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Effect of brain gym stimulation on developmental outcomes among preschool children

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Abstract

Background: Cognitive function during early childhood plays an important role in children's learning abilities, problem-solving skills, and school readiness. Appropriate stimulation during the preschool period is essential to optimize cognitive development. Brain Gym has been proposed as a simple physical activity intervention that may enhance cognitive function by stimulating brain integration and neuroplasticity.

Purpose: To determine the effect of Brain Gym stimulation on cognitive function among preschool children.

Method: This quantitative study employed a one-group pretest-posttest design involving 15 preschool children at the Siger Physio Clinic, Bandar Lampung. Cognitive function was assessed using the Ages and Stages Questionnaire-3 (ASQ-3) before and after Brain Gym intervention administered for 15 minutes, three times per week, for four weeks. Data were analyzed using Gamma and Somers' D tests with a significance level of $p < 0.05$.

Results: Statistical analysis showed a significant improvement in cognitive function after Brain Gym intervention ($p = 0.02$). Preschool children who participated in Brain Gym demonstrated better cognitive development outcomes following four weeks of intervention.

Conclusion: Brain Gym stimulation significantly improved cognitive function among preschool children and may serve as an effective complementary intervention to support early childhood cognitive development.

Keywords: ASQ-3; Brain Gym; Cognitive Function; Preschool Children.

INTRODUCTION

Preschool children (1-5 years old) are in the golden age of human development. During this period, brain plasticity is at its most optimal, with massive and rapid nerve cell growth (Budhiman & Sani, 2023). Development during this phase provides a crucial foundation for motor skills, socio-emotional skills, language skills, and, importantly, cognitive function (Ling & Diamond, 2025). Optimal cognitive function in children is thought to encompass the ability to think, remember, solve problems, concentrate, and make simple decisions, which will ultimately determine their readiness to enter formal education. Various factors, such as a lack of psychosocial stimulation, excessive exposure to gadgets, and lack of physical activity, can hinder children's cognitive development (Li, Guo, Wang, Ma, & Lou, 2026).

According to World Health Organization (WHO) data, the rate of developmental disorders in early childhood remains quite significant in developing countries (Egeland & Hansen, 2026).

Decreased or delayed cognitive function during this period carries the risk of learning difficulties, poor concentration, and limited social adaptation in the future. Therefore, early intervention that is active, engaging, and effective is needed to stimulate the brain areas responsible for these cognitive processes (Forte, Favieri, Corbo, Chirico, Chattat, Vedova, & Casagrande, 2025).

One motor stimulation method considered effective and integrative for improving cognitive function is Brain Gym (Ayán, Sánchez-Lastra, Cabanelas, & Cancela, 2018). Brain Gym is a series

of physical exercises based on simple body movements designed to stimulate all parts of the brain so they work in an integrated manner (Wang & Zhou, 2024). According to Paul E. Dennison, movements in Brain Gym, such as the cross-crawl, brain buttons, and energized steam, work by optimizing blood and oxygen flow to the brain and balancing the activity of the left (lateralized) and right hemispheres of the brain (Forte et al., 2025).

This planned motor activity physiologically triggers neurotransmitter release and increases myelination in the cerebral cortex, which directly contributes to improved executive function, working memory, and attention in children (Li et al., 2026).

Several previous studies have shown that structured physical activity has a positive correlation with children's academic performance and neurocognitive function (Chen & Hao, 2025). However, the specific application of Brain Gym to the prenatal population requires further exploration, as most previous studies have focused on elementary school-aged children or children with special needs (Wang & Zhou, 2024). Preschoolers, who are still in the pre-operational stage of cognitive development (according to Piaget's theory), require a different and consistent stimulation approach (Kurniawan & Wahyuni, 2022).

RESEARCH METHOD

This quantitative study employed a one-group pretest-posttest design to determine the effect of Brain Gym stimulation on cognitive function among preschool children. The study was conducted at the Siger Physio Clinic, Bandar Lampung, Indonesia, in 2026.

