Jurnal
Berita Ilmu Keperawatan

Jurnal Berita Ilmu Keperawatan
Vol. 19 (1), 2026
p-ISSN: 1979-2697
e-ISSN: 2721-1797
https://doi.org/10.23917/bik.v19i1.13115

Integrating the Traditional Games into Early Childhood Programs: Effects on Gross Motoric Skill Enhancement Using a One-Group Pretest–Posttest Design

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Abstract: **:**
Gross motoric skill development in children is a basic component of children's growth and their physical functional movement. This study was conducted using pilot quantitative study that evaluated the effectiveness of traditional Riau games in improving gross motoric skills, specifically balance, speed, and agility, among pre-school children. This study used a non-randomized, single-group pretest–posttest design without a control group, conducted on 50 participants. Gross motoric performance was assessed pre and post intervention by using an instrument of TGMD (Test of Gross Motoric Development). Data were analyzed using paired sample t-tests, with effect sizes calculated to estimate strong effects taken from this study. The results indicated statistically significant improvements in balance, speed, and agility following the intervention ($p < 0.001$), with a very large effect size (Cohen's $d = 2.39 \geq 0.80$). These findings suggest that traditional Riau games may represent a culturally appropriate and effective strategy for enhancing children's gross motoric skills. Nevertheless, the absence of a comparator group and the pilot nature of the study warrant cautious interpretation, and further controlled trials are recommended to confirm these results.

Keywords: traditional games; gross motoric skills; child development; physical activity; indigenous play

Submitted: 01 October 2025, reviewed: 02 January 2026, revised: 06 January, accepted: 07 January 2026, published: 03 February 2026

INTRODUCTION

Playing provides such a motivation for children to carry out activities that involve problem-solving and children find their own way to solve the problem. Playing will also strengthen children's abilities and skills in problem solving (Smeltzer, 2014). Games are a medium that improves children's cognitive development. Games allow children to practice the necessary competencies and skills in a relaxed and enjoyable ways (Watanabe, 2019). Traditional games are an activities that grow and develop in certain areas, which are full of cultural values and community life values and are taught from one generation to the next (Reginald et al., 2025). The benefits of the traditional game are that it can provide children with fun, the ability to develop relationships, cooperate, train social maturity with peers, practice roles with older people, train children to be patient in turns when playing a game, and the ability to accept defeat gracefully and acknowledge a friend's victory (Bastian et al., 2019).

Motoric skills are body movements caused by actions, while motoric development can be called the development of elements of maturity and control of body movements (Liew et al., 2018). Basically, this development develops in line with the maturity of the child's nerves, muscles or cognitive abilities (Damayanti & Nurjannah, 2017). Motoric development will develop in line with the maturity of the

child's nerves and muscles, which can improve gross motoric as well as doing exercise and sport (Shi et al., 2024). So, every movement as simple as they do is the result of a complex interaction pattern of various parts and systems in the body which are controlled by the brain. Motoric skills are divided into two parts, namely: 1) gross motoric skills; 2) fine motoric skills (Widayanti et al., 2023). Gross motoric skills are related to the movements that require coordination of body parts, muscles and nerves (Chen et al., 2024). Gross motoric skills are the skills that are activated in the large muscles of the arms, legs and trunk, such as walking and jumping. Gross motoric skills are fundamental to children's physical development, encompassing large muscle movements such as walking, running, jumping, and balancing. These skills are crucial for daily activities and significantly impact fine motoric skills development (Desmita, 2012). Early childhood is a critical period for developing these skills, and adequate stimulation is essential to prevent developmental delays (King-Dowling et al., 2020).

The gross motoric skill development is a milestone of the early childhood growth and development, it will be supporting children's cognitive, physical and also their social development. Studies argued the fundamentals of gross motoric abilities are supported by including balance, agility, speed, and coordination as well. It is to enable children to explore their environment, within interact with their friends, and also engage in age-appropriate learning activities (Rodrigues et al., 2019). In Indonesia, motoric development delays are prevalent among preschool-aged children. National surveys showed that almost 12–20% of children under five years demonstrate their challenges in gross motoric development (Kementerian Kesehatan RI, 2018). The delays in such motoric skills can also limit children's independence in doing activities, reduce participation in physical play, and for the negative effect, they are not aware of school readiness (Wijedasa, 2012).

