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What is the Relationship between Outdoor Play Breaks and No Play Breaks on Postural Balance? A Systematic Review

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ABSTRACT

The growing trend of sedentary behaviors in children has been linked to less play and physical activity opportunities. In addition, schools have traded physical education and recess for more classroom content time. A rising concern of children moving less daily is the development of postural balance deficiencies. These deficiencies have shown to decrease motor competence and increase non-fatal falls and injuries at earlier ages. A better understanding of play interventions and their impact on a child's postural balance may lead to motor competence improvement and a decline in non-fatal falls. **Purpose**: To conduct a systematic review on existing literature related to outdoor play breaks compared to no play breaks and how it affects postural balance of 3–14-year-old children. **Methods**: Three Electronic databases (PubMed, CINHAL & Google Scholar) and trial registers were searched for published and unpublished studies. All articles from the database inception to the present, published in English, were included. The inclusion criteria involved studies focused on 3–14-year-old school-aged children with typical or atypical developmental conditions. The intervention of interest was outdoor, active play breaks versus no play breaks. After duplicates were removed, titles and abstracts of the retrieved articles were reviewed against the inclusion criteria. Full text articles remaining were then reviewed in detail against the inclusion criteria to determine eligibility for the systematic review. **Results:** Out of 286 articles identified, two studies met the inclusion criteria. Both articles were cross sectional studies that evaluated outdoor play breaks versus no play breaks and postural balance among 3–14-year-old children. A total of 358 children were involved in the two studies. The outdoor play exposure intervention was described in both studies as outdoor recess, but two different motor coordination measurement tools were used to assess postural balance. When the studies were evaluated for quality, it was determined that both measurement tools were reliable and valid in evaluating postural balance and functional motor competence in 3- to 14-year-old school children. **Conclusion:** Despite the limited evidence, the findings suggested outdoor physical activity does have a positive impact on postural balance and functional motor skills (FMS). Both articles demonstrated the importance of incorporating at least 20 minutes of MVPA daily and its impact on how children perform FMS and postural balance.

Keywords: play, recess, children, sedentary, postural balance

1. INTRODUCTION

According to the CDC, an estimated 9.2 million children annually have visited the emergency room for an unintentional injury. Approximately 2.8 million of those children (33%) who visited the emergency room were due to injuries from a fall. For the past ten years, falls have been the leading cause of non-fatal injuries for those under 15 years old (CDC, 2019). Children are more often victims of falls resulting in injury because of motor deficits due to the growing trend of sedentary behaviors (CDC, 2021).

The growing trend of sedentary behaviors in children has been linked to fewer physical activity and play opportunities, especially in schools. Children spend more than eight hours daily in a school setting which should be the main place where they are provided opportunities to play and be physically active (Gray, 2017). Unfortunately, school personnel over the past few years have reduced the amount of time physical education (structured motor skill development) and recess (structured or unstructured play), are offered in order to focus more on academic outcomes through classroom time (Rhea, 2016). As a result, child advocates are very concerned about the motor deficits related to sedentary behaviors and inactivity as children develop.

Developmentally, children need access to play regularly throughout their childhood experiences (Spencer et al., 2021). Unstructured play is an essential part of childhood as it facilitates developmental outcomes, such as gross motor skills, cognitive, and social and emotional development (Dankiw et al., 2020). School recess, in its most basic form, is designed to be unstructured and outdoors, allowing children to engage with their natural environment and adapt to their surroundings as they develop necessary motor skills, learn how to fall safely, and socialize with others (Pellegrini & Bohn-Gettler, 2013). In addition, since children naturally engage in physical activity through outdoor unstructured play, gross motor skills are practiced naturally through activities such as running, climbing, jumping, and adapting to new surfaces. In order to complete gross motor skills in different environments, it involves precise movement of muscles with the intent to perform a specific task also known as Functional Motor Skills (FMS). Children are more likely to initiate these spontaneous movements repeatedly, unknowingly training their muscles to perform gross motor movements, i.e., FMS (Sutapa et al., 2021). Ultimately, the goal is these spontaneous movements will create strong postural balance so when a child does stumble or fall, the motor response will prevent injury. What is not known is the interaction between the outdoor play experience and the child's overall postural balance ability. Therefore, a better understanding of how unstructured, outdoor play versus no play impacts a child's postural balance is needed to show whether there is a decline in non-fatal falls and injuries.

