

## Physical activity levels during physical education in Spanish children

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### Abstract

**Introduction:** Physical education (PE) can contribute to total daily physical activity (PA) among children. In consequence, the Spanish Ministry of Education, Culture and Sport has developed 16 teaching units focused on increasing PA levels during PE lessons, called *Unidades Didácticas Activas* (UDA; Active Teaching Units).

**Objectives:** The goal of this study was to compare whether children participating in UDA lessons spent more time in moderate-to-vigorous physical activity (MVPA) than children participating in traditional lessons.

**Design:** Quasi-experimental design.

**Methods:** A total of 355 children (8–9 years old, 53.9% boys) from 7 schools in Granada participated in the study. Students were divided into two groups: a traditional PE group ( $n=204$ ) and a UDA group ( $n=151$ ). Time spent in MVPA was assessed using tri-axial accelerometers.

**Results:** Time spent in MVPA was higher in the group engaged in the UDA lessons compared to the group that received traditional lessons (13.6 vs 15.2 minutes,  $p=.021$ , Standard Error=0.27). The percentage of children who met international MVPA recommendations was similar for both groups (UDAs: 12.7% and traditional: 13.2%,  $p=.504$ ).

**Conclusions:** UDA lessons and their methodology favoured greater participation in MVPA compared to a traditional PE approach. It will be important to change PE methodology (including duration, frequency and focus) to achieve MVPA goals.

### Keywords

Children, moderate-to-vigorous, physical activity, physical education, Spain

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## Introduction

Low levels of physical activity (PA) may be a key factor underlying some diseases in the 21st century and the paediatric obesity epidemic (Hatfield et al., 2015). A sufficient level of PA, especially moderate-to-vigorous PA (MVPA), carries numerous health benefits, such as better cardiorespiratory fitness (Hsieh et al., 2014), self-esteem and psychological well-being (Biddle and Asare, 2011), improved academic achievement and greater psychological health (Bunketorp Kall et al., 2015). Moreover, high levels of PA in childhood and adolescence may track into adulthood (Telama et al., 2005). However, only a small percentage of children meet the minimum recommended daily 60 minutes of MVPA. According to a recent study of young people aged 11 to 17 years in 146 countries, 81% of participants were physically inactive (Guthold et al., 2020). Specifically in Spain, the percentage of children achieving this recommended amount was 12.3% among girls and 30.4% among boys (Konstabel et al., 2014). As a result, the promotion of PA among young people has been identified as a global health priority (World Health Organization (WHO), 2010).

Primary and secondary schools provide an ideal setting in which to promote health-related behaviour (Sevil et al., 2019). Although responsibility for promoting PA should be shared between schools, families and communities (Haerens et al., 2006), schools provide an ideal environment for PA interventions because no other institution has as much influence on children during two decades of their life (Story et al., 2009). Moreover, they provide the best way to reach the entire population, regardless of social status, since virtually all children attend school (WHO, 2004).

There are multiple opportunities during the school-day in which to increase PA (e.g. recess (Coolkens et al., 2018; Verstraete et al., 2006), physical education [PE] lessons (Hollis et al., 2017; Ntoumanis, 2005), and classroom activities (Watson et al., 2017)]. Despite the existence of research into promoting PA at school, it is not clear what the most effective means are to promote lifelong healthy behaviours (Dobbins et al., 2013). One of the main goals of PE is to engage children in PA during PE so as to prepare them for lifetime PA and acquire general motor and behavioural skills, (Hills et al., 2015; Sallis and McKenzie, 1991). The hope is that doing so may encourage young people to adopt an active lifestyle (Haerens et al., 2010) which can track to adulthood (Ekblom-Bak et al., 2018).

According to Bassett et al.'s (2013) review, attending PE lessons is associated with higher PA level and lower sedentary behaviour (Silva et al., 2018). In order to deliver health benefits, the Physical Activity Guidelines for Americans state that the intensity of PA in PE has to be at least moderate (Janssen and Leblanc, 2010). More specifically, children should be involved in MVPA for at least 50% of PE lesson time (U.S. Department of Health Human Services, 2000). However, children are often relatively inactive during PE lessons (McKenzie et al., 1993; Nader, 2003), and girls tend to be less active and less engaged than boys due to curricular and motivational factors (Solmon, 2014). Moreover, the proportion of time spent in MVPA during PE lessons (40.5%) is below the recommendations (Hollis et al., 2017).