This study uses traditional games, which are deeply embedded in Indonesian cultural heritage. It offers a promising avenue to improve gross motoric skills on the children actually in their social engagement and attitude (Latifah, 2025). These traditional games, namely Lulu Cina Buta games, usually involve running, jumping, dodging, and coordinating object manipulation, which can also actively stimulate neuromuscular coordination, sensory integration, and motoric learning processes as well. According to the gross motoric learning theory, children who repeatedly practice being structured, will also progressively challenge, then actively sound like goal-directed tasks promotes the acquisition and consolidation of movement skills through feedback, more adaptability, and gaining reinforcement (Schmidt, R. A., & Lee, 2018). Therefore, there are such culturally relevant traditional games which may serve as effective interventions for preschool-aged children by improving balance, agility, and speed while fostering cognitive and social engagement (Shi et al., 2024).

Despite the theoretical baseline, the empirical evidence also conducted to evaluate the effectiveness of traditional games on children's gross motoric growth and development in Indonesia is quite limited. In particular, studies examining Lulu Cina Buta, such a traditional game from Riau, are scarce and rare. By understanding the potential of this traditional game which can improve the motoric skills of children could be one of the culturally appropriate interventions in early childhood education and community programs. These traditional games are deeply rooted in cultural heritage, which can offer a valuable medium engagement for enhancing children's gross motoric skills. These games will also provide opportunities for prolonged physical activity in social activities and could also be an enjoyable context, promoting physical coordination, balance, and agility (Adi et al., 2022). Despite the valuable interest in utilizing traditional games for developmental purposes, some empirical studies examining their effectiveness in improving motoric skills are still limited. So, research on the impact of Lulu Cina Buta, a traditional game from Riau, on children's motoric development is not researchable.

The primary objective of this study was to evaluate the effect of the traditional game Lulu Cina Buta on gross motoric skills among children aged 4–6 years in Riau and West Sumatra. Participation in Lulu Cina Buta will lead to significant improvements in overall gross motoric skills, as measured by the TGMD-3. Then participation will result in measurable improvements in *balance*: the ability to maintain postural control during locomotoric and object-control tasks; *agility*: the ability to change direction efficiently while performing movement tasks; *speed*: the efficiency and quickness in executing locomotoric tasks.

By operationalizing these hypotheses, this study links culturally relevant play, neuromuscular development, and motoric learning theory, providing a framework to explore traditional games as an intervention for enhancing physical development in young children.

METHODS

Study Design

This study was using a quasi-experimental study with a pretest–posttest pilot trial approach which are designed to evaluate the effectiveness of a culturally relevant traditional game called Lulu Cina Buta on gross motoric skill and development among preschool-aged children or early childhood ages. This study design by using a non-randomized, single-group design was chosen due to the practical and generating the ethical considerations in the early childhood education settings. Random allocation particularly was not feasible in community-based centers, and the eligible children were offered the intervention to maximize participation and exposure to such culturally relevant games and activity. This design also aligns with the assessment of changes in gross motoric performance before and after the intervention (Creswell & Cresswell, 2018) and provides preliminary value of effect size estimates to inform the future controlled trials.

Trial Registration

The protocol was prospectively registered in the Indonesian Clinical Research Registry (INA-CRR) with the Registry Number: INA-C698E44. The trial registration included detailed information beyond the study objectives, the eligibility criteria, intervention procedures, outcome measures, analysis plans, ensuring transparency and adherence to international reporting standards.

Reporting Guidelines

All methods and results are officially reported in accordance with CONSORT 2025 guidelines which are adapted for non-randomized pilot trials, including detailed descriptions of recruitment, intervention, measurement, and data analysis procedures.