Purpose: To conduct a systematic review on existing literature related to outdoor play breaks compared to no play breaks and how it affects postural balance of 3–14-year-old children.

Definition

Postural Balance: The act of maintaining, achieving, or restoring a state of balance during any posture or activity (Ludwig et al., 2020).

2.METHODS

The methods for this systematic review are based on the Johanna Briggs institute systematic approach for systematic reviews (Tufanaru et al., 2020).

2.1 Search Strategy

The text words contained in the titles and abstracts of relevant articles, and the index terms identified to describe the articles were used to develop a full search strategy initially in MEDLINE (PubMed). The search strategy, including all identified keywords and index terms, were then adapted for each included information source. The following search terms used relevant Boolean Operators and MeSH terms identified for each individual database: 'child or children,' 'adolescence,' 'child development, 'play,' 'outdoor play,' 'nature play or natural,' 'no play,' 'sedentary behaviors,' 'postural balance,' 'postural control,' 'equilibrium,' 'balance,' and 'functional motor skills.' The search was limited to humans and the English language.

The following electronic databases were searched: MEDLINE, CINAHL, GOOGLE SCHOLAR, The Cochrane Library, and The Joanna Briggs Institute. All databases were searched from inception to September/October 2021, which yielded 286 records (Table 1). Hand searching relevant journals was also conducted including *Journal of Clinical Medicine*, *Journal of Sports Science and Medicine; International Journal of Early Years*; *Journal of Nutrition, Metabolism, and Cardiovascular Diseases*; *Journal of Children, Youth, and Environment;* and the *Journal of Physical Therapy Science*. Hand searching is the task of searching through published manuscripts for reports which are not indexed in the major electronic database like MEDLINE and CINAHL (Cochrane Handbook for Systematic Reviews of Interventions version 6.3, 2022).

Table 1 (Search Strategy)
Search Strategy: CINAHL Complete (Search Completed October 30, 2021)

Search	Query	Records retrieved
#1	Balance* OR Postural Balance OR Dynamic Balance AND Children AND Play	286
No date limits; limited to English language.		

2.2 Study Selection

Literature selection was conducted using a three-stage process. After conducting a cohesive literature search, the primary reviewer collated and uploaded all identified citations into EndNote X9, Research Smarter/ 2018 (Clarivate Analytics, PA, USA) and duplicates were removed. Next, the primary reviewer screened the titles and abstracts against the inclusion criteria. All relevant studies were then retrieved in full, and their citation details were imported into the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI; Joanna Briggs Institute, Adelaide, Australia). The full text of these selected citations was assessed in detail against the inclusion criteria by two of the review authors independently. Finally, the eligibility of each full independently reviewed text article was compared for any differences between reviewers and resolved through discussion.

2.3 Methodological Quality

The two independent reviewers critically appraised the eligible studies using standardized critical appraisal instruments from the Joanna Briggs Institute for experimental and quasi-experimental studies. Following critical appraisal, studies not meeting the quality threshold were excluded. Most often, articles were excluded at this level because the intervention or outcome was ultimately determined not to meet inclusion criteria.

