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THE EFFECT OF BRAIN GYMNASTICS ON FINE MOTOR SKILLS IN CHILDREN AT AL KAUTSAR ISLAMIC KINDERGARTEN IN SOUTH JAKARTA CITY IN 2024

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ABSTRACT

Fine motor skills are essential in early childhood development, supporting daily activities and school readiness. Brain gymnastics is a series of structured and simple movements involving coordination between the brain and body, designed to stimulate the nervous system and enhance motor development in a playful way. This study used a pre-experimental design with a one-group pretest-posttest approach. A total of 33 children aged 4–6 years were selected using purposive sampling. The Denver Developmental Screening Test (DDST) was used as the main instrument, completed through parent interviews and direct observation by the researcher before and after the brain gymnastics intervention. Data were analyzed using the Wilcoxon Signed-Rank Test. Before the intervention, 21 children (63.3%) showed delayed fine motor development. After the intervention, 30 children (90.9%) reached the normal developmental stage appropriate for their age. The Wilcoxon Signed-Rank Test revealed a significant difference with a p-value of 0.000 ($p < 0.05$), indicating a statistically significant improvement in fine motor skills. The results demonstrate that brain gymnastics effectively improves fine motor skills in children aged 4–6 years. Through engaging and coordinated movements, brain gymnastics stimulates neural pathways and supports optimal motor development. It can be applied as a fun and practical method of stimulation in early childhood education settings.

Keywords: brain gymnastics, fine motor skills, early childhood, developmental stimulation, DDST

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INTRODUCTION

Fine motor skills are crucial in early childhood as they support fundamental tasks such as writing, grasping, and manipulating objects. These skills require precise coordination between the brain, nervous system, and muscles, and typically develop rapidly in children aged 4–6 years, a critical period for foundational learning and school readiness (Sumiyani et al., 2024).However, developmental delays in fine motor skills remain a significant concern globally.

According to the World Health Organization (2022), approximately 5–25% of preschool-aged children experience mild neurological dysfunctions, including fine motor impairments. UNICEF (2022) also reports that among children under five, approximately 1.3 million out of 5 million cases of developmental delays involve motor disorders. The prevalence of fine motor issues in preschoolers ranges from 12–16% in the United States, 24% in Thailand, 22% in Argentina, and between 13–18% in Indonesia (Khasanah et al., 2022; Suwardi, 2021). Without timely intervention, these impairments may persist into adolescence or adulthood, negatively impacting educational performance and independence.

One promising strategy to address this issue is brain gymnastics (brain gym) a series of structured movements aimed at enhancing brain function, particularly in coordination and learning adaptability. This method stimulates the brain's neural pathways to support motor control and learning processes (Yuliansih, 2021). Brain gym activities can help strengthen the coordination between visual input and hand movement, which is essential for fine motor development in early childhood.

Several studies have demonstrated the effectiveness of brain gym interventions in improving children's motor abilities. For instance, recent research shows significant improvement in fine motor coordination among preschool children after consistent brain gym sessions (As'ari et al., 2023; Sukri & Purwanti, 2022). However, most existing studies focus on general motor or cognitive outcomes, with limited focus on fine motor development as a specific and measurable domain in Indonesian preschool contexts.

Preliminary observations conducted in September 2023 at Al Kautsar Islamic Kindergarten, South Jakarta, revealed that 4 out of 10 children were unable to stack five cubes without dropping them, and 2 out of 10 were unable to draw simple circles without guidance—suggesting potential delays in fine motor development. This is concerning, considering the National Standards for Early Childhood Education (Permendikbud No. 137 Tahun 2014), which emphasize the importance of developing finger dexterity and self-expression through fine motor control in children aged 4–6 years (Marliana, 2020).

Given the critical importance of fine motor skills in early learning, the high prevalence of developmental delays, and the limited localized research on targeted interventions such as brain gym, this study seeks to explore the effectiveness of brain gymnastics on fine motor skills in children aged 4–6 years at Al Kautsar Islamic Kindergarten in South Jakarta.

METHOD

This study employed a pre-experimental design with a one-group pretest-posttest approach. The intervention was conducted at Al Kautsar Islamic Kindergarten, South Jakarta, in March 2024. A total of 33 children aged 4–6 years were selected using a total sampling technique. Inclusion criteria included children who were in good physical and mental health, aged 4–6 years, cooperative during the intervention, had obtained parental consent, and attended all four sessions of the brain gym program. Exclusion criteria included children with diagnosed neurological or

motor impairments, those who missed more than two sessions, or children with communication difficulties that hindered participation in the exercises.

