



Section 4. Preschool education

DOI:10.29013/EJEAP-25-3-16-22



DESIGNING PHYSICAL ACTIVITY GAMES FOR OVERWEIGHT CHILDREN AGED 5–6 IN PRESCHOOLS

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Cite: Le Hai, Nguyen Thi Thanh Ngoc, Nguyen Ngoc Hoang Trang. (2025). *Designing Physical Activity Games for Overweight Children aged 5–6 in Preschools*. *European Journal of Education and Applied Psychology* 2025, No 3. <https://doi.org/10.29013/EJEAP-25-3-16-22>

Abstract

This study was conducted to design and verify the effectiveness of a system of physical activity games for overweight children aged 5–6 at Tam Hiep Kindergarten, Chau Thanh District, Tien Giang Province. Based on theoretical foundations regarding the role of physical activity games in physical, psychological, and social development, the research team selected seven optimal games through surveys, expert consultation, and initial trials. The official experiment was implemented over 12 weeks (three sessions per week) with 12 overweight children, focusing on three core criteria (comfort level, participation, and activity density) as well as physical indicators (weight, height, BMI). Results showed that the children's average weight decreased by 0.91 kg, height increased by 0.7 cm, and BMI decreased by 0.83 points, with all changes being statistically significant ($p < 0.05$). Moreover, the children participated more enthusiastically and confidently, while cooperation and positive exercise habits were cultivated. Games G6, G8, and G1 were particularly outstanding, achieving high scores in all three criteria. The study confirms that the system of physical activity games not only contributes to safe control of overweight and obesity but also enhances health and holistic development, and can be replicated in early childhood education.

Keywords: *physical activity games, overweight children, preschool, BMI, physical development*

I. Introduction

In the current context, childhood overweight and obesity have become major concerns for families, schools, and society at large. According to statistics from the World

Health Organization (WHO, 2023), the rate of overweight and obese children worldwide is rapidly increasing, particularly among preschool-aged children. In Vietnam, recent studies also reveal a rising prevalence

of overweight and obesity in urban areas, especially among children aged 5–6 – the age group preparing to enter primary school. This stage is crucial for forming and developing basic motor skills, laying the foundation for children's future health, physical fitness, and personality development. However, in practice, most overweight children tend to be shy, reluctant to exercise, and less likely to participate in collective physical activities. This not only affects physical development but also hinders children's cognitive, emotional, and social growth.

Therefore, finding suitable interventions that are both educational and motivating is essential in current preschool education. Physical activity games, combining fun, healthy competition, and educational value, are considered an effective means to encourage children's active participation in physical activities. Particularly for overweight children, appropriately designed games not only help burn energy and improve weight management but also foster confidence, cooperation, and a positive attitude toward exercise. From this practical and scientific foundation, the present study focuses on designing a system of physical activity games specifically for overweight children aged 5–6 in preschools. The aim is to provide a safe and engaging exercise environment, helping children develop healthy habits, improve physical fitness, and achieve holistic development.

II. Literature Review

2.1. Issues in designing games for overweight children

Game design is the process of developing ideas, constructing structures, and defining rules for play activities. In preschool education, designing games is not only for entertainment but also for promoting holistic physical, psychological, and social development (K. M., 2016). The design concept must be rooted in specific educational goals, appropriate to the age group and developmental needs – especially for overweight children, who require encouragement to engage in physical activities to regulate weight and build active lifestyles (Higgins & Kearney, 2017). The structure of a game includes space, time, organization, and supporting equipment. These elements should be arranged reasonably to create

a safe environment that encourages active, joyful, and comfortable participation (Ginsburg, 2007). Rules guide children's behaviors and must be simple, understandable, yet flexible enough to foster cooperation, sharing, and social skills (Ginsburg, 2007). According to Piaget (1962), play is a pathway for children's cognitive, thinking, and social development. Fisher (1996) also emphasized that game design in education should simultaneously promote motor skills, enhance communication, nurture self-confidence, and instill healthy living habits. For overweight children, physical activity games must be adjusted according to their psychological and health conditions. The Ministry of Health (2020) affirms that physical activity, including games, is a practical measure to prevent and control childhood obesity. Overall, designing physical activity games for overweight children is a process of constructing and organizing safe, engaging, and educational games to improve health, develop motor skills, and bring joy to daily exercise.

Games should balance the need for developing motor skills with the physical capacity of overweight children. Gallahue and Ozmun (2011) suggested that physical activity games should include fun activities that stimulate major muscle groups without overloading children's musculoskeletal systems. Categorizing games helps preschool teachers select and organize activities that match educational goals, children's physical conditions, and practical contexts. For overweight children, light to moderate games should be prioritized, with intensity gradually increased according to individual fitness (Pham, 2020).

