Improvement and Protection. Start Active, Stay Active a Report on Physical Activity for Health from the Four Home Countries' Chief Medical Officers. 2011. Available online: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/830943/withdrawn_dh_128210.pdf (accessed on 15 December 2021).
4. Education and Culture of European Commission. EU Physical Activity Guidelines. 2008. Available online: https://www.efdn.org/wp-content/uploads/2016/07/eu-physical-activity-guidelines-european-commission.pdf (accessed on 15 December 2021).
5. World Health Organization (WHO). Guidelines on Physical Activity, Sedentary Behaviour and Sleep for Children under 5 Years of Age. 2019. Available online: https://apps.who.int/iris/bitstream/handle/10665/311664/9789241550536-eng.pdf?sequence=1&isAllowed=y (accessed on 15 December 2021).
6. National Association for Sport and Physical Education. *Active Start: A Statement of Physical Activity Guidelines for Children from Birth to Age 5*, 2nd ed.; National Association for Sport and Physical Education: Reston, VA, USA, 2014. Available online: https://www.columbus.gov/uploadedFiles/Public_Health/Content_Editors/Planning_and_Performance/Healthy_Children_Healthy_Weights/NASPE%20Active%20Start.pdf (accessed on 15 December 2021).
7. Cardon, G.; de Bourdeaudhuij, I. Comparison of pedometer and accelerometer measures of physical activity in preschool children. *Pediatr. Exerc. Sci.* **2007**, *19*, 205–214. [CrossRef] [PubMed]
8. Tanaka, C.; Tanaka, S. Daily physical activity in Japanese preschool children evaluated by triaxial accelerometry: The relationship between period of engagement in moderate-to-vigorous physical activity and daily step counts. *J. Physiol. Anthropol.* **2009**, *28*, 283–288. [CrossRef] [PubMed]
9. Andersen, L.B.; Mota, J.; di Pietro, L. Update on the global pandemic of physical inactivity. *Lancet* **2016**, *388*, 1255–1256. [CrossRef]
10. Tremblay, M.S.; Aubert, S.; Barnes, J.D.; Saunders, T.J.; Carson, V.; Latimer-Cheung, A.E.; Chastin, S.F.M.; Altenburg, T.M.; Chinapaw, M.J.M.; on behalf of SBRN Terminology Consensus Proyect Participants. Sedentary Behavior Research Network (SBRN)—Terminology Consensus Project process and outcome. *Int. J. Behav. Nutr. Phys. Act.* **2017**, *14*, 75. [CrossRef]
11. Calahorro, F.; Torres-Luque, G.; López-Fernández, I.; Carnero, E.A. Niveles de actividad física y acelerometría: Recomendaciones y patrones de movimiento en escolares. *Cuad. Psicol. Deporte* **2014**, *14*, 129–140. [CrossRef]
12. Wijtzes, A.I.; Verloigne, M.; Mouton, A.; Cloes, M.; de Ridder, K.A.; Cardon, G.; Seghers, J. Results from Belgium's 2016 report card on physical activity for children and youth. *J. Phys. Act. Health* **2016**, *13*, S95–S103. [CrossRef]
13. Diouf, A.; Thiam, M.; Idohou-Dossou, N.; Diongue, O.; Mégné, N.; Diallo, K.; Sembène, P.M.; Wade, S. Physical Activity Level and Sedentary Behaviors among Public School Children in Dakar (Senegal) Measured by PAQ-C and Accelerometer: Preliminary Results. *Int. J. Environ. Res. Public Health* **2016**, *13*, 998. [CrossRef] [PubMed]
14. Wyszyńska, J.; Matłosz, P.; Szybisty, A.; Lenik, P.; Dereń, K.; Mazur, A.; Herbert, J. Obesity and Body Composition in Preschool Children with Different Levels of Actigraphy-Derived Physical Activity—A Cross-Sectional Study. *J. Clin. Med.* **2020**, *9*, 1210. [CrossRef] [PubMed]
15. Johansson, E.; Mei, H.; Xiu, L.; Svensson, V.; Xiong, Y.; Marcus, C.; Jianduan, Z.; Hagströmer, M. Physical activity in young children and their parents—An early STOPP Sweden-China comparison study. *Sci. Rep.* **2016**, *6*, 29595. [CrossRef] [PubMed]
