

ACTIVE PARTICIPATION IN 2-YEAR-OLD CHILDREN: SCHOOL TIME VERSUS OUT-OF-SCHOOL TIME

PARTICIPACIÓN ACTIVA EN NIÑOS DE 2 AÑOS: HORARIO ESCOLAR VERSUS HORARIO EXTRAESCOLAR 

PARTICIPAÇÃO ATIVA EM CRIANÇAS DE 2 ANOS: HORÁRIO ESCOLAR VERSUS HORÁRIO EXTRACURRICULAR 

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Abstract: This study aims to analyze the active participation of 2-year-old children during different times of the day to evaluate the influence of the school schedule. A total of 73 children aged 2 years (2.13 ± 0.48) participated in the study. They wore an “Actigraph GT3X” accelerometer for seven consecutive days of a school week, recording minutes of moderate-to-vigorous physical activity (MVPA) (min/day and percentage) and the number of MVPA bouts (2, 5, and 10 minutes) at different times (School Time vs. Out-of-School Time; Weekdays vs. Weekends). The results indicate that approximately 50% of the daily MVPA recommendations for this age group were met. A higher number of MVPA bouts occurred during School Time compared to Out-of-School Time, as well as on weekdays compared to weekends. The school setting emerges as an ideal context to develop intervention strategies that promote greater active participation.

Keywords: Accelerometry. Physical activity level. Early childhood. Schoolchildren

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1 INTRODUCTION

Active participation of children is a fundamental issue from both educational and health perspectives (Mannocci *et al.*, 2020; Santiago *et al.*, 2021). Physical activity (PA), active play, and engagement in dynamic learning environments not only foster physical development but also enhance cognitive, social, and emotional skills that are critical for early childhood development (Mannocci *et al.*, 2020; Vale *et al.*, 2011). This comprehensive approach to active participation has long-term implications for children's overall well-being and quality of life (Mak; Chan; Capio, 2021; Vale *et al.*, 2011).

To determine whether the PA levels in a given population are sufficient, the World Health Organization (WHO) (2020) has proposed guidelines for healthy childhood development. For children aged between three and six years, it is recommended to achieve 180 minutes of PA per day, including at least 60 minutes of moderate-to-vigorous physical activity (MVPA) (U.S. Department of Health and Human Services, 2018; U.K. Department of Health, Physical Activity, Health Improvement and Protection, 2011). Additionally, an increase of 120 minutes of MVPA per day is suggested for children aged two to three years and above (National Association for Sport and Physical Education – NASPE, 2014). To date, there seems to be a consensus in the literature regarding non-compliance with these recommendations (ranging from 35% to 60%), depending on geographical factors, seasonal variations, and other influencing elements (Coelho; Tolocka, 2020; Collings *et al.*, 2020; Díaz-Quesada *et al.*, 2022; González-Díaz; Fraguera Vale; Varela Garrote, 2017).

In examining children's behaviour, one particularly interesting parameter to analyse when studying PA patterns and proposing innovative school-based initiatives is the concept of PA "bouts." PA bouts refer to short yet continuous episodes of a specific level of PA (Herbert *et al.*, 2020). The accumulation of these bouts throughout the day can contribute to achieving healthy activity levels (Herbert *et al.*, 2020). These episodes can be brief, typically lasting between one and ten minutes, but when aggregated, they have been shown to positively impact health (Herbert *et al.*, 2020; Jakicic *et al.*, 2019). This finding is particularly relevant for implementing active methodologies in schools, where movement can be structured into short activity blocks. When integrated with the school's annual curriculum, this approach can have a long-term positive impact on crucial health parameters such as metabolic and cardiovascular health in children (Jakicic *et al.*, 2019). This is particularly relevant as studies indicate that children tend to decrease their PA levels when they begin formal schooling at around four to five years of age (Cooper *et al.*, 2015; Taylor *et al.*, 2013).

However, studies specifically investigating PA bouts in early childhood remain scarce, limiting our understanding of PA patterns in school settings and hindering the development of targeted intervention strategies. While data exist for older children, indicating that approximately 65% of children aged eight to 17 accumulate sporadic MVPA bouts lasting between one and four minutes, around 16–18% engage in short-to-long bouts lasting between five and nine minutes or more than ten minutes, respectively (Aadland *et al.*, 2018; Baquet *et al.*, 2007; Mark; Janssen, 2009).