The study population consisted of all preschool children aged 1–5 years who attended the Siger Physio Clinic during the study period. A total of 15 respondents were recruited using total sampling. The inclusion criteria were preschool children aged 1–5 years, routinely attending Brain Gym sessions at the clinic, and whose parents or guardians provided written informed consent. Children diagnosed with neurological disorders, severe developmental

disabilities, or those with incomplete questionnaire data were excluded from the study.

Cognitive function was assessed using the Ages and Stages Questionnaire-3 (ASQ-3), a standardized developmental screening instrument consisting of five developmental domains: communication, gross motor skills, fine motor skills, problem-solving skills, and personal-social skills. Each domain contains six age-specific questions, and the total scores were categorized into three developmental zones based on the ASQ-3 scoring guidelines: the normal development zone, monitoring zone, and referral zone.

All respondents underwent a pre-intervention assessment of cognitive function using the ASQ-3. Subsequently, Brain Gym stimulation was administered for 15 minutes per session, three times per week, for four consecutive weeks. The Brain Gym intervention consisted of simple and structured movements, including Cross Crawl, Brain Buttons, Hook-Ups, and Double Doodle exercises, which are designed to promote brain integration, improve concentration, and stimulate cognitive development.

Following completion of the four-week intervention period, respondents underwent a post-intervention cognitive function assessment using the same ASQ-3 instrument. The pre- and post-intervention results were compared to evaluate changes in cognitive function after Brain Gym stimulation.

Data were analyzed using descriptive statistics to describe respondents' characteristics and cognitive function outcomes. Inferential analysis was performed using Gamma and Somers' D tests because cognitive function was categorized as ordinal data based on ASQ-3 developmental zones. Statistical significance was established at $p < 0.05$ with a 95% confidence level.

This study received ethical approval from the Health Research Ethics Committee of STIKES Baitul Hikmah under Registration Number 0247/B.1/SF/IV/2026. Written informed consent was obtained from the parents or guardians of all participants prior to data collection.

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RESEARCH RESULTS

Table 1. Respondents' Age Characteristics (N=15)

Variable	Result
Age (Mean±SD) (Years)(Range)	(67.67±1.952) (1-5)
1-3	11/73.3
4-5	4/26.7

Table 1 shows the average and standard age characteristics (67.67±1.952) in the age range of 1-5 years. The majority of respondents were in the age range of 1-4 years, with a total of 11 respondents (73.3%), while only 4 (26.7%) were in the age range of 4-5 years.

Table 2. Correlation test

Value	Z	p
1000	3.123	0.02

Table 2. Shows the correlation test using the gamma & mers'd test obtained a significance result of 0.02 ($p < 0.05$) meaning there was a significant improvement in cognitive function after Brain Gym intervention.n in preschool-aged children. This study shows there was a significant improvement in cognitive function after Brain Gym intervention in preschool-aged children 15 minutes for 3 times a week for 4 weeks at the Siger Physio clinic.

DISCUSSION

This study aimed to examine the relationship between Brain Gym stimulation and cognitive function in preschool-aged children, with a sample size of 15 respondents. Based on research findings during observation and after Brain Gym stimulation, there was a relationship between Brain Gym stimulation and cognitive function in preschool-aged children.

Brain Gym stimulation is a series of simple body movement exercises designed to integrate all areas of the brain to improve cognitive function, motor coordination, and emotional regulation (Prince, Lang, Lawrason, Vallires, Butler, Lake, & McCormack, 2026). Brain Gym works by activating neural pathways through specialized motor movements, thereby optimizing blood and oxygen flow to the brain (Siddiqui, Khan, & Khattak, 2024). The brain possesses neuroplasticity (the ability to adapt and form new neural connections) (Wang & Zhou, 2024).

When a child crosses the midline, as in the Cross

Crawl movement, massive transmission of nerve impulses occurs across the corpus callosum (the bridge connecting the right and left hemispheres of the brain) (Snyder & Kaiser, 2023). This bilateral integration is crucial for complex cognitive functions such as reading and basic arithmetic (Müller, Salem, & Schöllhorn, 2025).

