



DURATION, INTENSITY, AND CONTENT OF PHYSICAL EDUCATION CLASSES IN A REPRESENTATIVE SAMPLE OF CHILDREN ATTENDING 5TH AND 6TH GRADES OF PRIMARY EDUCATION

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Abstract:

Physical Education (PE) is an educational process that develops the knowledge, skills, attitudes, and well-being of children, through games, sports, exercises, etc. The study aimed to evaluate the parameters of physical activity (PA) during PE class and to investigate the content, time, and intensity of children who participated in PE class, by gender and obesity status. PA and PE items were assessed by a self-administrated PA checklist, proper for children. A representative sample of Greek boys and girls aged 10 to 12 years (N=3195) participated in the study. Boys incorporated higher levels of moderate to vigorous PA (MVPA) (62 ± 45 min/d) than girls (27 ± 33 min/d, $p < 0.05$). Students, who participated in PE classes, presented increased total PA (139 ± 2 vs. 116 ± 51 min/d, $p < 0.05$) and MVPA (62 ± 38 vs. 40 ± 32 min/d, $p < 0.05$), and a higher percentage of them met (77 vs. 66%, $p < 0.05$) the recommended PA levels than those who didn't participate. Among participants in PE classes, boys reported higher time of MVPA than girls (19.4 ± 23.9 vs. 10.3 ± 17.7 min/d, $p < 0.05$), while girls had more time in light PA as compared to boys (15.1 ± 18.1 vs. 20.5 ± 21.3 min/d, $p < 0.05$). There were no significant differences between normal-weight and overweight/obese participants in PE classes neither in PA sub-components (total PA, LPA, and MVPA) nor in sports/games did they participate. PE classes play a significant role in students' levels of PA, especially for overweight/obese children.

Keywords: physical activity; physical education; overweight; participation

1. Introduction and Literature Review

According to the World Health Organization (WHO) and the American Academy of Sports Medicine and Exercise Science (ACSM), regular moderate-to-vigorous physical

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activity (MVPA) in children and adolescents promotes fitness, lifelong health, and quality of life (WHO 2020; ACSM 2019). Children and adolescents who regularly participate in moderate and/or high-intensity PA, compared to those who do not regularly have: (a) higher levels of cardiorespiratory fitness and muscular endurance, strength, and flexibility; (b) greater bone mass and greater bone strength and endurance; (c) better control of their body mass and lower rates of obesity; (d) reduced probabilities of developing diseases (e.g., cardiovascular disease, type II diabetes, blood pressure, cholesterol levels, some forms of cancer); (e) increased cognitive functions and academic performance; (g) higher levels of social skills, relationships, and behaviors; (i) reduced levels of depression and anxiety and consequently better mental health and increased confidence, self-esteem and developed life skills (WHO 2020; ACSM 2019). In addition, PA time was inversely associated with BMI levels in both boys and girls (Tambalis et al. 2013).

An unhealthy lifestyle in childhood easily leads to a similar lifestyle in adulthood, while a physically active child is more likely to continue to be active in adulthood, gaining significant health benefits (Fogelholm 2008). Children need daily at least 60 minutes of MVPA or at least seven hours per week (ACSM 2019). Also, amounts of PA greater than 60 minutes provide additional health benefits (ACSM 2019). The majority of daily PA is recommended to be aerobic exercise (ACSM 2019). Students also need to be informed that when they become adults, they need to do at least 150-300 minutes of MVPA or at least 75-150 minutes of high-intensity PA and at least twice a week large muscle group strength exercises weekly (WHO 2023).

PA in the school environment is highly recommended due to its positive effect and effectiveness, through the implementation of appropriate programs, in increasing the PA and physical fitness (PF) of children and, by extension, in promoting a healthy and active lifestyle (Morton et al. 2016). Important research data provide strong support for the positive role of physical education (PE) as an educational process for the development of knowledge, skills, and attitudes and in general the psychophysical health and well-being of children, mainly through PE and sports (Beets et al. 2011). PE is an integral part of the school program characterized by a planned, sequential curriculum and is recommended internationally as essential as it provides cognitive content and instruction designed to develop knowledge, motor skills, and behaviors to increase PA and organized exercise (US Department of Health and Human Services, US Department of Education 2020). Regular participation in PA is an international learning focus for PE, a focus intended to make possible the establishment of habitual engagement in PA (National Association for Sport and Physical Education (NASPE) and American Heart Association (AHA) 2012). These goals can be achieved by well-designed PE programs at school, because they address the majority of children with different levels of PE, affect and influence their development over a long time, and, in addition, can positively affect their families.

