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THE EFFECTIVENESS OF MOVEMENT GAMES ON BALANCE AND FUNDAMENTAL MOTOR SKILLS IN FIFTH-GRADE PUPILS IN VINH CITY: A COMPARATIVE STUDY

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Abstract:
This study aimed to assess the effectiveness of these games on these specific skills of fifth-grade pupils. All participants were fifth-grade pupils aged 10 years in Vinh City, Vietnam. They volunteered to participate in the study and were randomly assigned to either a Movement Games Group (MG) or a Control Group (CG). A total of 150 pupils participated (n=75 per group; 45 males, 30 females for each group). The movement games group participated in a twelve-week program, engaging in movement games twice weekly outside of regular class time. Each 45-minute session included a 10-minute warm-up, a 25-minute main activity, and a 10-minute cool-down. Conversely, the control group maintained their regular school physical education classes but did not participate in any additional physical activity programs. Outcome measurements are the Flamingo balance test and physical fitness tests. Following the twelve-week intervention, the movement games group (MG) showed significantly superior performance compared to the control group (CG) in balance and fundamental motor skills tests. Namely, Flamingo balance ($p = 0.000$), sit-ups ($p = 0.000$), standing long jump ($p = 0.000$), 30m sprint ($p = 0.000$), and 4x10m shuttle run ($p = 0.000$). Notably, the MG demonstrated significant improvements in speed, body control, and endurance. This finding suggests that movement games can effectively enhance balance, upper and lower extremity strength, core strength, speed, body control, and endurance in fifth-grade pupils.

Keywords: balance, movement games, motor skills, school pupils

1. Introduction

Sedentary lifestyles are becoming an increasingly serious health problem among children and adolescents [1]. Accumulating evidence suggests that independent of physical activity levels, sedentary behaviours are associated with increased risk of

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cardiometabolic disease, all-cause mortality, and a variety of physiological and psychological problems [2]. Recently, children have been engaging in numerous sedentary behaviours, such as sitting in the classroom while doing homework [3] and spending approximately 8 hours per day doing sedentary activities [4, 5]. Research consistently demonstrates that excessive daily TV viewing, exceeding two hours, is associated with detrimental effects on both physical and psychosocial health.

Physical exercise plays a vital role in enhancing both physical fitness and overall well-being. It has been demonstrated to significantly improve physical fitness levels and enhance executive functions. [6]. Regular physical activity, including active play and sports, offers a powerful means of achieving significant health benefits. These benefits arise both directly and indirectly, through its positive impact on major risk factors such as high blood pressure, high cholesterol, obesity, and stress [7]. Compelling evidence demonstrates that regular physical activity plays a crucial role in both the primary and secondary prevention of various chronic diseases while also significantly reducing the risk of premature death [8]. Moreover, active participation in play, games, and other physical activities, both within school settings and during leisure time, is fundamental for the healthy development of all young individuals [9]. Recent research strongly supports the multifaceted benefits of daily exercise, including reduced stress and anxiety, improved mood, enhanced self-confidence, improved cognitive function (e.g., memory), and strengthened musculoskeletal systems. Ultimately, regular physical activity contributes significantly to an improved quality of life [10, 11].

Sports and games possess the transformative power to enhance individual lives by fostering physical, psychological, emotional, and social well-being and development. Simultaneously, sport plays a vital role within cultures and communities worldwide [12]. Movement games are a dynamic form of play that demands significant physical and mental exertion from participants. They offer several key benefits such as entertainment, physical development and holistic development. Movement games are highly engaging due to their fun and lively nature, making them a popular choice for recreational activities and events, particularly in camp settings. These games provide an effective form of exercise, enhancing players' physical health, flexibility, and endurance. Additionally, movement games foster valuable social and emotional skills, including teamwork, discipline, perseverance, social interaction, and quick decision-making [13].

To our knowledge, limited research has investigated the effects of movement games on balance and fundamental motor skills of school pupils in Vinh City, Vietnam. Therefore, this study aims to evaluate the effectiveness of movement games on the balance and physical health of primary school pupils.

2. Materials and Methods

2.1. Participants

All participants were fifth-grade pupils aged 10 years in Vinh City, Vietnam. They were recruited voluntarily and randomly assigned to either a Movement Games Group (GG)

or a Control Group (CG). A total of 150 subjects participated in this study (n=75 per group; 45 boys, 30 girls). Prior to recruitment, parents provided written informed consent and reported their child's health history. Participants with chronic pediatric diseases or orthopedic conditions that would limit exercise participation were excluded from the study.

