Enhancing physical literacy through active play in overweight /obesity elementary students in Thailand

Mejorando la alfabetización física mediante el juego activo en estudiantes de primaria con sobrepeso u obesidad en Tailandia

Authors

Charinthip Manyuen [1]
Thanomwong Kritpet [1]
Raweewan Maphong [1]

[1] Chulalongkorn University (Thailand)

Corresponding author:
Raweewan Maphong
raweewan.m@chula.ac.th

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Abstract

Introduction: Overweight and obesity in children have been associated with reduced physical competence from risk due to their greater body mass, which negatively affects their overall physical competence

Objective: This study aimed to examine the effectiveness of a 6-week active play intervention in enhancing physical competence among overweight and obese upper elementary school students.

Methodology: An experimental, pre-and post-controlled trial was conducted with 50 overweight or obese students (aged 10–11 years), assigned to an intervention group (n = 25) and a control group (n = 25). Participants were selected using purposive sampling from a school located in Suphanburi province. The intervention group participated in a 6-week active play program. Physical competence was assessed using the Canadian Assessment of Physical Literacy-2 (CAPL-2), including the PACER (aerobic fitness), plank assessment (musculoskeletal endurance), and the Canadian Agility and Movement Skill Assessment (CAMSA) for motor performance.

Results: The intervention group showed statistically significant improvements in musculoskeletal endurance (t=2.146, p=.018), motor performance (t=2.293, p=.013), and total physical competence scores (t=2.829, p=.003) compared to the control group. Improvements were particularly notable in locomotor skills, while changes in manipulative skills and aerobic fitness were not statistically significant.

Discussion: The active play program produced improvements in physical competence, particularly musculoskeletal endurance, motor performance, and overall physical competence.

Conclusions: This study supports the efficacy of structured active play programs in enhancing physical competence in overweight and obese children. The results highlight the potential of developmentally appropriate, enjoyable play to address movement limitations, particularly in locomotor performance, and to promote overall physical competence.

Keywords

Active play program; physical competence; overweight or obese; FMS; locomotor skills.

Resumen

Introducción: El sobrepeso y la obesidad en los niños se asocian con una menor competencia física debido al exceso de masa corporal, lo que afecta negativamente su desarrollo motor y participación en la actividad física.

Objetivo: Examinar la efectividad de una intervención de juego activo de 6 semanas en la mejora de la competencia física en estudiantes de primaria superior con sobrepeso u obesidad.

Metodología: Se realizó un ensayo experimental con grupo control pre y post intervención con 50 estudiantes (10–11 años) seleccionados mediante muestreo intencional en una escuela de la provincia de Suphanburi. Los participantes se dividieron en un grupo de intervención (n = 25) y un grupo de control (n = 25). El grupo de intervención participó en un programa de juego activo durante 6 semanas. La competencia física se evaluó con la Canadian Assessment of Physical Literacy-2 (CAPL-2), que incluye PACER (aptitud aeróbica), prueba de plancha (resistencia musculoesquelética) y Canadian Agility and Movement Skill Assessment (CAMSA) para el rendimiento motor.

Resultados: El grupo de intervención mostró mejoras estadísticamente significativas en la resistencia musculoesquelética (t = 2.146, p = .018), el rendimiento motor (t = 2.293, p = .013) y las puntuaciones totales de competencia física (t = 2.829, p = .003) en comparación con el grupo de control. Las mejoras fueron especialmente notables en las habilidades locomotoras, mientras que los cambios en las habilidades manipulativas y en la aptitud aeróbica no fueron estadísticamente significativos.

Discusión: El programa de juego activo generó beneficios claros en la competencia física, especialmente en la resistencia musculoesquelética y el rendimiento motor.

Conclusiones: El estudio respalda la eficacia de programas de juego activo estructurado para niños con sobrepeso u obesidad y subraya el potencial de actividades lúdicas y apropiadas para superar limitaciones motoras y mejorar la competencia física global.

Palabras clave

Programa de juego activo; competencia física; sobrepeso u obesidad; habilidades motrices fundamentales; habilidades locomotoras.