16. Kwon, S.; Honegger, K.; Mason, M. Daily physical activity among toddlers: Hip and wrist accelerometer assessments. *Int. J. Environ. Res. Public Health* **2019**, *16*, 4244. [CrossRef]
17. Carson, V.; Lee, E.-Y.; Hewitt, L.; Jennings, C.; Hunter, S.; Kuzik, N.; Stearns, J.A.; Powley, S.; Poitras, V.J.; Gray, C.; et al. Systematic review of the relationships between physical activity and health indicators in the early years (0–4 years). *BMC Public Health* **2017**, *5*, 854. [CrossRef]
18. Best, J.R. Effects of physical activity on children's executive function: Contributions of experimental research on aerobic exercise. *Dev. Rev.* **2010**, *30*, 331–351. [CrossRef]
19. Tsukamoto, H.; Suga, T.; Takenaka, S.; Tanaka, D.; Takeuchi, T.; Hamaoka, T.; Isaka, T.; Hashimoto, T. Greater impact of acute high-intensity interval exercise on post-exercise executive function compared to moderate-intensity continuous exercise. *Physiol. Behav.* **2016**, *155*, 224–230. [CrossRef]
20. Legislación Consolidada. Ley Orgánica 2/2006, de 3 de Mayo, de Educación. *Boletín Of. Estado* **2006**, *106*, 1–112.
21. Decreto 149/2009, de 12 de mayo, por el que se regulan los centros que imparten el primer ciclo de la educación infantil. *Boletín Of. Junta Andal.* **2009**, *92*, 7–17. Available online: https://www.juntadeandalucia.es/boja/2009/92/1 (accessed on 1 December 2021).
22. Gauthier, A.P.; Laurence, M.; Thirkill, L.; Dorman, S.C. Examining School-Based Pedometer Step Counts Among Children in Grades 3 to 6 Using Different Timetables. *J. School Health* **2012**, *82*, 311–317. [CrossRef]

23. Martínez-Gómez, D.; Veiga, O.L.; Zapatera, B.; Gómez-Martínez, S.; Martínez, D.; Marcos, A. Physical Activity During High School Recess in Spanish Adolescents: The AFINOS Study. *J. Phys. Act. Health* **2013**, *11*, 1194–1201. [CrossRef] [PubMed]
24. Pate, R.R.; Davis, M.G.; Robinson, T.N.; Stone, E.J.; McKenzie, T.L.; Young, J.C. Promoting physical activity in children and youth: A leadership role for schools: A scientific statement from the American Heart Association Council on Nutrition, Physical Activity, and Metabolism (Physical Activity Committee) in collaboration with the Councils on Cardiovascular Disease in the Young and Cardiovascular Nursing. *Circulation* **2006**, *114*, 1214–1224. [CrossRef] [PubMed]
25. O'Neill, J.R.; Pfeiffer, K.A.; Dowda, M.; Pate, R.R. In-school and Out-of-school Physical Activity in Preschool Children. *J. Phys. Act. Health* **2016**, *13*, 606–610. [CrossRef]
26. Mendoza, J.A.; Watson, K.; Baranowski, T.; Nicklas, T.A.; Uscanga, D.K.; Hanfling, M.J. The walking school bus and children's physical activity: A pilot cluster randomized controlled trial. *Pediatrics* **2011**, *128*, e537–e544. [CrossRef]
27. Carlson, J.A.; Steel, C.; Bejarano, C.M.; Beauchamp, M.T.; Davis, A.M.; Sallis, J.F.; Kerner, J.; Brownson, R.; Zimmerman, S. Walking School Bus Programs: Implementation Factors, Implementation Outcomes, and Student Outcomes, 2017–2018. *Prev. Chronic Dis.* **2020**, *17*, 1–16. [CrossRef]
28. Price, K.; Bird, S.R.; Lythgo, N.; Raj, I.S.; Wong, J.Y.L.; Lynch, C. Validation of the Fitbit One, Garmin Vivofit and Jawbone UP activity tracker in estimation of energy expenditure during treadmill walking and running. *J. Med. Eng. Technol.* **2017**, *41*, 208–215. [CrossRef]
29. Migueles, J.H.; Cadenas-Sánchez, C.; Ekelund, U.; Delisle Nyström, C.; Mora-Gonzalez, J.; Löf, M.; Labayen, I.; Ruiz, J.R.; Ortega, F.B. Accelerometer Data Collection and Processing Criteria to Assess Physical Activity and Other Outcomes: A Systematic Review and Practical Considerations. *Sports Med.* **2017**, *47*, 1821–1845. [CrossRef] [PubMed]