Participants and Setting

The study population consisted of children aged 4–6 years who particularly enrolled in early childhood education centers namely: kindergartens and playgroups located in Riau and West Sumatra, Indonesia. The recruitment was conducted during November to December 2023. A total of 68 children were initially assessed for their eligibility, based on inclusion and exclusion criteria. Then, 50 children met the eligibility criteria and whose parents consent on provided information were also enrolled. The sample size of 50 participants was determined based on feasibility and pilot-study conventions for preliminary investigations of intervention effects on gross motoric skills. The sample size was deemed sufficient to estimate intervention effect sizes, assess feasibility, and identify potential procedural issues prior to larger-scale studies. All participating settings were community-based early childhood education programs with structured daily schedules, similar staff-to-child ratios (1:8–10), and safe play environments which are suitable for motoric skill activities. Sessions were conducted within the indoor and outdoor settings play spaces under standardized safety protocols and control. Recruitment process, enrollment, and retention were being carefully tracked. We documented all the attendance and session adherence which was also monitored throughout the four-week intervention, and no participants withdrew during the study process. For transparency, a CONSORT-style flow diagram adapted for a non-randomized, single-group design is recommended to depict the number of children: assessed for eligibility, enrolled, allocated to intervention, and analyzed for outcomes.

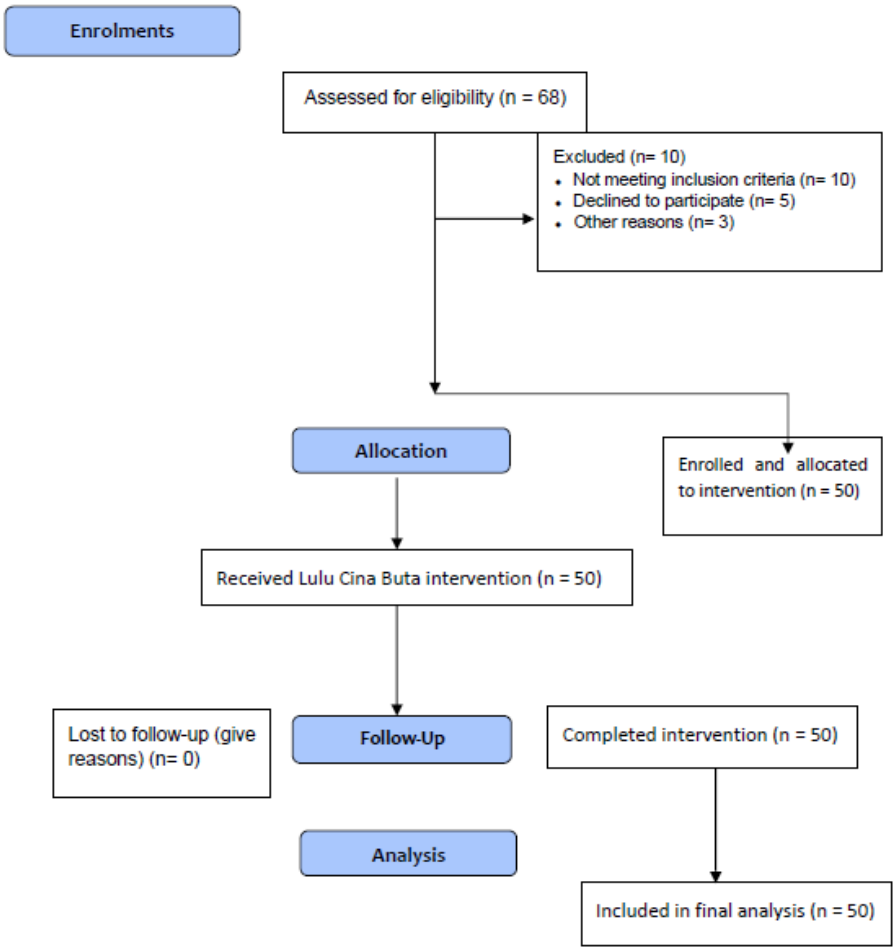

Figure 1. CONSORT flow diagram of participant enrollment, intervention, and analysis