In this regard, given the daily and global assessment of PA, it is crucial to acknowledge that children spend a significant amount of time in educational settings. This makes schools an ideal environment for promoting and increasing daily PA levels to meet the recommended guidelines (Alhassan *et al.*, 2019; Díaz-Quesada *et al.*, 2022; Gauthier *et al.*, 2012). Studies conducted over a decade ago highlighted low PA levels in school settings among children aged three to five years (O'Dwyer *et al.*, 2014; O'Neil *et al.*, 2016). However, in younger age groups, despite the scarcity of studies, evidence suggests that school time may provide more opportunities for MVPA than out-of-school time (Díaz-Quesada *et al.*, 2022), an observation that warrants further investigation.

It is important to note that in Spain, the Organic Law 2/2006 on Education (Spain, 2006) defines Early Childhood Education as a stage covering birth to six years of age, divided into two cycles: the first cycle encompasses birth to three years, while the second cycle includes children aged three to six years. Initiatives introduced during the first cycle can serve as a foundation for naturally integrating active participation strategies into the second cycle. Here, the role of teachers is crucial, as an essential component of children's active participation is play-based learning (Santiago *et al.*, 2021). Teachers who implement programmes focused on active play and PA in school settings have a direct impact on children's PA levels, motor development, and social-emotional skills (Mak; Chan; Capio, 2021; Mannocci *et al.*, 2020). Therefore, early childhood education centres are vital spaces for promoting PA through opportunities such as active play (Bower *et al.*, 2008; Copeland *et al.*, 2012; Vanderloo *et al.*, 2014). This is particularly significant given that, from the age of two, children experience a progressive increase in motor development, enabling more opportunities for engaging in PA (Schmutz *et al.*, 2018). Consequently, PA patterns evolve throughout childhood (Hnatiuk *et al.*, 2019), and while numerous factors influence these patterns, one notable aspect is that the school environment provides a stable setting that can facilitate long-term success in PA engagement and adherence (Laboy, 2019; Lanningham-Foster *et al.*, 2008).

Studies on children under the age of three remain limited, but understanding their active participation is essential for developing methodologies that not only increase PA levels but also identify the most effective initiatives, types of active play, and environmental conditions to achieve sustained PA bouts at a given intensity. This fosters adherence to holistic development at these early ages (Aparicio-Herguedas *et al.*, 2020).

Thus, examining active participation during school time can contribute to the development of strategies aimed at enhancing methodologies that promote PA from an early age. Therefore, the objective of this study is to analyse active participation among two-year-old children at different times of the day (PA bouts of 2, 5, and 10 minutes) and assess the influence of school time versus out-of-school time.

2 METHOD

2.1 PARTICIPANTS

A total of 73 children from the first cycle of early childhood education (mean age: 2.13 ± 0.48 years; 50.69% girls) were selected for this study. None of the participants had a physical disability or illness that would prevent them from taking part in the research. Participants were randomly recruited. The objectives of the study were explained to both the children and their families, who provided informed consent for their children's participation. The study was approved by the Ethics Committee of the Universidad de Jaén on Jun.17/6.

2.2 PROCEDURES

The participants wore an ActiGraph GT3X accelerometer (ActiGraph, Pensacola, FL, USA) for seven consecutive days during a regular school week (Frömel *et al.*, 2008; Trost *et al.*, 2005). This device records physical activity (PA) data across three orthogonal axes: vertical (Y), horizontal right-left (X), and horizontal front-back (Z). Additionally, it includes the “vector magnitude,” which is the square root of the sum of the squared values of each axis, making the device a validated tool for measuring PA (Santos-Lozano *et al.*, 2013).

The GT3X device was placed on the right hip, aligned with the iliac crest, using an adjustable strap (Evenson *et al.*, 2008; Sasaki; John; Fredson, 2011). In addition to verbal instructions given during device placement, families were provided with a detailed information sheet explaining how to position and use the accelerometer, including instructions to remove it during water-based activities (e.g., swimming or bathing) and sleep. Data were recorded in 15-second epochs, as recommended for quantifying PA in school-aged children (Pate *et al.*, 2010).