Several intervention programmes to increase PA levels in children during PE have been developed. We located six programmes that focused on the increase of PA levels during the PE lesson: three from the USA (Ignico et al., 2006; McKenzie et al., 1995; Sallis et al., 1997), one from Belgium (Verstraete et al., 2007), one from the UK (Rowlands et al., 2008) and one from Australia (Van Beurden et al., 2003). Four programmes used teaching strategies or an adjusted curriculum to increase PA levels during PE (McKenzie et al., 1995; Sallis et al., 1997; Van Beurden et al., 2003; Verstraete et al., 2007), one delivered fitness instruction (Ignico et al., 2006), and another study focused on dance and soccer (Rowlands et al., 2008). All of the intervention programmes succeeded at increasing the PA levels during the PE lessons. In Spain, seven intervention research

studies have been conducted in the last 15 years aiming at increasing PA levels in school children using different methodologies (e.g. organising activities with families, after-school activities). However, none of them focused on PE lessons (Avila-Garcia et al., 2016). High-quality interventions are needed to determine the most effective and sustainable ways to increase PA levels through PE (Lonsdale et al., 2013).

Recently, the Spanish Ministry of Health, Social Services and Equality and the Ministry of Education, Culture and Sport have jointly developed a series of *Unidades Didácticas Activas* (Active Teaching Units) (Abad and Cañada, 2014) aimed at increasing MVPA levels during PE lessons. In this context, this initiative promises to achieve a greater participation of students in MVPA during PE lessons than traditional methodologies. However, to our knowledge, this has not been scientifically tested so far. Therefore, the purpose of this study was to compare PA levels, with special attention to MVPA, during PE lessons using different methodologies (Traditional vs UDA) in Spanish third grade boys and girls (primary school students). It was hypothesised that children participating in UDAs would engage in more MVPA than children in traditional lessons and that lessons using UDAs will reach the recommendation of 50% of MVPA of total lesson time (DHHS, 2010).

## Material and methods

### *Participants and study design*

Seven different public primary schools from Granada (Spain) were selected by convenience and contacted to participate in this quasi-experimental study. All children ( $n=366$ , 3<sup>rd</sup> grade, with a mean age of  $8.05 \pm 0.25$  years old) from the 7 schools were asked to wear an accelerometer during the PE lessons (response rate 100%). After deleting those children who did not present complete data, the final sample was composed of 355 students. The data were collected between January 2017 and April 2017 as part of the PREVIENE Project (Tercedor et al., 2017). This project aims to increase PA levels in children and makes use of different intervention components: active commuting to school, sleep health, school recess and PE lessons through UDAs. Ethical approval was obtained from the Human Research Ethics Committee from the University of Granada (57/CEIH/2015).

The research team visited the schools and arranged a meeting with their staff (principals and PE teachers) as well as with the parents of the participating children. At this appointment, the researchers explained the aims of the study and obtained the parents' informed consent. Eight PE specialist teachers from the 7 schools expressed their willingness to participate in the research study. At this stage of the study, the research team opted to ensure the most optimal implementation of the UDAs. Therefore, group membership (traditional or UDA) was assigned according to the teachers' preferences. The research team conducted one individual meeting with the teachers in the traditional group and another one with the teachers in the UDA group for specific methodological advice, and they analysed the activities proposed to be sure teachers had all the necessary material to implement the lessons. After the meetings, the PE teacher delivered the PE lessons following the UDA instructions, focusing on increasing the MVPA levels during the lesson. A researcher visited each school during the PE lesson time and randomly selected 5–7 students to wear an accelerometer from the beginning until the end of the lesson. None of the students wore an accelerometer more than once in the 63 different PE lessons that were recorded, traditional ( $n=32$ ) and UDA ( $n=31$ ). The number of students per class was similar for the 7 schools, ranging from 22 to 26. Twenty-eight lessons were given indoors and 35 lessons were given outdoors. None of the schools had to change any activity of the lessons as a result of bad weather conditions (rain or low temperatures). The length of the PE lessons differed between schools: 6 schools had 45-minute lessons,

whereas 1 school had 60-minute lessons. Therefore, total duration was used as a covariate in the analyses as explained in the statistical analysis section.

