

# Effect of an Educational Program on Schoolchildren's Energy Expenditure during Physical Education Classes

Cristianne Troleis da Cunha<sup>I</sup>, Ana Paula Poblacion<sup>I</sup>, Fernando Antonio Basile Colugnati<sup>II</sup>, José Augusto de Aguiar Carrazedo Taddei<sup>I</sup>, Mario Maia Bracco<sup>III</sup>

<sup>I</sup> Universidade Federal de São Paulo, Departamento de Pediatria, Disciplina de Nutrologia, São Paulo, SP, Brazil.

<sup>II</sup> Universidade Federal de Juiz de Fora, Divisão de Nefrologia, Núcleo Interdisciplinar de Estudos e Pesquisas em Nefrologia (NIEPEN), Juiz de Fora, Minas Gerais, MG, Brazil.

<sup>III</sup> Hospital Israelita Albert Einstein, Hospital Municipal Dr. Moyses Deutsh, M'Boi Mirim. São Paulo, SP, Brazil.

**OBJECTIVE:** Physical activity is a means of prevention of noncommunicable diseases. The level of physical activity of children is decreasing in Brazil, and this can increase the risks of diseases associated with sedentary lifestyles and obesity.

**METHOD:** This is a school-based randomized controlled trial which evaluated the impact of an educational intervention on children's physical activity level, energy expenditure, and teacher's behavior during physical education classes at public schools in São Paulo. The studied population comprised children attending the 1<sup>st</sup> and the 2<sup>nd</sup> grades of eight schools (three exposed and five unexposed to teacher training on a course in nutrition and physical activity). Outcomes were measured by direct observation, recorded by a VHS camera during physical education classes; data from 78 physical education classes were analyzed by the System for Observing Fitness Instruction Time - SOFIT.

**RESULTS:** After intervention, results showed highly significant increases in children's physical activity level (walking,  $p < 0.001$ ; vigorous activities ( $p < 0.001$ ), and a decrease in the standing category ( $p < 0.001$ ). It also showed a non-significant increase in mean energy expenditure of children (70.6% = 27.6Kcal), but the interaction's effect of group and time (intervention) was highly significant (32.4Kcal; 95%CI 24.7 - 40.1,  $p < 0.001$ ) indicating the intervention effectiveness in increasing the energy expenditure of children during Physical Education classes. It also showed an increase in length of physical education classes (26.2 to 32.1 minutes ( $p = 0.01$ )).

**CONCLUSION:** There was a change in teachers' behavior with a positive impact on children's physical activity level and energy expenditure after the educational intervention.

**KEYWORDS:** Energy Expenditure; Physical Education; Child; Randomized Controlled Trial.

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E-mail: kit@medplast.med.br

## INTRODUCTION

Physical activity in all age groups has been increasingly valued as a protective factor against noncommunicable diseases, such as cardiovascular diseases, cancer and diabetes.<sup>1,2</sup> It can also be used as a tool for health promotion, disease prevention or therapeutic approach to non-transmissible chronic diseases.<sup>3</sup> An active lifestyle does not require a program

with vigorous exercises. Even small changes can reduce disease risks and contribute to a better quality of life.<sup>4</sup> Physically active individuals perform better at school or work, pursue healthier nutritional habits,<sup>5</sup> have lower rates of detrimental habits to health, such as smoking, alcohol and other drug use, and are less subjected to stress.<sup>6-8</sup>

Childhood physical inactivity has been considered as a public health issue given its association with childhood obesity; its prevalence is on the rise, worldwide, mainly so in the developing countries.<sup>9-11</sup> Physical activity habits acquired in childhood and adolescence seem to influence

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physical activities in adulthood, thus having a long-term positive effect.<sup>12</sup> Given that, schools represent a favorable environment to promote physical activity, contributing to the health of children and reducing risk factors for chronic diseases.<sup>13-15</sup> Nevertheless, school physical education is not generally perceived and valued as an effective strategy to promote physical activity in spite of a strong body of evidence that supports recommendations directed toward this purpose.<sup>16</sup>

Physical activity intervention programs should be based on behavior change models.<sup>17</sup> In this sense, intervention programs in schools should encourage children and adolescents to develop patterns of living a more active life, imprinting healthy habits during childhood that could be perpetuated into adulthood, preventing noncommunicable diseases.<sup>18</sup>

The aim of this study was to evaluate the impact of a classroom teachers' educational intervention on 1<sup>st</sup> and 2<sup>nd</sup> grades upon the physical activity level and energy expenditure of children during physical education classes in elementary public schools, in São Paulo, Brazil.