It is critical to maximize the time students move and exercise during the PE lesson as this contributes to increasing their PE levels (NASPE and AHA 2012). Research among children designed to quantify the potential benefits of PE during the school day

concluded that the benefits included reduced body fat, higher levels of PF, and lower risk for cardiovascular disease (Dwyer et al. 1979; Dwyer et al. 1983). Moreover, a study investigating the potential effects of daily PE in primary school on PA during adulthood showed that PE was significantly associated with PA in later life for females but not males (Trudeau et al. 1999). Similarly, longitudinal studies incorporated that PE experiences might be connected to adult engagement in PA (Glenmark 1994; Telama et al. 1997). According to the Association for PE, children should spend at least 50% of total PE class time in MVPA (Association for Physical Education 2015). Previous studies revealed that only one-third of the time spent in PE classes was dedicated to MVPA (Fairclough and Stratton 2005; Viciano et al. 2017). Historically, it is considered that PE class participation may contribute to students being more physically active and less likely to engage in sedentary behavior (Silva et al. 2022). Based on UNESCO's position statement for Quality Physical Education (QPE), all children (including overweight/obese, girls, etc.) should have the same opportunities for adequate time, MVPA, and appropriate activities to participate in PA during PE class (UNESCO 2015).

In Greek public schools, PE classes for the fifth and sixth grades are generally performed twice per week for 80 to 90 and/or 40 to 45 minutes duration, while, its curriculum, mainly is sport-based PE. To the best of our knowledge, no study has assessed PA levels within PE classes in primary education in Greece. Furthermore, it is crucial to know whether all children can achieve the Association for Physical Education recommended PA intensity and time levels during PE classes.

Thus, the present study aimed (a) to evaluate the parameters of PA during PE class and (b) to investigate the content, time, and PA intensity children participated in PE class by gender, age, and obesity status, in a representative sample of Greek students attending the fifth and sixth grades of primary school.

2. Material and Methods

2.1 Participants and Procedures

Population data derived from a national, school-based, follow-up health survey. A total of 3,195 children (1,602 from the 5th and 1,593 from the 6th grades) participated in the study. Five hundred and eighty-four children (18.2%) were recruited from rural areas and 2,611 children (81.8%) were recruited from urban areas (boys' 50.2% and 49.8% girls). Anthropometric, PA, and sedentary behavior data, and information about age, gender, and area, were collected from children in 70 elementary public and private schools randomly selected from the whole country. All the children from the selected school attending fifth and sixth grades were invited to participate, while, the participation rate was considered very high (almost 85%). To avoid potential seasonal effects on PA, the assessments were performed between September 10 and June 15 (compulsory operation period for all schools of primary education in Greece). The schools were from 28 prefectures of Greece, representing over 85% of the population. The sampling procedure ensured the proportional enrolment of children based on the urban/rural areas' student

population distribution (i.e., flat, mountainous, and island locations) as well as concerning the attendance or not of the PE course. The distribution between rural and urban areas and public and private schools was based on the Hellenic National Statistics Service criteria (consensus 2011). Areas with less than 5,000 inhabitants and a mean population density of 27 inhabitants per square kilometer were considered rural (Services HS 2011). To avoid the possible effect of seasonality on the PA and the teaching subjects of the PE, the study was conducted proportionally equally between September 10 and June 15 (the period during which students are required to attend primary schools). Also, aiming to investigate the average weekly PA of the participants, the study was implemented on Monday (recording the PA of Sunday) and from Tuesday-Friday (recording the PA of Monday to Thursday). The days of the survey were distributed in such a way that on Monday 2/7 of the measurements were performed (holidays) and the other 4 days (Tuesday-Thursday) the remaining 5/7 (school days), respectively. With this separation, an attempt was made to ensure the greater representativeness of the average daily valuation of the weekly PA and PE lessons. The sample number was determined with a sampling rate and statistical power of 85% ($\alpha=5\%$).

