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Physical Activity in Pre-school Children: Role of the Teacher during Free Play

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Abstract: It has become evident over the past decade that the lack of PA (physical activity) is a major concern for the population at large CDC (Center for Disease Control). This lack is a major reason for the increase in overweight and obese children (USDHHS, 2014). The CDC and the American Heart Association recommend children need at least 60 minutes of play time that is not scheduled PA. The purpose of this research was to examine whether children's PA will increase if teacher activity increases during unstructured free play time. Students' PA was determined by using the SOPLAY (system for observing play and leisure activity in youth-children). SOPLAY is a validated tool for directly observing PA and associated environmental characteristics in free play settings (e.g., recess and lunch at school). SOPLAY provides objective data on the number of participants and their PA levels during play and leisure opportunities in targeted areas. Children and teachers in a West Texas Lab School (mean age = 4.3 years) on a university campus were studied. Control group data (males = 13, female = 15) were analyzed and MVPA (moderate to vigorous physical activity) was calculated. Data showed that children spent only 30% of their free-time in the recommended intensity levels. Teachers' (n = 5) overall metabolic equivalents (METs) were recorded at 1.13. The experimental group (males = 11, female = 13) recorded teachers' (n = 6) METs at 2.47 and children MVPA at 44%. Both the MVPA and METs were significantly different ($p < 0.001$). The value and importance of unstructured play time are important for children as well as the teachers. Children need time to be creative and explore during play and teachers use this free time for various activities including cognitive breaks or administrative work. A stronger push to get teachers moving should be made as this slight increase in METs produces a significant increase in children's PA.

Key words: PA, free play, children, school, teacher.

1. Introduction

It has become evident over the past decade that the lack of PA (physical activity) in children is a significant concern for the population at large [1]. The prevalence of overweight among children in the U.S. has continued to increase since 1976 [2]. The CDC [1] reports that the prevalence of obesity in children has doubled in the past 30 years, meaning 17% of children ages 2-19 years are obese. Childhood obesity has immediate and long-term effects on physical, social, and emotional health [3]. In the long term, a child who is obese is more likely to be obese as an adult. An adult with obesity has a higher risk of developing heart disease, type 2 diabetes, metabolic syndrome, and many types of cancer [4].

A lack of PA is a major reason for the increase in overweight and obese children [5]. To combat these risk factors, the CDC [4] and the American Heart Association recommend children need at least 60 minutes of play time that is not scheduled PA and the National Association for Sport and Physical Education suggests that preschool children spend 60 minutes in structured PA [6]. Yet these suggestions are not being met.

In a study across seven countries, it was found that "nearly half" of children under six years of age do not engage in sufficient PA. The lack of PA is not isolated to the United States. Children across the globe are not meeting recommendations for PA [7, 8]. PA is essential for the development of the child for physical,

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social, and motor skills [9]. The impact of structured movement time for preschoolers has been studied and the importance of PA has been documented [5, 10-12].

Burdette and Whitaker [13] define "play" as the spontaneous activity in which children engage to amuse and to occupy themselves. It is also a way that children optimize their own brain development. When viewed from this perspective, inactivity in young children should be examined more closely because the consequences for child well-being extend far beyond the problem of obesity alone.

Free play is important, but traditionally has not been viewed in terms of PA but rather in terms of psychological and emotional development [14-16]. Children use both gross and fine motor skills in their play. They react to each other socially. They use language to talk to each other or to themselves, and they very often respond emotionally to the play activity. The integration of these skills and behaviors is key to the cognitive development of young children. Unstructured free play time serves a variety of purposes and not just for activity time and development for the children. Teachers often use this time for administration and managerial duties as well as recover from the stresses of teaching. Research has begun to take a closer look at using this unstructured free play time as a way to help increase overall PA for children.

In a policy statement released by the American Academy of Pediatrics [3]: Free play should be encouraged with an emphasis on fun, playfulness, exploration, and experimentation while being mindful of safety and proper supervision. Pre-school-aged children should take part in unorganized play, preferably on flat surfaces with few variables and instruction limited to a show-and-tell format all while trying to make activity enjoyable for children.

The Coordinated Approach to Child Health Early Childhood (CATCH CEC) program helps increasing preschoolers' PA during school and has shown to increase vigorous indoor PA [17]. The CATCH CEC is a school-wide program designed to teach children to make healthy choices and encourage PA. While a proven plan, is it feasible to incorporate these types of programs into school curricula that are already overloaded? This is indeed a question that only each school can address. However, it may not be feasible as teachers need breaks throughout the day to plan and re-energize. Depending on the school situation is it too much to ask teachers to implement additional behaviors during down times? It very well might be, but can overall PA be increased if teachers can minimally become involved during unstructured play by only encouraging movement and not drastically change their downtime?

The purpose of this study was to determine if young children's PA increases during unstructured free play by minimally increasing teacher activity.

2. Method

2.1 Participants and Procedures

A university institutional review board approved all research prior to data collection. Child participants [mean age = 4.3 years, (control, m = 13, f = 15) and (experimental, m = 11, f = 13) and teachers (control = 5, experimental = 6)] were recruited from an on-campus lab school.

