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EFFECTS OF PLAY-BASED CIRCUIT TRAINING ON LOCOMOTOR SKILL DEVELOPMENT IN PRESCHOOL-AGED CHILDREN

Andi Amry Yahya[1], Awaluddin[2], Muh. Ali Akbar[3]

[1]STKIP YPUP Makassar, Physical Education, Makassar, Indonesia
[2]Universitas Negeri Makassar, Physical Education, Makassar, Indonesia
[3]Universitas Sembilanbelas November, Physical Education, Kolaka, Indonesia

*Coressponding Author. Email: awaluddin@unm.ac.id
*Email Author: : andiamryyahya@stkip.ypupmks.ac.id, awaluddin@unm.ac.id, aliakbar@usn.ac.id

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Abstract
Purpose This study aimed to examine the effectiveness of an integrated play-based circuit training model in improving locomotor movement skills among preschool-aged children. The need for structured and engaging physical activity models in early childhood education is increasingly recognized, especially given rising concerns over declining motor competence in young children. Materials and Methods A quasi-experimental design was employed involving 40 children aged 5–6 years, who were randomly divided into an experimental group (n = 20) and a control group (n = 20). The experimental group participated in an 8-week intervention combining circuit-based motor activities with playful elements, conducted three times a week. The control group engaged in routine unstructured physical activities. Pre-test and post-test assessments of locomotor skills were conducted using the Test of Gross Motor Development–2 (TGMD-2). Statistical analysis included paired and independent t-tests to evaluate within-group and between-group differences, respectively, with significance set at $p < 0.05$. Results: The experimental group demonstrated a statistically significant improvement in locomotor skills compared to the control group. Mean post-test scores increased more markedly in the experimental group, indicating the effectiveness of the integrated model in enhancing movement competence. Conclusions: The findings support the hypothesis that a play-based circuit training model is effective in improving locomotor skills in preschool-aged children. This approach offers a practical, enjoyable, and developmentally appropriate method for early childhood educators to support motor development. Future research should explore broader implementation and long-term impact on physical literacy.
Keywords: Locomotor skills, Play-based learning, Circuit training, Preschool, Motor development

INTRODUCTION

Early childhood is a crucial period for motor development, as fundamental movement skills acquired during this stage form the basis for lifelong physical activity and healthy lifestyles. Motor competence developed in early years has been linked to higher levels of physical activity, better physical fitness, and positive health outcomes in later childhood and adolescence. Therefore,

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In recent years, changes in lifestyle patterns have led to a reduction in spontaneous physical activity among young children. Increased screen time, limited outdoor play, and constrained movement opportunities in educational settings have contributed to lower levels of motor skill competence. These trends highlight the need for structured yet developmentally appropriate physical activity programs that can effectively stimulate motor development while maintaining children's interest and motivation.

Locomotor skills such as walking, running, jumping, and hopping are foundational motor abilities that support children's physical, cognitive, and socio-emotional development. The early childhood period, especially between the ages of 5 and 6 years, is a critical phase for the development of these skills. However, a growing body of literature has raised concerns about the decline in physical activity levels and motor skill proficiency among preschool-aged children, largely due to sedentary lifestyles and limited structured movement opportunities in early childhood education settings (Logan et al., 2012; Robinson et al., 2015).

Recent studies have attempted to address this issue through structured motor intervention programs. Among the most promising are circuit training models that integrate various motor tasks in a sequential manner to develop strength, endurance, and coordination. Meanwhile, play-based approaches are widely accepted for engaging children in physical activities in a developmentally appropriate and enjoyable way. Despite the growing body of research supporting both methods independently, there remains a gap in understanding the potential synergistic effects of integrating circuit training with structured play to enhance locomotor skills in early childhood.

Some researchers argue that circuit training may be too structured or physically demanding for preschool-aged children, potentially limiting engagement and long-term benefits (Best, 2010). On the other hand, play-based methods, while effective in promoting participation, are often criticized for lacking targeted outcomes and measurable progress. This raises the central question: Can a hybrid model that combines the structure of circuit training with the motivation and enjoyment of play result in greater improvements in locomotor development?