## ■ MATERIALS AND METHODS

**Ethics Statement.** Data was collected from March to July 2000, in strict observance of the Declaration of Helsinki; all procedures involving human participants the parents' written consent form on behalf of enrolled minors was approved by the Ethics Committee of the Federal University of São Paulo/São Paulo Hospital (Case #330/00). In addition, this trial has been registered at ClinicalTrials under the protocol number NCT 02024763 and the authors confirm that all ongoing and related trials for this intervention are registered. This study was completed in 2002 and was released to the public through a Master's Degree Dissertation, available at the Institutional Library of the Federal University of São Paulo. At that time, registration at ClinicalTrials was not compulsory. Since then, it was used as reference to build up a project for the Centers for Disease and Prevention Control (CDC) named Promoting Physical Activity: Guide for Useful Interventions for Physical Activity in Brazil and Latin America (Project GUIA).<sup>19</sup> This Project identifies, tests, and disseminates potentially effective interventions that promote physical activity in the Americas in order to minimize noncommunicable diseases (physical inactivity, obesity, and related chronic diseases) in developing countries. Project GUIA reviewed English, Spanish, and Portuguese academic publications and included them in the systematic review included in the thesis that generated this article. Consequently, Project GUIA sent strong recommendations to implement local school-based physical activity programs to address obesity in children and adolescents in Brazil. Therefore, we found it important to register the trial at ClinicalTrials and make this study accessible to the public.

**Study Design.** This study is a School-based Randomized Controlled Trial. A three-step cluster sampling procedure was used for subject selection. In the first step, 8 schools in the Vila Mariana district (São Paulo) were purposely selected and randomly assigned either to physical activity intervention (3 schools) or control condition (5 schools). In the second step, all 48 classrooms from the 1<sup>st</sup> and 2<sup>nd</sup> grades of the three physical activity intervention schools were selected. In the third step, 352 children who belonged to those 48 classrooms were randomly selected to compose the observational group. Direct observation and questionnaire data were collected twice: "pre" (immediately before the intervention), and "post" (immediately after the intervention), with a six months interval between them. No educational intervention took place in the control schools during the running of the project. After the project was completed, control schools teachers received the same training.

**Eligibility and Selection Criteria.** Among all Public Schools located in the neighborhood of Vila Mariana/São Paulo (Brazil) eight schools were conveniently designated by the Central South Board of Education, which is the State Agency responsible for managing schools. From these eight elementary Public Schools we randomly selected four to receive an educational intervention for teachers, however one school refused to participate in the intervention group, because the training program was offered in the evenings and teachers weren't willing stay longer periods to be trained. Therefore this school was included in the control group, since this post randomization allocation agrees to the Intention to Treat Principle assumptions.<sup>20</sup> In order to evaluate the intervention results, all 1<sup>st</sup> and 2<sup>nd</sup> grade children, from exposed and unexposed schools (n = 48 classrooms) were enrolled for the selection of children to be evaluated. In each class, seven or eight children were randomly selected according to presence list, numbering a total of 352 selected children. Unavailable selected children were replaced by the subsequent child in the list.

**Sample Loss.** From initial sample, 53 of subjects were excluded because parents neither attended interview day at school, nor established telephone contact. In addition, 58 children were transferred or left school during the observational year, and 62 of them were excluded due to missing data in either observation. The final sample was composed by 179 children (90 boys and 89 girls) (Figure 1).