2.2 Self-Administered Physical Activity Checklist

The Self-Administered Physical Activity Checklist (SAPAC) used is a translated and slightly modified version of the original questionnaire, which includes the most common activities in the Greek data, suitable for epidemiological studies assessing PA in children (Sallis et al. 1996). In particular, baseball/softball and American football were removed from the standard questionnaire because they are not at all common among Greek students, and handball was added, which is included in the PE curriculum and martial arts (karate, judo, tae-kwon-do, kick-boxing, etc.) as a fairly widespread form of exercise among the children of our country. The SAPAC is a one-day recall questionnaire; it records information from the previous day, closed type, simple, clearly worded, and applied to the whole class at the same time. It includes a list of 21 activities, while there is the possibility of recording additional activities that are not mentioned in it. The children record the time (in minutes) for each of the activities listed in the previous day if it lasted at least 5 minutes. The day is divided into three parts: before, during, and after school. In addition, for each reported PA, the children record a personal assessment of its intensity, i.e. they state whether it caused them to pant or get tired: not at all, more or less. Therefore, the questionnaire assesses both organized exercise (school sports, extracurricular sports) and leisure time (walking, free play, etc.) and records their main factors (type, intensity, duration, total volume). Apart from these, other activities and habits of the children are reflected, such as watching TV, playing TV or computer games, and learning foreign languages so that it is possible to assess the overall picture and the leisure activities of the children. In addition, it is foreseen during the planning of the research to record if some children participated in the PE course the day before. The students were informed to record, in the during-school section, the physical activities they participated in the previous day in the PE lesson. The students completed the

questionnaire in the classroom under the guidance and supervision of trained PE teachers. Before completing the questionnaire, a short presentation preceded it, for students to better understand the requirements and possibly improve the accuracy of the reported data. The children were asked to read the completed questionnaire twice, while the researcher when needed provided the necessary assistance during its completion. A survey of a Greek student population aged 10-12 years showed that the questionnaire has good reliability ($r > 0.85$, $p < 0.001$) and validity ($r = 0.31$ to 0.37 , $p < 0.001$) (Giouxari et al. 2013).

2.3 Anthropometric Measurements

Body height was measured by the weight distributed on both legs, the back resting on the wall, and the head in a straight line with a portable height meter (Leicester Height Measurement, TANITA). Body mass was measured without shoes and with light clothing with electronic scales (Body Fat Monitor Scale, TANITA BF-522W), in kilograms to the nearest 0.1 kg (e.g. 38.3 kg). It has been imprinted in meters with two decimal places at the nearest 0.5 cm. In particular, for the electronic scale, quality control was performed quarterly regarding the accuracy of its measurements. The Body Mass Index (BMI) was calculated based on the equation: weight (kg) by height (m) squared (kg/m^2). BMI cut-off points were used by age and gender category (according to IOTF) for underweight, normal weight, overweight, and obese, as the most proper for epidemiologic studies (Cole et al. 2007).

Table 1: Descriptive characteristics and main physical activity variables of the participants

	5 th grade		6 th grade	
	Boys (n=826)	Girls (n=776)	Boys (n=809)	Girls (n=784)
Age (y)	10.5±0.5	10.5±0.5	11.5±0.5	11.5±0.5
Weight (kg)	43.9±9.8	43.8±10.2	50.0±11.6	50.6±10.3
Height (cm)	148.4±6.5	149.0±7.6	153.5±7.8	153.6±7.9
BMI (kg/m^2)	19.8±3.7	19.7±3.5	21.2±3.7	21.4±3.6
Overweight (%)	28.0	27.7	26.9	27.3
Obese (%)	10.8	9.7	11.8	11.2
Waist circumference (cm)	71.5±11.2	69.9±11.1	72.2±13.2	71.2±12.4
Total PA (min/d)	126±55*	116±56	128±61	117±57
Light PA (min/d)	65±42	89±52*	64±46	90±54*
Moderate to vigorous PA (min/d)	61±43*	27±31	64±46*	27±33
Total PA MET's score (MET)	672±328*	547±284	707±381*	553±313
Sedentary behaviours ¹ (min/d)	142±88	130±84	152±89	139±87
Active transportation to school ² (%)	44	46	47	48
Meeting recommended PA level ³ (%)	73.3*	57.5	72.2*	55.7

