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Meta-Analysis of the Influence of Games and Traditional Games on the Physical Motor Development of Children with Disabilities

Nurhidayah[1]*, Taruli Marito Silalahi [2], Roziah [3], Yulia Santi [4], Muhammad Fadli [5]

*[1,2 ,5] Fakultas Ilmu Pendidikan, Universitas Sari Mutiara Indonesia, Kota Medan, Sumatera Utara, Indonesia

[3]Fakultas Keguruan dan Ilmu Pendidikan, Universitas Islam Riau, Indonesia

[4]Program Pascasarjana, Universitas Almuslim, Bireuen, Aceh, Indonesia

nurhidayah@sari-mutiara.ac.id , taruli766hi@gmail.com , roziah@edu.uir.ac.id , yuliasanti@umuslim.ac.id , alfarabim51@gmail.com

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Abstract

Disability or special needs refer to a condition of functional limitations that hinder individuals from performing daily activities. This study aims to examine the effect of games and traditional games on the physical motor development of children with disabilities through a meta-analytic approach. Data were collected from 14 primary studies that met the inclusion criteria and analyzed using meta-analytic statistics. The analysis revealed a Q-value of 22.784 with a p-value of 0.04 (< 0.05), indicating heterogeneity in effect sizes across studies. Therefore, a random-effects model was employed to calculate the overall effect size. The results showed that games and traditional games have a significant positive effect on the physical motor development of children with disabilities, with a combined effect size of r = 0.744 (p < 0.05), which falls into the strong category. These findings underscore the importance of integrating traditional games into physical-motor intervention programs for children with disabilities. Future research is recommended to explore potential moderating factors affecting the effectiveness of such interventions, such as type of disability, age of the children, and duration of the intervention.

Keywords– *Traditional games ;Motor development ;Children with disabilities*

1. Introduction

Academic achievement among Indonesian students continues to lag behind that of students in OECD countries. According to the 2018 Programme for International Student Assessment (PISA), Indonesian students scored below the OECD average in mathematics, science, and reading (Ulkhaq, 2024). For instance, Indonesia's average mathematics score remained significantly lower than the OECD benchmark, indicating a persistent gap in learning readiness. A range of factors may influence children's learning outcomes, whether they are typically developing or living with disabilities. These factors include environmental conditions, curriculum and learning facilities, parental and teacher support, as well as internal child-specific factors such as interests, talents, motivation, emotional and mental well-being, and physical-motor development. Impairments in physical motor function can negatively affect students' learning abilities, attention span, and active participation issues that are even more pronounced for children with disabilities who face dual challenges: physical limitations and an often non-inclusive educational environment.

Children with disabilities or special needs are characterized by functional limitations that hinder their ability to perform daily activities independently. Thus, supportive tools that aid in their physical motor development are urgently needed. One such tool is play particularly traditional games which provide a natural medium for stimulating motor development in children with disabilities. Traditional games, passed down through generations within specific cultures or regions, are typically group-based activities conducted indoors or outdoors using simple materials, and are inherently enjoyable (Nurhidayah et al., 2024). These games often require movements involving balance, coordination, strength, and agility, all of which are foundational to both gross and fine motor skill development. A meta-analytic study by Abadi and Nugroho (2024) revealed that traditional games significantly enhance motor development scores in children. Popular

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Indonesian games such as engklek, gobak sodor, and jump rope have been shown to promote physical motor development in children with disabilities.

Supporting this, Hasan et al. (2021) confirmed the positive contribution of traditional games to the motor development of children with special needs. Similarly, Mulya (2024) found that implementing traditional games with 25 children with disabilities (average age 12) led to significant improvements in gross motor abilities, such as long jumping, broad jumping, and throwing skills, as demonstrated in a pre-post experimental design. Additionally, Dzakiyyah et al. (2024), through a literature review, concluded that traditional games play an important role in enhancing balance, coordination, movement control, muscular strength, and other aspects of gross motor development in children with disabilities.

However, findings across studies are not always consistent. For example, Badriyah (2019) reported that engklek significantly improved both motor skills and mathematical logic in early childhood. In contrast, a study by Tan et al. (2020) on preschool children found no statistically significant difference in motor skill scores (measured by MABC-2 standards) between traditional game interventions and free-play methods. Similarly, Mulyah (2020) observed only modest and statistically insignificant improvements in gross motor development among children with disabilities following traditional game interventions. These discrepancies may be attributed to differences in research methodology, participants' age and type of disability, the specific games used, the duration of intervention, and the tools employed to assess motor outcomes. Therefore, the variation in findings from strongly positive to statistically insignificant suggests the need for a more systematic and integrative approach such as meta-analysis.