30. Sperlich, B.; Holmberg, H.C. Wearable, yes, ¿but able . . . ? It is time for evidence-based marketing claims! *Br. J. Sport. Med.* **2017**, *51*, 1240. [CrossRef]
31. Böhm, B.; Karwiese, S.D.; Böhm, H.; Oberhoffer, R. Effects of Mobile Health Including Wearable Activity Trackers to Increase Physical Activity Outcomes Among Healthy Children and Adolescents: Systematic Review. *JMIR Mhealth Uhealth* **2019**, *7*, e8298. [CrossRef] [PubMed]
32. Díaz-Quesada, G.; Puga-González, E.; Muñoz-Galiano, I.M. Efecto de la utilización de pulseras inteligentes para el incremento de la actividad física en adolescentes de un entorno rural: Estudio Piloto. *J. Underrepresent. Minority Prog.* **2021**, *3*, 10–16. [CrossRef]
33. Alsubheen, S.A.; George, A.M.; Baker, A.; Rohr, L.E.; Basset, F.A. Accuracy of the vivofit activity tracker. *J. Med. Eng. Technol.* **2016**, *40*, 298–306. [CrossRef] [PubMed]
34. El-Amrawy, F.; Nounou, M.I. ¿Are currently available wearable devices for activity tracking and heart rate monitoring accurate, precise, and medically beneficial? *Healthc. Inform. Res.* **2015**, *21*, 315–320. [CrossRef]
35. Müller, J.; Hoch, A.-M.; Zoller, V.; Oberhoffer, R. Feasibility of Physical Activity Assessment with Wearable Devices in Children Aged 4–10 Years—A Pilot Study. *Front. Pediatr.* **2018**, *6*, 5. [CrossRef]
36. Wahl, Y.; Düking, P.; Droszez, A.; Wahl, P.; Mester, J. Criterion-validity of commercially available physical activity tracker to estimate step count, covered distance and energy expenditure during sports conditions. *Front. Physiol.* **2017**, *8*, 725. [CrossRef]
37. Jacobsen, R.M.; Ginde, S.; Mussatto, K.; Neubauer, J.; Earing, M.; Danduran, M. Can a Home-based Cardiac Physical Activity Program Improve the Physical Function Quality of Life in Children with Fontan Circulation? *Congenit. Heart Dis.* **2016**, *11*, 175–182. [CrossRef] [PubMed]
38. Pérez-Trabazo, L.; Barcala-Furelos, R.; Peixoto-Pino, L.; Rico-Díaz, J. Physical activity in the recess of childhood education: A pilot study using Garmin Vivofit Jr wristbands. *J. Human Sport Exerc.* **2020**, *16*, 1–10. [CrossRef]
39. Schoeppe, S.; Salmon, J.; Williams, S.L.; Power, D.; Alley, S.; Rebar, A.L.; Hayman, M.; Duncan, M.J.; Vandelanotte, C. Effects of an Activity Tracker and App Intervention to Increase Physical Activity in Whole Families—The Step It Up Family Feasibility Study. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7655. [CrossRef]
40. Linke, D.; Link, D.; Weber, H.; Lames, M. Decline in match running performance in football is affected by an increase in game interruptions. *J. Sports Sci. Med.* **2018**, *17*, 662–667. [PubMed]
41. Doncaster, G.; Page, R.; White, P.; Svenson, R.; Twist, C. Analysis of physical demands during youth soccer match-play: Considerations of sampling method and epoch length. *Res. Q. Exerc. Sport* **2019**, *1669766*, 326–334. [CrossRef]
42. Ly, A.; Verhagen, J.; Wagenmakers, E.J. Harold Jeffreys's default Bayes factor hypothesis tests: Explanation, extension, and application in psychology. *J. Mathl. Psych.* **2016**, *72*, 19–32. [CrossRef]
43. Wagenmakers, E.J.; Marsman, M.; Jamil, T.; Ly, A.; Verhagen, J.; Love, J.; Selker, R.; Gronau, Q.F.; Smira, M.; Epskamp, S.; et al. Bayesian inference for psychology. Part I: Theoretical advantages and practical ramifications. *Psychon. Bull. Rev.* **2018**, *25*, 35–57. [CrossRef] [PubMed]
44. Lee, M.D.; Wagenmakers, E.J. *Bayesian Data Analysis for Cognitive Science: A Practical Course*, 1st ed.; Cambridge University Press: New York, NY, USA, 2013.