Introduction

The World Health Organization (WHO) reported that the prevalence of overweight and obesity has been continuously increasing. In 2022, more than 390 million children and adolescents aged 5–19 years were classified as overweight, including 160 million who were classified as obese (WHO, 2024). Overweight and obesity refer to an abnormal or excessive accumulation of body fat. In Thai children aged 6–19 years, this condition is defined as having a weight-for-height Z-score greater than +2 standard deviations (S.D.) according to the national growth reference standards (Department of Health, 2020). One of the major contributing factors to the increasing number of children with overweight or obesity is insufficient physical activity (PA) (Hills, Andersen, & Byrne, 2011). Engaging in PA is crucial for preventing overweight and obesity during childhood and adolescence, and it also helps lower the likelihood of developing obesity later in adulthood (Pereira, Padez, & Nogueira, 2019).

According to WHO, children and adolescents aged 5–17 years are recommended to engage in at least 60 minutes of moderate-to-vigorous-intensity physical activity (MVPA) per day, primarily aerobic in nature (WHO, 2020). According to global PA data from 57 countries (Tremblay et al., 2022), only 27% of Thai children and adolescents meet the WHO's recommended daily PA guidelines of 60 minutes. In the Global Matrix report by the Active Healthy Kids Global Alliance, Thailand received a grade of "D" for overall PA levels among children and youth. This grading system includes six main levels: A, B, C, D, F, and INC (Incomplete). PA is defined as any bodily movement produced by large skeletal muscles that results in energy expenditure (WHO, 2020).

PA is associated with PL, as well as health and wellbeing outcomes (Mayordomo-Pinilla, Sánchez-Miguel, Galán-Arroyo, Castillo-Paredes, & Rojo-Ramos, 2025). PL is an individual's ability to move confidently and competently in a wide range of situations and contexts. It encompasses motivation and confidence, physical competence, knowledge, and understanding related to movement and the appropriate engagement in PA (HALO, 2017).

PA refers to the integration of motivation, confidence, physical competence, knowledge, and understanding that enables individuals to sustain appropriate levels of PA throughout their lives. It has four key components. First, physical competence refers to the ability to move the body efficiently and effectively. Second, daily behavior involves engaging in PA as part of one's everyday routine. Third, knowledge and understanding relate to the awareness of movement and its impact on health and well-being. Lastly, motivation and confidence reflect an individual's enthusiasm and self-assurance, which contribute to enjoyment and long-term participation in PA. Together, these elements support the development of an active lifestyle that can be maintained across the lifespan (HALO, 2017; M. Whitehead, 2010; Margaret Whitehead, 2001).

Fundamental movement skills (FMS) are essential movement abilities necessary for the development of physical competence. Physical competence is a core component of PL, representing the skills and abilities individuals acquire and apply to movement (Commission, 2019). It is typically assessed through two domains: physical fitness and motor performance (HALO, 2017). Physical fitness refers to the body's ability to perform work or PA without undue fatigue. Individuals with good physical fitness can work efficiently and participate effectively in recreational or leisure-time activities (Chodzko-Zajko et al., 2009; Shah & Diwan, 2024). One key measure is aerobic fitness, which reflects the efficiency of the heart, lungs, and circulatory system in delivering oxygen to working muscles during sustained activity (Armstrong & Welsman, 1994). Another component is muscular endurance, the ability of a muscle or muscle group to perform repeated contractions against resistance over an extended period. Motor performance refers to the ability to perform movement skills with efficiency, coordination, and control. This can be assessed through task-specific skill evaluations that are performed within a set time frame, demonstrating the individual's agility and coordination in executing sequences of movement. (HALO, 2017).

