Original Article

Intensity and perceived exertion in physical education due to the seniority of the teacher

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Abstract:

Introduction: There is scientific evidence pointing out that children who do not engage in above 60 minutes of day of moderate-to-vigorous physical activity coincides with overweight and obesity, in physical education the teacher can be an influence in its contents and guide regarding the intensity of the physical activity of the students. The study aimed to compare the moderate-to-vigorous physical activity and perceived exertion among fourth, fifth and sixth grade children in Physical Education classes given by teachers with seniority lower or higher than 16 years. **Material and Methods:** Seventy physical education lessons conducted by teachers with < than 16 years of experience (n=47) and teachers with ≥ of 16 years of experience (n=23) were evaluated among fourth, fifth and sixth grade children (Mean age=10.4±.3 years), using the System for observing fitness and instruction time (SOFIT) to assess the moderate-to-vigorous physical activity quantified the intensity as the proportion of time than students engaged in walking and very active physical activity during physical education, also to determine the perceived exertion, the pictorial children's effort rating table (PCERT) was completed, after physical education lessons; children chose an option in an illustrated scale 1–10 perceived exertion. **Results:** A cross-sectional design was used, the equality of variance was calculated using the Student t test for independent samples resulting moderate-to-vigorous physical activity (P-value=.173) and perceived exertion (P-value=.356), $\alpha \leq$ more than 0.05. **Conclusions:** In both groups the moderate-to-vigorous physical activity did not achieve international guidelines of reach at least 50% of the lessons time engaged in walking and very active physical activity, the average value of perceived exertion was less than 5 points of the scale, which is insufficient to enhance physical fitness, it is recommended that future studies build on teachers seniority to feedback in strategies for involving children in moderate-to-vigorous physical activity as recommend the World Health Organization.

Key Words: physical education, elementary education, teaching experience.

Introduction

Systematic review and meta-analysis suggests that children and adolescents than engage in regular physical activity are associated with lower risk of chronic diseases as obesity (Sims et al., 2015); The World Health Organization (WHO) recommends that children aged 5-17 years should accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily. In schools, physical education lesson has been highlighted as the place to reach most young people to promote a healthy active lifestyle (Langford et al., 2015; Hollis et al., 2016), when Physical Education classes are applied by professors they should establish pedagogical and physical effort activities that should engage the students in fun and pleasurable activities that will induce them to practicing extra school physical activities (Hellin, Garcia-Jimenez and Garcia-Pellicer, 2020); Additionally, the international guidelines established by the National Association for Sport and Physical Education (NASPE), outlined that students should engage in moderate-to-vigorous physical activity at least 50% of the Physical Education lesson, with activities with an energy expenditure similar to walking or running (Banville, 2006). Research shows teachers who guide content in physical education with moderate to vigorous activity improve aerobic capacity in students (Hall-López et al., 2017; Cvejić et al., 2018; Jovanović and Minić, 2018).

Perceived exertion is related to physical activity and refers mainly to a muscular work that implies tension mostly of the musculoskeletal, cardiovascular, and pulmonary systems; along with motivational and emotional aspects (Borg et al., 1987), intensity is determined based on energy expenditure and physical effort versus some sort of resistance, thus causing more strain on the body within a specific period of time (McKenzie and Van der Mars, 2015), is the feeling that a person has to identify how exerting a physical activity (Borg et al., 1987).