Values are mean ± SD or frequencies (%); BMI, body mass index; PA, physical activity; MET, metabolic equivalent;
¹Sedentary behaviours including screen viewing and playing electronic games on screen;
²Active transportation to school including walking and biking;
³Recommended activity level ≥ 60 min of moderate to vigorous PA daily. * $P < 0.05$ for differences between genders from the same grade (fifth or sixth).

2.4 Data Processing and Statistical Analysis

Initially, all components of SAPAC were encoded in Metabolic Equivalent (MET) values using the original categorization (Ainsworth et al. 2000). PA components were rated as low (LPA) if their value was <2.9 MET, and moderate to vigorous intensity (MVPA) if their value was ≥ 2.9 MET. The minutes of each recorded PA were multiplied by the corresponding MET value to calculate their MET score. Participants were classified as "active commuters" if they walked or biked to and from school and "passive commuters" if they were driven to and from school.

Additionally, participants were stratified depending on meeting the recommended activity level or not. Specifically, children who participated in MVPA for at least 60 minutes per day were considered to meet the recommendations for PA level (Bull et al. 2020). Descriptive characteristics are presented as mean \pm standard deviation (mean \pm SD) or as percentages (%). Differences in PA sub-components between genders were assessed using an independent samples t-test. Comparisons of the categorical variables (i.e., gender, and BMI categories) were performed using Pearson's chi-square test. The normality of residuals, homoscedasticity, and serial dependency were graphically assessed through Q-Q plots. All analyses were performed using the SPSS version 18.0 software for Windows (SPSS Inc., Chicago, Ill, USA). The statistical significance level from two-sided hypotheses was accepted at the 5% level ($p \leq 0.05$).

A section intended to contain a detailed description of all the methods, materials, collaborators, and participants in the study. The protocols used for data acquisition, techniques and procedures, investigated parameters, methods of measurements and apparatus should be described in sufficient detail to allow other scientists to understand, analyze, and compare the results. The study subjects and participants should be described in terms of number, age, and sex. The statistical methods should be described in detail to enable verification of the reported results. This section could contain a separate sub-section that comprises the explanation of the abbreviated terms used in the study.

3. Results and Discussion

3.1 Results

Table 1 presents mean values for descriptive participants' characteristics by gender and age. Boys in fifth and sixth grade incorporated higher levels of total PA, MVPA, and total MET score than girls, respectively, (all p -values < 0.05), while a greater proportion of them met PA guideline recommendations, as compared to girls from the same grade (Table 1). On the contrary, girls reported longer time on LPA (p -value < 0.001) than boys from the same grade. The higher LPA of girls was more free games (e.g. chase, tag, hopscotch), outdoor play (e.g. climbing trees, hide and seek), and outdoor and indoor chores (data not shown).

When we compared the children by PE classes (yes or not) (Table 2), we found that children from 5th and 6th grade who participated in PE class had significantly higher total

PA and MVPA as compared to children who did not participate (all p-values<0.05), in both genders, while statistically significant more boys and girls from 5th and 6th grade participated in PE classes, met the current recommendations for PA than those did not participate, respectively.

