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Physical Activity of Preschool Children: A Review

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Summary

The aim of this study was to determine the level of physical activity of children during the period of stay in preschools, and associated factors. A literature search was conducted in databases Web of Science, Sport Discus, Science Direct, PubMed and Scopus. Inclusion criteria were: articles concerning physical activity of children aged 2-6 years in preschools. Seven original articles were included. The methods of evaluation were: accelerometers, pedometers and direct observation. In total, we analyzed 1485 children aged 2-6 years. Findings indicated on average 7.51 h/day and 7.22 h/day of stay of children in preschool, with the highest percentage of sedentary physical activity. Conclusion that children attending preschools spend most of the day in sedentary behavior. Activities initiated by adults tend to result in lower levels of physical activity among children. The space inside for games, outdoor games, markings on the floor to play, jumping and climbing equipment are some actions that increase the level of daily physical activity of children in such places.

Keywords: Child care; Environment; Epidemiology

Introduction

Children in preschool age should be encouraged to practice fun activities, games, exploring various physical and emotional experiences and environments, such as play and activities, including several actions, including; run, swim, jump, play, think, draw up plans, in insurance and supervised environments [1]. In this context, we can include physical activity, at early ages, being associated with positive effects on health, even in age from 2 to 6 years. A review with children from 1 month to 4.9 years, found the positive relationship between increased physical activity with favorable measures of adiposity, bone density and factors cardiometabolic [2].

The pattern of physical activity of children of 4 and 6- year old is characterized by an intermittent pattern of long periods of low activity intensity mixed with very short shots of vigorous activity, and jump or run, suggested as extremely important for the bone mineralization. Mean MVPA (moderate to vigorous physical activity) in preschool children is about 16 minutes per day. It seems that it takes at least twice that amount to the positive effects above bone mineralization [3].

In addition to these factors, the daily physical activity recommendations for preschool children are 60 minutes/day MVPA [4]. Thus, the chances of these recommendations for preschool children would be rare, even extrapolating for an all-day [3]. An aggravating factor is that parents think that children are highly active in preschool, and so offer fewer opportunities for active behavior in other environments, reducing the level of physical activity of children over day [5].

The change in the social scene, with the inclusion of women in the labor market, has contributed to the increase in the number of children enrolled in childcare centers, Children's Education Centers (CEIs) and Child Education schools. Therefore, the relationship between frequency of these institutions and the level of physical activity (LPA), has aroused the interest of researchers. The daily average stay of children in these institutions is around nine hours. So stop being paternalistic and become a place of education of children, and thus, as one of its actions to promote health [6].

In 2008, was published a systematic review of the physical activity of children of 2-6 years old, as well as meeting the guidelines for physical activity NASPE [4], 60 min/day MVPA [7]. This review showed a reflection of the participation of children in physical activities, and the importance of early intervention. The review involved 39 studies published between 1986 and 2007, representing 10,316 children in seven countries. The results of this review reported children MVPA for at least 60 min/day in 21 (54%) studies. Therefore, 18 studies (46%) children did not meet the daily recommendation of PA. The author points out that while a little over half of the studies meet the recommendations of 60 min/day physical activity, the preschool environment must provide structured and unstructured activities (60 min/day each). Thus, if the criteria of the review studies would use 120 min/day of physical activity, only 23% of the studies would be valid [7].

Another more recent [8] systematic review study aimed to analyze and provide a critical summary of evidence on the LPA by objective methods, within the preschool. The review only included studies with objective measures of physical activity in children 3-6 years old, preschools, in the period 2000-2008. The results found 12 articles, with 96 preschools and 1,900 children. The author concludes that the LPA, measured by objective methods, within the preschools were low, with high performance sedentary [8].

The findings of these studies review [7,8] described the physical activity of preschool children by different methods of measurement. However, do not report specifically activities in preschools, but during the day, at different times and environments. In addition, revisions have data from 1980 to 2008. Thus, there was the need for new studies to describe the current data on physical activity in children, specifically in preschool environment, as well as influential factors in that environment. This review was the proposal to provide data on the level

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of physical activity of children during the period of stay in preschools, as well as the factors that can influence, to reflect on the contribution of preschool environment in daily physical activity of children.