In Mexico, the Secretariat of Public Education (SEP for its abbreviation in Spanish) establish that Physical Education is part of the mandatory curriculum and students must to participate twice a week for 50 minutes per lesson, as a policy the Physical Education is conducted in a model of competencies that promotes a pedagogical intervention which lead children lifelong physically active (SEP, 2014). Research conducted in Mexican elementary schools assessing duration, intensity, and context of Physical Education lessons using the System for observing fitness and instruction time (SOFIT) as an instrument (McKenzie et al., 1992), the results showed that the duration of the Physical Education class was of 37.3 minutes (Pérez Bonilla, 2009) and 39.8 minutes (Jennings-Aburto et al., 2009), out of the 50 minutes that the SEP has established in Mexico for Physical Education lesson; Regarding moderate-to-vigorous physical activity over 50%, results showed 38.2% and 29.2% they argued it was related to the lack of material so that the students could have the opportunity to participate more, students spent long periods of time standing while the teacher organized the rest of the group and very long transition times between the activities. (Jennings-Aburto et al., 2009; Pérez Bonilla, 2009). The results can be due to the fact that teaching strategies implemented by the teachers took the most significant amount of time in managing and organizing the activities related to giving instructions such as making or switching teams, or changing activities within the class (Pérez Bonilla, 2009). In contrast when assessing children during recess period time they carried out 40% moderate to vigorous activity without following any instructions from the teachers (Jennings-Aburto et al., 2009). According to the SEP in Mexico, seniority refers to the years worked as a teacher in the basic education system (SEP, 2014). Studies correlate the fact that the higher the seniority of the Physical Education teacher, the higher the intensity of the Physical Education classes (Hollis et al., 2016; Sutherland et al., 2016). The link between the seniority suggest that environment within which physical education lessons are delivered can greatly effect on moderate-to-vigorous physical activity (Hollis et al., 2016), it was hypothesized that more experienced teachers conduct with more intensity the physical education lesson, therefore, to help build on this research it is relevant to compare the moderate-to-vigorous physical activity and perceived exertion among fourth, fifth and sixth grade children in Physical Education classes given by teachers with seniority lower or higher than 16 years.

Material & methods

Participants

The present was conducted on cross-sectional baseline, with a non-probabilistic convenience sample, in total 70 physical education teachers were evaluated from public elementary schools located in the urban area of Mexicali Baja California, Mexico; Encompassed schools which most closely reflect the majority of school in the City, classified as low socioeconomic status, morning sessions, the schools were required to possess a minimum of facilities to conduct the physical education lessons, population above 500 students at least two groups of fourth, fifth and sixth grade students. The study followed the ethical principles regarding human experimentation proposed by the Helsinki declaration; and was approved by the research program of the Faculty of Sports of the Autonomous University of Baja California.

The 70 physical education lessons attended by fourth, fifth and sixth grade students of elementary school (Mean age=10,4±0,3 years), were evaluated n=47 conducted by teachers with < than 16 years of experience and n=23 conducted by teachers with ≥ of 16 years of experience, they were divided into two groups with an average seniority of 8.62 ± 0.66 years (range 1 to 15) and 20.83 ± 0.93 years (range 16-31) working in the SEP (Secretariat of Public Education). We set as a cutoff point 16 years of experience because the retirement in men is 32 years of service and women at 30 years.

Procedure

In order to quantify the physical activity during physical education lessons, the System for Observing Fitness Instruction Time (SOFIT) was used, SOFIT is an objective tool for assessing the quality of physical education instruction that provides a measure of student activity levels and has been calibrated using heart rate monitors and validated using accelerometers (McKenzie et al., 1992). Onset of the physical education lessons, trained observers randomly select 4 students (2 girls and 2 boys) based on the order in which they arrived at the class, using the procedures outline in the SOFIT manual, in summary observers record intensity of physical activity using a time-sampling system of 10-seconds observe and 10-seconds records intervals while being paced by audio prompts from a mp3 player; The coded intensity of physical activity was scored as 1=lying down; 2=sitting; 3=standing; 4=walking; 5=very active. To identify moderate-to-vigorous physical activity the codes 4=walking and 5=very active were combined as the proportion of time than students are engaged in these codes. Four data collectors were trained following the standard of SOFIT protocol, memorizing operational definitions of codes and learning the tactical procedures, reliability measures were taken in 100% of the classroom observations (Kappa statistics 0.83). Interpretation of Kappa was according to the following scale: excellent 1.00–0.81; good 0.80–0.61; moderate 0.61–0.40; weak 0.40–0.21; and absence of agreement 0.20–0 when compared to the trained observers and the chance of agreement in to consideration with the reference data collector.

The lesson context in physical education classes were identify as M=management; K=general knowledge; P=physical fitness knowledge; F=fitness activity; S=skill drills; G=game play; O=other (e.g., free play).

Perceived exertion was determined by means of the Pictorial Children's Effort Rating Table (PCERT) developed by (Yelling et al., 2002) based on Borg's CR-10 scale (Borg et al., 1987). Adjusting it to the cognitive development of the children, they added figures to the scale making it more appropriate to choose an option of a representative value for age of the children. The scores ranged from 1 to 10 with a median value corresponding to 5. This instrument was translated and validated to Spanish and the application of the scale was performed immediately to the four same physical education students evaluated by SOFIT after the Physical Education class was finished, and in the same facilities of the elementary school (Hernández-Alvarez et al., 2010).