Table 2: Self-reported physical activity variables by Physical Education class participation status

	5 th grade			
	Yes		No	
	Boys (n=192)	Girls (n=194)	Boys (n=607)	Girls (n=562)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total PA (min/d)	142 (53)*	140 (58)	121 (55)*	107 (53)
Light PA (min/d)	63 (42)	94 (53)	66 (43)	87 (51)
Moderate to vigorous PA (min/d)	79 (46)*	46 (40)*	55 (41)	20 (23)
Total MET score (MET)	777 (332)*	696 (314)*	644 (318)	501 (252)
Sedentary behaviours (min/d)	126 (82)	132 (84)	148 (90)*	131 (84)
Active transportation to school (%)	48.2	49.9	51.1	50.3
Meeting recommended PAŞ level (%)	84.2*	69.5*	67.9	54.9
	6 th grade			
	Yes		No	
	Boys (n=162)	Girls (n=135)	Boys (n=622)	Girls (n=612)
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total PA (min/d)	146 (59)*	131 (51)*	123 (60)	114 (57)
Light PA (min/d)	60 (47)	94 (51)	64 (46)	89 (54)
Moderate to vigorous PA (min/d)	86 (43)*	37 (39)*	59 (45)	25 (30)
Total MET score (MET)	859 (353)*	625 (288)*	659 (354)	543 (306)
Sedentary behaviours (min/d)	154 (85)	149 (87)	152 (90)	146 (85)
Active transportation to school (%)	52.3	50.9	49.7	49.1
Meeting recommended PAŞ level (%)	87.1*	68.1*	68.1	52.8
Values are mean (SD) or frequencies (%); PA, physical activity; *P<0.05 for differences between Physical Education class participation status from the same gender.				

Table 3 presents the duration of self-reported physical activity (LPA, MVPA, and total PA) during PE classes by gender and age. It seems that boys from 5th and 6th grade incorporated higher time of MVPA than girls, while girls reported more time in LPA as compared to boys, respectively.

Additionally, comparisons between non-overweight and overweight/obese boys and girls from the same age (5th and 6th grade) did not reveal statistically significant differences in the time participated in either LPA or MVPA (Table 4).

Table 3: Self-reported physical activity during Physical Education classes by gender and age

	5 th grade	
	Boys	Girls
	Mean (SD)	Mean (SD)
Light PA (min/d)	16.8 (20.6)	22.3 (21.5)*
Moderate to vigorous PA (min/d)	18.3 (23.5)*	12.3 (19.8)
Total PA (min/d)	35.1 (29.1)	34.6 (26.7)
	6 th grade	
	Boys	Girls
	Mean (SD)	Mean (SD)
Light PA (min/d)	13.2 (16.9)	18.5 (21.2)*
Moderate to vigorous PA (min/d)	20.5 (24.4)*	8.2 (15.3)
Total PA (min/d)	33.7 (28.1)	26.7 (24.7)
Values are mean (SD); PA, physical activity; *P<0.05 for differences between genders		

Among teaching physical activities during PE classes, it seems that more boys participated in basketball and football as compared to girls (all p-values<0.05), while higher percentages of girls participated in volleyball, dancing, and jump-rope in comparison to boys (all p-values<0.05) (Table 5). Further stratified analysis, by obesity group, did not reveal significant differences among non-overweight and overweight/obese children in the content of the PE courses (e.g., basketball, chores, etc.), in both genders and age groups (data not shown).

Table 4: Self-reported physical activity during Physical Education classes by gender, age, and obesity status

	5 th grade			
	Boys		Girls	
	Normal weight (n=192)	Overweight/ obese	Normal weight (n=192)	Overweight/ obese
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total PA (min/d)	37.6 (30.1)	33.4 (29.1)	36.5 (28.5)	33.6 (25.7)
Light PA (min/d)	18.6 (21.7)	15.6 (19.9)	23.5 (22.7)	21.9 (20.7)
Moderate to vigorous PA (min/d)	19.0 (24.4)	17.8 (23.4)	12.9 (20.8)	11.7 (19.4)
	6 th grade			
	Boys		Girls	
	Normal weight (n=192)	Overweight/ obese	Normal weight (n=192)	Overweight/ obese
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total PA (min/d)	34.9 (27.6)	31.6 (28.7)	27.1 (25.1)	24.6 (23.9)
Light PA (min/d)	13.9 (18.1)	11.7 (14.9)	17.8 (20.5)	17.7 (20.8)
Moderate to vigorous PA (min/d)	21.0 (24.4)	19.9 (24.9)	8.8 (14.9)	7.6 (15.4)
Values are mean (SD); PA, physical activity.				