PA levels were determined by classifying the recorded counts according to the cut-off points established by Pate *et al.* (2006): sedentary behaviour < 200 counts/15 s; light PA 200–419 counts/15 s; moderate PA ≥ 420 counts/15 s; and vigorous PA ≥ 842 counts/15 s, as previously applied in other studies (Pate *et al.*, 2016). A valid recording was considered as at least ≥ 10 hours/day for a minimum of ≥ 5 days per week (including at least 4 weekdays and 1 weekend day) (Troiano *et al.*, 2008).

Additionally, PA bouts (both frequency and duration) were analysed, defining them as continuous activity blocks exceeding the threshold for moderate PA. These PA bouts were examined in segments of 2, 5, and 10 minutes. Finally, data were categorised based on different times of the day to assess differences between school time (08:00–14:00) and out-of-school time (14:01–23:00), as well as weekday (Monday–Friday) versus weekend (Saturday–Sunday) patterns. All data were subsequently analysed using ActiLife 6.0 software (Actigraph, 2016).

2.3 STATISTICAL ANALYSIS

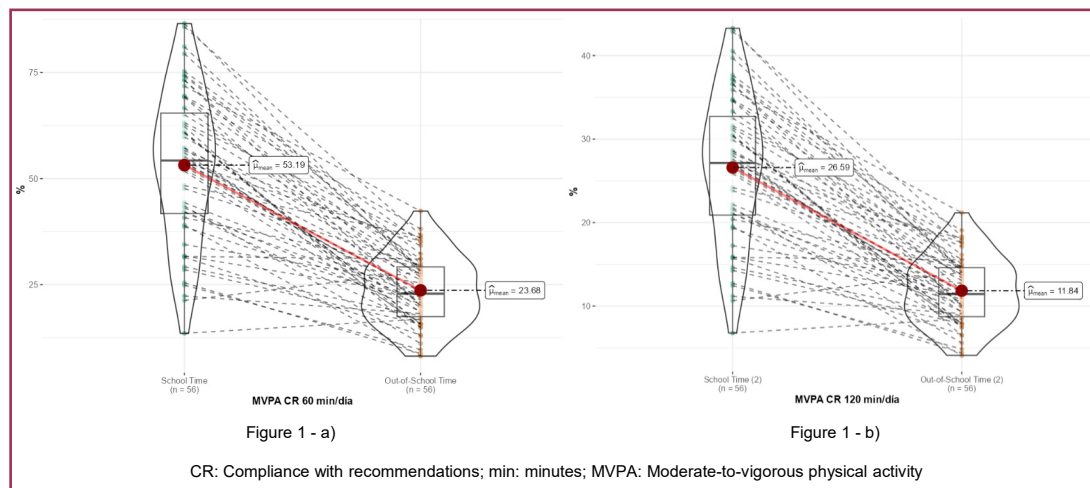
First, a descriptive analysis of the data was conducted, presenting the results as mean and standard deviation. Second, the Kolmogorov-Smirnov normality test confirmed a normal distribution. Third, a Student's paired t-test was used to assess differences between different periods (school time versus out-of-school time; Monday–Friday versus Saturday–Sunday). Finally, Bayesian inferences were conducted to perform both paired and independent t-tests.