Active play was describing PA through their play. When children engage in active play, they use their whole body with all their senses and large muscles (Myers, Gibbons, Arnup, Volders, & Naughton, 2015; Sääkslahti, 2014). Encouraging active play in children's leisure time has potential to increase PA levels while promoting optimal child development (Brockman, Fox, & Jago, 2011) and It can also enhance the development of FMS (Johnstone, Hughes, Martin, & Reilly, 2018). But the overall statistics on active play among children and youth in 57 countries, as reported in the Report Card Global Matrix 4.0 Active

(Tremblay et al., 2022) showed that Thai children were once again graded "F" for active play. This is consistent with the previous evaluation from the Global Matrix 2.0 report (Tremblay et al., 2016) where Thailand also received an "F" grade. Active play can be developed into a structured program with clear guidelines and goals, led and supervised by instructors or facilitators. Such a program can effectively increase PA levels and enhance FMS—whether focusing on locomotor skills or object control skills—for school-aged children (Moghaddaszadeh & Belcastro, 2021).

Active play is a component of PA. Children who are overweight or obese tend to lack consistent engagement in PA. If this group of children is neglected in PA promotion efforts, policy-level strategies aimed at fostering lifelong PA habits may not effectively reach them. Promoting FMS within the physical competence domain of PL can help support the maintenance of PA throughout life. Active play serves as a valuable tool for such development, as it integrates FMS with diverse and flexible activity designs. These activities are adaptable in terms of rules and structure, and they emphasize fun, challenge, and engagement, making them more appealing and accessible for all children.

In Thailand, Children's is influenced by sociocultural and environmental constraints such as limited such as academic pressure and screen-based leisure (Katewongsa et al, 2021). Urban schools offer more opportunities and environments that encourage children to be physically active than rural schools do. (Tiaotrakul, 2024). The prevalence of overweight and obesity among children has been increasing. Additionally, a concerning number of children have consistently received an "F" grade in PA assessments in Global Matrix report since 2016. Active play, a form of PA, is essential for encouraging movement and promoting lifelong physical development through the practice of FMS. Children with overweight or obese often face physiological barriers, such as excess body fat, which limit their ability to move effectively. Therefore, promoting health and PA among this group is of particular importance. Although previous Thai studies have examined correlates of PA and tested the feasibility but not yet no local experimental interventions have been conducted to promote physical literacy though active play among overweight or obese children. Addressing this gap, the present study investigates the effectiveness of a six-week active play program to enhancing physical competence among overweight/obese upper elementary school students in rural area in Thailand.

Method

This study employed experimental research design with pre-and post-controlled trial design. The purpose of the study was to evaluate the effectiveness of a structured active play program on the physical competence domain of PL among overweight and obese upper elementary school students. This study was conducted with 50 overweight or obese students (aged 10-11 years), assigned to an intervention group (n=25) and control group (n=25). Participants were selected using purposive sampling from a school located in Suphanburi province. The intervention group participated in a 6-week active play program. Physical competence was assessed using the CAPL-2, including PACER (aerobic fitness), plank assessment (musculoskeletal endurance), and Canadian Agility and Movement Skill Assessment; CAMSA (motor performance). This study was approved by the Research Ethics Review Committee for Research Involving Human Subjects, Group 1, Chulalongkorn University. The project was reviewed in accordance with the Belmont Report (1979), Declaration of Helsinki (2013), and CIOMS guidelines (2016). Approval was granted on October 7, 2024, under the protocol number COA No. 218/67 (Project ID: 670140).

Participants

A purposive sampling technique was employed to recruit upper elementary school students Fifty overweight or obese in aged 10–11 years who were classified as overweight or obese (BMI-for-age Z-score > +2 SD) based on the 2020 Thai National Growth Reference. Participants were selected using matched-pair sampling method based on their weight status that ranked from highest to lowest body weight and then alternately assigned to the intervention and control groups to ensure comparability between groups. The sample size war determined using Cohen's (Cohen, 1988) table, with significant level of 0.05, statistical power of test 0.80 and effect size of 0.75. According to these parameters, a minimum of 23 participants per group (46 total) was required. To account for potential attrition, the sample size was increased by 5% in each group, resulting in a final sample of 50 participants (25 in the

intervention group and 25 in the control group). Students were selected from a school located in Suphanburi province and assigned to either intervention group (n=25) or control group (n=25). To minimize contamination, groups were separated, and allocation aimed to balance average body weight across both intervention and control groups.