Intervention

The interventions were completely used in the traditional Riau game Lulu Cina Buta, delivered in structured group sessions over two weeks. Sessions were conducted three times per week, each lasting approximately 30 minutes. Sessions were led by trained facilitators with formal qualifications in early childhood education or pediatric physical activity, who underwent 8 hours of standardized training to ensure protocol consistency, safety, and accurate measurement on TGMD scoring.

There were three parts to each session: (1) The first part was a 5-minute warm-up that included simple stretching, light hopping, and getting ready to move. (2) The main part of the game lasted 20 minutes, during which blindfolded seekers tried to find other players using their hearing and spatial awareness. The game needed running, dodging, and body control, which worked on balance, agility, speed, motoric coordination, and spatial awareness. To keep people interested and help them master motoric skills, the task got harder each week by changing the intensity of the movements, the size of the groups, and the rules of the game. (3) Ending: Cool down and think for 5 minutes. This includes breathing exercises, balance activities, and a guided discussion about how much fun and engaged you are. We looked at fidelity in both a qualitative and a quantitative way. Standardized training, session checklists, and weekly supervision meetings helped make sure that facilitators were consistent. During these sessions, facilitators went over the game rules, movement directions, and safety protocols. Safety procedures included using soft play surfaces, keeping a tight eye on the children, and following the rules for how many children should be with each facilitator. This structured traditional game intervention is a culturally relevant, age-appropriate by pre-school age, and low-cost way to get kids moving. It can actively help children learn gross motoric skills by getting them to move and interact with others, which encourages cooperation, fun, and mental involvement in one set.

Measurement of Gross Motoric Skills

By using Test of Gross Motoric Development, Third Edition (TGMD-3), the subcomponents measured were balance, speed, motoric coordination, and agility. Trained observers who didn't know how the sessions were going did assessments at the start (pretest) and just after the four-week program (posttest). To make sure that the scores were consistent, observers were trained and inter-rater reliability checks were done. Gross motoric skills were assessed using the Test of Gross Motoric Development, Third Edition (TGMD-3), a widely validated instrument for children aged 3–10 years. TGMD-3 primarily evaluates locomotoric and object-control skills, which serve as proxies for broader motoric domains such as balance, speed, and agility. There were three parts to each session: (1) The first part was a 5-minute warm-up that included simple stretching, light hopping, and getting ready to move. (2) The main part of the game lasted 20 minutes, during which blindfolded seekers tried to find other players using their hearing and spatial awareness. The game needed running, dodging, and body control, which worked on balance, agility, speed, motoric coordination, and spatial awareness. To keep people interested and help them master motoric skills, the task got harder each week by changing the intensity of the movements, the size of the groups, and the rules of the game. (3) Ending: Cool down and think for 5 minutes. This includes breathing exercises, balance activities, and a guided discussion about how much fun and engaged you are. We looked at fidelity in both a qualitative and a quantitative way. Standardized training, session checklists, and weekly supervision meetings helped make sure that facilitators were consistent. During these sessions, facilitators went over the game rules, movement directions, and safety protocols. Safety procedures included using soft play surfaces, keeping a tight eye on the children, and following the rules for how many children should be with each facilitator. This structured traditional game intervention is a culturally relevant, age-appropriate by pre-school age, and low-cost way to get kids moving. It can actively help children learn gross motoric skills by getting them to move and interact with others, which encourages cooperation, fun, and mental involvement in one set.