This methodology, which quantifies the relative degree of evidence supporting two competing hypotheses—the null hypothesis (H_0) versus the alternative hypothesis (H_1)—using the Bayes factor (BF_{01} – BF_{10}) (Doncaster *et al.*, 2020; Linke *et al.*, 2018), has recently been suggested as a more robust alternative to traditional frequentist statistics (which rely on confidence intervals and p-values) for hypothesis testing. Bayesian statistics offer several advantages, including: (i) BF_{10} quantifies the evidence provided by the data in support of H_1 versus H_0 , (ii) BF_{10} can also quantify evidence in favour of H_0 , and (iii) BF_{10} is not “violently biased” against H_0 (Ly; Verhagen; Wagenmakers, 2016; Wagenmakers *et al.*, 2018). The BF_{10} was interpreted using the evidence categories suggested by Lee and Wagenmakers (2013): $<1/100$ = extreme evidence for H_0 ; $1/100$ to $<1/30$ = very strong evidence for H_0 ; $1/30$ to $<1/10$ = strong evidence for H_0 ; $1/10$ to $<1/3$ = moderate evidence for H_0 ; $1/3$ to <1 = anecdotal evidence for H_0 ; 1 to 3 = anecdotal evidence for H_1 ; 3 to 10 = moderate evidence for H_1 ; 10 to 30 = strong evidence for H_1 ; 30 to 100 = very strong evidence for H_1 ; 100 = extreme evidence for H_1 . The BF_{01} was positioned opposite BF_{10} (e.g., >3 to 10 = moderate evidence for H_0). The effect size was interpreted according to the criteria established by Hopkins *et al.* (2009): 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 significance level for the frequentist analysis was set at $p < 0.05$ for all tests. Data analysis was conducted using IBM SPSS Statistics 25.0 for Windows (IBM Software Group, Chicago, Illinois, USA) and the Jamovi spreadsheet (version 2.6.13), based on the R graphical interface.

3 RESULTS

Figure 1 illustrates the percentage of compliance with physical activity (PA) recommendations across different contexts (school time versus out-of-school time), specifically: a) 60 minutes per day and b) 120 minutes per day.

Figure 1 - Physical activity compliance

Source: The authors

Figure 1 shows extreme evidence ($BF_{10} > 100$) in favour of H_1 for both variables: MVPA compliance with 60 min/day (%) and MVPA compliance with 120 min/day (%), comparing school time versus out-of-school time. Bayesian analyses indicated extreme support for the alternative hypothesis (H_1) in both variables. The robustness of Bayesian factors remained consistently stable (maximum BF_{10} : 3.29×10^{17} at $r = 1.5$; ultrawide prior $BF_{10} = 3.242 \times 10^{17}$; wide prior: $BF_{10} = 2.798 \times 10^{17}$). Furthermore, the analysis exhibited zero error (BF_{10} robustness check: 0.00). Effect sizes were extremely large: MVPA compliance 60 min/day (%): $\delta > 1.884$, 95% CI [1.478, 2.295]; MVPA compliance 120 min/day (%): $\delta > 1.884$, 95% CI [1.478, 2.295]. Frequentist analyses confirmed statistically significant differences ($p < 0.001$).

Table 1 presents Student's paired-sample t-test results along with Bayesian inference results for these comparisons.

Table 1 - Differences in MVPA Bouts in Children Between School Time and Out-of-School Time.

Variable	School Time	Out-of-School Time	<i>p</i>	error %	Bayesian Factor	δ
MVPA CR 60 min/day (%)	53.19 ± 17.58	23.68 ± 8.13	<0.001	0.00	$BF_{10} = 2.227 \times 10^{17}$	1.892
MVPA CR 120 min/day (%)	26.59 ± 8.79	11.84 ± 4.07	<0.001	0.00	$BF_{10} = 2.227 \times 10^{17}$	1.884
MVPA 2 min bouts (numbers)	25.43 ± 16.85	10.59 ± 8.62	<0.001	0.00	$BF_{10} = 1.170 \times 10^{07}$	0.954
MVPA 2 min bouts (time)	59.7 ± 41.63	25.80 ± 21.41	<0.001	0.00	$BF_{10} = 777001.779$	0.850
MVPA 5 min bouts (numbers)	2.84 ± 3.79	1.52 ± 1.84	0.012	0.01	$BF_{10} = 3.127$	0.334
MVPA 5 min bouts (time)	16.06 ± 22.18	8.79 ± 10.45	0.019	0.01	$BF_{10} = 2.111$	0.306
MVPA 10 min bouts (numbers)	0.05 ± 0.30	0.02 ± 0.13	0.419	0.07	$BF_{01} = 5.002$	0.105
MVPA 10 min bouts (time)	0.69 ± 3.99	0.27 ± 2.03	0.486	0.07	$BF_{01} = 5.426$	0.089

MVPA: Moderate-to-vigorous physical activity; CR: Compliance with recommendations; min: minutes