Inclusion Criteria

Participants were boys or girls' students aged 10–11 years, enrolled in upper elementary school, and classified as overweight or obese (Z-score > +2 SD based on the 2020 Thai National Growth Reference). All participants agreed voluntarily to participate and provided signed informed consent form.

Exclusion Criteria

Students were excluded if they had pre-existing medical conditions (e.g., cardiovascular or respiratory diseases) diagnosed by a physician, experienced injuries or illness during the study, withdrew consent, or attended less than 80% of the intervention sessions (fewer than 13 out of 16 sessions).

Procedure

The implementation of this research began with a comprehensive literature review related to active play programs, PL, physical competence, and characteristics of children who are overweight or obese. This review was conducted to synthesize and design appropriate activities based on the framework of the CAPL-2. The program developed was designed to include a variety of activities that are fun, challenging, and flexible, with the aim of encouraging student participation through the integration of FMS and motor performance abilities.

Following the program design, a pilot study was conducted with a small group of four students to evaluate the appropriateness of activity intensity, based on heart rate monitoring during the sessions. The results were then used to revise and enhance the program before implementation. Furthermore, the content validity of the program was verified by three experts, and the Item Objective Congruence (IOC) value was calculated at 0.97, indicating a high level of content alignment with the objectives.

Subsequently, a feasibility study was conducted with eight students who shared similar characteristics to the intended sample group. This was done to assess the practicality of the program and its reliability. Reliability was analyzed using the Intraclass Correlation Coefficient (ICC), which yielded a result of 0.829, demonstrating a good level of consistency.

The sample selection process was systematically carried out in coordination with a school located in Suphanburi province. These students were then screened based on specific inclusion criteria to finalize the research sample group, focusing on those who were overweight or obese.

Participants were randomly assigned into experimental and control groups, stratified by gender and weight. The experimental group participated in the active play program for six weeks, totaling 16 sessions. Meanwhile, the control group continued with their normal daily routines without involvement in the program.

Data collection was conducted before and after the intervention period by trained research assistants. Physical fitness was assessed through measures of aerobic capacity and muscular endurance while motor performance was evaluated using CAMSA.

The active play program used in the intervention was structured into four phases. Phases 1 and 2 focused on developing FMS with and without equipment, while phases 3 and 4 integrated FMS with motor performance skills. Each session lasted 60 minutes and included a 10-minute warm-up, 40 minutes of main activity, and a 10-minute cool-down.

Throughout the activities, students' perceived exertion levels were monitored using the Rating of Perceived Exertion (RPE) scale. Any unusual fatigue or health issues were carefully observed. If necessary, students were instructed to rest or were referred to the school's nurse, and if symptoms did not improve, they were taken to a nearby hospital. The researcher assumed responsibility for any medical expenses incurred.

Finally, post-intervention data collection was conducted, using the same variables as in the pretest. The results were statistically analyzed by comparing the prettest and posttest outcomes between the experimental and control groups to assess the effectiveness of the implemented active play program.

Active play Program

The active play program was developed based on several key principles aimed at effectively promoting physical movement and FMS development in children. The program's structured design and phased implementation allow for progressive skill acquisition and increasing physical challenges.

The development of the active play program is grounded in six fundamental principles:

1. Progression of FMS from Simple to Complex: The program gradually increases the difficulty of movement skills, starting with simple actions and advancing to more complex tasks, facilitating continuous and natural skill development.

2. Increase in Exercise Intensity: Beginning with light exertion, the program systematically escalates intensity to moderate-to-vigorous levels to promote physical adaptation and endurance building.

3. Movement Progression from Stationary to Locomotor Activities: Initial activities focus on stationary (on-the-spot) movements, progressing toward locomotor activities such as running and jumping.

4. Introduction of Equipment in Later Phases: Early phases emphasize movement without equipment; subsequently, equipment is introduced to add variety and increase the challenge level of activities.