## Intervention

The randomized schools were contacted for an awareness process by the research team of the Reducing Risks of Illness and Death in Adulthood - RRIDA Project. The team presented the study purposes and the methodology that would be used to the principals and teachers participating.

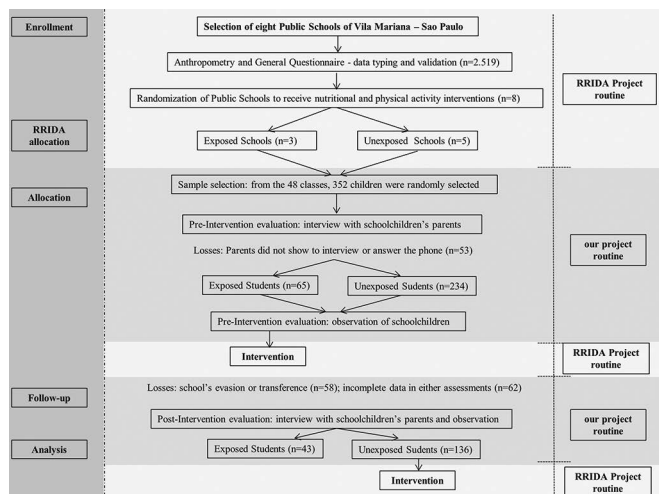


Figure 1. Study Flow Chart

The intervention was designed for and focused on classroom teachers and consisted of a 30 hour refresher course in nutrition and physical activity.<sup>21</sup> Training lasted six weeks, with 12 hours devoted to physical activity and 18 hours to nutritional contents. Classroom teachers were invited to attend and upon successful completion they were granted a participation certificate by the Federal University of São Paulo. In addition the time spent in the course was added to teacher's continuing studies log, counting as pedagogy tasks. Modules of educational activities were delivered to classroom teachers so as to be replicated at Physical Education (PE) classes to children from 1<sup>st</sup> and 2<sup>nd</sup> grades of three exposed schools.

The physical activity module was delivered by classroom teachers (not by PE specialists) in four sessions of three hours each. Theoretical content was delivered by the RRIDA's physical activity coordinator in each of these meetings. The contents were (i) physical activity benefits and risks for the overall health, (ii) children's physical fitness and physiological exercise patterns, (iii) limitations according to growth and neuromotor development, (iv) physical education as a public health strategy, and (v) behavior change models that could be fitted in the PE classes.

In each meeting, the PE teachers of the RRIDA team performed PE classes with the classroom teachers roleplaying as pupils, and focusing on strategies to keep them in movement for most of the PE class duration in order to stimulate students' joint participation instead of individual participation or playing common games (described elsewhere).<sup>22,23</sup> The educational method followed a framework that enhances theoretical and real living approaches to be replicated to children in the PE classes.<sup>24</sup> Thus, the objectives of the intervention were to provide knowledge about physical activity to the classroom teachers. In addition, it intended to highlight the importance of physical activity to the overall health and characteristics

of the children, and to empower the teachers to promote more active PE classes.

### Outcome measures

To assess children's level of Physical Activity (PA), the Physical Education classes were recorded. The analysis of the videotapes set the level of each student's physical activity, the teacher's attitude towards the class/students, and the class context. The observational instrument used was SOFIT - System for Observing Fitness Instruction Time.<sup>25</sup> This tool recommends observations of student's physical activity level, class context and teacher's attitude every 20 seconds throughout PE class period. It allows the calculation of children's energy expenditure through the correlation with heart rate, validated in a previous study.<sup>26</sup> Exposed children wore distinctly colored shirts to be best observed on videotapes; we used a video camera (JVC GR-AX657UM) placed on a tripod at a distance that allowed clear visualization of each child and the teacher during classes. SOFIT's assessments were performed independently by two previously trained PE professors.

To test reproducibility, ten classes were coded simultaneously by the two PE professors (806 intervals) in order to verify the consistency of observations, interval by interval, between them. Levels of agreement for Student's Physical Activity Engagement, Lesson's Context/Content, and Instructor's Behavior were 84.5%, 97.3% and 88.0%, respectively.