2.4 Data Management

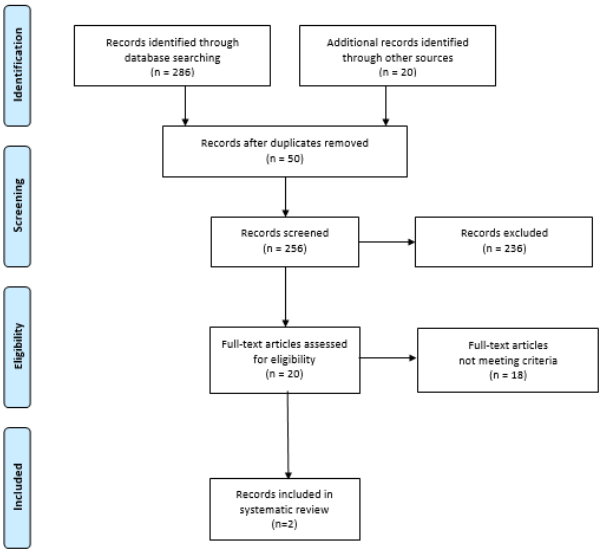
A meta-analysis of included articles was not feasible due to the lack of comparable value of the evidence. Though both studies used similar methodological designs and evaluated active play breaks versus sedentary or no play breaks for children, they used different evaluation tools and age ranges which could present a risk of bias in the expected outcome. A narrative analysis for both studies was, therefore conducted in this systematic review.

3. Results

3.1 Study Selection

The PRISMA flow diagram (Figure 1) for study includes the inclusion and exclusion criteria. The search identified 286 studies from the databases and other sources. A total of 20 studies were excluded after full text review: 2 for ineligible population, 10 for ineligible interventions, 3 for ineligible settings, and 5 for ineligible measurement outcomes. After removal of 50 duplicates (n=236) and screening of records, two studies were ultimately deemed eligible for inclusion in the review.

Figure 1 PRISMA Flow Chart



3.2 Findings

The two studies meeting inclusion criteria were conducted in Spain and Northwestern England. Foweather and colleagues (2021) did a quasi-experimental design study to evaluate play behaviors and functional motor skills (FMS) during preschool recess. The study included 12 preschools in urban northwestern England with a total sample of 240 children (age range 3-5 years old) who received parental consent to participate. The Children's Activity and Movement Assessment Study (CHAMPS) and Children Motor Skill Protocol (CMSP) (Williams et. al, 2008) were used to assess FMS, which directly correlates to postural balance skills in children. The assessments evaluated six locomotor tasks: running, board jumping, leaping, hopping, galloping, and sliding. The study divided participants into two play behavior groups: those assessed as an active group, described as children playing

active games outside) and those assessed as a sedentary group, defined as inactive either inside or outside. Children categorized as inactive did not participate in outdoor play, rather, they stayed inside during recess with no active play experiences included. Inactive children who did go outside during recess did not participate in any activities, but rather sat and observed from a distance. The findings revealed that non-locomotion and sedentary behaviors negatively impacted children's motor skills more than children who participated in active outdoor play ($p<.05$). Furthermore, the outdoor play group was observed most often walking and engaging in moderate and vigorous physical activities with peers. Males and females were also similar in the types of physical activities or sedentary behaviors recorded. Finally, a significant association was found between FMS and activity types ($p<.05$). For example, children engaging in active outdoor play with loose parts or interacting with playground equipment positively impacted their balance scores. The researchers supported that participating in specific types of play behaviors outdoors during recess was potentially crucial for FMS development in young children between 3-5 years old.

Garcia-Soidan et al., 2020 completed a cross-sectional study to evaluate the effect of physical activity practice on postural control in school-aged children. The 118 study participants involved typically developing children between the ages of 8 and 12 in Pontevedra, Spain. The participant's inclusion criteria were the ability to walk and perform functional motor skills (FMS) during physical activity. If they had any injuries, they were excluded from the study. The body has to be able to demonstrate postural balance in order to assess whether physical activity impacts FMS development. Postural balance is assessed best by evaluating static and dynamic balance. Static balance was assessed by balancing on one leg with eyes closed (OLCE) and again with eyes open (OLOE). Dynamic balance was assessed by two different methods. The first method was balancing on one leg on a foam mat with eyes open to induce the appearance of dynamic balance reactions (DOL). The second method was having each participant walk a normal speed towards a cone located 10 meters away, then they were instructed to walk around the cone and return to the starting point (NG). The researchers used an accelerometric process (accelerometer and telemetry connectors) to evaluate static and dynamic balance skills in the vertical axis (transverse plane), sagittal axis (coronal/frontal plane), and perpendicular axis (anteroposterior plane). They also characterized participants into similar groups as the first study. The active group participated in outdoor play experiences, while the inactive group engaged only in sedentary behaviors. The researchers found outdoor play had a positive relationship with children's static and dynamic balance skills ($p<0.001$). In addition, sedentary behaviors during the play breaks harmed students' functional motor skill competence.