5. Integration of Both Stationary and Locomotor Activities: The program blends stationary and locomotor activities, both with and without equipment, to ensure a comprehensive development of diverse movement skills.

6. Emphasis on Fun, Enjoyment, and Teamwork: A core focus is placed on fostering an enjoyable environment and encouraging collaboration through cooperative play, enhancing participant engagement and motivation.

The active play program is structured into three main segments for each activity session:

•Warm-up: 10 minutes to prepare the body and mind for the main activities.

•Active play Session: 40 minutes dedicated to the primary activities focused on movement skill development.

•Cool-down: 10 minutes to gradually lower heart rate and relax muscles after activities.

The active play program is implemented over four distinct phases, each with different objectives and emphases:

•Phase 1 (Sessions 1–4): Focuses on FMS development without the use of equipment, establishing foundational movement skills.

•Phase 2 (Sessions 5–8): Continues FMS development, introducing the use of equipment to enhance engagement and skill complexity.

•Phase 3 (Sessions 9–12): Integrates FMS and motor performance activities using equipment, emphasizing skill coordination and agility.

•Phase 4 (Sessions 13–16): Continues the integration of FMS and motor performance with equipment, increasing the complexity and challenge of activities.

This systematically designed Active play program holds significant potential as an effective approach for promoting PA and developing movement skills across various target groups.

Outcome Measurements

Anthropometrics and physiological outcomes

Anthropometric and physiological parameters were assessed to evaluate participants' physical status. Body weight was measured using a calibrated digital weighing scale to ensure accuracy and consistency. Height was determined with a standard stadiometer while participants stood upright. Blood pressure

and pulse rate were recorded using an automatic digital blood pressure monitor to capture cardiovascular status. Body composition, including metrics such as body fat percentage and muscle mass, was evaluated using a bioelectrical impedance device (Omron HBF-375, Kyoto, Japan). All measurements were conducted by trained research assistants.

Physical competence outcomes

Physical competence was assessed based on the Canadian Assessment of Physical Literacy-2 (CAPL-2) (HALO, 2017) framework, which encompasses multiple domains of physical fitness and skill performance. Aerobic fitness was measured using the Progressive Aerobic Cardiovascular Endurance Run (PACER) shuttle run test, which assesses cardiovascular endurance through incremental shuttle runs. Musculoskeletal endurance was evaluated through the plank assessment, measuring the duration a participant could maintain a prone plank position. Motor competence and skill performance were quantified using the Canadian Agility and Movement Skill Assessment (CAMSA) score, which evaluates fundamental motor skills and agility through a standardized obstacle course.

Data analysis

Data was analyzed using the Statistical package for the Social Science (SPSS), version 26. Descriptive statistics, including means and standard deviations, were calculated. The normality of data distribution was assessed using the Shapiro-Wilk test. To compare the mean scores within the intervention and control group before and after the 6-weeks intervention with paired t-test. Additionally, independent t-tests were used to compare the difference between the intervention and control group before and after 6-weeks period.

Results

The sample characteristics of the intervention group (IV) and control group (CT), each consisting of 25 participants. In the IV group, 56.0% were boys (n = 14) and 44.0% were girls (n = 11), with a mean age of 10.28 years (SD = 0.46). In the CT group, 60.0% were boys (n = 15) and 40.0% were girls (n = 10), with a mean age of 10.44 years (SD = 0.51) are shown in Table 1.

Table 1. Sample Characteristics

Characteristics	IV (N=25)		CT (N=25)	
	N (%)	M (SD)	N (%)	M (SD)
Gender				
Boys	14 (56.0)		15 (60.0)	
Girls	11 (44.0)		10 (40.0)	
Aged		10.28 (0.46)		10.44 (0.51)

Note: IV= Intervention Group; CT= Control Group; p<0.05

Anthropometric and physiological outcomes

At the posttest, there were no statistically significant differences in body weight, height, BMI, or body fat percentage between the IV and CT groups. However, the IV group showed a significant reduction in systolic blood pressure (SBP) (p = .029) and diastolic blood pressure (DBP) (p = .005) compared to the CT group. Additionally, the IV group had a significantly smaller hip circumference than the CT group (p = .004).