Meta-analysis is a quantitative technique that integrates findings from multiple studies to produce a comprehensive estimate of effect size while assessing heterogeneity across studies. Its advantages include increased statistical power, reduced publication bias, and a more holistic understanding

than single studies can provide. Moreover, meta-analysis allows for the examination of moderating variables and subgroup differences, offering explanations for outcome variability. This approach is particularly well-suited to address inconsistencies and to generate in-depth insight into the effects of traditional games on the motor development of children with disabilities.

While some prior meta-analyses have explored the effects of physical activity or play on children's motor development such as the work of Abadi and Nugroho (2024) in general populations, and Sun and Chen (2024), who studied sports play interventions with strong effect sizes (Std diff = 0.93) few have focused specifically on traditional games. Even fewer have targeted populations of children with disabilities. The novelty of the current study lies in three key aspects: (1) its explicit focus on child-centered and culturally rooted traditional games, (2) its dedicated emphasis on children with disabilities as a special population, and (3) its investigation of moderating variables such as type of disability and type of game intervention.

Accordingly, this study aims to (1) map and quantitatively analyze the effects of traditional games on the physical motor development of children with disabilities, (2) estimate the magnitude of the effects through meta-analytic techniques, and (3) identify potential moderating factors that influence the strength of these relationships. The significance of this research lies in its scientific contribution to building evidence-based support for inclusive education strategies rooted in traditional play, and in its practical value for informing educational policy and program development for children with special needs in Indonesia.

2. Method

This meta-analytic study employed a systematic approach to identify, select, and analyze primary studies that investigated the relationship between traditional games and physical motor development in children with disabilities. To ensure methodological rigor and the relevance of the studies

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included, specific inclusion criteria were established. First, only studies published within the last seven years, from 2018 to 2024, were considered to ensure the currency and relevance of findings in relation to contemporary educational and therapeutic practices. Second, the studies had to be published in nationally accredited academic journals, thereby meeting acceptable standards of peer-reviewed scholarship. Third, publications in either Indonesian or foreign languages, including English, were eligible, provided they met all other criteria. Fourth, eligible studies were those that explicitly examined the relationship or impact of "games" or "traditional games" as independent variables and "physical motor development" as the dependent variable. Finally, the studies were required to report sufficient statistical information for effect size calculation such as correlation coefficients (r) with sample sizes, t-values with sample sizes, or significance levels (p-values) with corresponding sample sizes.

Data collection was carried out through a comprehensive search using the Google Scholar online database. To identify relevant literature efficiently, a combination of carefully selected keywords was used. These included variations and synonyms of the terms “influence,” “impact,” or “relationship,” paired with “games,” “traditional games,” or “small games,” and finally combined with disability-related terms such as “disability,” “intellectual disability,” “hearing impairment,” “speech impairment,” “physical disability,” “autism,” and “Down syndrome.” This keyword strategy was designed to capture the widest possible range of studies relevant to the research objective. The search process was followed by a meticulous screening of the studies based on the predefined inclusion criteria. As a result, a total of 14 primary studies were identified as eligible and included in the meta-analysis.

To facilitate the subsequent stages of analysis, a structured data extraction process was conducted. Key information was systematically extracted from each selected study to ensure consistency and accuracy. The extracted data included the title of the study, year of publication, educational

setting or level (e.g., school level or age of participants), the specific type of disability addressed, the type of game or traditional play utilized as the intervention, and the dependent variable representing physical motor development. This comprehensive data extraction allowed for a more nuanced analysis of the effects and provided the necessary foundation for calculating effect sizes and conducting further moderator analyses.