### *PE lessons*

In Spain, the education system provides for two PE lessons per week (Spanish Ministry of Education, Culture and Sport, 2006). The number of PE specialist teachers in schools is unknown, but according to the Spanish education system it is not mandatory to be a specialist to work in school as a PE teacher. The Spanish Ministry of Education, Culture and Sport has established a general curriculum with the main objectives and contents that must be prepared by each teacher in their annual programme. In line with this document, teachers must develop teaching units and the activities that they will use to achieve the aims of the school year established in the national curriculum.

The UDA lessons focus on increasing the time spent in MVPA during the PE lesson through teaching strategies and curriculum development. UDAs provide some methodological advice (e.g. checking attendance during the lesson when students are involved in activities or using music to increase motivation during some forms of exercise) to keep students physically active during the lesson. They also include two teaching units with 16 fully developed lessons for every 2 years of primary education ([https://www.msbs.gob.es/profesionales/saludPublica/prevPromocion/Estrategia/docs/UDA\\_Completo.pdf](https://www.msbs.gob.es/profesionales/saludPublica/prevPromocion/Estrategia/docs/UDA_Completo.pdf)). Some of the activities aimed to increase PA time (e.g. orienting races or fitness circuits). In relation to lesson content, the UDAs suggest activities focused on four of the five Primary Education content areas for third grade in PE: the body: image and perception; motor skills; physical activity and health; and sports.

On the other hand, traditional lessons follow the usual curriculum, focusing on the teaching units and activities developed by the PE teacher in line with the Spanish PE curriculum. The PE teacher establishes the order of the content and the activities undertaken in every lesson as they usually do. During these lessons, the PE teacher can decide to use any content and any exercise to address the objectives and the competences included in the curriculum. The research team did not offer advice on the best way to achieve a higher time of PA during the activities or the lessons. The teachers assigned to the traditional group were selected in the first interview according to their interests, and were asked to continue working as usual without any change to the curriculum.

### *Measures*

**Anthropometry.** We assessed children's weight and height in PE clothes (shorts and short sleeve t-shirt) and barefoot. Weight was measured with a 0.1 kg approximation using a weighing system (Seca 876, Hamburg, Germany). Height was measured using the Frankfort plane, with a 0.1 cm approximation using a Seca stadiometer (both from Seca, LTd. Hamburg, Germany). Both height and weight were measured twice, and the average of the two measurements was used in the analyses. Body mass index (BMI) was calculated as the weight in kilogrammes divided by the square of the height in metres. The weight status was determined from BMI using age- and gender-specific cut points (Cole et al., 2007).

**Physical activity.** Physical activity during PE lessons was measured using a tri-axial accelerometer (Actigraph wGT3X-BT, Pensacola, FL, USA), a valid tool to measure PA levels in public health programme evaluations (Troiano et al., 2008). Children were instructed to wear the accelerometer attached to the left side of their waist, secured with an elastic belt and underneath their clothing. Using the default mode filter option, the data were collected at a rate of 30Hz and raw data was

transformed to an epoch length of 15 seconds. Sedentary time, light PA, moderate PA and vigorous PA (min/day) were calculated based upon the recommended PA vector magnitude cut points (Evenson et al., 2008): 0–100, 101–2295, 2296–4011, and  $\geq 4012$  cpm, respectively. MVPA was calculated as the sum of moderate and vigorous PA, and the total PA (min/day) was calculated as the sum of light PA and MVPA. We calculated percentages of sedentary time, light PA, and MVPA dividing these variables by the total accelerometer wear time. Data download, reduction, cleaning and analysis were conducted using Actilife™ v.6.11.7 desktop software. Two members of the research team were present during the PE lessons.