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The instrument yields standardized scores, which in this study were subsequently transformed into a 3-point ordinal scale (1 = below average, 2 = average, 3 = above average) to enhance statistical analysis and interpretation in a limited sample pilot study. This scaling illustrates how well one subdomain did compared to the others, but it also shows how things changed from before to after. To make sure that the scoring was the same for everyone, two trained raters looked at 20% of the sample during both the pretest and the posttest. Inter-rater reliability in this study ranged from 0.77 to 0.91 across subdomains, signifying remarkable agreement. To reduce measurement error (Wagner et al., 2015). Assessments were performed individually within a regulated play setting at baseline (pretest) and immediately following the four-week intervention (posttest). The TGMD items were all given out according to conventional rules, and the scores for locomotoric and object-control skills were used to figure out derived indicators for speed, balance, and agility.

Even while TGMD doesn't directly test balance or speed, the tasks that involve moving about and controlling objects naturally require these skills. Using TGMD scores to measure these areas is a useful way to find out how well a young child's gross motoric abilities are. It also fits with what research says about how children's motoric skills develop around the world. TGMD-2 has been validated across many populations, including children with special needs, and is useful for assessing locomotoric and object-control skills (Bakke et al., 2019). The instrument provides standardized scores and is sensitive to changes in motoric skill development, making it suitable for both research and clinical practice in early childhood motoric assessment.

Data Analysis

Data were analyzed using data analyzing software SPSS. Descriptive statistics were conditionally used to summarize participants'characteristics and also the baseline value data on gross motoric skill scores. Prior to inferential analysis, this study conducted the assumption of normality for pretest–posttest difference scores examined by using the Shapiro–Wilk test using histograms visualization. As the data met the assumptions for this kind of parametric testing, paired sample t-tests were conducted to evaluate and compare pretest and posttest on gross motoric skill scores. The level of statistical significance was shown on $p < 0.05$. Effect sizes were calculated using Cohen's d to estimate the magnitude of the intervention effect with the value of Cohen's $d = 2.39 \geq 0.80$.

Ethical Considerations

The study was approved by the Institutional Review Board of Abdurrab University (approval number: 146/Kep-Univrab/IX/2023), and all procedures adhered to the principles of the Declaration of Helsinki. Participation was voluntary, and children could withdraw at any time without consequences. Confidentiality and anonymity were strictly maintained.

RESULTS

Participant Characteristics

A total of 50 children aged 4–6 years participated in this study. Table 1 presents the demographic characteristics of the participants. The mean age was 5.0 ± 0.8 years. Male participants slightly outnumbered females, with 26 boys (52%) and 24 girls (48%). All participants were healthy and had no known motoric disabilities.

Table 1. Participant Demographics (n = 50)

Characteristics	Mean (SD)	Category	Frequency	Percentage (%)
Age (years)	4.68 (0.627)			
Gender		Male	26	52
		Female	24	48

The mean age of participants was 4.68 (0.627) years. There was a slightly higher proportion of male participants (52%) compared to female participants (48%). All participants were healthy children without known motoric disabilities, and parental consent was obtained prior to participation.

Descriptive Statistics of Gross Motoric Skills

Gross motor skills were assessed at three points of the term; they are balance, agility, and speed. This result also showed the overall motoric skills before and after the intervention. Table 2 presents the descriptive statistics for each variable.

Table 2. Descriptive Statistics of Gross Motoric Skills Pretest and Posttest

Variable	Test	Mean	Min	Max	n
Balance	Pretest	1.4	1	2	50
	Posttest	2.4	2	3	50
Agility	Pretest	1.3	1	2	50
	Posttest	2.6	2	3	50
Speed	Pretest	1.4	1	2	50
	Posttest	2.4	2	3	50
Overall Motoric Skills	Pretest	1.2	1	2	50
	Posttest	2.5	1	3	50

Each component of gross motoric skills also demonstrated marked improvement: balance increased from a mean of 1.4 to 2.4, agility from 1.3 to 2.6, and also speed from 1.4 to 2.4.

These results indicate participation in the traditional Riau game Lulu Cina Buta that effectively enhanced children's gross motoric skills, including balance, agility, and speed. The substantial increase in mean scores and the statistically significant t-test values suggest that the intervention had both statistical and practical significance in promoting motoric development in early childhood.