### Sample Size Calculation and Statistical Analysis

Accepting that among the unexposed students the proportion of low energy expenditure during PE classes would be observed in 10% of them while for the exposed students the proportion would be 23%, corresponding to a risk ratio of 2.30, the sample sizes considering three unexposed for each exposed student, with a significance level of 5% ( $\alpha = 0.05$ ), and a power of 80% ( $\beta = 0.20$ ), would be of 352 children, 264 unexposed and 88 exposed.

After considering the sample loss, statistical analyzes were performed with 179 children. Frequency distributions of biological variables were used to access selection biases possibly introduced by the losses in exposed and unexposed groups. To test differences between enrolled and lost individuals we used chi-square test with 5% significance level. To perform SOFIT assessments we used paired and unpaired t-tests. The paired t-test was used for intragroup comparisons and the unpaired t-test was used for intergroup comparisons.

The evaluation of the influence of interventions in the Physical Activity measurements was performed using a generalized linear mixed-model approach<sup>27</sup> in a multilevel fashion. The intercepts for schools and classes were modeled as random effects representing the two main levels of the study design. The idea was to control for the likely

intra-class correlation induced by students in same classes and classes into the same school. The models assumed normal distribution for errors and identity link function. To perform statistical procedures we used STATA 12.0/IC (StataCorp LP, College Station, TX, USA).

## RESULTS

In order to access selection biases due the high dropout rate, we compared the distributions for nutritional status, sex and age variables (Table 1). The similarity over distributions of lost and enrolled individuals showed no differences between groups.

From a total of 30 minutes duration PE class, the total mean duration of children's physical activity at PE classes in the pre-intervention observation, in both sets of schools (exposed and unexposed) were 26.2 and 27.5 minutes, respectively. However, after the intervention there was a significant increase in the mean total duration of PE classes only at the exposed schools, rising to 32.1 minutes ( $p = 0.01$ ). We did not find this modification among unexposed schools, as shown in Table 2.

Table 3 shows the distribution of teacher's involvement during PE lessons according to SOFIT categories. Independently of intervention, there was a tendency to diminish teacher's involvement in the PE classes. In both groups, there was a significant reduction in the category named "demonstrates fitness". If teachers reduced their time spent showing how to execute the exercise, they compensated this behavior watching students perform the exercises. Therefore the category "observes"

increased during lessons in both groups, but was found significant only in the unexposed group.

Table 4 indicates that during classes no theoretical content (categories 2 and 3) was provided. In addition, no practice skills were performed during PE classes in both groups, but after intervention the exposed group had this content incorporated by teachers ( $p = 0.03$ ). The 6<sup>th</sup> category "Game play", showed in table 4, was the most frequent during PE classes in both groups, with a significantly increase in the unexposed group.

Table 5 shows on one hand a significant increase after the intervention in the categories of higher energy expenditure, such as walking ( $p < 0.001$ ) and vigorous activity ( $p < 0.001$ ); on the other hand the table shows a significant decrease in the standing category ( $p < 0.001$ ). For the unexposed group, there was a small but significant increase in the walking category ( $p < 0.001$ ) and a decrease at vigorous activity category ( $p = 0.002$ ).

Figure 2 shows that in the exposed group there was an increase of 70.6% (27.6Kcal) in mean energy expenditure of children after the intervention, while there was a decrease in mean energy expenditure of 8.6% (-4.7Kcal) in the unexposed group. Neither of these results was significant. However, Table 6 brings the highly significant joint effect of group and time (32.4Kcal; 95%CI 24.7-40.1,  $p = 0.0001$ ) indicating the intervention effectiveness in increasing the energy expenditure of children during PE classes. The school, class, and children's random effects and its 95%CI were respectively, 15.39Kcal (8.20-28.87); 10.60Kcal (7.18-15.64); 9.04Kcal (6.25-13.07).

