

The Effect of Baby Swimming on Gross Motor Development in Babies Aged 3-9 Months

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Abstract:

Infancy represents a critical period for growth and neurodevelopment, during which appropriate stimulation is essential to optimize developmental outcomes. Baby swimming has been proposed as an early stimulation intervention that may promote motor development through structured movement in a warm-water environment. This study aimed to examine the effect of baby swimming on gross motor development in infants aged 3–9 months. A quantitative study was conducted using a pre-experimental one-group pretest–posttest design. The sample consisted of 15 infants aged 3–9 months recruited from Yuki Mom and Baby Spa, Probolinggo City, Indonesia, using purposive sampling. The intervention involved baby swimming sessions in a warm pool (38–40°C) using a baby float for 10–15 minutes. Gross motor development was assessed before and after the intervention. Data were analyzed using the Wilcoxon signed-rank test. The results showed a statistically significant improvement in gross motor development following the intervention ($p = 0.02$). These findings suggest that baby swimming may have a positive effect on gross motor development in early infancy. Baby swimming can be considered a potential non-pharmacological intervention to support gross motor development in infants. However, further studies with larger sample sizes and controlled designs are recommended to strengthen the evidence.

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INTRODUCTION

Early childhood represents a crucial period of growth and development that significantly influences a child's future health and functional outcomes (Fu et al., 2022). This stage is often referred to as the golden age because of its unique, non-repeatable nature, during which rapid physical, cognitive, and neurological development occurs (Ramesh, 2022). Simultaneously, it is considered a critical period, as infants are highly sensitive to environmental stimuli that shape developmental trajectories (Luby et al., 2022). The rapid maturation of the brain during infancy underscores the importance of providing appropriate and timely stimulation to support optimal development (Leisman & Alfasi, 2025).

Gross motor development is a fundamental domain of early childhood development, involving the coordination of large muscle groups responsible for movements such as rolling, sitting, crawling, and walking (Dumuids-Vernet et al., 2022). The acquisition of these skills depends not only on biological maturation but also on environmental input and stimulation (Zorlular et al., 2024). Structured activities, including play and physical exercise, are essential in promoting motor skill acquisition (Abusleme-Allimant et al., 2022). Without adequate stimulation, infants may experience delays that can affect subsequent developmental milestones (Hua et al., 2022).

Motor development delays may arise from a range of biological and environmental factors (Tan & Lim, 2025). Neuromuscular disorders, such as muscular dystrophy, can impair muscle function and delay motor milestones (Lowe et al., 2024). In addition, conditions such as cerebral palsy, Down syndrome, autism spectrum disorder, and attention deficit hyperactivity disorder are commonly associated with motor impairments (Lin et al., 2024). Environmental influences, including limited physical activity and inadequate stimulation, also contribute to delayed motor development, underscoring the importance of early intervention strategies (Sangkarit & Tapanya, 2024).

One form of early stimulation that has gained attention is baby swimming, a structured, water-based activity conducted in a controlled, warm environment (Borioni et al., 2022). Water provides a unique medium that reduces gravity's effects, allowing infants to move more freely and engage multiple muscle groups simultaneously (Burnay et al., 2023). This condition facilitates muscle activation, enhances flexibility, and promotes coordination (Santos et al., 2022). Furthermore, water-based activities may contribute to muscle relaxation and improve overall motor function, making them a potentially beneficial intervention for infants (Leo et al., 2022).

Despite the theoretical benefits of baby swimming, empirical evidence examining its effect on gross motor development in early infancy remains limited, particularly in community-based settings. Therefore, this study aims to analyze the effect of baby swimming on gross motor development in infants aged 3–9 months. The findings are expected to contribute to the evidence base on early stimulation interventions and provide practical implications for parents and healthcare providers in supporting optimal infant development (Jakobowicz & Ogonowska-Slodownik, 2023).

METHOD

Research Design

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design. In this design, measurements of infants' gross motor development were conducted before and after the intervention to evaluate changes attributable to the baby swimming program. The intervention lasted one month, with sessions held on Saturdays and Sundays.

Participants

The study was conducted at Yuki Mom and Baby Spa, Probolinggo City, Indonesia. Participants were selected using purposive sampling, a non-probability sampling technique in which subjects are chosen based on specific inclusion criteria relevant to the research objectives. The sample consisted of 15 infants aged 3–9 months who met the eligibility criteria.

Data Collection

Data were collected using structured observation sheets and the Infant Motor Development Questionnaire (Kuesioner Pra Skrining Perkembangan/KPSP). The KPSP instrument was used to assess whether each infant's developmental level was age-appropriate. The scoring criteria were as follows: scores of 9–10 indicated appropriate motor development, scores of 7–8 indicated questionable development, and scores below 6 indicated delayed or deviant motor development. Assessments were conducted before (pretest) and after (posttest) the intervention.

Data Analysis

Data analysis was performed in two stages: univariate and bivariate analysis. Univariate analysis was used to describe the characteristics of the study variables and was presented in tabular and descriptive form. Bivariate analysis was conducted to examine the effect of baby swimming on

gross motor development using the Wilcoxon signed-rank test. A p-value of less than 0.05 was considered statistically significant.