### *Statistical analyses*

Descriptive statistics (means, standard deviations and percentages) were calculated. The Kolmogorov–Smirnov test and Levene test were used to test the normality of the data and the homogeneity of variances, respectively. We analysed differences between groups according to children's age, children's BMI, percentages of sedentary, light PA, moderate PA, vigorous PA, MVPA, and total time of PA, by gender using analysis of variance (ANOVA). To analyse differences in PA variables between traditional and UDA lessons, we used analysis of covariance (ANCOVA) controlled for the total PE lesson time and BMI. We performed multilevel analyses controlled for the total PE lesson time and BMI to study differences in sedentary, light PA, moderate PA, vigorous PA, MVPA and total PA between genders (boys vs girls) and methodology of PE lessons (Traditional vs UDA). Cohen's *d* value was used to assess the effect size and was considered to be small ( $<0.2$ ), medium ( $0.2\text{--}0.8$ ) or large ( $>0.8$ ) (Cohen, 1988). In addition, partial eta squared value were calculated and considered small ( $<0.01$ ), medium ( $<0.06$ ) or large ( $<0.14$ ) (Cohen, 1969). Analyses were undertaken using the Statistical Package for Social Sciences (SPSS Version 20.0 for Windows, IBM Corp., Armonk, NY, USA), with the level of significance set at  $p < .05$ .

## **Results**

### *Descriptive data of participants*

Due to problems wearing or registering the accelerometer in 11 children, the final sample consisted of 355 children. The main characteristics of the participants as well as the PA percentages are presented in Table 1. Participants comprised 192 boys and 163 girls, and based on their BMI they could mostly be classified as normal weight (66.6%). PA levels were higher in boys compared to girls, only for moderate PA and MVPA (both  $p < .05$ ).

### *Comparison of percentages of PA between groups according to methodology*

Differences in the percentages of PA intensity levels between traditional and UDA PE lessons are shown in Figure 1. The percentages of sedentary time, light PA and moderate PA did not significantly differ between UDA lessons and the traditional lessons (21.0 vs 23.8%, 42.4 vs 43.0%, and 18.4 vs 18.2%, respectively), but the percentage of vigorous and MVPA were higher in the UDA lessons compared to the traditional lessons (36.6 vs 33.2% and 18.2 vs 15.0%, respectively, both  $p < .05$ ).

The percentage of children who were sufficiently active according to MVPA recommendations in the PE lessons is presented in Figure 2 (DHHS, 2010). The percentage of children who accomplished the MVPA recommendations during PE lessons was 12.7% in the UDA lessons and 13.2%

**Table 1.** Percentage of sedentary time, light PA, moderate PA, vigorous PA, MVPA and total PA time in traditional lessons and UDA lessons.

	All	Boys	Girls	<i>p</i>
	<i>N</i> = 355	<i>N</i> = 192	<i>N</i> = 163	
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	
Children's weight status ( <i>n</i> (%))				
Normal weight	236 (66.6)	130 (67.9)	106 (64.8)	.576
Overweight	76 (21.2)	42 (21.6)	34 (21)	
Obese	43 (12.2)	20 (10.5)	23 (14.2)	
Number of children ( <i>n</i> (%))				
Attending traditional lessons	204 (57.7)	104 (54.2)	100 (61.1)	.116
Attending UDAs	151 (42.3)	88 (45.8)	63 (38.9)	
PA percentages in physical education (% ( <i>SD</i> ))				
Sedentary	22.6 (16.9)	22.0 (17.1)	23.3 (16.8)	.474
Light PA	42.8 (12.4)	41.8 (12.1)	43.8 (12.7)	.134
Moderate PA	<b>18.3 (6.8)</b>	<b>19.0 (7.1)</b>	<b>17.5 (6.4)</b>	<b>.042</b>
Vigorous PA	16.4 (10.1)	17.2 (10.4)	15.4 (9.4)	.088
MVPA	<b>34.7 (13.6)</b>	<b>36.1 (14.1)</b>	<b>32.9 (12.8)</b>	<b>.023</b>
Total PA	77.4 (17.0)	78.0 (17.2)	76.7 (16.8)	.474

PA: physical activity; MVPA: moderate-to-vigorous physical activity; *SD*: standard deviation; UDA: *Unidades Didácticas Activas*.

Statistically significant values are highlighted in bold ( $p < 0.05$ ).

in the traditional lessons ( $p = .504$ ). A total of 18.4% of the boys in the UDA lessons and 14.9% in the traditional lessons spent  $\geq 50\%$  of the lesson time in MVPA ( $p = .328$ ), whereas 8.2% of the girls in the UDA lessons and 9.5% of the girls in the traditional lessons did so ( $p = .488$ ).