The intervention consisted of brain gym exercises carried out for 15 minutes per session, every school day (Monday to Friday) for 12 consecutive school days. The sessions were led by the researcher and supported by the class teachers. The exercises included nine brain gym movements: Brain Button, Earth Button, Space Button, Positive Point, Hook-ups, Owl, Active Arms, Thinking Cap, and Cross Crawl. Simple educational tools such as blocks, pencils, and paper were used to support hand–eye coordination training.

The assessment instrument used was the Denver Developmental Screening Test II (DDST-II), specifically focusing on the fine motor-adaptive domain. Items evaluated included eye-hand coordination, manipulation of small objects, and basic drawing skills. The DDST form was completed by the researcher based on direct observation and interviews with parents before and after the intervention.

Data were analyzed using the Wilcoxon Signed-Rank Test to determine differences in fine motor development before and after the brain gym intervention, using SPSS version 25. This research has passed the ethical review of the Health Research Ethics Commission of the Faculty of Health Sciences, State Islamic University (UIN) Syarif Hidayatullah Jakarta with Number: Un.01/F.10/KP.01.1/KE.SP/02.08.022/2024.

RESULT

The study involved 33 children aged 4–6 years from Al Kautsar Islamic Kindergarten in South Jakarta. Most of the participants were 5 years old (42.4%), followed by those aged 6 years (30.3%) and 4 years (27.3%). In terms of gender, the distribution was relatively balanced, with 17 boys (51.5%) and 16 girls (48.5%).

Table 1: Characteristics of Respondents

Characteristic	Category	Frequency (n)	Percentage (%)
Age	4 years	9	27.3%
	5 years	14	42.4%
	6 years	10	30.3%
Gender	Male	17	51.5%
	Female	16	48.5%

Table 2 shows the distribution of fine motor development stages before and after the brain gym intervention. Prior to the intervention, a majority of children, 21 out of 33 (63.6%), were categorized in the fall (delayed development) group. Six children (18.2%) were in the suspect category, and only six children (18.2%) demonstrated normal development.

Table 2: Distribution Of Fine Motor Development Stages Before And After The Brain Gym Intervention in Students of AL Kautsar Kindergarten South Jakarta Year 2024

Developmental Stage	Pre-Test		Post-Test	
	Frequency	Percentage	Frequency	Percentage
Fallr	21	63.6%	1	3.0%
Suspect	6	18.2%	2	6.1%
Normal	6	18.2%	30	90.9%
Total	33	100%	33	100%

After 12 sessions of brain gymnastics, there was a significant shift in developmental outcomes. The number of children in the fall category decreased drastically to only 1 child (3.0%), while the suspect group slightly decreased to 2 children (6.1%). Most notably, the number of children with normal development increased sharply to 30 children (90.9%). These findings indicate a substantial improvement in fine motor development following the brain gym intervention.

Table 3 : Normality Test Using Shapiro-Wilk

Variable	Shapiro-Wilk Statistic	df	Sig. (p-value)
Fine motor development (pre-test)	0.671	33	0.000
Fine motor development (post-test)	0.330	33	0.000

The results of the Shapiro-Wilk test indicate that both the pre-test and post-test data on fine motor development were not normally distributed ($p < 0.05$). Therefore, the non-parametric Wilcoxon Signed Rank Test was used to analyze the differences between pre- and post-intervention scores.

Table 4: Wilcoxon Signed-Rank Test Results on Fine Motor Development Before and After Brain Gym Intervention

Variable	Z	Asymp. Sig. (2-tailed)
Fine Motor Development	-4.635	0.000

The Wilcoxon Signed-Rank Test revealed a statistically significant improvement in fine motor development following the brain gym intervention ($Z = -4.635$, $p < 0.001$). The calculated effect size was $r = 0.81$, indicating **a** large and practically meaningful impact of the intervention.

DISCUSSION

Based on the data in Table 1, the majority of respondents were 5 years old (42.4%), followed by those aged 4 years (33.3%) and 6 years (24.2%). This finding reflects that most children were in the active developmental stage, particularly for fine motor skills. The age range of 4–6 years is often referred to as the golden age of development, during which the central nervous system and muscle coordination are rapidly maturing. During this stage, children begin to refine hand movements required for tasks such as drawing, writing, and object manipulation (Sumiyani et al., 2024).