Source: The authors

Table 1 presents the results of Student's paired-samples t-test (Bayesian and frequentist statistics), showing extreme evidence ($BF_{10} > 100$) in favour of H_1 for the following variables: MVPA 2-min bouts (count) and MVPA 2-min bouts (duration). Moderate evidence ($BF_{10} = 3-10$) was found in favour of H_1 for MVPA 5-min bouts (count), while anecdotal evidence ($BF_{10} = 1-3$) supported H_1 for MVPA 5-min bouts (duration) when comparing school time versus out-of-school time (school time < out-of-school time). These findings indicate that it is 1.170×10^{17} times more likely to observe higher mean values in favour of school time than out-of-school time. The numerical algorithm used to compute the results demonstrated high stability (error% = 0.01).

The robustness of the Bayes factors remained stable (e.g., maximum BF_{10} : 1.22×10^7 at $r = 0.9476$; ultrawide prior: $BF_{10} = 1.131 \times 10^7$; wide prior: $BF_{10} = 1.216 \times 10^7$; user prior: $BF_{10} = 1.17 \times 10^7$). The posterior distribution revealed a large effect size for the following variables: MVPA 2-min bouts (count): $\delta > 0.954$, 95% CI [0.629, 1.286]; MVPA 2-min bouts (duration): $\delta > 0.850$, 95% CI [0.536, 1.162]; MVPA 5-min bouts (count): $\delta > 0.334$, 95% CI [0.067, 0.600]; MVPA 5-min bouts (duration): $\delta > 0.306$, 95% CI [0.044, 0.567]

Frequentist analysis confirmed statistically significant differences in MVPA 2-min bouts (count) and MVPA 2-min bouts (duration) ($p < 0.001$); MVPA 5-min bouts (count) ($p < 0.012$); and MVPA 5-min bouts (duration) ($p < 0.019$). No statistically significant differences were found in MVPA 10-min bouts (count) or MVPA 10-min bouts (duration).

Table 2 presents the results of the Student's paired-sample t-test and Bayesian methodology used to examine differences in MVPA bouts (1, 5, and 10 minutes).

Table 2 - Differences in MVPA bouts in children between Monday–Friday and Saturday–Sunday.

Variable	Monday-Friday	Saturday-Sunday	<i>p</i>	error %	Bayesian Factor	δ
MVPA CR 60 min/day (%)	113.29 ± 34.99	113.21 ± 43.38	0.986	0.09	$BF_{01} = 7.297$	0.001
MVPA CR 120 min/day (%)	56.64 ± 17.49	56.61 ± 21.69	0.986	0.09	$BF_{01} = 7.297$	0.002
MVPA 2 min bouts (numbers)	52.61 ± 29.95	21.48 ± 15.3	<0.001	0.00	$BF_{10} = 1.163 \times 10^{13}$	1.318
MVPA 2 min bouts (time)	127.16 ± 75.13	53.29 ± 38.66	<0.001	0.00	$BF_{10} = 8.533 \times 10^{11}$	1.233
MVPA 5 min bouts (numbers)	6.52 ± 6.95	3.22 ± 3.61	<0.001	0.00	$BF_{10} = 1530.642$	0.573
MVPA 5 min bouts (time)	38.53 ± 43.95	19.04 ± 21.37	<0.001	0.00	$BF_{10} = 420.277$	0.525
MVPA 10 min bouts (numbers)	0.38 ± 1.09	0.14 ± 0.35	0.083	0.03	$BF_{01} = 1.706$	0.206
MVPA 10 min bouts (time)	4.48 ± 13.02	1.66 ± 4.19	0.087	0.03	$BF_{01} = 1.761$	0.206

CR: Compliance with recommendations; min: minutes; MVPA: Moderate-to-vigorous physical activity

Source: The authors

In Table 2, Student's paired-samples t-test (Bayesian and frequentist statistics) showed extreme evidence ($BF_{10} > 100$) in favour of H_1 for the following variables: MVPA 2-min bouts (count), MVPA 2-min bouts (duration), MVPA 5-min bouts (count), and MVPA 5-min bouts (duration), when comparing Monday–Friday versus Saturday–Sunday (Monday–Friday < Saturday–Sunday).