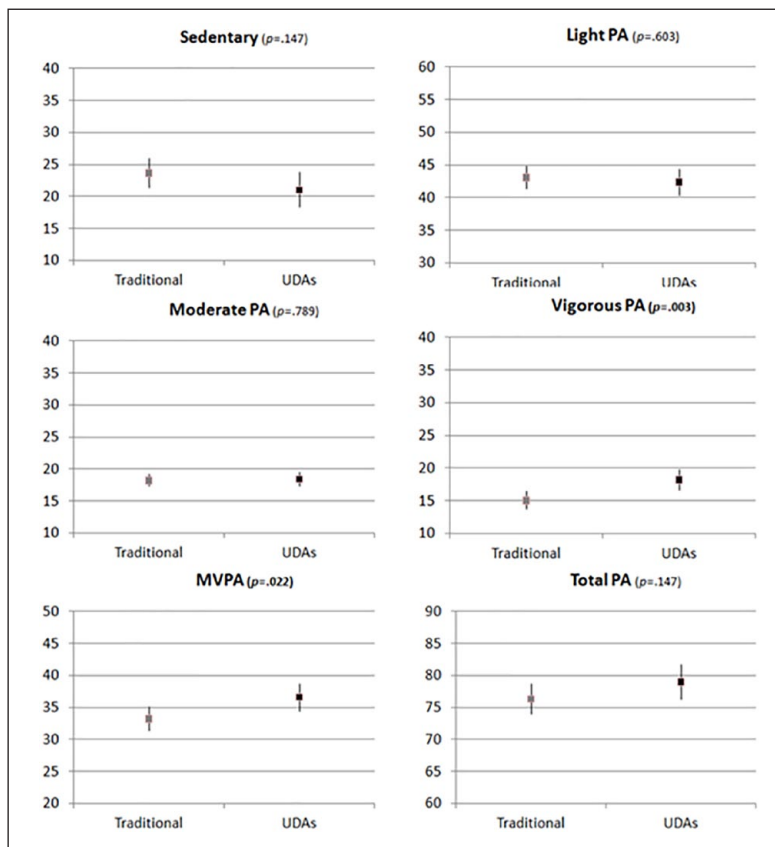
### Minutes of PA across methodology of PE lessons by gender

The time spent in PA intensity levels and in total PA across the PE lessons by gender and methodology are presented in Table 2. Children spent more time in vigorous and MVPA during UDA lessons than during traditional lessons (both  $p < .05$ ). No differences were found in the time spent in PA intensity levels across the PE lessons between boys and girls.

## Discussion

Findings from this study revealed that on average children who engaged in UDA lessons spent one and a half minutes more in MVPA compared to those in traditional lessons, regardless of gender. This difference does not support the claim that UDA lessons substantially increase the MVPA time of children to achieve current recommendations for MVPA engagement during PE lessons.

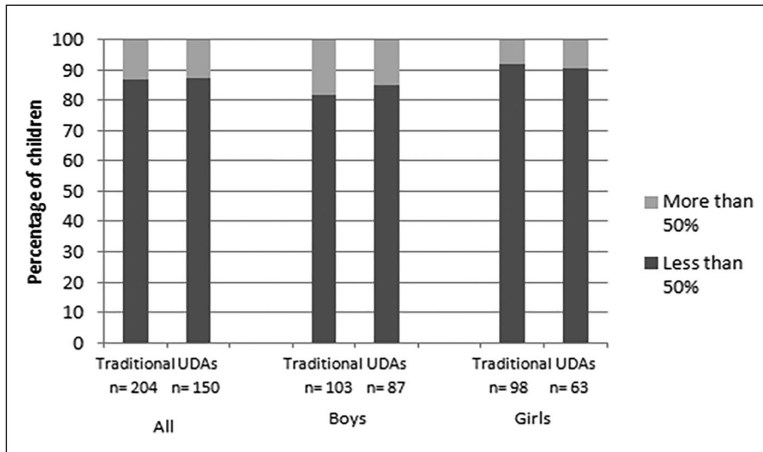
The amount of time during PE lessons that children spent in vigorous PA was slightly higher in UDA lessons compared to traditional lessons. Active Teaching Units were associated with only one and a half minutes more MVPA than traditional lessons, so this alternative methodology contributes only modestly to recommended total daily MVPA of 60 minutes. The CATCH (McKenzie et al., 1995) study, conducted in US schools, found similar results and reported an increase of only