Table 1. Summary of Primary Studies Included in the Meta-Analysis

No	Researcher(s)	Educational Level	Type of Disability	Type of Game	Dependent Variable
1	Gandasari (2024)	Special School for the Deaf (SDLB)	Intellectual Disability	Engklek and Zig-Zag	Static and Dynamic Balance
2	Jumadi (2023)	Early Childhood Education (PAUD, 1–3 years)	Down Syndrome	Geometric Puzzle	Fine Motor Skills
3	Athirah, et al. (2023)	SD-SMALE	Down Syndrome	Tug of War	Hand Muscle Strength
4	Baharuddin & Siafa (2021)	SDLB Bina Bangsa Sidrap	Down Syndrome	Catch Ball Game	Gross and Fine Motor Coordination
5	Suswandari (2020)	SMPLB YPPLB Makassar	Deaf	Modified Gobak Sodor	Hand and Foot Coordination
6	Putri & Kartini (2019)	SDLB-B	Disability	Modified Engklek	Gross Motor Development
7	Kartini (2019)	Inclusive School	Autism	Jumping Circle	Motor Balance
8	Yasin (2018)	SLB-C YPPLB Makassar	Intellectual Disability	Modified Soccer	Ball Handling Coordination
9	Suwirman (2018)	SMALB-C Tunas Harapan (Ages 16–19)	Intellectual Disability	Traditional Game	Physical Fitness Level
10	Priskila & Christina (2021)	SGKK Majalengka, West Java (Ages 18)	Intellectual Disability	Small Games	Physical Skills
11	Athirah, et al. (2020)	SLB-C Makassar 2	Intellectual Disability	Traditional Game	Locomotor Movement Skills
12	Mulya (2020)	Mean Age 12	Intellectual Disability	Modified Gobak Sodor	Gross Motor Development
13	Nurhidayah, et al. (2024)	SLBN (Grades 4, 5, 6)	Intellectual Disability	Traditional Games	Physical Fitness Level
14	Firdas & Irfan (2023)	SLB Al-Gifari, Makassar (Ages 13–15)	Intellectual Disability	Bocce Game	Physical Fitness Level

The data analysis process in this meta-analytic study was conducted using the Comprehensive Meta-Analysis (CMA) software, a robust statistical tool widely utilized in meta-research for synthesizing quantitative findings

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across multiple studies. The meta-analysis followed a structured and multi-stage framework to ensure accuracy, reliability, and transparency in the results. The first stage involved calculating the effect size for each individual study. Effect size serves as a standardized metric that quantifies the magnitude of the relationship between the independent variable (i.e., traditional games) and the dependent variable (i.e., physical motor development) in each included study. The effect sizes were computed based on the statistical data reported in the primary studies, such as correlation coefficients, t-values, p-values, and sample sizes.

The second stage entailed assessing heterogeneity across the included studies. This was done to determine the extent to which the variability in effect sizes was due to true differences among studies rather than chance. The heterogeneity test, typically using the Q statistic and the I^2 index, informed the decision to apply a random-effects model rather than a fixed-effects model, acknowledging that the studies varied in sample characteristics, intervention types, and measurement tools. Subsequently, the combined or overall effect size was computed, providing an aggregated estimate of the influence of traditional games on the motor development of children with disabilities.

In the third stage, publication bias was evaluated to ensure the robustness and generalizability of the findings. This was done using the File Safe N approach, which estimates the number of unpublished or missing studies with null results that would be required to negate the observed overall effect. A high File Safe N value suggests that the results are stable and unlikely to be significantly altered by the inclusion of missing data.

The interpretation of effect sizes in this study followed the conventional classification proposed by Cohen et al. (1988), which categorizes effect sizes as small ($r \approx 0.10$), medium ($r \approx 0.30$), and large ($r \geq 0.50$). This framework provided a meaningful context for understanding the strength of the observed relationships and allowed for a consistent comparison across studies. Overall,

the application of CMA software and adherence to established meta-analytic procedures enhanced the methodological rigor and validity of this research.

Table 2. Classification of Effect Size of Correlation Studies

Small	Medium	Large
r ≤ 0. 10	r = 0.30	r ≥ 0.50

3. Result and Discussion

The Effect of Games and Traditional Games on the Physical Motor Development of Children with Disabilities

This study aims to examine the impact of games and traditional games on the physical motor development of children with disabilities. The analysis employed effect size calculations for each primary study using Comprehensive Meta-Analysis (CMA) version 3 software. The effect size is a statistical indicator that represents the magnitude of the intervention effect across the included studies. Table 3 below presents the effect sizes of the 14 studies that met the inclusion criteria, along with their respective confidence intervals (lower and upper limits) and effect size categories.

The findings demonstrate that all included studies reported large effect sizes, indicating that both games and traditional games have a strong and statistically significant impact on the motor development of children with disabilities. For example, Svamsuddin (2020) reported an effect size of 0.982 with a confidence interval ranging from 0.749 to 0.999, while Astuti, Orhan, Amsari, and Sari (2024) reported an effect size of 0.877. These consistently high values suggest that traditional and structured play-based interventions are highly effective in improving aspects of gross and fine motor skills among children with various disabilities, including intellectual disability, Down syndrome, and autism.

Moreover, even the study with the lowest effect size conducted by Supriyana, Yuda, and Dimvati (2022) still reported a strong impact (effect size = 0.663), reinforcing the reliability and practical importance of traditional games in therapeutic and educational contexts. These results support the

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integration of traditional play into inclusive education strategies and physical development programs for children with special needs.