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 21.0 for Windows (IBM Corporation, New York, USA), by calculating the descriptive values of the variables. In order to verify the normality of the groups and the data variables, we used the statistical Kolmogorov-Smirnov test, since it was an amount higher than 30 assessments in the fixed variables amount that included Physical Education classes taught by teachers with a seniority lower than 16 working years and the statistical Shapiro-Wilk test because it was less than 30 assessments in the fixed variable amount that included the Physical Education classes taught by teachers with a seniority higher than 16 working years presenting both a degree of significance $P\text{-value} \geq 0.05$. As a cross-sectional study to compare fixed variables of two groups of teachers with different seniority, with the numerical random variables being moderate-to-vigorous physical activity and perceived exertion, parametric statistics were used: the t Student test for independent samples in order to calculate the equal variance, determining a level of $\alpha \leq 0.05$, i.e. 5% as a percentage of error of the statistical test.

Results

Descriptive statistics on the duration and intensity assessed by the System for Observing Fitness Instruction Time (SOFIT) during Physical Education classes can be seen in Table 1. The duration in minutes of the Physical Education class in the forty seven Physical Education classes taught by teachers with less than 16 years of seniority at the Secretariat of Public Education was 39.98 ± 1.10 (range 19-52) and in the twenty three Physical Education classes of teachers with more than 16 years seniority at the Secretariat of Public Education was 38.73 ± 2.14 minutes (range 12-60). The current study showed that moderate-to-vigorous physical activity in Physical Education lessons taught by teachers considered in this research was 43.52 ± 15.44 for Physical Education teachers with a seniority lower than 16 years and 39.33 ± 19.43 for teachers with a seniority higher than 16 years at the Secretariat of Public Education; The results of Physical Education the context in both groups was similar, the instruction was more on G) Game (32.5%), M) General content (28%) and F) Physical Preparation (17%) respectively, where it was generally perceived that teacher instructions took too long to manage the Physical Education class, giving instructions, transitioning activities, organizing training equipment, creating long lines where students remained and were classified by codes 1) lying down, 2) sitting, 3) stopped when assessed by the SOFIT (Mckenzie et al., 1992). The percentage of intensity of physical activity during class while lying down, sitting and standing was 0.5%, 8.5% and 47.1% for teachers with less than 16 years in practice and 1%, 6.9% and 51.1% for teachers with more than 16 years in practice.

Perceived exertion of children who participated as students in Physical Education classes taught by Physical Education teachers with less than 16 years in practice the value was 4.44 ± 1.70 , in the case of teachers with more than 16 years in practice the value was 4.80 ± 1.96 .

Table 1. Descriptive statistics for the sample (n = 70).

Variables	Teachers (< than 16 years of experience) (n=47 measures)			Teachers ($\geq$ of 16 years of experience) (n=23 measures)		
	M	SD	RANK	M	SD	RANK
1) Lying Down (min)	0.2 $\pm$ 0.8		0-5	0.4 $\pm$ 1.6		0-7.33
2) Sitting (min)	3.4 $\pm$ 4		0-20.3	2.7 $\pm$ 4.2		0-15
3) Standing (min)	18.8 $\pm$ 7.3		3.3-42	19.8 $\pm$ 8.2		4.3-33
4) Walking (min)	10.5 $\pm$ 5.2		2.3-23.3	10.2 $\pm$ 5.8		0.3-20.33
5) Very Active (min)	7 $\pm$ 4.2		1-16.7	5.6 $\pm$ 4.4		0-17.33

In the statistical test analysis of Kolmogorov-Smirnov and Shapiro Wilk the value resulted with a P-value ≥ 0.05 indicating normality of groups and variance homogeneity of data, resulting in fixed duration variables (.008) moderate-to-vigorous physical activity (.963) in lessons taught by teachers with seniority lower and higher than 16 years, the average and standard deviation ($\pm$) of the variables studied in Physical Education classes taught by teachers according to seniority, equal variance was calculated using the Student t test for independent samples. This resulted in a significance level of P-value higher than $0.05 \alpha \leq$ in physical activity index (.173) and perceived exertion (.356) respectively. (Figure 1 and 2).