**Table 1.** Distribution of biological variables between enrolled and lost individuals in each comparison group

Variables	Exposed			Unexposed			
	Enrolled (%)	Lost (%)	P <sup>b</sup>	Enrolled (%)	Lost (%)	P <sup>b</sup>	
Sample	43	22		136	98		
Nutritional Status	Overweight + Obesity	72.1	77.3	0.65	71.3	73.5	0.71
	Underweight + Normal	27.9	22.7		28.7	26.5	
Sex	Male	53.5	59.0	0.66	49.3	46.9	0.72
	Female	46.5	41.0		50.7	53.1	
Age <sup>a</sup>	< 7,3 years	53.5	54.5	0.93	49.3	48.0	0.84
	> 7,3 years	46.5	45.5		50.7	52.0	

<sup>a</sup> categorized according to the median age of the initial sample; <sup>b</sup> probability.

**Table 2.** Mean and standard deviations of children's physical activity total duration (minutes) at PE classes, at exposed and unexposed schools, pre and post-intervention

	Schools					
	Exposed			Unexposed		
	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>
Children's physical activity total duration	26.2 (7,39)	32.1(6.08)	0.01	27.5 (10.32)	24.1 (9.00)	0.13

<sup>a</sup> standard deviation; <sup>b</sup> probability.

**Table 3.** Mean and standard deviations of teacher's involvement (percentage) during PE classes according to SOFIT's categories at exposed and unexposed teachers, pre and post-intervention (n=53).

Teacher's involvement	Teachers					
	Exposed N = 18			Unexposed N = 35		
	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>
1. Promotes fitness	7.3 (11.0)	2.9 (3.4)	0.12	2.1 (5.3)	2.1 (4.2)	1.00
2. Demonstrates fitness	11.4 (13.7)	4.0 (4.0)	0.04	7.9 (13.0)	1.9 (5.4)	0.02
3. Instructs	17.1 (11.2)	17.9 (6.2)	0.79	16.6 (14.2)	13.2 (7.9)	0.22
4. Manages	39.3 (19.2)	40.2 (10.0)	0.86	34.5 (21.2)	26.4 (10.6)	0.04
5. Observes	24.6 (20.9)	33.7 (11.5)	0.11	33.9 (23.7)	48.5 (16.2)	0.004
6. Other-task	0.2 (0.9)	1.1 (4.3)	<0.001	5.0 (11.0)	7.8 (15.5)	0.38

<sup>a</sup> standard deviation; <sup>b</sup> probability.

**Table 4.** Mean and standard deviations of the duration of class context (percentages) in PE classes according to SOFIT's categories at exposed and unexposed classes, pre and post-intervention (n = 79)

Knowledge content	Class Duration					
	Exposed			Unexposed		
	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>
1.General content	36.6 (14.28)	30.63 (16.20)	0.25	27.93 (17.03)	18.94 (16.6)	0.03
2.General knowledge	0	0	-	0	0	-
3. Fitness knowledge	0	0	-	0	0	-
4. Fitness practice	13.7 (20.8)	5.54 (5.16)	0.12	10.0 (18.34)	1.31 (3.32)	0.01
5.Skill practice	0	6.61 (11.66)	0.03	0	0	-
6.Game play	49.66 (21.27)	57.22 (21.61)	0.29	62.05 (25.25)	79.74 (17.05) <sup>c</sup>	0.001

<sup>a</sup> standard deviation; <sup>b</sup> probability.

**Table 5.** Mean and standard deviations of time spent (percentages) in PE classes according to student's physical activity engagement under SOFIT's categories at exposed and unexposed students, pre and post-intervention (n=179)

Student's physical activity engagement	Students					
	Exposed			Unexposed		
	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>	Pre Mean (SD) <sup>a</sup>	Post Mean (SD) <sup>a</sup>	P <sup>b</sup>
Lying down	0.4 (1.4)	0.2 (1.0)	0.44	1.0 (3.5)	0.9 (1.0)	0.74
Sitting	21.9 (21.5)	15.5 (14.8)	0.11	20.7 (23.3)	16.5 (23.7)	0.14
Standing	65.5 (22.4)	42.7 (13.7)	<0.001	48.3 (22.7)	51.5 (22.5)	0.24
Walking	5.6 (4.8)	25.5 (11.4)	<0.001	12.8 (15.5)	13.8 (10.6)	<0.001
Vigorous	6.5 (4.4)	16.1 (9.6)	<0.001	15.5 (15.6)	10.6 (9.7)	0.002

<sup>a</sup> standard deviation; <sup>b</sup> probability.