Physical competence outcomes

After posttest, significant improvements were observed in the IV group in several physical competence measures compared to the CT group; musculoskeletal endurance (plank test; p = .018), plank score level (p = .028), motor performance (CAMSA score and level; p=.013) and total physical competences score (p=.003). Although aerobic fitness increased in the IV group, the differences were not statistically significant compared to the CT group.

Skill performance outcomes

Table 2 highlights improvement in FMS. At posttest, the IV group showed significant greater improvement than the CT group in the following: two-foot jumping (p=.038), Sliding (p=.042), Skipping (p<.001), one-foot jumping (p<.001) and total skill performance score (p<.001). Catching, throwing and kicking showed no significant group differences.

Table 2. Outcomes between pre and post active play intervention

Outcome	Pre-test (N=25)		Post-test (N=25)		t	P	Cohen's d	95% CI
	IV (N=25)	CT (N=25)	IV (N=25)	CT (N=25)				
	M (SD)	M (SD)	M (SD)	M (SD)				
Weight (kg)	62.00 (12.92)	67.73 (15.53)	63.13 (12.76)	68.98 (15.71)	-1.444	.078	-.408	[-.967]-.154
Height (cm)	147.44 (8.42)	149.92 (8.96)	148.90 (8.12)	151.34 (8.14)	-1.061	.147	-.300	[-.856]-.259
Systolic blood pressure (mmHg)	117.13 (13.74)	117.68 (11.88)	114.20 (10.12)	120.88 (13.91)	-1.941	.029*	-.549	[-1.111]-.019
Diastolic blood pressure (mmHg)	77.24 (12.49)	77.20 (10.74)	68.52 (6.74)	74.04 (7.60)	-2.718	.005*	-.769	[-1.340]-[-.190]
Resting heart rate (beats per minute)	103.56 (12.85)	102.44 (12.88)	103.56 (12.85)	102.44 (12.88)	.308	.380	.087	[-.468]-.641
Body fat percentage (%)	30.14 (1.91)	30.76 (2.01)	29.60 (2.11)	30.57 (2.21)	-1.590	.059	-.450	[-1.009]-.114
Body Mass Index (BMI)	28.23 (3.55)	29.76 (4.20)	28.18 (3.43)	29.93 (4.26)	-1.606	.057	-.454	[-1.014]-.110
Whole body (kg)	17.20 (3.98)	18.59 (4.30)	17.81 (4.10)	18.99 (4.40)	-.982	.166	-.278	[-.833]-.281
Trunk lean mass (kg)	12.82 (2.63)	13.65 (2.89)	13.34 (2.73)	13.96 (2.95)	-.767	.223	-.217	[-.722]-.340
Arm lean mass (kg)	20.12 (5.41)	21.50 (6.12)	20.74 (5.37)	21.87 (6.38)	-.676	.251	-.191	[-.746]-.365
Leg lean mass (kg)	26.92 (6.50)	29.46 (7.13)	27.90 (6.64)	30.06 (7.32)	-1.096	.139	.072	[-.474]-.628
Waist circumference (cm)	91.32 (10.95)	94.52 (10.67)	91.20 (9.03)	93.32 (10.32)	-.773	.222	-.219	[-.774]-.339
Hip circumference (cm)	98.64 (9.42)	101.60 (10.57)	97.04 (7.59)	103.92 (10.01)	-2.738	.004*	-.774	[-1.346]-[-.195]
PACER shuttle run (number of laps)	9.28 (2.15)	8.56 (2.82)	10.16 (3.26)	9.32 (2.06)	1.089	.141	.308	[-.251]-.864
Score level (0–10 points)	1.36 (0.57)	1.44 (0.65)	1.56 (0.71)	1.32 (0.48)	1.401	.084	.396	[-.166]-.954
the plank assessment (seconds)	34.26 (17.61)	32.05 (12.95)	41.90 (15.33)	32.73 (14.86)	2.146	.018*	.607	.037-1.172
Score level (0–10 points)	1.88 (1.74)	1.72 (1.31)	2.72 (1.54)	1.88 (1.48)	1.965	.028*	.556	[-.012]-1.118
CAMSA (score)	18.04 (2.54)	17.10 (2.20)	19.18 (2.59)	17.56 (2.41)	2.293	.013*	.648	.076-1.214
Score level (0–10 points)	6.44 (0.90)	6.11 (0.79)	6.85 (0.92)	6.27 (0.86)	2.293	.013*	.648	.076-1.214
Total Physical Competence Score (0–30 points)	9.68 (2.17)	9.27 (1.94)	11.13 (2.02)	9.47 (2.01)	2.829	.003*	.800	.219-1.373
Two-foot jumping (0–2 points)	1.94 (0.13)	1.94 (0.15)	2.00 (0.00)	1.97 (.08)	1.809	.038*	.512	[-.055]-1.073
Sliding (0–3 points)	2.98 (0.13)	2.95 (0.13)	2.95 (0.25)	2.76 (0.48)	1.767	.042*	.500	[-.066]-1.061
Catching (0–1 point)	0.93 (0.14)	0.88 (0.16)	0.93 (0.18)	0.86 (0.23)	1.190	.120	.337	[-.223]-.893
Throwing (0–2 points)	1.34 (0.50)	1.24 (0.36)	1.41 (0.30)	1.27 (0.49)	1.224	.113	.346	[-.214]-.903
Skipping (0–2 points)	1.40 (0.52)	1.30 (0.54)	1.89 (0.21)	1.58 (0.42)	3.322	<.001*	.940	.350-1.520
One-foot jumping (0–2 points)	1.20 (0.75)	1.14 (0.64)	1.59 (0.37)	1.18 (0.49)	3.316	<.001*	.938	.348-1.518
Kicking (0–2 points)	1.76 (0.27)	1.86 (0.23)	1.92 (0.17)	1.85 (0.26)	1.121	.134	.317	[-.243]-.873
Total Skill performance (0-14 points)	11.55 (1.32)	11.31 (0.89)	12.69 (0.79)	11.47 (1.16)	4.344	<.001*	1.229	.617-1.829