Methodological Procedures

Were conducted searches in the databases Web of Science, Sport Discus, Science Direct, PubMed, Scopus, in May 2013. According to the proposed objectives were selected in January 2008 articles to December 2013, referring to the physical activity of children aged 2-6 years during the period of stay in preschools. The descriptors used were: (preschool child OR child day care centers) AND (physical activity) AND (OR accelerometer direct observation OR pedometers OR HR monitoring). During the searches, filters for the year of publication (2008-2013) were used, type of publication (scientific papers), language (English/ Portuguese), totaling 893 articles found.

The first search yielded 893 articles identified in the aforementioned database. Subsequently, the reading of all the titles of the articles that resulted in the exclusion of 693 was held, and among these, 25 were repeated articles. Then proceeded to read the summary of the 200 eligible articles of which 118 were excluded. So they were read in full 82 articles where 75 were excluded.

For the review, they included studies with preschool children from 2-6 years old to assess physical activity only during the child's stay in preschool environment, regardless of the method of evaluation. Articles that used proxy-report as a method of evaluation of physical activity were excluded from the review to be answered by the parents of children, not just providing information about physical activity specifically in the preschool environment. The studies were analyzed by two evaluators and if there were discrepancies in the results, the evaluators they reviewed the criteria for inclusion in the final joint decision. Below in Figure 1, with the elapsed steps for conducting the review.

Results

The first stage of the search resulted in 893 articles found. After reading the titles, abstracts and full reading of the studies, it amounted to seven articles used for review (Figure 1). The seven original articles included in the review analyzed the physical activity of children of 2-6 years old, only during the period of stay in preschools, and used accelerometers, pedometers and direct observation and measurement methods of physical activity.

The descriptions and characteristics of the seven studies included in this review are summarized in Table 1.

Children spend an average of 22.5 to 30 hours per week in preschools [9,5], between 7.22 and 7.51 ± 1.14 horas hours [3,10,11] a day on average. Most of the time the children are inactive, predominantly SB, in all studies, with an MVPA around Week for 1 hour [12]. The time observed within the preschool was 87%, with a predominance of SB, 10% of the time was observed outside the classroom and the transition from outdoors to internal it was 3% [13]. The proportion of MVPA was 4% for children of 3 years old and 3.3% between 4-5 years old [10]. The average time spent on light to vigorous physical activity (i.e.: not sedentary activity) was 50 (± 17) minutes during the period of preschool [10]. Boys had a higher percentage of MVPA, and 3.2% against 2.5% in girls, p=0.01[5].

As for the choice of the sample, two selected by convenience [10,3]. In total, 91 preschools were analyzed, totaling 1485 children aged 2-6 years old. The physical activity of preschool children was part of the purpose of all studies. However, the relationship between physical space and the social environment within the preschools and predictors conditions of physical activity, comparison of steps per day with counts per minute, biological and demographic characteristics and comparisons between physical activities indoors and outside were some of the other objectives analyzed in the studies.

To measure the physical activity of preschool children, five studies used the OSRAC-P (Observational System for Recording Physical Activity in Children-Preschool) as direct observation instrument [9,5,13-15]. The accelerometer of ActiGraph mark GT1M was used in a study as the single instrument [3], and in two other studies combined with the use of pedometers Yamax SW-200 [10] and direct observation [14,15]. The cutoffs of Sirard et al. [16] and 15 second epoch were used in three studies with accelerometers. For direct observation method was used one to two days of observation and studies presented accelerometers five days of use.

Discussion

The review reports on the different levels of physical activity of children in preschool presented preschoolers with higher SB values that total physical activity (TPA). For activity in specific environments children spend more time indoors, averaging 323 ± 114 min/day versus 149 ± 115 min/day outdoors. In contrast, are more active in outdoors [13,15].

Physical activity levels showed changes between ages. The percentage spent in MVPA and sedentary time on, tended to decrease while the time LMPA tended to increase in older children [9,10,5,13].