Building on these perspectives, this study proposes the integration of play and circuit training as a comprehensive movement model tailored for children aged 5–6 years. The underlying hypothesis is that such an integrative approach will lead to significant improvements in children's locomotor abilities compared to traditional unstructured physical activity programs.

The purpose of this study is to examine the effectiveness of a play-based circuit training model in improving locomotor movement among preschool-aged children. This research contributes to both the theoretical discourse on motor development in early childhood and practical applications for curriculum development in early childhood education settings.

METHODOLOGY

This study involved a total of 40 preschool-aged children (20 boys and 20 girls) aged 5–6 years from two early childhood education centers in South Sulawesi, Indonesia. The participants were selected using purposive sampling based on inclusion criteria: (1) aged between 5–6 years, (2) had no physical or neurological impairments, and (3) had obtained parental consent. The children were randomly assigned into two groups: the experimental group (n = 20), which received the play-based circuit training model, and the control group (n = 20), which continued with their regular unstructured physical activity routines.

The study followed a quasi-experimental design with a pretest-posttest control group approach. The research was conducted over a period of 8 weeks, with sessions held three times per week, each lasting 30–40 minutes. The experimental group participated in a structured motor learning program that integrated play-based circuit training, which included locomotor tasks such as running through cones, jumping over hurdles, hopping in rings, and galloping between markers. Each activity station emphasized a specific locomotor movement and incorporated playful elements such as storytelling, music, or game-like challenges to maintain engagement. The control group engaged in typical unstructured physical activities provided by their school, such as free play or general movement time, without any targeted instruction on locomotor skills. The experiment was carried out in three stages: Initial Assessment (Pretest): Locomotor skills were assessed using the Test of Gross Motor Development–2 (TGMD-2). Intervention Phase (8 weeks): The experimental group followed the integrated circuit-play model under the supervision of trained instructors. Final Assessment (Post-test): The same TGMD-2 assessment was administered to measure changes in locomotor performance.

All collected data were analyzed using SPSS version 25.0. Descriptive statistics (mean, standard deviation) were used to summarize participant characteristics and locomotor scores. The Shapiro-Wilk test was conducted to assess the normality of data distribution. The Levene's test was

applied to check the homogeneity of variances. To examine the effect of the intervention, an independent samples t-test was used to compare post-test results between the experimental and control groups. The paired samples t-test was employed to determine within-group differences between pre- and post-tests. A significance level of $p < 0.05$ was set for all statistical tests.

RESULTS

The results of the study are presented in two tables: the first summarizes the locomotor scores for both experimental and control groups, while the second displays the results of statistical analyses.

Table 1. Summary of Locomotor Scores

Group	Test	Mean	Standart Deviation
Control	Post-test	61.77	4.81
Control	Pre-test	59.87	4.1
Experimental	Post-test	66.35	5.2
Experimental	Pre-test	59.14	4.8

The experimental group showed a marked improvement in locomotor skills after the intervention. The mean pre-test score for the experimental group was lower than the post-test mean score, indicating significant progress following the application of the play-based circuit training model. Similarly, the control group also exhibited an increase in their post-test scores, though the improvement was less substantial compared to the experimental group.

Table 2: Statistical Test Results

Comparison	T-Value	P-Value
Experimental Pre vs post	11.09	9.68
Control Pre vs Post	2.55	0.019
Experimental vs Control (Post-test)	2.88	0.006

A paired sample t-test for the experimental group revealed a statistically significant improvement in post-test scores compared to pre-test scores ($t = 11.09$, $p < 0.001$). The control group also showed a significant increase ($t = 2.55$, $p = 0.019$), though to a lesser degree. Furthermore, an independent sample t-test comparing post-test scores between the experimental and control groups demonstrated a significant difference ($t = 2.89$, $p = 0.006$), favoring the experimental group. These findings indicate that the integration of play and circuit training significantly enhanced the locomotor abilities of preschool-aged children more effectively than

traditional unstructured physical activities. The model can be considered a valuable strategy for early childhood motor development interventions.