Table 3. Gross Motoric Skill Scores Before and After Intervention

Variable	Mean	SD	t	p	Cohen's (d)
Pretest	1.2	0.404	-16.898	0.0001	2.39
Posttest	2.5	0.544			
	*α=0.05				

The paired sample t-test indicated a significant improvement in gross motoric skills by following participation in the Lulu Cina Buta traditional game ($t = -16.898$, $p < 0.001$,*α=0.05). The mean gross motoric score increased from 1.2 (SD = 0.404) as a pretest to 2.5 (SD = 0.544) in the posttest, which demonstrates a substantial positive effect of the intervention. The results indicated statistically significant improvements in balance, speed, and agility following the intervention ($p < 0.001$), with a very large effect size (Cohen's $d = 2.39 \geq 0.80$).

These results mainly suggest that the traditional game can be effectively enhanced the rough motoric coordination, including balance, speed, and agility on the children. The effect size, calculated using t-test, indicated a significant effect, will also further supporting the practical significance of the intervention in promoting gross motoric skill development among children in pre-school age.

DISCUSSIONS

The observed in this study completely being improvements in children's gross motoric skills by following participation in the traditional Riau game Lulu Cina Buta which are consistent with previous studies that report positive associations between traditional games activities and motoric development as well. Prior research also showed that traditional games may support generous components of gross motoric skills, including balance, agility, and also speed (Saroinsong et al., 2022). The present study extends this literature by providing preliminary empirical and evidence based from a Country in Southeast Asian Continent as a cultural context, where traditional games continue to be a part of community engagement (Ospankulov et al., 2023).

In several years, children may be included in playing patterns and will have increasingly shifted toward technology-based activities. Nowadays, it may limit opportunities for physical movement and sedentary activities much implemented in children's daily life. Early childhood, especially in the pre-school term, represents a crucial and critical developmental timing during which motoric skills, perception, and social interaction are more rapidly continuing on development of children's growth (Istiqomah et al., 2025). Despite both modern and traditional games having the potential benefits,

traditional games are often characterized by active bodily movement, more social interaction, and also cultural meaning, which may contribute to motoric skill and their stimulation (Yusroni & Alimah, 2023). Traditional games also frequently involve a lot of moving action, and interacting more with each other which also may help improve their motoric skills (Reginald et al., 2025).

Previous studies have examined the role of traditional games in promoting gross motoric development in young children. For example, the traditional game Engklek Fruit was found to enhance children's gross motoric skills by helping them control their body movements, read bodily cues, and develop agility (Pratiwi & Kristanto, 2014). Play activities in early childhood education settings, such as kindergartens, provide enjoyable opportunities for motoric skill development and can be effectively stimulated through traditional games. Another study on the traditional game Bakiak demonstrated improvements in children's gross motoric abilities, particularly in eye–foot coordination, body balance, agility, and leg strength (Winarsih et al., 2023). These findings highlight that traditional games can serve as an engaging and culturally relevant strategy to enhance gross motoric development in young children. Then, by combining teaching games among playground children can make them more understanding about activities and sport so that it can improve student emotion regulation, intrapersonal intelligence and psychomotor skills (Nazari et al., 2025).

The results of this study are relevant with previous research which found that participation in traditional games led to significant improvements in children's motoric skills (Saroinsong et al., 2022). Similarly, (Istiqomah et al., 2025) reported that traditional games positively influenced children's balance and coordination. These studies, along with the current research, underscore the importance of incorporating traditional games into early childhood development programs. The results of the research above are in accordance with the opinion that playing has several benefits for children, where through skills, children's motoric skills can entertain themselves and gain feelings of joy, such as children feeling happy by having the skills to play with dolls, throw and catch balls or move game tools (Chandra et al., 2025).