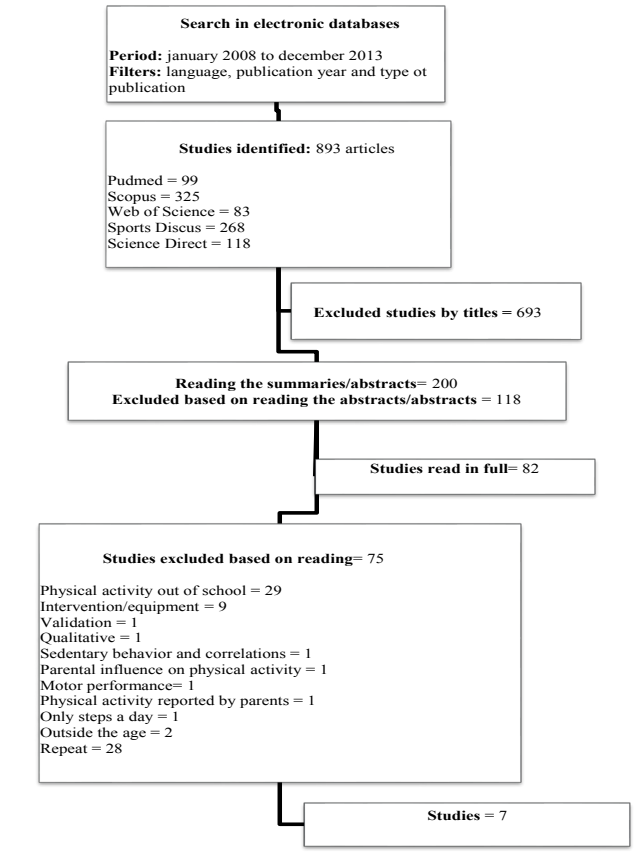

Figura 1: Organizational chart of the steps elapsed to perform the review.

Author	Sample	Study Objectives	Measure PA and descriptions	Results
Bower et al. [9]	3-5 years, 20 CC	Measure PA children in CC and associate with the physical environment	**Environment: EPAO**, **PA**: **OSRAC-P**, 2 consecutive days	**12% MVPA** **55% SB**
Pate et al. [12]	4.2 ± 0.7 years, 24 preschools, 438 preschoolers, 50% boys	Describe PA in preschool and correlate demographic factors	**PA**: **OSRAC-P**, 10 days	**Active=**13.9%, **MVPA**=3.4% **LPA**=10.5% **SB**=83.4%. **MVPA**:3.2% boys x 2.5% girls (p=0.01)
Brown et al. [13]	24 preschols, 476 preschoolers inside (4.2 ± 0.7years) e 372 preschoolers outside (4.2 ± 0.6years)	Describe PA of preschools, environment and social life and determine predictive contextual conditions MVPA in outdoor periods	**PA**: **OSRAC-P**, 5-6 hours	**MVPA** Inside: 1% Outside: 17% **LPA** Inside: 5% Outside: 27% **SB** Inside: 94% Outside: 56% More active boys.
Pagels et al. [10]	4.5 (3.4-5.7) years, 4 preschools, 2 Sweden e 2 NC, 55 preschoolers, 28 boys	Measure and compare the PA levels using pedometer and accelerometer for preschool	**Accelerometer:** ActiGraph GT1M -cutoff of Sirard et al., (2005) and epoch 15 sec. **Pedometer:** Yamax SW-200. 5 days	7.22 h/day preschool 7.313 steps/day **Boys/Girls** **Counts/day** 317.799/281.040 **Steps/day** 8.385/6.202 **MVPA min/day** 16.6/17.4 **LVPA min/day** 50/46 **Sdentary min/day** 396/397 **r= 0.67**-counts and steps/day **r=0.76**-LVPA and steps/day
Alhassan et al. [14]	4.1(± 0.8) years,10 preschools, 34 classrooms, 315 preschoolers	Describe PA in the baseline of CG and IG of STEP and the biological characteristics and demographic of the participants	**Accelerometer:** ActiGraph-GT1M - cutoff of Sirard et al., (2005), epoch 15 sec., 5 days, 7:00a.m.-16:30p.m., during the preschool **Direct observation: OSRAC-P**, 1 day	**Accelerometer** **MVPA (average/day)** 6.40% **LPA (average/day)** 18.60% **SB (average/day)** 74.20% **Direct observation: MVPA (average/day)** 33.60% **LPA (average/day)** 40% **SB (average/day)** 24.50%
Raustorp et al. [11]	4.3 (3.33-5.58) years, 4 preschool, 2 Sweden e 2 NC, 50 preschoolers, 26 boys	Evaluate and compare LPA indoor and outdoor, and compare PA among preschool Swedes and Americans, And between boys and girls	**Accelerometer:** ActiGraph GT1M – cutoff of Sirard et al., (2005), epoch 15 sec. 5 days, morning and afternoon	471 min/day in the preschool **Indoor * ł l/Outdoor * ł** 323min/149min **Counts-indoor*/Count-outdoor** 493min/1098min **MVPA indoor/outdoor** 2.3 %/7.3% **LPA indoor*/outdoor** 8.5 %/17.6% **SB indoor*/outdoor** 89.1 %/75.2 % **Increased PA outdoor:** SWE:47% x USA:18%
Gubbels et al. [15]	2.6 years, 9 preschools, 175 preschoolers, 50.9% boys	Describe PA in preschoolers of 2-3 years in the preschools, and associate with environment and facilities	Environment: **EPAO**, PA: **OSRAC-P**, 2 days 1 day morning, another afternoon	**MVPA** Indoor: 5.5% Outdoor: 21.3% **SB** Indoor: 59.4% Outdoor: 31.2%