45. Hopkins, W.G.; Marshall, S.W.; Batterham, A.M.; Hanin, J. Progressive Statistics for Studies in Sports Medicine and Exercise Science. *Med. Sci. Sports Exerc.* **2009**, *41*, 3–12. [CrossRef] [PubMed]
46. McCullough, A.K.; Duch, H.; Garber, C.E. Interactive dyadic physical activity and spatial proximity patterns in 2-year-olds and their parents. *Children* **2018**, *5*, 167. [CrossRef]
47. Hnatiuk, J.A.; Ridgers, N.D.; Salmon, J.; Hesketh, K.D. Maternal correlates of young children's physical activity across periods of the day. *J. Sci. Med. Sport* **2017**, *20*, 178–183. [CrossRef]

48. Torres-Luque, G.; Calahorro, F.; López-Fernández, I.; Nikolaidis, P.T. Análisis de la distribución de la práctica de actividad física en alumnos de educación infantil. *Cuad. Psicol. Deporte* **2015**, *16*, 261–268.
49. Vale, S.; Trost, S.; Ruiz, J.J.; Rêgo, C.; Moreira, P.; Mota, J. Physical activity guidelines and preschooler's obesity status. *Int. J. Obes.* **2013**, *37*, 1352–1355. [CrossRef]
50. Dlugonski, D.; DuBose, K.D.; Rider, P. Accelerometer-measured patterns of shared physical Aactivity Aamong mother-young child dyads. *J. Phys. Act. Health* **2017**, *14*, 808–814. [CrossRef] [PubMed]
51. Santaliestra-Pasías, A.M.; Dios, J.E.L.; Sprengeler, O.; Hebestreit, A.; de Henauw, S.; Eiben, G.; Felso, R.; Lauria, F.; Tornaritis, M.; Veidebaum, T.; et al. Food and beverage intakes according to physical activity levels in European children: The IDEFICS (Identification and prevention of Dietary and lifestyle induced health EFfects In Children and infantS) study. *Public Health Nutr.* **2018**, *21*, 1717–1725. [CrossRef] [PubMed]
52. Konstabel, K.; Veidebaum, T.; Verbestel, V.; Moreno, L.A.; Bammann, K.; Tornaritis, M.; Eiben, G.; Molnár, D.; Siani, A.; Sprengeler, O.; et al. Objectively measured physical activity in European children: The IDEFICS study. *Int. J. Obesity* **2014**, *38*, S135–S143. [CrossRef] [PubMed]
53. Van Tuyckom, C.; Scheerder, J. A multilevel analysis of social stratification patterns of leisure-time physical activity among Europeans. *Sci. Sport.* **2010**, *25*, 304–311. [CrossRef]
54. World Health Organization. Physical Activity Factsheets for the 28 European Union Member States of the WHO European Region. 2018. Available online: https://www.euro.who.int/__data/assets/pdf_file/0005/382334/28fs-physical-activity-euro-rep-eng.pdf?ua=1 (accessed on 15 December 2021).