**Figure 1.** Percentage of sedentary time, light PA, moderate PA, vigorous PA, MVPA and total PA time in traditional lessons and UDA lessons.

one minute of MVPA in classes taught by a specialist teacher. On the other hand, the SPARK (Sallis et al., 1997) programme developed an intervention which included 32-hours of teacher training and follow-up support, which doubled MVPA time relative to the control group. In a similar vein, (Verstraete et al., 2006) supported teachers over a 20-year period (through training and follow-up consultations) to increase the amount of MVPA in the total PE time by 12%. Following the programme, members of the intervention group were involved in MVPA for 56.3% of the lesson time (Verstraete et al., 2007).

By way of comparison, a US study aimed to increase PA through the introduction of a mountain biking unit in PE lessons, but it did not find any significant change in the PA time in the PE lessons (Palmer et al., 2018). In making sense of these findings, it is important to take into account the instructional behaviour of teachers (Chow et al., 2008) and the need to improve the motor competence of children more generally to increase MVPA levels during PE lessons and overall daily PA (De Meester et al., 2016). PE teachers have an important role to play in the promotion of PA in schools (Centers for Disease Control and Prevention, 2013) since they can enhance PA levels at school during and beyond PE lessons (Rink, 2014). Accordingly, well prepared, specialist PE teachers may increase MVPA during PE, but this improvement must not come at the expense of other important PE outcomes (Hobbs et al., 2018).



**Figure 2.** Percentage of children meeting recommended levels of MVPA during PE lessons.

**Table 2.** Time of sedentary, light PA, moderate PA, vigorous PA, MVPA and total PA across PE lessons, by methodology and by gender.

		All	<i>P</i>	ES	Boys	Girls	<i>p</i>	PES
		<i>M</i> (CI)			<i>M</i> (SD)	<i>M</i> (SD)		
Sedentary	Traditional UDAs	9.8 (8.8–10.7)	.160	.16	9.9 (8.6–11.1)	9.7 (8.4–11.1)	.221	.004
	UDAs	8.6 (7.5–9.8)			8.0 (4.5–9.4)	9.5 (7.8–11.2)		
Light PA	Traditional UDAs	17.8 (17.1–18.5)	.492	.08	17.1 (16.1–18.1)	18.5 (17.5–19.5)	.129	.007
	UDAs	17.4 (16.5–18.2)			17.5 (16.4–18.6)	17.2 (15.9–18.1)		
Moderate PA	Traditional UDAs	7.3 (6.9–7.7)	.166	.16	7.5 (7.0–8.1)	7.0 (6.5–7.6)	.714	.000
	UDAs	7.8 (7.3–8.2)			8.1 (7.4–8.6)	7.3 (6.7–8.1)		
Vigorous PA	Traditional UDAs	<b>6.3 (5.7–6.9)</b>	<b>.028</b>	<b>.26</b>	6.6 (5.8–7.5)	6.0 (5.1–6.8)	.926	.000
	UDAs	<b>7.4 (6.7–8.2)</b>			7.7 (6.8–8.6)	7.1 (6.1–8.2)		
MVPA	Traditional UDAs	<b>13.6 (12.8–14.4)</b>	<b>.021</b>	<b>.27</b>	14.1 (13.1–15.3)	13.1 (11.9–14.1)	.911	.000
	UDAs	<b>15.2 (14.3–16.2)</b>			15.7 (14.5–16.9)	14.5 (13.1–15.9)		
Total PA	Traditional UDAs	31.4 (30.5–32.4)	.160	.17	31.3 (29.9–32.6)	31.5 (30.2–32.9)	.221	.004
	UDAs	32.6 (31.4–33.7)			33.2 (31.8–34.7)	31.7 (30.0–33.4)		

CI: confidence interval; ES: Cohen's effect size; SD: standard deviation; PES: partial eta squared effect size; PA: physical activity; MVPA: moderate-to-vigorous physical activity; UDA: *Unidades Didácticas Activas*. Statistically significant values are highlighted in bold. Time presented in minutes.