These findings indicate that it is 1.163×10^{13} times more likely to observe higher mean values in favour of school time than out-of-school time. The numerical algorithm used to compute the results demonstrated high stability (error% < 0.001).

The robustness of the Bayes factors remained stable (e.g., maximum BF_{10} : 1.39×10^{13} at $r = 1.3234$; ultrawide prior: $BF_{10} = 1.388 \times 10^{13}$; wide prior: $BF_{10} = 1.34 \times 10^{13}$; user prior: $BF_{10} = 1.163 \times 10^{13}$).

The posterior distribution revealed a large effect size for the following variables: MVPA 2-min bouts (count): $\delta > 1.318$, 95% CI [1.013, 1.648]; MVPA 2-min bouts (duration): $\delta > 1.233$, 95% CI [0.937, 1.568]; MVPA 5-min bouts (count): $\delta > 0.573$, 95% CI [0.308, 0.846]; MVPA 5-min bouts (duration): $\delta > 0.525$, 95% CI [0.274, 0.786]; MVPA 10-min bouts (count): $\delta > 0.206$, 95% CI [-0.032, 0.449]; MVPA 10-min bouts (duration): $\delta > 0.206$, 95% CI [-0.041, 0.447]

Frequentist analysis confirmed statistically significant differences in MVPA 2-min bouts (count) and MVPA 2-min bouts (duration) ($p < 0.001$); MVPA 5-min bouts (count) ($p < 0.012$); and MVPA 5-min bouts (duration) ($p < 0.019$). No statistically significant differences were found in MVPA compliance with 60 min/day (%), MVPA compliance with 120 min/day (%), MVPA 10-min bouts (count), or MVPA 10-min bouts (duration).

4 DISCUSSION

This study analyses the active participation of two-year-old children during school time versus out-of-school time and weekdays versus weekends, evaluating their moderate-to-vigorous physical activity (MVPA) using accelerometers. This research addresses a critical gap in the existing literature, as few studies provide detailed analyses of PA at such early ages. The results offer key insights for developing school-based intervention strategies to promote an active lifestyle from the earliest years.

Initially, higher compliance with daily MVPA recommendations was observed during school time compared to out-of-school time, with an increase of 15–20% for both the 60-minute and 120-minute MVPA recommendations (Figure 1). This finding highlights the importance of the school environment, although PA recommendations set by institutions are not being fully met (NASPE, 2014; WHO, 2020). It is particularly interesting to note that this result is consistent with previous research indicating that structured environments, such as educational settings, facilitate higher PA levels by providing specific opportunities for movement (Díaz-Quesada *et al.*, 2022; O'Neil *et al.*, 2016). This aligns with prior evidence identifying schools as key spaces for promoting structured movement opportunities, contributing not only to physical development

but also to children's overall well-being (Mak; Chan; Capio, 2021; Mannocci *et al.*, 2020). Early childhood education centres, which cater to children in the first cycle of preschool education (Spain, 2006), often have dedicated resources and spaces, such as playgrounds and guided activities, making them ideal environments for fostering movement (Schmutz *et al.*, 2018; Vanderloo *et al.*, 2014).

However, when comparing weekdays versus weekends, no statistically significant differences were found (Table 2). This is particularly noteworthy, as there is a prevailing trend in the scientific literature suggesting that PA levels tend to be significantly higher on weekdays compared to weekends, largely due to structured PA opportunities both in school and in extracurricular activities (Collings *et al.*, 2020; Pate *et al.*, 2016). Weekends typically lack such structured PA opportunities, relying instead on family dynamics and spontaneous activities, which tend to be less consistent and varied (Ridgers; Stratton; Fairclough, 2006; Schmutz *et al.*, 2018). Studies such as those by Hnatiuk *et al.* (2019) have shown that sedentary time significantly increases on weekends, while MVPA levels decline, reducing the likelihood of meeting daily PA recommendations set by organisations like the WHO (WHO, 2020). Previous research has demonstrated that family involvement in PA can increase children's adherence to active practices (Alhassan *et al.*, 2019; González-Díaz; Fraguela Vale; Varela Garrote, 2017). Therefore, a key recommendation is collaboration between schools and families, encouraging joint initiatives such as weekend PA programmes and awareness campaigns on the importance of movement for child development.