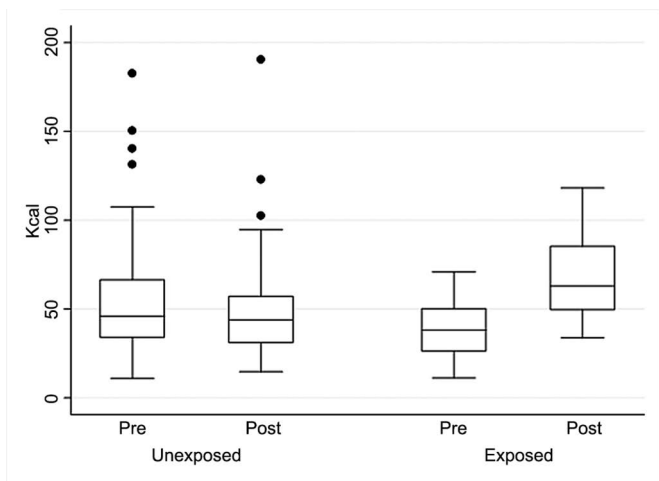
## DISCUSSION & RECOMMENDATION

This is one of the five trials with strong evidence to support a practice recommendation to increase physical activity in Latin America included into a systematic review.<sup>18</sup> The combination of a randomized controlled design and an educational intervention with classroom teachers led to changes (i) in the net percentage of physical activity from baseline in estimated caloric expenditure (80.5%); (ii) in the time spent being vigorous during PE classes (179.3%); and time spent walking during PE classes

(307.4%). Furthermore, the use of direct observation that insured the inclusion of all students initially randomized to be witnessed in order to assess energy expenditure measurements reinforced the internal validity of our observations. In addition to that, we tested the consistency of observations: a satisfactory level of reproducibility between the two PE professors was obtained. Finally, we used a validated instrument which has reproducibility within expected levels for interventional studies.

On the other hand, the sample loss of half of those initially randomized to compose comparison groups is





**Figure 2.** Box Plot of energy expenditure between unexposed and exposed children, pre and post- intervention.

**Table 6.** Student's mean energy expenditure (kcal) during PE lessons according to SOFIT's calculations at exposed and unexposed groups, pre-and post-intervention (N = 179)

	Coef. <sup>a</sup>	CI <sup>b</sup> (95%CI)	P>z <sup>c</sup>
Pre/Post Momentum	-4.8	(-8.6; -1.0)	<0.0001
Exposed/Unexposed Groups	-15.6	(-39.4; 8.1)	0.2
Interaction (Momentum*Groups)	32.4	(24.7; 40.1)	<0.0001
Constant	54.7	(40.4; 69.0)	<0.0001

<sup>a</sup> coefficient; <sup>b</sup> confidence interval; <sup>c</sup> probability

a limiting factor that hinders the adoption of results as definitive. Even if they remained similar according to measured biological variables as shown in Table 1, we cannot guarantee the maintenance of group equality defined by randomization. However, it should be noted that this weakness might not invalidate the body of evidence observed in terms of size and significance of the observed effect.<sup>28</sup> In addition, another limitation of this evidence is power, resulting in the fact that our results can only be directly applied in schools with similar conditions in which classroom teachers were trained instead of PE specialists.