Play-based physical activities have been shown to support children's motoric competence, balance, and coordination across diverse settings (Robinson et al., 2015). Play-based activities are widely recognized as an essential component of early childhood development, contributing not only to motoric skills but also to emotional well-being and social adaptation (Hurlock, 2014; Sampson et al., 2016). Adequate motoric development enables children to engage more confidently in peer interactions and school-related activities, whereas delays may affect participation and social integration (Wulandini et al., 2022). Within this context, traditional games may represent one of several supportive approaches to fostering motoric skill development, rather than a singular or definitive solution.

The results of research regarding cat and cat games improve gross motoric skills, through skills, children's motoric skills can move from a condition of "helplessness" (helpless) in the first months of life, to a condition of "independence" (free, not dependent). Increased sedentary behavior and screen-based play have been associated with reduced opportunities for motoric skill development in young children (Hall et al., 2018; King-Dowling et al., 2020; Schmutz et al., 2020). Children can move from one place to another and can do things for themselves. This condition will support the development of "self-confidence". Through motoric skills children can adapt to the school environment. At pre-school age (kindergarten) or the early grades of elementary school, children can be trained in writing, drawing, painting and lining up. Another research said that normal motoric development allows children to be able to play or socialize with their peers, whereas abnormal ones will prevent children from being able to socialize with their peers and will even result in them being isolated or becoming marginalized children (fringer) (Wulandini et al., 2022).

Pediatric nurses play an important role in promoting physical activity and movement-based interventions as part of holistic child development and preventive health strategies (Temel et al., 2023). From a pediatric nursing perspective, the findings highlight the potential role of culturally appropriate play activities in supporting child development. Pediatric nurses, educators, and caregivers may consider traditional games as a complementary component of holistic child development programs,

particularly in settings where such activities are culturally familiar . However, these implications should be viewed as exploratory, given the pilot nature of the study and its methodological limitations.

This study also has several limitations that should be acknowledged. By employment of a non-randomized, or single-group pretest–posttest design, this study will restrict such a causal interpretation. The sample size was a relatively small group, and the intervention only focused on a single traditional game within a specific cultural setting, so that there was a limiting generalizability. Future research should be conducted and incorporate controlled or randomized designs with larger and more diverse samples and settings. Another comparative and longitudinal studies examining multiple traditional games would also be valuable to better understand their short- and long-term contributions to children's gross motoric development.

CONCLUSION

The findings of this study can be suggested to be the valuable and cultural participation in the traditional Riau game Lulu Cina Buta as being associated with improvements on children's gross motoric skills, especially in their balance, agility, and speed. These results also indicate the potential value of culturally relevant traditional games as a supportive intervention to enhance physical development in early childhood. However, given the design by non-randomized, single-group and the absence of a control group, the observed effects should be not fully interpreted as well. While traditional games may be considered as a complementary strategy and activities within early childhood settings as a fun experience, further studies employing controlled and randomized designs are needed to confirm their effectiveness. Pediatric nurses, educators, and also parents may explore more about the incorporation of traditional games as part of holistic motoric development and stimulation, taking into account contextual factors and the individual needs of early childhood.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the children and their parents for participating in this study. We also extend our appreciation to the early childhood education centers in Riau and West Sumatra for their support and cooperation during data collection. Special thanks to the research assistants who contributed to the implementation of the intervention and data management. Finally, we acknowledge the guidance and support provided by Universitas Abdurrab in facilitating this research.

AUTHOR'S CONTRIBUTION

PWS contributed to the study's conception and design, data acquisition, and data analysis, wrote the first draft of the manuscript, revised the final draft, and gave final approval of the version to be published. IRK contributed to extraction thematic data acquisition, and data analysis, wrote and revised the manuscript.

DECLARATION OF CONFLICTING INTEREST

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING

This research receives a grant from Universitas Abdurrab in scheme of cooperation funding with Fort De Kock University.

ETHICAL CONSIDERATION

The study approval was obtained from the Ethical Committee of Abdurrab University (Approval number 146/Kep-Univrab/IX/2023).

DATA AVAILABILITY STATEMENT

The dataset generated during and analyzed during the current study is available from the corresponding author upon reasonable request.

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