55. Hinkley, T.; Salmon, J.; Okely, A.D.; Crawford, D.; Hesketh, K. Preschoolers' Physical Activity, Screen Time, and Compliance with Recommendations. *Med. Sci. Sport. Exer.* **2012**, *44*, 458–465. [CrossRef]
56. Beets, M.W.; Bornstein, D.; Dowda, M.; Pate, R.R. Compliance with National Guidelines for Physical Activity in U.S. Preschoolers: Measurement and Interpretation. *Pediatrics* **2011**, *127*, 658–664. [CrossRef]
57. Soini, A.; Tammelin, T.; Sääkslahti, A.; Watt, A.; Villberg, J.; Kettunen, T.; Mehtälä, A.; Poskiparta, M. Seasonal and daily variation in physical activity among three-year-old Finnish preschool children. *Early Child Dev. Care* **2013**, *184*, 589–601. [CrossRef]
58. Muñoz-Galiano, I.M.; Connor, J.D.; Gómez-Ruano, M.A.; Torres-Luque, G. Influence of the Parental Educational Level on Physical Activity in Schoolchildren. *Sustainability* **2020**, *12*, 3920. [CrossRef]
59. Garriguet, D.; Colley, R.C. Daily patterns of physical activity among Canadians. *Health Rep.* **2012**, *23*, 27–32.
60. Miguel-Berges, M.; Santaliestra-Pasias, A.; Mouratidou, T.; de Miguel-Etayo, P.; Androutsos, O.; de Craemer, M.; Galcheva, S.; Koletzko, B.; Kulaga, Z.; Manios, Y.; et al. Combined Longitudinal Effect of Physical Activity and Screen Time on Food and Beverage Consumption in European Preschool Children: The ToyBox-Study. *Nutrients* **2019**, *11*, 1048. [CrossRef] [PubMed]
61. Ruiz, R.M.; Sommer, E.C.; Tracy, D.; Banda, J.A.; Economos, C.D.; JaKa, M.M.; Evenson, K.R.; Buchowski, M.S.; Barkin, S.L. Novel patterns of physical activity in a large sample of preschool-aged children. *BMC Public Health* **2018**, *18*, 1–8. [CrossRef] [PubMed]
62. Jones, R.A.; Hinkley, T.; Okely, A.D.; Salmon, J. Tracking Physical Activity and Sedentary Behavior in Childhood. *Am. J. Prev. Med.* **2013**, *44*, 651–658. [CrossRef]
63. Martínez-Gómez, D.; Ruiz, J.R.; Gómez-Martínez, S.; Chillón, P.; Rey-López, J.P.; Díaz, L.E.; Castillo, R.; Veiga, O.L.; Marcos, A.; AVENA Study Group. Active commuting to school and cognitive performance in adolescents: The AVENA study. *Arch. Pediatr. Adolesc. Med.* **2011**, *165*, 300. [CrossRef]
64. McDonald, N.C.; Steiner, R.L.; Lee, C.; Rhoulac-Smith, T.; Zhu, X.; Yang, Y. Impact of the safe routes to school program on walking and bicycling. *J. Am. Plann. Assoc.* **2014**, *80*, 153–167. [CrossRef]
65. Foweather, L.; Knowles, Z.; Ridgers, N.D.; O'Dwyer, M.V.; Foulkes, J.D.; Stratton, G. Fundamental movement skills in relation to weekday and weekend physical activity in preschool children. *J. Sci. Med. Sport* **2015**, *18*, 691–696. [CrossRef] [PubMed]
66. Vale, S.; Silva, P.; Santos, R.; Soares-Miranda, L.; Mota, J. Compliance with physical activity guidelines in preschool children. *J. Sport. Sci.* **2010**, *28*, 603–608. [CrossRef]
67. Aibar, A.; Bois, J.E.; Zaragoza Casterad, J.; Generelo, E.; Paillard, T.; Fairclough, S. Weekday and weekend physical activity patterns of French and Spanish adolescents. *Eur. J. Sport Sci.* **2013**, *14*, 500–509. [CrossRef]
68. Ramirez-Rico, E.; Hilland, T.A.; Foweather, L.; Fernández-Garcia, E.; Fairclough, S.J. Weekday and weekend patterns of physical activity and sedentary time among Liverpool and Madrid youth. *Eur. J. Sport Sci.* **2013**, *14*, 287–293. [CrossRef]