Economic, political, social and cultural changes occurred in the world since the nineteenth century and were intensified during the last century, producing significant changes in society life, especially in health related issues. Children in developing countries have been experiencing rapid urbanization leading to fewer opportunities to be physically active in safe environments, thus contributing to a sedentary lifestyle.<sup>29</sup>

The level of physical activity is still far from ideal,<sup>30</sup> especially because children tend to establish a sedentary lifestyle early in life.<sup>31</sup> In this sense, schools are critical settings for promoting physical activity interventions contributing to the child's health and wellbeing, since the majority of children attend school for long periods and

schools have the obligation and the resources to provide physical activity as part of its curriculum.<sup>8,32</sup>

In the educational context, PE covers the cognitive, affective, social and motor development of the child. Besides, it has been seeking the playful component of education.<sup>33</sup> According to the Brazilian 1<sup>st</sup> Grade Physical Education Curriculum Proposal, PE follows the constructivist line, involving children in the construction of knowledge by integrating the subject into the world. It is a method of search, discover, rediscover, invent and create, that is important in the teaching-learning process.<sup>34</sup> Thus, the stimulus to accomplish physical activity provides pleasant moments, and promotes health benefits for the child.<sup>35</sup>

Unfortunately, there is a worldwide trend toward physical inactivity. A 51-country prevalence study, showed that overall about one fifth of them are at risk for chronic diseases due to physical inactivity.<sup>36</sup> Children have also been experiencing it as well, wherever physical education classes are declining at schools.<sup>8,16</sup>

According to that, the Brazilian government has found it necessary to promote Physical Education Guidelines in order to enhance the value of this practice.<sup>34</sup> Although the Guidelines are dictating what is considered the basis of PE at schools, PE classes ministered to 1<sup>st</sup> to 4<sup>th</sup> grades of elementary state schools are not usually under the responsibility of PE professionals. Instead, these classes are often assigned to classroom teachers. According to the Guidelines and Bases of National Education,<sup>37</sup> the presence of the PE specialists has become dispensable for classes in the 1<sup>st</sup> cycle. That given, physical activity level and energy expenditure may have decreased, probably due to PE classes being ministered by inexperienced professionals.<sup>38</sup>

In order to enable classroom teachers to increase children's physical activity level and energy expenditure, the RRIDA Project formulated an Educational Intervention. Tables 2 and 5 concisely show results that enable us to conclude that the educational intervention was successful in increasing physical activity among schoolchildren.

The evidence of this trial shows a 20% increase (from 26.2 to 32.1 minutes) in children's physical activity total duration (minutes) at PE classes in exposed schools, which was not observed in the unexposed schools (Table 2). This study has also shown an increase in the time children spent doing physical activity at PE classes: a 355% increase in walking and a 148% increase in vigorous activities among the exposed children. The amount of time spent in PE classes and its intensity accounted for half of daily physical activity recommendations, time required to improve physical performance and achieve the health benefits associated with physical activity.<sup>39</sup> This was not found in the unexposed children in whom we observed a small increase of 7.8% in walking and an expressive decrease of -31.6% in vigorous activities, meaning that children from schools that did not receive the Educational

Intervention diminished their energy expenditure along the timeline (Table 5).

The joint impact of group (exposed vs. unexposed), and time (pre vs. post intervention) is well shown by the interaction factor at the multilevel model; thus, it is a better measurement of the trial's impact factor of a 32.4 kcal increase in children's energy expenditure during PE classes (Fig. 2). Although the amount of calories may seem low, formal PE classes are not the only opportunity for students to engage in physical activity, but such classes offer a regular schedule and a structured format, both excellent incentives for engaging in physical activity that have an impact in establishing habits early in life.<sup>14</sup> So it is true that only exposed children changed their physical activity behavior incorporating extra activities in their daily life such as playing sports in which we observed a 18.7% increase ( $p = 0.02$ ); and playing outside with an increase of 25% ( $p = 0.04$ ). Also we observed a 9.9% increase among the exposed children who started going to school walking or cycling ( $p = 0.05$ ) (data not shown).