From a policy perspective, it is essential to advocate for the implementation of public policies that encourage structured PA both in schools and at home. Studies in Europe and Australia have shown that public initiatives such as the "Daily Mile" and "Active Schools Framework" have significantly increased PA levels in children by allocating dedicated time for structured exercise and supporting teacher training (Chesham *et al.*, 2018; Daly-Smith *et al.*, 2020). For instance, incorporating clear PA objectives into national education policies can be an effective strategy to improve daily PA levels and enhance children's academic performance. Studies from Finland and Japan have demonstrated that the implementation of school policies promoting regular PA has had a positive impact on cognitive development, academic performance, and emotional well-being (Haapala *et al.*, 2017; Ishii *et al.*, 2020).

One of the most relevant findings of this study is the analysis of MVPA bouts at different times of the week (Tables 1 and 2). Despite the limited literature available on this topic, previous studies suggest that children aged 3–4 years tend to accumulate more frequent short MVPA bouts of 1–2 minutes, compared to longer bouts of 5 minutes or more (Torres-Luque *et al.*, 2016). In the present study, although data were analysed in separate timeframes, the findings confirm that the most frequent MVPA bouts lasted 2 minutes, followed by 5 minutes, while 10-minute bouts were nearly non-existent. This result reinforces the idea that PA patterns at early ages are highly transient, with PA being accumulated intermittently (Sanders *et al.*, 2014; Torres-Luque *et al.*, 2016).

A more in-depth analysis based on different timeframes reveals highly insightful results. School time accumulated a greater volume of 2- and 5-minute MVPA bouts compared to out-of-school time (Table 1). These findings confirm that young children predominantly engage in short MVPA bouts, as no significant differences were found for 10-minute bouts, aligning with previous studies (Torres-Luque *et al.*, 2016). Furthermore, although teaching methodologies were not directly assessed, the findings suggest a proactive role of teachers in promoting MVPA, highlighting the school environment's potential to foster PA (Mak; Chan; Capio, 2021). From an educational perspective, it is well-established that active learning methodologies, such as project-based learning, collaborative learning, and experiential learning, are effective in increasing student engagement (Mannocci *et al.*, 2020). Additionally, the availability of outdoor spaces, playgrounds designed for active play, and allocated movement time can contribute 5–40% of the daily recommended PA in children (Laboy, 2019; Ridgers; Stratton; Fairclough, 2006). This study provides evidence supporting the effectiveness of teacher-led interventions while also highlighting the need to design specific, structured interventions to extend PA episodes in early childhood, maximising the positive cumulative impact (Herbert *et al.*, 2020; Jakicic *et al.*, 2019).

Educational institutions should consider implementing specific strategies such as pedagogical methods prioritising intermittent and structured PA, particularly during key time slots. Recent studies have shown that micro-intervals of PA during lessons improve both physical health and academic focus in students (Donnelly; Lambourne, 2011; Howie; Beets; Pate, 2014). Examples include integrating movement routines into curricular activities and designing outdoor spaces to encourage active play (Laboy, 2019; Vanderloo *et al.*, 2014). Additionally, teacher training programmes focused on active methodologies and project-based learning could significantly increase PA levels in children and foster a more dynamic learning environment (Beets; Wallner; Beighle, 2010; Comprehensive School..., 2013). When analysing weekdays versus weekends, differences were found for all MVPA bout durations (2, 5, and 10 minutes). While no differences were observed in overall MVPA compliance, the distribution of MVPA bouts varied (Table 2). Given the marked contrast between school and out-of-school PA, this difference logically extends to the weekend. However, this weekend decline is consistent with previous research suggesting that the lack of structured PA opportunities at home and in extracurricular settings contributes to lower PA levels (Collings *et al.*, 2020). This finding underscores the importance of engaging families and communities in PA promotion through accessible and adapted recreational programmes (Alhassan *et al.*, 2019; González-Díaz; Fraguera Vale; Varela Garrote, 2017).