2.2. Intervention Protocol

Subjects in the movement games group were instructed to participate in movement games for twelve weeks, two times a week outside class time. Each training session lasted 45 minutes, consisting of a 10-minute warm-up, 10-minute cool down and 25-minute main part. Participants in the control group were asked not to participate in any new physical program but still followed normal physical lessons at school during class time. The same instructors tested and trained the same participants and the physical tests were performed in the same order with identical equipment, positioning, and testing technique. Subjects of both groups were tested before and after intervention. Selected movement games used in this study included: Ship – Sea - Shore; Simon says; Possession ball; Pass and Catch; Bull in the ring; Red light – Green light; Circle hoop; Traditional hopscotch; Toe in line; Activity Circuit; Circle pass delay; Dribbling the ball delay.

2.3. Outcomes Measurements and Data Collection

- **Test 1:** The Flamingo balance test is a test to determine how well subjects can stand on one leg. This says something about balance [14]. The Flamingo test is a good tool for testing balance. Stand on the balance beam with the preferred leg. Take the instep of the other foot and pull this towards the buttock. With the other arm, subjects can try to find balance. Try to keep this position for as long as possible. If one lets go of the raised leg, time stops. The time starts again once you have regained balance. Write down the number of mistakes subjects make within one minute. The number of mistakes is equal to the number of scored points. So eight mistakes gives a score of 8, for example. If more than fifteen mistakes are made within one minute, the test stops, and the score is fifteen [14].
- **Test 2:** 30-second Sit-ups (times): to measure abdominal muscular strength and endurance of the abdominals and hip-flexors, important in back support and core stability [15].
- **Test 3:** Standing long jump (cm): to measure the explosive power of the legs [16].
- **Test 4:** 30-meter sprint (s): to determine acceleration and speed [17].
- **Test 5:** 4x10m shuttle running (s): test of speed, body control and the ability to change direction (agility) [18].

2.4. Data Analysis

The statistical significance has been estimated at a probability (p-value) equal to or less than 0.05. Data are expressed as means ± standard deviation. A paired samples t-test was used to analyze the changes within the group. An independent t-test was performed to

analyze the differences between pre-test (baseline) and post-test (endpoint) between groups.

3. Results

No significant differences in height, weight, or BMI were observed between the experiment and control groups at baseline ($p > 0.05$), as shown in Table 1.

Table 1: Group statistics

Variables	**MG**		**CG**		
Total	75		75		
Male	45		45		
Female	30		30		
	Mean	**SD**	**Mean**	**SD**	**Sig.**
Weight (kg)	37.21	6.07	36.81	6.32	0.883
Height (m)	1.43	0.06	1.44	0.04	0.694
BMI (kg/m²)	17.61	2.13	17.02	2.15	0.095

MG: Movement games Group; CG: Control Group; BMI: Body Mass Index; SD: Standard Deviation.

3.1 Movement games on balance and fundamental motor skills of fifth-grade pupils

Table 2: Comparison of test performance within CG at pre-test and post-test

Tests	**Pre-test**		**Post-test**		**Sig*.**
	Mean	**SD**	**Mean**	**SD**	
Flamingo balance (times)	12.90	1.98	12.94	1.93	0.181
Sit up (times/30s)	12.29	2.57	12.33	2,61	0.181
Standing long jump (cm)	146.86	7.26	147.02	7.40	0.103
30m sprint test (s)	6.94	0.65	6.94	0.65	0.124
4x10m shuttle running (s)	14.91	0.77	14.92	0.76	0.117

*Paired samples t- test; SD: Standard Deviation

No significant differences were observed in balance or fundamental motor skills within the control group between pre-test and post-test assessments (Table 2). Paired samples t-tests revealed no statistically significant differences for any of the tests ($p > 0.05$).

Table 3: Comparison of test performance within MG at pre-test and post-test

Tests	**Pre-test**		**Post-test**		**Sig*.**
	Mean	**SD**	**Mean**	**SD**	
Flamingo balance (times)	12.34	2.25	6.10	1.59	0.000
Sit up (times/30s)	12.06	2.53	16.12	3.66	0.000
Standing long jump (cm)	146.80	7.09	153.77	8.81	0.000
30m sprint test (s)	6.90	0.69	6.37	0.69	0.000
4x10m shuttle running (s)	14.82	0.85	14.06	0.73	0.000

*Paired samples t- test; SD: Standard Deviation

Statistically significant improvements were observed in both balance and fundamental motor skills among the MG group from pre-test to post-test (Table 3). Paired samples t-tests revealed significant differences for all tests ($p < 0.000$).

Table 4: Comparison of means of balance and fundamental motor skills between MG and CG at pre-test

Tests	MG (n=75)		CG (n=75)		Differences	Sig.*
	Mean	SD	Mean	SD		
Flamingo balance test (times)	12.34	2.25	12.90	1.98	-0.56	0.108
Sit up (times/30s)	12.06	2.53	12.29	2.57	-0.22	0.588
Standing long jump (cm)	146.80	7.09	146.86	7.26	-0.06	0.955
30m sprint test (s)	6.90	0.69	6.94	0.65	-0.04	0.731
4x10m shuttle running (s)	14.82	0.85	14.9	0.77	-0.08	0.504

*Independent t-test; SD: Standard Deviation.