EPAO: *The Environment and Policy Assessment and Observation;* **OSRAC-P***: Observational System for Recording Physical Activity in Children-Preschool;* **STEP**: *Short bouts of Exercise for Preschoolers;* **CC**: Childcare Centers; **PA**: physical activity; **MVPA**: moderate to vigorous physical activity; **LPA**: light physical activity; **LVPA**: light to vigorou physical activity; **LMPA**: light to moderate physical activity; **SB**: sedentary behavior; **LPA**: level of physical activity; **NC**: North Caroline; **SWE**: Sweden **CG**: control group; **IG**: intervention group; *significant differences between USA and SWE (p<0.001); ł significant differences between USA and SWE (p<0.001) for boys and ł significant differences between USA and SWE (p<0.001) for girls.

Table 1: Description and characteristics of the seven studies included in this review of the physical activity of children in preschools.

One factor to consider for older children have lower MVPA values is the greatest time in the classroom, in educational activities that younger [5].

The following results will be discussed by topic: measuring instruments and physical activity; internal environment, physical activity and influencing factors and external environment, physical activity and influencing factors.

Measuring instrument and physical activity

Of the seven studies included in the review, three used accelerometer [10,3,14] as a measure of physical activity instrument, and in two used pedometer and direct observation together [10,14]. Other studies used direct observation as a tool both for evaluation of physical activity of children and for the environment [9,5,13,15].

Regarding the instrument to measure physical activity, studies using direct observation [9,5,13,15] report higher MVPA values when compared to studies using accelerometer [10,3,14], and the variation of 1% values 33.6%. For SB, studies that used direct observation [9,5,13,15] reported lower values compared to accelerometer [10,3,14], ranging from 31.2% to 94%.

Relevant factors on the discrepancy of values found for the intensity of physical activity, in addition to the different instruments are criteria for the use of the instruments. Within the studies using direct observation [9,5,13,15] as a method of evaluation of physical activity, time of observation of children ranged from hours to days, or only during specific activities. The findings demonstrate the lack of common criteria for measuring and evaluating physical activity and constitute a limitation regarding the methods and measures of physical activity assessment. We should be cautious when comparing studies that assess physical activity, even when using the same evaluation method.