4. Discussion

Table 5: Participation rates and time of Physical Education content by gender and age

	5 th grade			
	Boys		Girls	
	Participation (%)	Min/d (Mean ± SD)	Participation (%)	Min/d (Mean ± SD)
Exercises (e.g. jumping jacks)	7.9	6.0 (1.9)	6.8	6.3 (2.1)
Basketball	12.5	32.8 (6.6)	7.6*	31.9 (6.0)
Soccer	32.2	33.9 (12.3)	5.7*	29.9 (10.6)
Handball	3.8	27.8 (12.5)	4.5	27.4 (11.7)
Running/track and field sports	14.4	12.0 (11.9)	18.6	12.8 (11.4)
Jump-rope	0.6	10.8 (4.5)	3.5*	12.4 (5.2)
Mixed running and walking	10.3	14.8 (8.0)	13.5	14.2 (8.6)
Ball-games	13.4	27.1 (12.2)	17.2	26.9 (16.7)
Volleyball	2.6	33.4 (8.7)	12.8*	32.7 (9.6)
Gymnastics	0.3	9.7 (3.7)	0.9	12.0 (4.4)
Dance	1.1	16.9 (10.0)	4.6*	17.8 (11.7)
Walking	9.6	13.5 (6.5)	13.2	14.3 (7.1)
Racket sports	0.3	2.6 (3.6)	0.7	3.6 (4.0)
Games (e.g. chase, tag)	31.8	24.9 (11.2)	34.3	23.8 (10.4)
Other physical activity	0.9	9.8 (3.0)	1.3	13.4 (4.0)
	6 th grade			
	Boys		Girls	
	Participation (%)	Min/d (Mean ± SD)	Participation (%)	Min/d (Mean ± SD)
Exercises (e.g. jumping jacks)	7.8	6.1 (1.9)	6.5	6.4 (2.2)
Basketball	12.4	32.3 (6.9)	7.7*	31.4 (5.9)
Soccer	32.5	34.0 (12.9)	5.7*	29.9 (10.6)
Handball	3.6	27.3 (13.5)	4.5	27.1 (11.4)
Running/track and field sports	14.3	11.8 (12.0)	18.5	12.6 (11.8)
Jump-rope	0.5	10.6 (4.7)	3.4*	12.2 (5.3)
Mixed running and walking	10.2	14.6 (8.2)	13.2	14.1 (8.5)
Ball-games	13.2	27.0 (12.0)	16.8	27.3 (16.4)
Volleyball	2.5	33.3 (8.9)	12.9*	32.9 (9.2)
Gymnastics	0.3	9.4 (3.3)	1.0	12.1 (4.1)
Dance	1.0	16.6 (10.9)	4.5*	17.7 (11.4)
Walking	9.5	13.5 (6.6)	12.9	14.1 (7.3)
Racket sports	0.3	2.5 (3.4)	0.8	3.7 (4.1)
Games (e.g. chase, tag)	31.5	24.7 (12.1)	34.0	23.5 (9.9)
Other physical activity	0.8	10.0 (2.8)	1.2	13.0 (3.2)

*P<0.05 for differences between genders.

PA levels during PE class have drowned attention as key factors that affect children's health (Errisuriz et al. 2018). The current study aimed to incorporate the time and the intensity of PA during PE classes and to explore components of PE such as children's participation rates and curriculum, by gender and obesity status. Population data were

derived by two-year research in a representative sample of 3,195 children. The PA questionnaire used in this study was considered proper for children and highly reliable as compared to other related PA questionnaires (Sirard and Pate 2001). Public and private schools in primary education in Greece organized PE classes with consideration to both times in class and curriculum. PE classes are normally performed twice per week for 80 to 90 and/or 40 to 45 minutes duration, while, some private schools have autonomy for more classes. PE curriculum in the fifth and sixth grades of Greek primary education was supported mainly on a sport-based model. Specifically, course classification usually consists of either monothematic classes in which one sport is used during all the classes (e.g., a class about chess) or polythematic classes in which boys and girls participate in different sports and exercises (e.g., football and volleyball).