DISCUSSION

The present study set out to examine the effectiveness of an integrated play-based circuit training model in enhancing locomotor movement among preschool-aged children. It was hypothesized that combining the structure of circuit training with the engagement and enjoyment of play would produce greater improvements in locomotor skills compared to traditional, unstructured physical activity. The results support this hypothesis. Children in the experimental group demonstrated a significantly higher improvement in TGMD-2 locomotor scores compared to those in the control group. This finding aligns with earlier studies that emphasized the value of structured motor skill interventions (Logan et al., 2012) and the motivational benefits of play-based learning (Pellegrini & Smith, 2005). However, unlike previous studies that treated these approaches independently, the current study integrated them into a single model, offering both cognitive stimulation and physical development within a fun, child-centered framework.

These findings contribute new evidence to the field of early childhood motor development, particularly in contexts where structured physical education is often underemphasized. The study demonstrated that when physical tasks are embedded in meaningful and enjoyable play scenarios, children not only engage more fully but also show measurable gains in motor competence. This hybrid approach addresses the common criticisms of both traditional circuit training (too rigid) and free play (lacking targeted outcomes), providing a balanced solution that fosters both development and participation.

The observed improvements in locomotor skills can be explained through principles of motor learning and developmental theory. Repeated exposure to varied movement tasks within a structured circuit allows children to practice fundamental skills in multiple contexts, enhancing motor coordination and adaptability. When combined with play-based elements, these repetitions occur naturally and without excessive cognitive or physical strain, which supports sustained engagement and effective skill acquisition during early childhood.

Furthermore, the integration of play and circuit training aligns with developmentally appropriate practice (DAP) principles, which emphasize learning through active exploration and enjoyment. By incorporating clear movement objectives within playful activities, the model ensures that children remain motivated while still achieving specific motor outcomes. This approach supports not only physical development but also cognitive processes such as attention, problem-solving, and self-regulation, which are essential components of early childhood learning.

From a practical standpoint, the model holds significant promise for implementation in early childhood education settings. It requires minimal equipment, can be adapted to various space constraints, and is easily facilitated by educators with basic training in child motor development. This makes the approach scalable and accessible for preschools and community programs aiming to improve foundational movement skills at a critical stage of development.

The implications of these findings extend beyond physical development. Locomotor proficiency is positively associated with self-confidence, school readiness, and long-term physical activity habits (Robinson et al., 2015). Thus, interventions like this can play a preventive role against physical inactivity and its long-term health consequences, contributing to healthier lifestyle trajectories from an early age.

Nevertheless, this study has limitations. The sample size was relatively small and geographically limited to two preschools. Future research should expand to a more diverse population and explore long-term effects of the intervention through follow-up assessments. Additionally, it would be valuable to investigate cognitive and social-emotional outcomes linked to such integrative physical models, offering a more holistic picture of child development.

In conclusion, this study demonstrates the effectiveness of integrating play and circuit training in enhancing locomotor skills among children aged 5–6 years. The results support a shift toward structured yet playful approaches in early physical education, emphasizing the value of intentional movement experiences. Future research should build upon these findings to refine, adapt, and scale the model in various educational and community contexts.

CONCLUSION

This study examined the effectiveness of a play-based circuit training model in improving locomotor skills in preschool-aged children. The results showed that the integrated play-circuit model significantly improved locomotor performance in children aged 5–6 years, as measured by the TGMD-2 test. The experimental group demonstrated greater improvements than the control group, which participated in unstructured physical activity. These findings indicate that structured physical activity embedded in playful contexts effectively enhances fundamental movement skills without reducing children's engagement or enjoyment. Furthermore, the results support the implementation of developmentally appropriate, structured movement programs in preschool settings and confirm that the play-based circuit training model is an effective strategy for improving locomotor competence during early childhood.

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