According to the Indonesian Ministry of Health (2019), child development is cumulative and interrelated, meaning that the mastery of earlier developmental milestones supports the achievement of later ones. Fine motor skill development during the preschool years is directly linked to school readiness, especially in tasks involving writing and tool use. Therefore, interventions such as brain gym are considered more effective when implemented during this critical period.

As presented in Table 2, most of the respondents were male (51.5%), while females accounted for 48.5%. Although this gender distribution was relatively balanced, previous studies have suggested that girls may develop fine motor skills slightly earlier than boys, particularly in tasks involving drawing and writing (Mustamin et al., 2021). Nevertheless, in the current study,

both boys and girls demonstrated improvement in fine motor performance following the intervention, suggesting that brain gym is effective regardless of gender.

In summary, the respondent characteristics in terms of age and gender were diverse yet proportionate, providing a robust sample to support the effectiveness of brain gym. These results indicate that brain gym exercises can be widely applied across various age groups in early childhood and are suitable for both boys and girls.

The results of this study demonstrate that brain gym exercises significantly enhance fine motor development in children aged 4–6 years. As indicated in Table 4, there was a marked improvement in fine motor skills following the intervention, with the percentage of children categorized as “normal” increasing from 18.2% to 90.9%. This improvement was statistically significant ($Z = -4.635$, $p < 0.001$) with a large effect size ($r = 0.81$), as shown in Table 4.

The effectiveness of brain gym can be explained through the lens of neuroplasticity and sensorimotor integration. Neuroplasticity refers to the brain’s ability to reorganize itself by forming new neural connections in response to experience or learning (Kolb & Gibb, 2021). Brain gym exercises involve coordinated, cross-lateral body movements that activate multiple regions of the brain, including motor, sensory, and cognitive processing areas. These repetitive and intentional movements enhance neural pathways associated with motor control, ultimately supporting the development of fine motor coordination (Green et al., 2020).

Sensorimotor integration plays a critical role. Brain gym exercises encourage synchronization between visual input, proprioception, and hand movement, fostering improved efficiency in eye-hand coordination. Children’s brains integrate feedback from sensory organs with motor planning areas such as the cerebellum and parietal cortex, enabling refined motor control (Damiano & DeJong, 2021). This aligns with the dramatic post-test shift in this study, where 90.9% of children achieved normal fine motor levels after the intervention.

Moreover, brain gym promotes sensorimotor integration, the process by which the brain combines sensory input (such as vision, touch, and proprioception) with motor output. Fine motor tasks like drawing or stacking objects require accurate timing, planning, and execution, all of which rely on efficient integration of sensory and motor signals. Regular brain gym activities help children refine these processes, leading to improved eye-hand coordination, grip strength, and movement precision (Sukri & Purwanti, 2022; Yuliansih, 2021).

These findings are consistent with previous studies. As’ari et al. (2023) reported that structured brain gym sessions led to significant improvements in motor performance and task focus among preschoolers. Nurkamelia (2020) also found that early and targeted stimulation could accelerate the development of neural circuits responsible for motor skills.

However, this study is not without limitations. The pre-experimental design lacked a control group, so changes cannot be fully attributed to the intervention alone. The short intervention duration (12 sessions) limits understanding of long-term outcomes. Moreover, the study was conducted in a single institution, which restricts generalizability to broader populations. These limitations suggest the need for future randomized controlled trials (RCTs) with larger, diverse samples and longitudinal follow-ups**.**

CONCLUSION

This study supports the implementation of brain gymnastics as an early intervention strategy for fine motor development in preschoolers. The significant improvement observed after 12 sessions of brain gym exercises highlights its potential as a low-cost, simple, and effective method that can be integrated into daily school routines.

Given the high neuroplasticity and responsiveness of the developing brain during the preschool years, structured motor activities such as brain gym can enhance neural connections, promote sensorimotor integration, and prepare children for school-related tasks like writing and drawing.

RECOMMENDATIONS

Early childhood teachers and educators are encouraged to routinely incorporate brain gym activities into daily learning programs as a form of stimulation to support fine motor development. To ensure continuity beyond the classroom, parents can be engaged through counseling sessions or training, enabling them to integrate brain gym exercises into daily routines at home. Educational institutions are also advised to adopt brain gym as an essential element of holistic learning approaches that foster both motor and cognitive school readiness. At a broader level, policy-makers and curriculum developers are expected to consider the integration of brain gym into the national early childhood education curriculum, particularly in regions with limited access to developmental support services. Collectively, these recommendations aim to foster inclusive and preventive strategies for addressing developmental delays and to enhance overall school readiness among preschool-aged children.

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