The results of this study revealed that boys as compared to girls, from the same grade, had higher levels of total PA and MVPA, while a greater proportion of them met the recommended levels of PA (≥ 60 min MVPA per day). In line with our results, several studies have presented that boys had increased levels of total PA and MVPA than girls (Kriemler et al. 2008; Purslow et al. 2008; Jones et al. 2009). Similar research in Greece among primary school children showed that more boys participated in MVPA than girls (Magkos et al. 2006; Manios et al. 1999). In addition, a review study among schoolchildren (41 countries including Greece) incorporated less PA and a decreased proportion of girls met the recommended PA levels as compared to boys (Haug et al. 2009).

Furthermore, the previous review proposed that the higher LPA time for girls than boys is attributed to the higher time in outdoor and free games, and in indoor and outdoor work (Haug et al. 2009). It is clearly defined that the school has a significant probability of helping children to increase their total PA and to meet the recommended PA (UNESCO 2015). Also, school programs have been proposed to act as a crucial investment to raise PA at the population level (GAPA 2012). PE classes contribute to an increase in daily total PA and MVPA among children and adolescents (Mooses et al. 2017; Silva et al. 2022). Moreover, recent studies propose that children are more physically active on PE days as compared to non-PE days supporting the long-held notion that PE classes provide favourable opportunities for children to augment their PA levels ([Mayorga-Vega et al. 2018](#); [Viciano et al. 2017](#)). Following previous conclusions, our findings suggest that children who participated in PE classes presented increased total PA and MVPA than children who did not, in both genders, while a greater proportion of the participants met the recommendations for PA compared to not participants. Specifically, almost 86% of boys and 68% of girls covered the recommendations for PA if the PE lesson was included in the school curriculum, and as a consequence, PE is undoubtedly proposed.

During PE lessons, boys and girls in this study reported 34 min and 30 min of total PA, respectively, which means that they were physically active at almost 80% (for boys) and 72% (for girls) of the time lasts the PE lesson. Further analysis of findings presented in Table 3 showed that MVPA during PE classes accounted for almost 56% and 34% of total PA for boys and girls, respectively, while it seems that girls reported more time in

LPA (66% of total PA) as compared to boys (44% of total PA). It is estimated that in-school PA contributes to almost 40% of children's MVPA, while, a significant part of this is due to the contribution of the PE course (Fairclough and Stratton 2005; Gidlow et al. 2008; Meyer et al. 2013). Several studies conclude that PE classes enhance time spent in MVPA (Mayorga-Vega et al. 2018; Viciano et al. 2017), and in addition, children on days with PE, had 12.8 min more MVPA than non-PE days (Mooses et al. 2017). Association for PE and International Organizations statements state that children should spend at least 50% of total PE class time in MVPA (Association for Physical Education 2015; Pate et al. 2006). Observational studies proposed that only a percentage of 33% of the time spent in PE classes was derived from MVPA (Fairclough and Stratton 2005; Viciano et al. 2017), while systematic reviews studies conclude that children during PE classes spend a smaller amount of 45% of total PE in MVPA (Fairclough and Stratton 2005; Hollis et al. 2016). Taking into consideration previous findings we could conclude that our findings for Greek students aged 10 to 12 years old are in line with it. Analytically, it seems that boys meet the Association of PE recommendation (MVPA for 50% of PE lesson time), but girls spend less than proposed (34%), nearly to the previous results. Because children spend a significant part of the day at school, the states must make sure that they participate at least 30 min per day in MVPA during the school day, preferably in PE classes.

QPE proposes that all children (including overweight/obese, girls, etc.) should have the same opportunities for PA, MVPA, and appropriate physical activities to participate in during PE classes (UNESCO 2015). Our research revealed an interesting and promising finding. Specifically, it was found that the time spent by overweight/obese children in total PA and MVPA did not differ statistically significantly from non-overweight, of the same gender. Following our results, a recent study conducted among 138 children 7 to 11 –years old in the USA, using the accelerometer to assess PA, presented no significant differences between normal-weight and overweight/obese participants for LPA, MVPA, and total PA during PE class (Pope et al. 2020). Also, a study that evaluated PA levels between overweight and normal-weight American students (n=198) during game play in PE classes found no significant difference in PA between them regardless of the game (Hannon, 2008).