4. DISCUSSION

The purpose of this systematic review was to examine the impact of outdoor, active play breaks versus no play breaks on 3–14-year-old children's postural balance, from the limited body of articles that met the inclusion criteria (n = 2). Despite the limited evidence, the findings suggested outdoor physical activity does have a positive impact on postural balance and FMS. Both articles demonstrated the importance of incorporating at least 20 minutes of MVPA daily and its impact on how children perform FMS and postural balance.

There is a slight discrepancy between the types of activities children engaged in while outside and how the activities that were chosen directly impacted their postural balance skills. The results from the cross-sectional study (Garcia-Soidan et al., 2020) revealed that outdoor active play breaks for girls and boys are important because both sexes exhausted lower accelerations when performing static and dynamic balance tasks, whereas sedentary boys and girls showed a decline in FMS competence. Furthermore, in this study, girls naturally performed static balancing tasks better than boys ($p<.01$). Even when the boys were given more practice time, the researchers observed the girls sustained a better base of support during the two static balance tasks than the boys. Although sex differences with static balance were found, the researchers needed to examine dynamic balance as well to identify whether postural balance was achieved better with physical activity or without. The dynamic balance skills required were strength, agility, and speed to create FMS to uphold one's posture. Active boys had higher accelerations than sedentary girls in the gait test ($p<.05$), confirming physical activity from play affects the state of postural control rather than engaging in sedentary behaviors. Therefore, allowing children to engage in outdoor play will help them develop a better base of support. In addition, the unstable, outdoor surfaces presented challenges which was good because it enhanced their movement patterns and overall postural control ability compared to no play breaks at all.

Both articles had smaller, location specific sample sizes so it is hard to generalize to other countries. Other studies are needed to provide postural balance recommendations for children to follow. Future research should focus on other unstructured, outdoor play studies of differing physical activity amounts daily to identify functional motor skill benefits by gender and age. Both studies evaluated outdoor play up to 20 minutes at a time. This is the standard amount of time of recess that children receive during a traditional school day. Examining children's postural balance skills when children receive no recess, 20 minutes, 45 minutes, or 60 minutes of recess could be very beneficial to identify gender and age postural balance and

motor skill differences. This evidence has not been determined through the two studies examined. Standardizing an assessment tool could also be helpful in analyzing across studies with a meta-analysis.

4.1 Implications

While there was evidence that outdoor physical activity affects postural balance more positively for children who receive play breaks compared to children who do not receive play breaks, there was a significant lack of literature examining MVPA and postural balance in children. Throughout the literature search, we found that multiple articles discussed one intervention but did not examine the difference between outdoor play and no play/sedentary behaviors. With the growing focus on academics and the decline of recess in schools, there is a need to evaluate how children's postural balance skills are impacted.

We had to exclude many articles due to limited assessment tools that targeted gross motor skills for children considered to be normally developing. Some of the tools included were CHAMPS**,** CMSP, accelerometers and telemetry connectors. Most of the studies that evaluated gross motor skills evaluated only children with physical or mental impairments that directly impacted their motor coordination skills. While these studies are informative and are needed, there is also a need for assessment tools that evaluate children who have no physical or mental impairments in order to establish typically developing physical activity norms.