2.2. Principles and Methods of Organizing Games for Overweight Children

Organizing physical activity games in preschools is not only recreational but also vital for children's physical, psychological, and social development. For overweight children aged 5–6, these games serve as a health education measure, supporting weight adjustment and fostering active lifestyles. To ensure effectiveness, several basic principles and scientific methods must be followed:

Age- and ability-appropriateness: At 5–6 years old, children have developed basic motor skills such as running, jumping, and throwing. However, overweight children

often struggle with agility or endurance. Thus, games must be tailored to moderate intensity, avoiding excessive pressure or feelings of failure (Tsai et al., 2014; Piaget, 1951).

Safety assurance: Since games usually take place outdoors or in large spaces, hazardous obstacles should be removed, and surfaces should be soft and non-slippery. Proper clothing and equipment are also necessary to minimize injury risks and ensure comfort (Jones et al., 2018).

Motivation and interest creation: Fun and excitement are prerequisites for active participation. Encouragement, praise, and a positive atmosphere foster confidence and sustained interest (Huang & Cummings, 2020). Gentle competition and unexpected elements in games also stimulate voluntary engagement (Jones et al., 2018).

Integration into daily routines: Simple activities such as tidying toys, skipping rope, or running around the schoolyard can be organized as games. This integration promotes frequent exercise while avoiding rigid training (Gentier et al., 2013).

Diversity and flexibility: Preschool children easily get bored with repetitive activities. Teachers should frequently vary organizational forms, use different tools, or arrange mini-competitions to maintain interest (Tsai et al., 2014). Creative games like “chasing balloons,” “walking in a maze,” or “hopping on one foot” both develop physical skills and stimulate creativity (Jones et al., 2018).

Reasonable timing: Each game should last 10–20 minutes, with breaks in between to prevent fatigue. Games should be fast-paced and interactive to maintain children’s focus and enthusiasm (Gentier et al., 2013).

In terms of methodology, physical activity games for overweight children should naturally and safely burn excess energy (WHO, 2020), while improving endurance, coordination, and self-confidence (Tsai et al., 2014; Jones et al., 2018). Regular participation not only enhances physical fitness but also forms positive exercise habits, leading to a healthy lifestyle (Nguyen & Tran, 2021). Teachers should prioritize safety, suitability, encouragement, diversity, and integration of health–nutrition education. For example, games can incorporate messages such as “eat more vegetables to be

strong” or “exercise to have a flexible body” (Bui, 2022).

When organizing for overweight children, playtime should be limited to 10–15 minutes per session, with breaks for recovery (Jones et al., 2018). Parents should also be encouraged to exercise with their children at home to maintain positive habits (Huang & Cummings, 2020). Teachers need training in designing specialized games for overweight children rather than mechanically applying general games (Nguyen & Tran, 2021).

2.3. Objectives of Designing Physical Activity Games

The design of physical activity games for overweight children aged 5–6 at Tam Hiep Kindergarten aims to achieve the following objectives:

Improving physical health and fitness of overweight children: Through appropriate physical activity games, children are encouraged to engage in active movement, thereby helping to burn excess energy, regulate body weight, develop the musculoskeletal system, and enhance overall fitness (Ministry of Health, 2020; WHO, 2022).

Enhancing motivation and interest in physical activity: The games are designed to evoke enjoyment and excitement, attracting children’s active participation, thus fostering the habit of regular physical activity – an important factor in improving health and preventing obesity (Tran Thi Thao, 2021).

Supporting the development of fundamental motor skills: The games help children practice age-appropriate motor skills such as running, jumping, throwing, climbing, and balancing, while also improving motor qualities such as agility, flexibility, and coordination (Nguyen Thi Bich Hang, 2019; Nguyen Anh Tuyet, 2023).

Contributing to holistic education: In addition to physical activity, the games integrate educational elements such as cooperation, discipline, self-control, creativity, and problem-solving skills – thereby supporting children’s all-round development (Ministry of Education and Training, 2017).

III. Research methods

3.1. Pilot design

The study was conducted to verify the feasibility and effectiveness of 12 physical ac-

tivity games selected after consultation with teachers, school administrators, and early childhood education experts. These games were piloted in short-term experiments to assess three core criteria: (1) participation level, (2) comfort level, and (3) activity density. The pilot results provided both theoretical and practical bases for selecting eight optimal games that were appropriate for the physical and psychological characteristics of overweight children aged 5–6, while also feasible for implementation under preschool conditions.

Participants and duration. The pilot involved a group of overweight children aged 5–6 at Tam Hiep Kindergarten, meeting the study's physical criteria. The duration was two weeks, with each game played at least once to ensure that children had sufficient opportunities to experience and demonstrate physical and psychological responses. Activities took place in the schoolyard or outdoor play areas with safe, spacious environments.