A limitation of this study is its sample, which was restricted to a single school, potentially affecting the generalisability of the findings. Future research could address this limitation by including a more diverse sample in terms of socioeconomic and cultural background. Additionally, it is crucial to examine contextual variables such as the level of family support and local policies that promote physical activity in early childhood. An open question remains as to how cultural and socioeconomic factors may influence the effectiveness of such interventions. Previous research

has demonstrated that cultural barriers and socioeconomic inequalities significantly impact the implementation and success of physical activity programmes, highlighting the need for context-adapted approaches for each community (Biddle *et al.*, 2019; Tremblay *et al.*, 2014). This is, therefore, an area that requires further exploration.

Nevertheless, in conclusion, the findings reinforce the idea that the school environment is a privileged space for promoting physical activity (PA) from an early age. Understanding active participation at these ages will contribute to better classroom curriculum design. However, to maximise the benefits, it is crucial to combine school-based strategies with interventions that involve families and communities, creating a holistic approach to promoting active lifestyles. By adopting an integrated approach, children will not only achieve the recommended PA levels but also develop essential social, cognitive, and emotional skills that are fundamental to their future well-being (Mak; Chan; Capio, 2021; Vanderloo *et al.*, 2014). This coordinated effort will help lay the foundation for a healthier and more resilient generation.

5 CONCLUSION

The active participation of two-year-old children is higher during school time compared to out-of-school time, both in terms of compliance with moderate-to-vigorous physical activity (MVPA) recommendations and the accumulation of 2- and 5-minute MVPA bouts, with no differences observed in 10-minute bouts. The school environment is an ideal setting for implementing specific educational intervention strategies that foster greater and progressively increasing active participation.

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Resumen: El objetivo de este estudio, es analizar la participación activa en niños de 2 años en diferentes momentos del día para ver la influencia del horario escolar. Participaron 73 niños de 2 años (2.13 ± 0.48). Portaron un acelerómetro "Actigraph GT3X" siete días consecutivos de una semana escolar, recogiendo los minutos de actividad física moderada a vigorosa (AFMV) (min/día y porcentaje) y el número de bout de AFMV (2, 5 y 10 min) en diferentes momentos (Horario Escolar vs Horario Extraescolar; Lunes a Viernes vs Fin de semana). Existe un cumplimiento en torno al 50% de las recomendaciones diarias de AFMV para estas edades. Hay un mayor número de bloques de AFMV en el Horario Escolar vs Horario Extraescolar, así como en los días entre semana frente al fin de semana. El contexto escolar es un lugar idóneo para generar estrategias de intervención que promuevan una mayor participación activa.

Palabras clave: Acelerometría. Nivel de actividad física. Infantil. Escolares

Resumo: O objetivo deste estudo é analisar a participação ativa de crianças de dois anos em diferentes momentos do dia para avaliar a influência do horário escolar. Participaram 73 crianças de dois anos ($2,13 \pm 0,48$). Elas usaram um acelerômetro "Actigraph GT3X" durante sete dias consecutivos de uma semana escolar, registrando os minutos de atividade física moderada a vigorosa (AFMV) (min/dia e porcentagem) e o número de blocos de AFMV (2, 5 e 10 minutos) em diferentes períodos (Horário Escolar vs. Horário Extracurricular; Dias da Semana vs. Fins de Semana). Aproximadamente 50% das recomendações diárias de AFMV para essa faixa etária foram atendidas. Um maior número de blocos de AFMV foi registrado durante o Horário Escolar em comparação ao Horário Extracurricular, bem como durante os dias da semana em relação aos fins de semana. O ambiente escolar é um contexto ideal para desenvolver estratégias de intervenção que promovam maior participação ativa.

Palavras-chave: Acelerometria. Nível de atividade física. Infantil. Escolares

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CONFLICT OF INTERESTS

The authors declare that this work involves no conflict of interest.

AUTHOR CONTRIBUTIONS

Enrique Ortega-Toro: Conceptualization; Research; Writing - review and editing.

Gema Torres-Luque: Conceptualization; Research; Methodology; Writing - original draft.

Gema Díaz-Quesada: Research; Data analysis; Resources; Validation; Writing - review and editing.

Rosario Padial Ruz: Research; Methodology; Data curation; Supervision.

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EDITORIAL RESPONSIBILITY

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