Note: IV= Intervention Group; CT= Control Group; p<0.05 M=Mean; SD= Standard deviation; CI= Confidence interval

Discussion

This study examined the effect of an active play program on promoting PL, focusing on physical competence, in upper elementary school students with overweight and obesity. The findings suggest that the IV group demonstrated significant improvement in several keys in physical competence components compared to the CT group.

In terms of anthropometrics and physiological outcomes, the IV group led to significant reductions in SBP and DBP, as well as hip circumference, PA interventions (in case this study an active play program)

have been considered one of the key factors of reducing blood pressure (BP) (Hassan, Zhou, Ye, He, & Gao, 2024; Pozuelo-Carrascosa et al., 2018; Sun et al., 2013) despite of it haven't significantly changed in weight, height, BMI, body fat percentage in overweight and obese students

An active play program led to significant improvements in physical competence, as evidenced gain was in musculoskeletal endurance (plank test), motor performance (CAMSA) and total physical competence scores. These findings indicate that the IV group strongly supports the effectiveness of the active play program. They also illustrate how adhering to recommended activity levels can yield significant health benefits, especially for children with overweight or obese, a group for whom such gains are particularly impactful. Notably, similar intervention studies have reported parallel outcomes. For example, a recreational exercise program for young overweight children produced significant increases in musculoskeletal endurance (Oliveira et al., 2022). In motor performance for instance, guided active play programs that involve high levels of MVPA have demonstrated improvements in FMS in children (Moghaddaszadeh & Belcastro, 2021).