Evaluation criteria. The three main criteria included: comfort level (measured using the Leuven five-point scale, from 1 = not comfortable to 5 = very comfortable); participation level (reflecting focus, enthusiasm, and engagement, also using the Leuven scale, from 1 = very low to 5 = very high); and activity density (measured as each child's actual active time, converted to a 1–5 scale: <8 minutes = 1 point, ≥20 minutes = 5 points). The Leuven scale, developed by Laevers and colleagues (University of Leuven), was chosen as the main assessment tool due to its reliability and holistic reflection of children's well-being and involvement – two key indicators of early childhood development (Laevers, n.d.; VVOB Vietnam, n.d.). The combination of these three criteria allowed for a comprehensive evaluation of the feasibility and effectiveness of the physical activity games.

3.2. Experimental method

Purpose. The formal experiment was carried out to verify the effectiveness of the seven optimal games, assessing both physical and psycho-behavioral aspects of children. The monitored indicators included BMI, activity density, participation level, comfort level, cooperation, and confidence. The results reflected the direct impact of physical activity games on children's health while con-

firmed their role in weight management and holistic development (WHO, 2022; Ministry of Health, 2020).

Participants and scope. The experiment involved 12 overweight children aged 5–6 in class La 1 at Tam Hiep Kindergarten (Chau Thanh District, Tien Giang Province). Sampling criteria were based on BMI above the Ministry of Health standard. Homeroom teachers and school administrators participated in supporting, observing, and recording data to ensure objectivity.

Duration and location. The experiment lasted for 12 weeks (January–April 2025), with a frequency of three sessions per week. Games were organized outdoors in the schoolyard for vigorous activities, or indoors when weather conditions were unfavorable.

Format and organization. Each session included 2–3 games, repeated at least twice per game. The content incorporated nutrition education, health care, and cooperation skills. The organizational process consisted of: Preparation (sample selection, training, equipment preparation, observation forms); Implementation (following game rules, with observers recording data); Measurement and evaluation (BMI before–after, Leuven scale, teacher and parent interviews); Synthesis and analysis (comparing results, identifying strengths and weaknesses, proposing applications).

Assessment tools. These included BMI measurement charts following the Ministry of Health standards, observation forms for children's behavior based on the Leuven scale, and surveys for teachers and parents. The evaluation criteria focused on: *Physical effectiveness* (BMI reduction or maintenance at healthy levels, increased endurance); *Psycho-behavioral effectiveness* (active participation, cooperation, confidence); and *Suitability and attractiveness* (safety, feasibility, ability to engage children).

IV. Research Results

4.1. Expert, teacher, and administrator consultation

After drafting 15 prototype physical activity games, the research team sought feedback from the school board, the school health unit, and teachers directly working with overweight children at Tam Hiep Kindergarten. This consultation helped refine the content

to ensure suitability for children's psychological and health characteristics and feasibility given the available facilities. Creativity, attractiveness, and educational value were also emphasized to increase engagement and foster positive exercise habits. Survey results indicated that most games were highly rated, with mean scores (M) ranging from 4.00 to 4.54. Several games stood out—"Magic Energy Tower," "Agile Transporter," "Super-Health Racetrack," and "Jump Across the River" (all M = 4.54)—receiving "very good" evaluations. Other games such as "Pass the Ball to the Finish" (4.38), "Rescue Captain" (4.38), and "Fitness Dance" (4.46) also showed promising results. However, "Power-Rope Tug" and "Energy Rainbow" achieved only M = 2.08, reflecting limited suitability.

4.2. Pilot testing of the games

Observations in Table 2.3 revealed marked differences across the games.

Comfort: Most games reached high to very high levels, notably G1, G2, G3, G5, G6, G8, and G9 (M = 4.75–4.92). In contrast, G4 (2.33) and G7 (2.75) were only moderate/low.

Participation: G1, G2, G3, G5, G6, G8, and G12 all scored M = 4.75–4.92, indicating sound design that encouraged enthusiasm and agency. Some games – G4, G7, G11–had average scores (M = 2.92–3.08), suggesting a split between more and less active children.

Activity density: G2, G3, G5, G6, and G8 achieved very high levels (M = 4.67–4.83), while G4, G7, G10, G11, and G12 were average (M = 2.75–3.25).

4.3. Finalization of the Game set

Based on quantitative results, seven optimal games were selected: G5, G8, G2, G6, G3, G1, and G9. These games scored M = 4.58–4.92 on at least two criteria and maintained high activity density. In particular, G5 ("Green-Energy Bike Race") and G8 ("Fitness Dance") approached near-perfect scores; G2 ("Super-Health Racetrack") and G6 ("Forest Terrain Challenge") stood out for full-body movement; G3 ("Energy Rainbow") and G1 ("Obstacle Course Journey") trained diverse skills; G9 ("Agile Transporter") developed speed and coordination.