The effectiveness of community-based interventions to improve physical activity was recently analyzed in a systematic review of the literature<sup>18</sup> and concluded that school-based programs were successful at improving the physical fitness among school-aged children when compared with other types of interventions. Although the evidence showed high variability in the net percentage change in physical activity of school-based programs, this could be attributed (i) to differences in age group (elementary, primary schoolchildren); (ii) to study design (randomized or non-randomized design); (iii) to different types of measurements (minutes spent in moderate and vigorous physical activity; percentage of children meeting physical activity goals; (iv) to the percentage of children biking or walking to school, (v) to estimated energy expenditure, (vi) to the percentage of children being very active during PE classes; (vii) to the percentage of time spent walking during PE classes; (viii) to aerobic capacity as estimated by VO<sub>2</sub> max results from timed runs, (ix) to endurance capacity as estimated by the shuttle run test.

## ■ CONCLUSION

This study contributes strong evidence that school-based educational intervention programs to classroom teachers increases energy expenditure of children, although issues related to income, work environment such as physical space, and structural resources still persist as barriers, leading schools to struggle in offering high-quality PE classes. Regardless, PE seems to be an effective but underused way to promote physical activity.

The additional step is to encourage new studies to verify the relationship between the increase in children's energy expenditure and its benefits, such as the decrease in cardiometabolic outcomes aiming to change obesity rates.

## ■ ACKNOWLEDGEMENTS

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## ■ CONFLICT OF INTEREST

Authors declare no conflict of interest regarding this project.

## ■ AUTHOR PARTICIPATION

Cunha CT: acquisition of data, interpretation of data and writing the article; Poblacion AP: interpretation of data, writing the article and final approval of the submitted version; Colugnati FAB: analysis of data, critical review of article and final approval of submitted version; Taddei JAAC: conception and design of the project, critical review of the article and final approval of submitted version; Bracco MM: conception and design of the project, interpretation of data, critical review of the article and final approval of submitted version.

## EFEITO DE UM PROGRAMA DE EDUCAÇÃO NO GASTO ENERGÉTICO DE ESCOLARES DURANTE AS AULAS DE EDUCAÇÃO FÍSICA

**OBJETIVO:** A prática de atividade física é uma forma de prevenção de doenças não transmissíveis. O nível de atividade física das crianças tem diminuído no Brasil, fato que pode contribuir para o aumento do risco de doenças associadas com o sedentarismo e a obesidade.

**MÉTODO:** Este é um ensaio educacional randomizado controlado que avaliou o impacto de uma intervenção educacional para professores no nível de atividade física e no gasto energético das crianças, e no comportamento do professor durante as aulas de educação física em escolas públicas de São Paulo. A população estudada compreendeu crianças de 1<sup>a</sup> e 2<sup>a</sup> series de oito escolas (três expostas e cinco não-expostas ao treinamento de professores em nutrição e atividade física). Os resultados foram medidos por observação direta e gravados por uma câmera VHS durante as aulas de educação física. Dados de 78 aulas de educação física foram analisados segundo o System for Observing Fitness Instruction Time - SOFIT.

**RESULTADOS:** Após intervenção, os resultados mostraram aumentos significantes no nível de atividade física das crianças (caminhada,  $p < 0.001$ ; atividades vigorosas ( $p < 0.001$ ), e diminuição na categoria na qual a criança permanecia em pé ( $p < 0.001$ )). No entanto,

os resultados mostraram um aumento não-significante na média do gasto energético pelas crianças (70.6% = 27.6Kcal), porém a interação do grupo e do tempo (intervenção) foi altamente significativa (32.4Kcal; 95%CI 24.7; 40.1,  $p < 0.0001$ ) indicando a efetividade da intervenção em aumentar o gasto energético das crianças durante a aula de educação física. Os resultados mostraram também um aumento na duração da aula de educação física (26.2 para 32.1 minutos ( $p = 0.01$ )).

**CONCLUSÃO:** Houve diferença no comportamento dos professores com um impacto positivo no nível de atividade física e no gasto energético das crianças após a intervenção educacional.

**PALAVRAS-CHAVE:** Gasto energético; Educação Física; Criança; Ensaio Randomizado Controlado.

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