On the opposite, a study by Gao et al. (2011) observed that normal-weight children participate in significantly more MVPA than overweight/obese during PE classes (Gao et al. 2011). The aforementioned observations of the present study could be partially attributed to the game/sport orientation of the PE classes wherein PE teachers increase PA time engaging all students (games/sports required practically continuous PA). Nevertheless, healthcare specialists and PE teachers should make further efforts to promote more total PA for overweight/obese students although, in this particular study, these children were not recorded to lag in total and MVPA. Additionally, there were no significant differences in the participation time in the sports/games of the PE courses between non-overweight and overweight/obese students (data not shown). This finding undoubtedly states that there are no restrictions or exclusions in the PE classes among

students of different BMI categories, but a successful attempt for equal participation opportunities.

Moreover, the present results revealed no significant differences in the participation time of games/exercises/sports activities during PE classes between the two sexes, with the exception that girls participate more time in jump rope, a finding that probably means that when children participate in PE classes follow the same program. Also, the current results revealed that overweight/obese children participated in the same sports/games/exercises as non-overweight ones of the same gender. The higher participation rates of girls in volleyball and boys in football and basketball could be attributed to their free choices which are partially acceptable during the PE course in fifth and sixth grade in Greek schools.

A comparative or descriptive analysis of the study based on results, on previous studies, etc. The results should be presented in a logical sequence, giving the most important findings first and addressing the stated objectives. The number of tables and figures should be limited to those absolutely needed to confirm or contest the premise of the study. The authors should deal only with new or important aspects of the results obtained. Material from the Results section should not be repeated, nor new material be introduced. The relevance of the findings in the context of existing literature or contemporary practice should be addressed. The current results should be evaluated and interpreted with awareness about probable confounding factors (e.g., energy intake, etc.), which have not been incorporated. Furthermore, the self-reported PA questionnaire for children we have used, although it is widespread, mainly for its easy use and low cost, it is not accurate to create estimates of the type and duration of PA (Warren et al. 2010). Moreover, sexual maturity has not been assessed and consequently, it was not probable to exclude its potential effect on gender differences. It is considered that differences in the level of sexual maturity between genders could affect the levels of PA (Drenowatz et al., 2010). In addition, the current research as an observational study cannot produce causal correlations but only hypotheses for additional investigation.

5. Recommendations

Informing school and health experts and officials concerning the levels of PA of children could facilitate the improvement of public health policies, and the creation of in-school or/and out-of-school procedures to protect the health of children. Particularly, these actions concern: (a) the increase of the PE course hours in all classes and types of schools; (b) the modification of the curriculum of PE to emphasize the rise of time spent in MVPA, and (c) the construction of proper conditions (security, suitable spaces, equipment, etc.), so that students be more physically active during school.

6. Conclusion

To sum up, the present study demonstrates that gender has a significant effect on PA levels among Greek children aged 10 to 12 years. Students, who participated in PE classes, presented increased total PA and MVPA and a higher percentage of them met the international recommendations for PA as compared to those who didn't participate. Among those who participated in PE classes, boys incorporated higher time of MVPA than girls, while girls reported more time in LPA as compared to boys. Probably, the most significant finding was that there were no significant differences between non-overweight and overweight/obese boys and girls of the same age at the time who participated in either LPA or MVPA. During PE classes, more boys participated in basketball and football as compared to girls (all p-values<0.05), while higher percentages of girls participated in volleyball, dancing, and jump rope in comparison to boys. Stratified analysis, by the obesity group, did not reveal significant differences among non-overweight and overweight/obese children in the content (sports/games/exercises) of the PE courses, in both genders. PE classes play a significant role in the levels of PA of all students, independently of the BMI category, which could be further improved with interventions such as increasing the times per week of PE classes.

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Conflict of Interest Statement

The authors declare no conflicts of interest.

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