Figure 1. Mean of moderate-to-vigorous physical activity in physical education classes (n=70). **Figure 2. Mean of Perceived exertion of students in physical education classes (n = 70).**

Dicussion

The purpose of this study was to compare the moderate-to-vigorous physical activity and perceived exertion among fourth, fifth and sixth grade children in Physical Education classes given by teachers with seniority lower or higher than 16 years. It was hypothesized that more experienced teachers conduct with more intensity the physical education lesson (Hollis et al., 2016), our findings were different to those in previous research conducted by Sutherland et al., (2016) who found that more experienced teachers conducted lessons with significantly more moderate-to-vigorous physical activity ($p=.001$) compare to less experienced teachers.

These results of moderate-to-vigorous physical activity were similar to those studies carried out in Mexico using the exact measurement protocol and where teachers used the same mandatory curriculum of Physical Education conducted in a pedagogical model of competencies (Jennings-Aburto et al., 2009; Pérez Bonilla, 2009) but partial contradict with other findings than showed 54% of moderate-to-vigorous physical activity in class time (Gharib et al., 2015). Understanding the physical activity patterns of youth is an essential in

programming interventions needed to change behavior (Mjåtveit and Giske, 2017; Fernández Rivas and Espada, 2020); In our data, neither of two groups reached the internationally established standards set by the National Association for Sport and Physical Education (NASPE), recommending that Physical Education lessons should engage students in moderate-to-vigorous physical activity at least 50% of the Physical Education lesson (Banville, 2006). As a way of explanation of the intensity of physical activity determined for the goals and purposes offered of the physical education an alternative pedagogical assessment we used to determine the perceived exertion, the pictorial children's effort rating table (PCERT) (Yelling et al., 2002); in both groups the average value was less than 5 points on the scale, taking into account that values equal to or greater than 5 represent a heart rate above 150 beats per minute (Cowden et al., 2003), which according to our result is considered insufficient to produce the necessary adjustments for a better organ function resulting from physical activity. The data from this study is consistent with other research conducted in school-age children in Spain (Hernández-Álvarez et al., 2010).

The reasons for the differences in intensity of physical activity during physical education can be influenced by the environment as, teacher experienced, teacher credentials, equipment, facilities, scheduled lesson, class size, length and the number of lessons provided per week (Hollis et al., 2016; Hall-López et al., 2017; Hall-López et al., 2018; Hellin, Garcia-Jimenez and Garcia-Pellicer, 2019). Regarding seniority, Griffey and Housner (1991) found that experienced teachers asked many more questions before they began planning than did inexperienced teachers, experienced teachers plans reflected a concern about contingencies that might arise during instruction, whereas inexperienced teachers plans did not and interaction, therefore, student engagement showed marked differences between experienced and inexperienced teachers. In addition, a study investigates whether experienced physical education teachers perceive the same frustrations and negative orientations as beginning teachers, data suggest that in many respects their working conditions and orientations are more supportive and positive than those reported for beginning physical educators (Macdonald, 1991; Weissbluth and Tali, 2019).

Conclusions

The present study is limited by the sample size of Physical Education teachers and delimited to Mexican teachers who conduct a curriculum in a pedagogical model of competencies; in addition, this cross-sectional study prevents us from inferring causality, also the instrument to perceived exertion was translated into the Spanish using a validated reference. Despite of these limitations, the results presented here allow us to better understand potential restrictions when the physical education lessons without strategies for involving the students in moderate-to-vigorous physical activity, the measure instruments used in the research are valid, easy to apply in large samples, they have a low cost and offer a non-invasive means to measure the intensity and perceived exertion in physical education as well as providing educational support for teachers within the context and teachers might find it useful to design proposals aimed at increasing the physical activity among children.

The results provide important information that contributes to a better understanding that can be of reference to physical culture professionals to have more elements that will allow them to implement strategies that contribute through their roles in the school environment, and to apply healthy lifestyle oriented promotion programs. However, there is still the need of carrying out further research that takes into account the age of the Physical Education teacher, with a greater control of the variables such as stratifying evaluations by gender, number of students per class, physical workspaces, public and private education; also to increase the amount of assessment time, and to use probabilistic sampling in order to obtain extrapolable results. In summary, results from this current study add a much-needed contribution to our understanding of the seniority of the teacher related to the intensity of physical activity and perceived exertion of children in physical education lessons providing some contrasting findings to international guidelines and recommendations to enhance physical activity during the school period.

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