Importantly, the IV group exhibited significantly greater improvements in FMS performance, particularly in locomotor skills such as two-foot jumping, sliding, skipping and one-foot jumping. These skills form the foundation of children's ability to participate in more complex PA, sports and life (Zhang et al., 2025). Moreover, guided active play focusing on locomotor skills significantly improved locomotor scores and gross motor (Moghaddaszadeh & Belcastro, 2021). Children with overweight or obesity often experience difficulties in movement, particularly in locomotor skills, due to their greater body mass (Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Stodden et al., 2008). While in manipulative skills such as catching, throwing and kicking, the differences were not statistically significant. Although the intervention provided structured teaching, manipulative skills such as catching, throwing, and kicking did not show statistically significant improvements. This may be attributed to the inherent perceptual-motor complexity of object control skills, the limited intervention duration, insufficient feedback, and learners' low perceived competence. These findings align with previous research (Gallahue, 2012; Morgan et al., 2013; Zhang et al., 2025) that structured practice alone is not sufficient; targeted feedback and extended practice time are crucial for developing manipulative skills in children.

While improvements were observed in aerobic fitness, the differences were not statistically significant. Although the active play program was designed to incorporate MVPA for at least 60 minutes per day, in accordance with the WHO's recommendations (WHO, 2020), students who are overweight or obese often have a high accumulation of body fat, which can limit their physical movement (Lubans et al., 2010; Stodden et al., 2008). According to the study by Fogelholm, Stigman, Huisman, and Metsämuuronen (2008), overweight and obesity are negatively associated with physical fitness, particularly aerobic fitness. At the same time, PA plays a crucial role in promoting physical fitness.

Moreover, the active play program demonstrates a feasibility and a low-cost approach that can be sustained within school settings using minimal equipment. The structure of the program allows adaptation to different age groups and school contexts (urban and rural areas), supporting its potential transferability across various educational environments. From a public health perspective, school-based active play interventions align with Thailand's National Physical Activity Plan 2018–2030, which aims to increase the proportion of children and adolescents' PA recommendations and reduce overweight and obesity. By embedding playful, fundamental movement skills in school settings, the present program offers a feasible strategy to strengthen physical literacy and support sustainable behavior change in Thai children.

In particular, this program was implemented among overweight and obese children, resulting in improvements in motor competence, body composition, and confidence to participate in PA. If sustained over a longer period, such interventions have the potential to foster healthier behaviors, improve psychological well-being, and enhance self-efficacy related to body image and movement participation (Babic et al., 2014; Chen, Hammond-Brown, & Chen, 2022). These outcomes are critical for reducing participation barriers and encouraging inclusive PA engagement among children with excess weight. Moreover, positive changes in perceived physical competence and enjoyment can facilitate a lifelong commitment to PA (Stodden et al., 2008; Candia-Cabrera et al., 2025). This is consistent with the findings of Candia-Cabrera et al. (2025), who reported that an active play–based intervention emphasizing enjoyment and the development of fundamental movement skills significantly enhanced physical competence, motivation, and perceived enjoyment among overweight children. These psychosocial and

motor outcomes are recognized as key determinants of sustained participation in PA across the lifespan and contribute to reducing gender disparities and social inequalities in movement opportunities. Such insights should be carefully considered when designing school-based programs, particularly in socially or economically vulnerable contexts where disparities in access to PA are more pronounced.

This study had some limitations, including the absence of a follow-up assessment and the lack of another component of PL such as motivation, confidence and knowledge and understanding measures that could be further explained behavioral changes. In the future research should employ mixed-method or longitudinal designs to capture all PL domains improvement and to assess the long-term sustainability of active play program interventions.

Conclusions

This demonstrates an active program can be effective approach to enhancing physical competency among upper elementary school students with overweight and obesity. The result indicated significant improvements in muscular skeleton endurance, model performance and overall physical competency in the intervention group compared to the control group. These findings support the growing practical and impactful strategy for promoting PL in children facing weight-related health risks.

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Authors' and translators' details:

Charinthip Manyuen	yingppalmmy@gmail.com	Author
Thanomwong Kritpet	tkritpet@gmail.com	Author
Raweewan Maphong	raweewan.m@chula.ac.th	Corresponding author
Sitha Phongphibool	phongphibool@outlook.com	Translator