Despite the fact that UDAs focused on increasing MVPA to achieve international recommendations, both traditional lessons and UDA driven lessons resulted in a similar percentage of children accomplishing the  $\geq 50\%$  of MVPA target (DHHS, 2010). In Spain, a low percentage of children accomplish PA recommendations in PE and recess (Grao-Cruces et al., 2019). The UDA lessons required some methodological changes and the inclusion of specific activities to achieve the recommendations. Moreover, the UDAs suggest activities that focus on intense action rather than fun activities. However, since students' motivation is central to increasing PA during PE lessons (Haerens et al. (DHHS, 2010), it is advisable to develop interventions a strong motivational



component to increase MVPA. In the light of this, new approaches such as the inclusion of music during cardiorespiratory fitness exercise may increase PA time (Lamoneda et al., 2020). In addition, since the content of lessons influences the total time spent in MVPA, including fitness activities such as orienteering and game playing could also be important in increasing daily MVPA (Fröberg et al., 2017).

In this study, the recommendation to spend more than 50% of total PE time in MVPA was only achieved by 12.7% of children across the methodologies used. Worldwide, there is a high variability in the percentage of children who meet MVPA recommendations during PE lessons, ranging from 5% in Canada (Nettlefold et al., 2011) to 50% in Hong Kong (Chow et al., 2008). Nettlefold et al. (2011) reported that the low percentage of children meeting these recommendations (5%) may be due to the curriculum approach employed (active living, movement skills and safety, fair play and leadership) and the short duration of lessons (less than 40 minutes). On the other hand, Chow et al. explain the high numbers of children in their study meeting recommended MVPA levels in terms of the fact that the teachers were PE specialists and children being punished for sitting inactively (Chow et al., 2008). Further research is clearly needed to understand the most effective way of delivering PE in order to achieve international MVPA recommendations.

Both in UDA and in the traditional PE lessons, the total time devoted to PA was similar for both sexes, but boys spent more time in moderate PA and MVPA. These results are consistent with those from other studies of children in third grade where the total time of PA was similar for boys and girls, but boys spent more time in MVPA than girls (Nader, 2003; Robinson et al., 2014). As Solmon, 2014 has explained, the most important reason behind these gender differences may lie in the nature of the curriculum, whereby the inclusion of boys and girls in the same classes results in the maintenance of a boys' focused sports-oriented curriculum with less attention paid to what girls value and are interested in (Solmon, 2014). Importantly, another study found that the PA levels during PE lessons were similar in both sexes, which could be related to the curricular focus on non-PA factors (e.g. safety, fair play and leadership) (Nettlefold et al., 2011). It is crucial therefore to develop future PE practices and curricula which include and encourage girls and boys to a similar degree.

### ***Strengths and limitations***

The strengths of this study include the relatively large sample size and the high number of schools participating, as well as the use of a valid instrument to assess PA levels (Troiano et al., 2008). The study had some limitations, however, that deserve mentioning. There was no control over traditional lesson content (some content was more closely connected to MVPA involvement (e.g. activities aimed at improving aerobic capacity) than others (e.g. postural attitude). There was also no random recruitment of schools and students, setting limits on the validity of findings. Furthermore, the students wore the accelerometer during only one specific PE lesson, and teacher and students might have been influenced by this fact.

### **Conclusion**

In this study, children engaged in UDA lessons reported on average only one and a half minutes more MVPA than those in traditional lessons. Furthermore, the time children spent on MVPA in PE lessons was insufficient according to current international recommendation, regardless of the methodology used (traditional or UDA). Given this, the UDAs used in this study should be reviewed in terms of the activities outlined and accompanied by teacher education and training to ensure appropriate delivery. In so doing, it is important to provide school-based activities designed specifically to facilitate PA among both boys and girls. Although institutional efforts to date have

focused on creating a new curriculum and activities to increase MVPA, the low percentage of children who achieved international recommendations offers a call to action for administration, schools and teachers to work towards the further improvement of PE. To increase MVPA in children, it is necessary to rethink the school environment and the materials provided to teachers as well as the methodology, frequency and duration of lessons in order to achieve important PE goals.

### Authors' note

Víctor Segura-Jiménez is also affiliated with Biomedical Research and Innovation Institute of Cádiz (INIBICA) Research Unit, Puerta del Mar University Hospital University of Cádiz, Cádiz, Spain.

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