Students' PA was determined using the SOPLAY (system for observing play and leisure activity in youth-children). SOPLAY is a validated tool for directly observing PA and associated environmental characteristics in free play settings (e.g., recess and lunch at school). SOPLAY provides objective data on the number of participants and their PA levels during play and leisure opportunities in targeted areas [18].

SOPLAY is based on momentary time sampling techniques in which systematic and periodic scans of indivdiuals and contextual factors within pre-determined target areas (play-ground) are made. During a scan the activity of each individual is mechanically or electronically coded as sedentary (lying down, sitting, or standing), walking, or very active. Separate scans are made for females and males,

and simultaneous entries are also made for time of day, temperature, and accessibility, are usability, presence of supervision, presence and classification of organized activity, and equipment availability. Summary counts describe the number of males and females in any given setting and their activity levels (MVPA (moderate to vigorous physical activity) level). The instruments permits PA level comparisons to be made among different environments or with the same environment over different time periods. Energy expenditure rates (Kcal/kg/min) can also be calculated based on previously validate constants for each activity [18].

During the observational data collection was conducted from a distance as not to disrupt children. Consensus for observational data was reached by two researchers before entered. If consensus was not reached, a third reviewer was used to validate the data.

Adult activity was measured using an Actiheart. The ACTi heart is a compact, chest-worn monitoring device that records heart rate, IBI (Inter-Beat-Interval), and PA (METs) in one combined, light-weight waterproof unit. It is considered a new gold standard for measuring Activity Energy Expenditure: validated against Doubly Labeled Water. The ACTi heart has two clips which attach directly to standard ECG electrodes. One electrode is adhered at V1 or V2 (4th intercostal) and the second electrode is placed approximately 10 cm away on the left side at V4 or V5, although this placement can be adjusted to be comfortable for the subject. The number of R-waves detected is recorded in 15, 30, or 60-second epochs. Simultaneously, an internal accelerometer senses the frequency and intensity of the subject's torso movements.

Baseline data were obtained and recorded for students' MVPA and teachers' metabolic equivalents (METs). Students and teachers were then placed in one of two groups, control or experimental. The experimental group had the teachers encourage students to be active and move during the free play time. The control group did not change from their normal duties during free play time. Teachers were fitted with the ACTi heart before school and wore the device all day. The ACTi heart was removed at the end of the school day and refitted the next day.

3. Results

Baseline data were established first and group data were collected over the next three weeks at the free play/recess time periods. Students and teachers had two free play times each day 30 minutes each time for a total of 60 minutes of alloted time each day.

Coded data were entered using SPSS 23.0 and analyzed. Descriptive data for the activity level for both the children and adults are presented in Table 1. A MANOVA was performed for the dependent variables of MVPA for children and the metabolic equivalents (METs) for adults. The results were significant and are presented in Table 2.

Table 1 Activity data for participants.

Teachers	Mean METs
Baseline: $n = 10$	2.07
Control: $n = 5$	2.01
Experimental: $n = 6$	2.47**
Participants	MVPA time per 60 minutes
Baseline total	19 minutes and 3 seconds (31.75%)
Control total	** 18 minutes and 10 seconds (30%)
Male: $n = 13$	22 minutes and 10 seconds
Female: n = 15	14 minutes and 15 seconds
Experimental total	** 26 minutes and 40 seconds (44%)
Male: $n = 11$	30 minutes and 30 seconds
Female: $n = 13$	22 minutes and 10 seconds

** $p < 0.001$.

Table 2 MANOVA for MVPA and METs.

Effect	df	Wilks Lambda	F
Group	1	0.204	50.829**

4. Discussion

Results indicate that children's PA can be increased with little involvement from the teachers. The children improved their time spent in MVPA from 30% to 44% with the teachers' metabolic equivalents (METs) only increasing to 2.47. A MET of 2.47 is roughly equal to walking very slowly [19]. Thus the increase in MVPA by the child is achieved with minimal effort from the teacher. The rise in MVPA for the children to 44% represents 22 minutes of PA during free play in one session. Children receive two free play times during the day (one in the morning and afternoon), and thus the increase in MVPA would represent approximately 45 minutes of the recommended 60 from the American Heart Association. This increase, to 45 minutes at school, can now be combined with play time at home and children should be able to meet the specified guidelines set forth.

This increase is essential from both a health and administration point of view. Children can meet suggested PA while the teachers can utilize the downtime. Children need time to be creative and explore during play and teachers' use this free time for various activities including cognitive breaks or administrative duties. With the large numbers of children enrolled in preschool settings, these environments offer schools and centers the opportunity to engage children effectively in PA without extensive training for the teachers. The increase in PA can contribute to lowering the levels of inactivity in young children.

5. Limitations

Limitations to the study include the sample size of the study and the reliance of the accuracy of the ACTi heart monitoring devices. In addition, data were collected from a local lab school.

6. Conclusions

Although there is limited research in this area, the results of this study are encouraging and provide further evidence that raising the levels of moderate to vigorous activity in preschoolers which is an achievable goal in childcare settings. Free play has the potential to improve many aspects of the physical and emotional well-being of young children. Although the debate remains regarding free time versus structed activity, educators should embrace and encourage free play time as a time well-spent in engaging children's minds and bodies. Free play not only encourages movement through PA, but it promotes creativity, expression, as well as friendship possibilities for children. Additional research studies in preschool settings are needed to further document the results of these findings.

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