69. Hesketh, K.R.; McMinn, A.M.; Ekelund, U.; Sharp, S.J.; Collings, P.J.; Harvey, N.C.; Godfrey, K.M.; Inskip, H.M.; Cooper, C.; van Sluijs, E.M.F. Objectively measured physical activity in four-year-old British children: A cross-sectional analysis of activity patterns segmented across the day. *Int. J. Behav. Nutr. Phys. Act.* **2014**, *11*, 1. [CrossRef] [PubMed]
70. O'Dwyer, M.; Fairclough, S.J.; Ridgers, N.D.; Knowles, Z.R.; Foweather, L.; Stratton, G. Patterns of Objectively Measured Moderate-to-Vigorous Physical Activity in Preschool Children. *J. Phys. Act. Health* **2014**, *11*, 1233–1238. [CrossRef] [PubMed]
71. Lee, J.E.; Stodden, D.F.; Gao, Z. Young Children's Energy Expenditure and Moderate-to-vigorous Physical Activity on Weekdays and Weekends. *J. Phys. Act. Health* **2016**, *13*, 1013–1016. [CrossRef] [PubMed]
72. Dowda, M.; Brown, W.H.; McIver, K.L.; Pfeiffer, K.A.; O'Neill, J.R.; Addy, C.L.; Pate, R.R. Policies and Characteristics of the Preschool Environment and Physical Activity of Young Children. *Pediatrics* **2009**, *123*, e261–e266. [CrossRef]
73. Calahorro-Cañada, F.; Torres-Luque, G.; López-Fernandez, I.; Carnero, E.A. Análisis fraccionado de la actividad física desarrollada en escolares. *Rev. Psicol. Deporte* **2015**, *24*, 373–379.

74. Ridgers, N.D.; Saint-Maurice, P.F.; Welk, G.J.; Siahpush, M.; Huberty, J. Differences in Physical Activity During School Recess. *J. School Health* **2011**, *81*, 545–551. [CrossRef]
75. Blaes, A.; Ridgers, N.D.; Aucouturier, J.; van Praagh, E.; Berthoin, S.; Baquet, G. Effects of a playground marking intervention on school recess physical activity in French children. *Prev. Med.* **2013**, *57*, 580–584. [CrossRef]
76. Donnelly, J.E.; Hillman, C.H.; Castelli, D.; Etnier, J.L.; Lee, S.; Tomporowski, P.; Lambourne, K.; SzaboReed, A.N. Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Med. Sci. Sport. Exer.* **2016**, *48*, 1197–1222. [CrossRef]
77. Watson, A.; Timperio, A.; Brown, H.; Best, K.; Hesketh, K.D. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: A systematic review and meta-analysis. *Int. J. Behav. Nutr. Phys. Act.* **2017**, *14*, 1–24. [CrossRef]
78. Schmidt, M.; Benzing, V.; Kamer, M. Classroom-Based Physical Activity Breaks and Children's Attention: Cognitive Engagement Works! *Front. Psychol.* **2016**, *7*, 1474. [CrossRef]
79. Riley, N.; Lubans, D.R.; Holmes, K.; Morgan, P.J. Findings from the EASY Minds Cluster Randomized Controlled Trial: Evaluation of a Physical Activity Integration Program for Mathematics in Primary Schools. *J. Phys. Act. Health* **2016**, *13*, 198–206. [CrossRef] [PubMed]
80. Kidokoro, T.; Shimizu, Y.; Edamoto, K.; Annear, M. Classroom Standing Desks and Time-Series Variation in Sedentary Behavior and Physical Activity among Primary School Children. *Int. J. Env. Res. Public Health* **2019**, *16*, 1892. [CrossRef] [PubMed]
81. Díaz-Quesada, G. *Proyecto de actividad física y alimentación. ¡La patrulla al rescate de los alimentos perdidos! In Etapa Infantil y Motricidad. Estrategias para su Desarrollo en Educación Física*, 1st ed.; Torres-Luque, G., Hernández-García, R., Eds.; Wanceulen Editorial: Seville, Spain, 2019; pp. 111–130.