Internal environment, physical activity and influencing factors

About 84% of the intervals observed indoors in preschool, are characterized by sedentary behavior [13]. The main activities reported within the preschools, inactive nature were: nap (99% sedentary) large groups (91% sedentary), internal transition (81% sedentary), lunch (97% sedentary) and handling activities (91% sedentary) [13]. Among the factors that can influence the behavior of children active in the internal environment of preschools, the routine stands out the use of some equipment and size of the area available for play as influents [3,15].

When compared preschools in two different cities, significantly higher percentage of MVPA were observed in Malmo, 2.9% against 1.8% in Raleigh with $p<0.001$. This difference between preschools was explained through the routine of children. In Raleigh, the activities were related to rules and routines, led by adults, so the children were stopped or inhibited in some activities or behaviors. Additionally, children of preschool Raleigh napped or kept in a sedentary activity, between 1-3 pm, most of the time with respect to the center of Malmo [3].

Another influential factor in the behavior of children in the indoor were the equipment. The children were significantly more active in the domestic environment when equipment was jumping, pushing, pulling and portable slides. And were significantly less active in the presence of sand and water toys, and construction toys as little horses [15]. The size of the indoor play area is also a factor that influenced the preschool activity and was positively correlated with the physical activity levels of children ($r=0:17$, $p<0.001$), being more active when the internal play area it was larger [15].

External environment, physical activity and influencing factors

The activities carried out on the outside of the preschools, only 10% of the time are characterized active behaviors [3], and the most common activities were [13]: walk (7% MVPA), race (100% MVPA), crawl (4% MVPA), jump or jump (56% MVPA) and scale (29% MVPA) [13].

As for the possible influential factors in the active behavior of preschool children in the outdoor of preschools, we can highlight, as well as to the indoor, the use of some equipment and size of the area available for play, contexts and initiators of activities were reported as factors influencing the active behaviors in that environment [3,13,15].

Children were significantly more active in the presence of fixed equipment, jumping, markings on the floor to play, climbing frames, tunnels and sandbox [15] boxes. In contrast, portable waterslides and outdoor rocking equipment were negatively associated with the level of physical activity of children [15].

The size of the area available for play is another influential factor in the active behavior of preschoolers. The size of the outdoor park was significantly and positively correlated with the level of physical activity of children [15]. The most common contexts associated with LVPA in the outdoor were space using balls and objects (26% MVPA), open spaces (23% MVPA), toy run (14% MVPA), fixed equipment (13% MVPA) and activities sociodramatic (10% MVPA) [13].

As for the activities of initiators during outdoor play, activities initiated by children were frequent and associated with more MVPA intervals than when activities are initiated by adults [13]. Regarding the environment for physical activity, the assessments of the physical space of preschools by direct observation, higher total scores consecutively reported higher values of MVPA in relation to low scores [9]. This fact demonstrates the positive influence of the environment conducive to the practice of physical activity in preschools.

Conclusion

In conclusion of this review study, children who attend preschools, spend most of the day in sedentary behavior. Activities initiated by children tend to result in higher levels of physical activity. The space inside for games, outdoor games, markings on the floor to play, jump from climbing equipment are some possible actions to be taken for increasing physical activity these places.

Should avoid riding toys/wheelies in small spaces, among other static toys. The use of slides swings and sandboxes that must be examined with caution as they may limit the level of physical activity of children [15]. Topics related to physical activity, as well as teacher training, and internal policies for physical activity, deserve greater attention regarding the best occupation and best stocks in preschools [13,15].

One of the limitations of this review was limited was the inclusion of studies with different methods of measurement of physical activity. However, this fact is very common as to compare results of physical activity not only among preschool children, as in studies that measure habitual physical activity, which exposes the need for clarification in relation to the study objectives with the criteria and methods to be used. Another limitation is the language to be displayed only in English studies.

Intervention studies conducted to evaluate possible strategies

increase the physical activity of preschool children, demonstrate the need for more research to verify the possible physical, environmental and political influents [15,16]. One should take into account the fact that the greater accumulation of MVPA during play of gross motor skills usually occur during the first half of play and represents a small fraction of the amount of time that preschool children engage in MVPA. Based on this evidence, the actions for higher performance assets of these preschool should investigate the possibility of exposing them to more short bouts of physical activity structured along the preschool day [14].

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