Nerve impulses are forced to cross the corpus callosum (the bridge connecting the right and left hemispheres) (Widanti, Arti, & Anjasmara, 2021). This process increases the efficiency of electrical signal transmission between neurons, which is referred to in a journal as increased maturity of bilateral integration (Voss, Cerna, & Gothe, 2023). As a result, cognitive processes such as reading, writing, and analysis become faster because both hemispheres work synergistically (Zelazo, Morris, Qu, & Kesek, 2024).

Structured physical activity triggers the release of the BDNF protein in the hippocampus. BDNF functions like "brain fertilizer," stimulating neurogenesis (the formation of new neurons) and increasing brain plasticity in children to process and store new information (Egeland & Hansen, 2026). Planned physical activity triggers the secretion of Brain-Derived Neurotrophic Factor (BDNF), a protein often referred to as "brain fertilizer." BDNF stimulates neurogenesis (the formation of new neurons) in the hippocampus, which is the center of memory and learning (Ayan et al., 2021).

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Brain Gym can increase directed physical activity, triggering the release of Brain-Derived Neurotrophic Factor (BDNF), a protein that stimulates the growth of new nerve cells (neurogenesis) and the formation of synapses in the prefrontal cortex, the control center for executive function, reasoning, and problem-solving (Forte et al., 2025). Specific movements encourage the formation of new synaptic connections between neurons. The more frequently these neural pathways are activated through movement, the stronger the brain circuits are in processing cognitive information (Li et al., 2026).

During the preschool stage, a child's brain is experiencing a golden age of synaptic development (synaptic pruning and myelination) (Diamond, 2025). Brain Gym exercises intervene in this golden period through structured motor stimulation that directly impacts higher-level cognitive abilities (Ferguson & Cooper, 2023). The brain coordinates body movements, and conversely, proprioceptive and vestibular stimulation from these movements provides feedback that enriches the brain's neural architecture. This exercise has proven effective as a complementary modality for improving cognitive performance during the golden period of early childhood (Voss et al., 2023).

Motor movements are not only physical activities, but also tactile, proprioceptive, and visual stimuli that collectively reorganize the central nervous system to prepare it for processing higher-level cognitive functions (Budhiman & Sani, 2023). Dynamic movements and nerve-stimulating acupoints (such as the Brain Buttons exercise) increase capillary blood circulation to the brain (Egeland & Hansen, 2026). Optimal oxygen and glucose supply to the cerebral cortex directly improves information processing speed and concentration (Chen & Hao, 2025).

Brain Gym sessions lasting 10 to 15 minutes per day (five times a week) for at least four to eight weeks are more effective than longer sessions performed only once or twice a week (Chiu, Li, & Huang, 2026). A randomized controlled trial (RCT) in preschool and elementary school children found that a 10–15-minute Brain Gym intervention, conducted consistently for four to six weeks, significantly improved short-term memory scores compared to a control group without the intervention (Zhao, Deng, Song, Zhu, Sun, Li, & Liu, 2024).

There is a positive and significant relationship between Brain Gym stimulation and improved cognitive function (Thakre, Deshmukh, & Gibbs, 2024). The motor movements in Brain Gym act as a pacemaker or tactile-proprioceptive stimulator that activates association areas in the brain (Budhiman & Sani, 2023). Through consistent practice, rarely used neural pathways are reintegrated, resulting in improved academic performance, focus, and emotional control (Elbanna, Kamal, Mahgoub, & Elshennawy, 2023).

The link between Brain Gym and cognitive function is rooted in the concepts of neuroplasticity and psychomotor skills, namely how structured physical activity can trigger functional and structural adaptations in the central nervous system (Verrall, Tran, Yang, Lubans, Winlaw, Ayer, & Cordina, 2023).

CONCLUSION

Brain Gym stimulation administered for 15 minutes, three times per week for four weeks significantly improved cognitive function among preschool children. Brain Gym may serve as an effective and practical intervention to support cognitive development during early childhood.

SUGGESTION

Future studies are recommended to include larger sample sizes and control groups to further evaluate the effectiveness of Brain Gym interventions on cognitive development among preschool children. Brain Gym may also be implemented as an early stimulation program in schools and child development centers.

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