4.4. Outcomes of the intervention

As shown in Table 2.5, after 12 weeks, all 12 children showed positive changes. **Weight** decreased by 0.5–1.5 kg (about 1

kg on average) without abrupt loss. **Height** increased by 1 cm in 7/12 children, with the remainder unchanged, confirming safety. **BMI** decreased for all children by –0.32 to –1.45 points (mean –0.9). The greatest reductions were seen in children M03 (–1.45), M07 (–1.31), and M05 (–1.06). Results were consistent across both boys and girls, demonstrating uniform effectiveness. Overall, the seven-game system contributed to reasonable weight reduction, maintained height growth, improved BMI, and increased enthusiasm for physical activity, thereby enhancing the health and quality of life of overweight children aged 5–6.

Experimental results. Table 2.6 shows clear changes in three indicators after 12 weeks. **Weight:** mean change $d = -0.91$ kg (–5.28%), evidencing appropriate energy expenditure without adverse effects on physical development; $t = 7.607$, $p = .000 < .05$ indicates a statistically significant difference. **Height:** $d = +0.7$ cm (+0.58%), reflecting normal growth; $t = 4.69$, $p = .001 < .05$ confirms reliability. **BMI:** mean reduction $d = -0.83$ points (–4.52%), the key indicator for overweight status; $t = 9.818$, $p = .000 < .05$, demonstrating strong intervention effects. Thus, the game system not only supports reasonable weight loss but also sustains height development and markedly improves BMI.

Detailed results show comprehensive effectiveness – physical, psychological, and behavioral – of the seven-game set. **G6** (*Forest Terrain Challenge*, comfort M = 4.83), **G8** (*Fitness Dance*, participation M = 4.75), and **G1** (*Obstacle Course Journey*, activity density M = 4.75) were notable for high and stable scores, sustaining interest and exercise intensity. The most actively participating children (M03, M09, M10, M12) also had the most pronounced BMI improvements, moving from obese to overweight or from overweight to normal categories. Conversely, **G3** and **G5** recorded lower mean scores, indicating fatigue or uneven intensity; hence, rules should be adjusted, duration shortened, or engaging elements increased to optimize impact.

In summary, 100% of the children reduced BMI, with **33.3%** changing classification, confirming the feasibility and practical value of the game set. Beyond physical benefits, children showed higher comfort,

interest, cooperation, and confidence, thereby forming positive exercise habits.

Aligned with the theoretical framework, the findings reinforce Piaget's (1962) view that movement is a crucial pathway to holistic development. The results also accord with WHO (2020) recommendations that children need at least 180 minutes of physical activity per day, including 60 minutes of vigorous activity. Implemented three times per week over 12 weeks, the game set helped reduce BMI by **0.3–1.2** units and increased height by **0.7 cm** on average. Compared with prior studies (Tremblay et al., 2012; Nguyen Thi Mai, 2021), the present study yields comparable outcomes (100% BMI reduction; 33.3% reclassification) while adding novelty by incorporating psycho-behavioral assessment via the Leuven scale (Laevers, 1994).

In conclusion, the seven-game system for overweight children aged 5–6 at Tam Hiep Kindergarten demonstrated comprehensive effectiveness: safe weight reduction, BMI improvement, sustained height growth, and enhanced confidence, cooperation, and enthusiasm for movement. These results provide a basis for recommending wider implementation as a feasible solution for preventing and controlling overweight and obesity in early childhood.

V. Conclusion

The 12-week intervention using a system of seven physical activity games for overweight children aged 5–6 at Tam Hiep Kindergarten produced clear improvements in both physical and psycho-behavioral outcomes. Physically, the children's average weight decreased by 0.91 kg (5.28%), height increased by 0.7 cm (0.58%), and BMI decreased by 0.83 points (4.52%), with statistically significant differences ($p < .05$). These changes reflect appropriate energy expenditure, stable height growth, and safe improvement in overweight status. Psychologically and behaviorally, children exhibited active participation, high comfort, and strong activity density, particularly in G6, G8, and G1. Beyond physical training, the games enhanced confidence, cooperation, and the formation of positive exercise habits. Accordingly, the designed game system is not only an effective measure for managing overweight and obesity in preschoolers but also provides holistic educational value. It is well-suited for broader adoption in early childhood settings to help improve children's health and overall quality of life.

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submitted 18.09.2025;

accepted for publication 02.10.2025;

published 31.10.2025

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