Table 3. Effect Size of Each Study

No	Study Name	Effect Size	Lower Limit	Upper Limit	Effect Size Category
1	Baharudin & Siafa (2021)	0.908	0.128	0.994	Large
2	Svamsuddin (2020)	0.982	0.749	0.999	Large
3	Putri & Kartiko (2019)	0.945	0.114	0.872	Large
4	Pratiwi & Kartiko (2022)	0.761	0.481	0.902	Large
5	Supriyana, Yuda & Dimvati (2022)	0.663	0.144	0.896	Large
6	Priyono, Sahudi & Hendrayana (2021)	0.745	0.285	0.958	Large
7	Astuti, Orhan, Amsari & Sari (2024)	0.877	0.611	0.965	Large
8	Rovana et al. (2023)	0.467	0.031	0.754	Large
9	Firdas & Irfan (2023)	0.708	0.457	0.864	Large
10	Gandasari (2024)	0.468	0.165	0.690	Large
11	Jumanti (2025)	0.876	0.521	0.981	Large
12	Athirah, Arimbi & Ichsani (2021)	0.678	0.084	0.912	Large
13	Yasin (2018)	0.907	0.645	0.976	Large
14	Mulya (2020)	0.744	0.494	0.880	Large

Combined Effect Size, Heterogeneity Analysis, and Publication Bias Evaluation

Table 3 previously illustrated the variation in effect sizes across the 14 studies included in the meta-analysis, ranging from 0.467 to 0.982. Based on these results, 13 of the 14 studies (92.8%) reported large effect sizes, while one study fell into the small effect size category. To determine the combined or overall effect size and examine the consistency of findings across studies, a heterogeneity analysis was conducted. Table 4 presents the results of this analysis, including calculations under both fixed-effect and random-effects models.

Table 4. Analysis of Heterogeneity and Combined Effect Size

Estimation Method	K	r	p-value	Df	Heterogeneity	
					Q	p-value
Random-Effect	14	0.744	0.00	13	22,784	0.044
Fixed-Effect	14	0.702	0.00	13		

According to Table 4, the Q-value was 22.784 with a p-value of 0.044, which is lower than the significance threshold ($\alpha = 0.05$). This result indicates significant heterogeneity among the studies, suggesting that the effect sizes vary

not merely by chance, but due to actual differences between the studies such as variations in population characteristics, types of disability, interventions, or measurement tools. Therefore, the random-effects model was deemed more appropriate for estimating the overall effect size. Under this model, the combined effect size was $r = 0.744$ ($p < 0.05$), which is categorized as a strong effect. This finding supports the conclusion that games and traditional games have a statistically significant and substantial positive impact on the physical motor development of children with disabilities.

To assess the possibility of publication bias that is, whether the meta-analysis results might be distorted by the exclusion of unpublished or null-result studies the Fail-Safe N (FSN) method was employed. Table 5 summarizes the FSN analysis. The observed Fail-Safe N was 537, meaning that 537 additional studies with an average effect size of zero would be required to bring the overall result to non-significance ($p > 0.05$). According to Rosenthal's formula, the minimum threshold for a stable result is calculated using the equation $5K + 10$, where K is the number of studies. In this case, with 14 studies, the threshold value is $5(14) + 10 = 80$. Since the actual Fail-Safe N (537) far exceeds this threshold, it can be concluded that the findings are highly robust and unlikely to be affected by publication bias.

Together, these results reinforce the strength and reliability of the meta-analysis. Not only do traditional games show a large and significant effect on motor development in children with disabilities, but the consistency of this finding across diverse studies and the minimal likelihood of publication bias further validate its scientific and practical relevance.

Table 5. FSN Results Summary

P	**0.00**
Alpha	0.05
z for Alpha	1.96
K	14
File-Safe n	537

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Discussion

The results of the meta-analysis conducted across 14 primary studies reveal that games and traditional games have a significant and substantial effect on the physical motor development of children with disabilities, with a combined effect size of $r = 0.744$ ($p < 0.05$). This strong effect size reflects a robust relationship between culturally rooted play activities and improvements in both gross and fine motor skills. These findings align with and reinforce previous research, such as that by Hasan et al. (2021) and Mulyah (2020), which emphasized that traditional games are not only enjoyable but also function as effective tools for stimulating motor development in children with special needs. Traditional games often require complex and structured physical movements such as running, jumping, throwing, and catching that enhance coordination, balance, and muscle strength. These activities provide rich sensory and motor experiences that are crucial for children with disabilities, who often face delays or impairments in motor functions.