The second recommendation is to design studies that use alternative gross motor assessments evaluating typical and atypical children. Typical is defined as children with no physical or mental impairments and atypical is defined as children with physical or mental impairments that hinder their motor coordination competence. Because schools typically consist of a variety of children with diverse behavioral and growth needs despite being the same age and grade level, establishing an assessment tool that evaluates gross motor skills will help researchers, practitioners, and physical educators better meet the needs of children regardless of developmental levels.

Lastly, there is a need to generate broader terms or concepts within the play literature. Play is a term that has been around for ages but has consistently grown to include terms used in everyday terminology. Because of this "familiarity" with the term play, researchers are not precise in defining how they use the term in their research studies. These terms need to be addressed specifically within the research literature to help researchers establish a precise understanding of what type of play children may engage. For example, unstructured play would be a beneficial term to use because children can engage in active, outdoor play without participating in organized games or playing with equipment. Children can play in different forms like dancing, running, jumping, doing cartwheels or somersaults to evoke

preciseness on what the children are engaging in outdoors. Expanding the play terminology could also help researchers, practitioners, school officials, and physical educators develop studies to identify how outdoor play within the school system can benefit children outside the classroom. Establishing the benefits of outdoor play can help critical stakeholders optimize a balance between attention to scholarship as well as gross motor development in children during these critical years of growth.

4.2 Limitations

While this review used a comprehensive and robust methodology, there were still some limitations. The number of children included in sedentary play breaks compared to the children who were receiving outdoor play breaks were unequal, providing a bias towards the outdoor play groups. The students were allowed to self-select which activity level they associated with, active play or sedentary behaviors. In one study, parents completed a questionnaire that specified the amount of time their child participated in physical activity. If students did not engage in physical activity that would demonstrate the realization that children choosing to engage in sedentary activities would need to be encouraged or enticed to participate in outdoor play activities. The main concern is the lack of literature comparing outdoor activity to sedentary or no play activities in school aged children. Both studies selected were from different countries, therefore, more studies are needed globally including the United States to help build a broad body of knowledge of the impact plays breaks can have on children's postural balance. The studies that were included did not thoroughly describe the population, their methodology, or findings. Researchers need to thoroughly report critical information such as the type of play children are engaging in and its effect on their postural development. There also needs to be more of distinction between the types of activities male and female children naturally gravitate towards, in an effort to encourage more inclusive and intersectional play. Finally, researchers need to provide more statistical analyses that can support the methodologies being used.

5. CONCLUSIONS

In conclusion, there is a lack of evidence and literature supporting the differences between children engaging in outdoor play breaks versus no play breaks and the effects it has on a child's postural balance. Only two articles were found supporting the purpose of the review and there remain some concerns about the quality of the current evidence base. However, both studies provided information that warrants the need to further encourage outdoor play breaks. They suggest that if children are allowed to engage in outdoor play, they have a better chance of enhancing their overall postural balance ability because of the natural unstable surfaces and motor actions

performed during their play breaks like running, jumping, and climbing that challenge their support base. It is suggested that researchers need to generate more studies that detail the benefits of outdoor play breaks for parents, school districts, children, and other types of researchers. In addition, an expansion of the play terminology would be helpful for researchers to identify what type of play behaviors children engage in when they are outdoors. For example, using terms like structured or unstructured play will help researchers be able to justify what type of play impacts postural balance most. Finally, there should be an emphasis on discovering or developing an inclusive assessment tool that allows researchers to evaluate children who present with mental or physical impairments and normally developing children to allow for a more comprehensive look at the impact of play breaks on all children. Future studies should develop play interventions that allow children to experience more outdoor play breaks within a school day. Implementing this type of intervention would allow for an evaluation of the difference between outdoor play breaks versus no play breaks with varying amounts of outdoor play to discover the postural balance benefits.

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6.2 Conflict of Interest

The authors declare no conflicts of interest.

6.3 Contribution of Authors

DCP wrote a significant portion of the manuscript, collected, and analyzed data. DR, mentor and director of the LiiNK Project, assisted with writing of the manuscript and providing edits/revisions throughout the process. KB assisted with the overview of the review methodology and assisting with providing edits/revision.

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