Table 4 shows that there were no significant differences between the MG and CG groups before the intervention for balance ability, strength of lower and upper extremities and abdomen, speed, body control, and endurance. Specifically, the Flamingo test ($p = 0.108$), sit-up test ($p = 0.599$), standing long jump test ($p = 0.955$), 30m sprint test ($p = 0.731$), and 4x10m shuttle run test ($p = 0.504$) all showed non-significant differences between the groups.

Table 5: Comparison of means of balance and fundamental motor skills between MG and CG at post-test

Tests	MG		CG		Differences	Sig.*
	Mean	SD	Mean	SD		
Flamingo balance test (times)	6.10	1.59	12.94	1.93	-6.84	0.000
Sit up (times/30s)	16.12	3.66	12.33	2.61	3.78	0.000
Standing long jump (cm)	153.77	8.81	147.02	7.40	6.74	0.000
30m sprint test (s)	6.37	0.69	6.94	0.65	-0.57	0.000
4x10m shuttle running (s)	14.06	0.73	14.92	0.76	-0.85	0.000

*Independent t-test; SD: Standard Deviation.

Table 5 reveals significant differences between the two groups in five tests: Flamingo balance ($p = 0.000$), sit-ups ($p = 0.000$), standing long jump ($p = 0.000$), 30m sprint ($p = 0.000$), and 4x10m shuttle run ($p = 0.000$). These findings indicate that after twelve weeks of intervention, the MG group demonstrated significantly better results than the CG group in tests assessing balance, strength of lower extremities and abdomen, speed, body control, and endurance.

4. Discussion

This study aimed to evaluate the effectiveness of movement games in enhancing the balance ability and fundamental motor skills of primary school pupils. Findings revealed

a significant improvement in both balance and fundamental motor skills among participants following a twelve-week training program incorporating movement games. It is in agreement with previous findings that movement games have enhanced physical strength and stabilized vestibular function in primary school pupils [19, 20]. Exercise classics enhanced coordination abilities and improved vestibular stability in schoolchildren [21]. Increasing the time dedicated to playing games, both within classroom settings and during extracurricular activities, had a positive impact on children with mental disabilities. This indicates that the implementation of the proposed movement games resulted in significant improvements in the pupils' psychomotor and mental functions, including enhanced memory, improved perception of reality, and increased attention span [22].

The finding of this study aligns with previous research, which has demonstrated the effectiveness of movement games and relays in enhancing strength and motor skill development among primary school students [23]. Furthermore, it has been established that movement game activity is a valuable educational approach that significantly contributes to improvements in both physical fitness levels and mental health outcomes for students [24]. Additional findings indicate that traditional games, a type of movement game, positively influence the development of fundamental motor skills in pupils [25-27].

Research has consistently demonstrated the positive impact of physical activity on children's development. The study showed that both physical games and manipulative games significantly contribute to the development of fundamental motor skills in elementary school students [28]. Furthermore, educational programs incorporating coordination exercises have been shown to effectively enhance the development of basic motor movements in preschool children, preparing them for the transition to higher levels of education by ensuring adequate psychomotor development [29]. Physical exercises not only improve physical qualities but also positively influence vestibular stability in schoolchildren [30]. The integration of outdoor games into physical education lessons for first-grade students has been shown to have a significant and positive impact on the development of their physical qualities [31]. Regular and organized physical activity during leisure time plays a crucial role in developing the physical abilities of school-aged children. These activities lay the foundation for overall physical fitness, contributing to a healthy lifestyle in adulthood [32]. Additionally, research has demonstrated that physical games can significantly enhance enjoyment levels in children and adolescents [33].

While this study successfully met its research objectives, it is important to acknowledge a potential limitation. The study design may have introduced bias due to the differential treatment of the groups: the intervention group received movement games, while the control group remained inactive. To address this limitation in future research, the use of an exercise control group is recommended. This could involve a group participating in a different type of exercise intervention, such as traditional physical education classes, to provide a more robust comparison.

5. Conclusion

The study recruited 170 subjects. Participants are primary school pupils aged 10 years in the fifth grade at Vinh City of Vietnam. Movement games which were selected and applied for training included: Ship – Sea - Shore; Simon says; Possession ball; Pass and Catch; Bull in the ring; Red light – Green light; Circle hoop; Traditional hopscotch; Toe in line; Activity Circuit; Circle pass delay; Dribbling the ball delay. After twelve weeks of movement games training, it has been found to improve balance and physical fitness of primary school children. Based on the results, the movement games are beneficial for enhancing balance, strength of lower extremities and abdomen, speed, and body control of primary school children. It is recommended that movement games be widespread in schools to contribute to improving the physical health of school children.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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