The high effect size found in this study ($r = 0.744$) is categorized as strong according to Cohen's criteria, indicating that traditional game interventions are not only theoretically sound but also practically impactful, particularly within inclusive educational and therapeutic contexts. This highlights that children with disabilities can achieve meaningful physical development through culturally meaningful and participatory interventions. Thus, the results of this study present compelling scientific evidence to support the incorporation of traditional games into child development programs in schools, therapy centers, and community-based rehabilitation settings. Such integration would serve not only physical goals but also foster social interaction, enjoyment, and engagement critical elements in holistic child development.

The study also reveals a key limitation: significant heterogeneity among the included studies, as indicated by a Q-value of 22.784 ($p = 0.044$). This heterogeneity suggests considerable variation in effect sizes, which may stem from differences in study contexts, participant demographics (e.g., type of disability and age), intervention durations, and types of games used.

Additionally, some studies lacked detailed reporting on intervention procedures, which may have affected the precision of effect size calculations and the overall reliability of synthesis. Therefore, while the overall findings are promising, they must be interpreted with caution, taking into account the possible influence of unmeasured or unreported moderator variables.

The implications of this research are broad and impactful. The findings underscore the importance of incorporating play-based and culturally embedded approaches in inclusive education and rehabilitation programs. In an era dominated by digital entertainment, traditional games have often been overlooked; yet, this study demonstrates their continued relevance and potential, especially for children with special needs. Future research is recommended to delve deeper into potential moderating factors, such as gender, type of disability, and the instructional methods employed by teachers or facilitators. It is also critical to assess the long-term effects of traditional game-based interventions, particularly their influence on social-emotional development, cognitive functioning, and adaptive behaviors in children with disabilities.

Traditional games are not merely cultural artifacts; they represent a pedagogically powerful and accessible intervention strategy that can bridge the gap between therapeutic goals and inclusive educational practices. Their structured nature, physical demands, and social engagement offer a multidimensional benefit that merits greater integration into modern intervention frameworks.

4. Conclusion

Based on the results of a meta-analysis encompassing 14 primary studies, it can be concluded that both games and traditional games exert a significant and strong influence on the physical motor development of children with disabilities, with a combined effect size of $r = 0.744$ ($p < 0.05$). This finding highlights that play-based activities especially those rooted in local culture can serve as effective intervention strategies to enhance motor skills in children

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with special needs. Whether in formal educational settings or community-based rehabilitation programs, incorporating structured and culturally familiar games has the potential to support improvements in both gross and fine motor coordination.

However, the analysis also revealed significant heterogeneity across studies ($Q = 22.784$; $p = 0.04$), indicating variability in study contexts, game types, participant characteristics, and intervention designs. These differences suggest that while the overall impact of play is positive, its effectiveness is not absolute, and likely influenced by a range of contextual and implementation factors. For instance, teaching methods, the quality of the learning environment, and the presence of social support systems including parental involvement and peer interaction may all serve as moderating variables that either enhance or diminish the effectiveness of play-based interventions.

Therefore, it is crucial to move beyond general claims of efficacy and instead pursue a more nuanced understanding of the factors that strengthen or weaken the relationship between play activities especially traditional games and the physical motor development of children with disabilities. Future research should focus on identifying and testing these moderating variables, thereby allowing practitioners, educators, and policymakers to tailor interventions that are both evidence-based and context-sensitive.

Based on the conclusions drawn from this meta-analysis, it is recommended that educational institutions and rehabilitation centers for children with disabilities actively incorporate games particularly traditional games into their physical development and learning programs. These culturally rooted and participatory activities have demonstrated strong potential to enhance motor skills and should be viewed not merely as recreational tools, but as integral components of inclusive pedagogical and therapeutic strategies.

Future research is strongly encouraged to explore potential moderating variables that may influence the effectiveness of traditional game interventions. These include child-specific factors such as age and type of disability, as well as intervention-specific factors such as game type, intensity, duration, and the

instructional approaches employed by educators or facilitators. Investigating these elements will enable more targeted and individualized interventions, optimizing outcomes for diverse groups of children with special needs. Moreover, it is imperative to conduct longitudinal studies to assess the long-term impacts of traditional play-based interventions, not only on physical motor development but also on other key developmental domains, including social-emotional skills, cognitive functioning, and adaptive behavior. Such research would provide a more holistic understanding of the role of traditional games in the broader context of child development. The integration of traditional games into educational and therapeutic settings offers an added cultural benefit: the preservation and revitalization of local heritage. Utilizing traditional games not only fosters physical development in children with disabilities but also reinforces cultural identity and community values, aligning well with the principles of inclusive and culturally responsive education.

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