Ethical Clearance

Prior to data collection, informed consent was obtained from the parents or guardians of all participating infants. Participants were assured that all data would be kept confidential and used solely for research purposes. This study received ethical approval from the Faculty of Health Sciences, Institute of Technology, Science and Health, Dr. Soepraoen Hospital.

RESULT

The analysis used to describe respondents' characteristics regarding the effect of baby swimming on gross motor development in infants aged 3-9 months was based on age, gender, pretest questionnaire score, and posttest questionnaire score. This analysis provides information on the distribution of respondents across categories, thereby facilitating an understanding of the proportion of the effect of baby swimming on gross motor development in infants aged 3-9 months. Respondent characteristics are shown in Table 1.

Table 1. Frequency Distribution of Respondents by Age and Gender

Characteristics	Category	Frequency	Percentage
Baby Age	3 months	4	26.7
	6 months	6	40.0
	9 Months	5	33.3
Gender	Woman	8	53.3
	Man	7	46.7

Based on Table 1, the results of the frequency distribution analysis based on age show that there are 15 respondents; most respondents are 6 months old, namely 6 people (40.0%), respondents who are 9 months old are 5 people (33.3%), and respondents who are 3 months old are 4 people (26.7%). It can be concluded that most babies who swim to improve gross motor skills are 6-month-olds, accounting for 6 people (40.0%). Most of the respondents who swim is female (8, 53.3%), while male respondents are 7 (46.7%). It can be concluded that most babies who swim to improve gross motor skills are female (8 people, 53.3%).

Table 2. Respondents' Development Before and After Being Given Swimming

Development	Frequency	Percentage
9-10 (appropriate motor development)	5	33.3
7-8 (doubtful motor development)	7	46.7
Total	15	100.0

The results of this study indicate a decrease. Initially, during the pretest, 7 people (46.7%) were included in the category of babies with doubtful motor development, a decrease of 2 people (13.3%). In the appropriate motor development category, 5 people (33.3%) experienced an increase, while 13 people (86.7%) did not. Moreover, in the poor/deviant motor development category, there was a 100% decrease.

Table 3. Frequency of Pretest and Posttest Scores Questionnaire Crosstabulation

Questionnaire Pretest Score	Posttest Score Questionnaire		Total
	9-10 (Appropriate motor development)	7-8 (Doubtful motor development)	
9-10 (appropriate motor development)	5	0	5
7-8(Doubtful motor development)	6	1	7
<6 (Poor motor development/deviation)	2	1	3
Total	13	2	15

The results of this study show that gross motor development after baby swimming increased in 6 babies with appropriate motor development.

Table 6. Wilcoxon Test of Infant Swimming Therapy to Improve Gross Motor Skills in Infants

	Posttest score questionnaire- posttest score questionnaire
Z	-3.051
Asymp. Sig. (2-tailed)	0.002

Based on the Wilcoxon test, a p-value of 0.002 was obtained after swimming therapy, which is smaller than 0.05, indicating a significant difference in the effect of infant swimming therapy on gross motor skills. This indicates that the more frequently babies are given swimming therapy, the faster their development. The analysis results show that, with swimming therapy to improve gross motor skills, the frequency of babies receiving it increased from 46.7% to 86.7%.

DISCUSSION

This study demonstrated a significant improvement in gross motor development following the baby swimming intervention. The proportion of infants with appropriate motor development increased from 46.7% to 86.7%, while developmental delays decreased markedly. These findings suggest that baby swimming can be an effective early stimulation method to enhance motor development in infants (Kano et al., 2024).

Gross motor development in infancy follows a predictable progression: head control and rolling, then sitting, crawling, and supported standing. Baby swimming activities support these milestones by encouraging active movement and muscle coordination in a low-gravity environment. As a result, infants may achieve developmental milestones more effectively with appropriate stimulation (Pratt et al., 2023).

Although most participants in this study were female, gender did not significantly influence gross motor development outcomes. In early infancy, development is primarily determined by neurological maturation and environmental stimulation. Therefore, the observed improvements are more likely related to the intervention rather than gender differences (Chen et al., 2024).

Before the intervention, only 46.7% of infants showed appropriate motor development, indicating variability in early developmental status. While infants naturally progress through developmental stages, insufficient stimulation may delay milestone achievement. These findings highlight the importance of providing consistent and structured stimulation during infancy (Dumuids-Vernet et al., 2023).

Baby swimming not only supports gross motor development but also contributes to cognitive, social, and emotional growth. Water-based activities promote confidence, sensory exploration, and parent-child interaction. Additionally, early exposure to physical activity may encourage long-term healthy developmental outcomes (Sinclair & Roscoe, 2023).

CONCLUSION

This study demonstrates that baby swimming has a positive effect on gross motor development in infants aged 3–9 months. The findings indicate a statistically significant improvement in motor development following the intervention, as evidenced by the Wilcoxon test results. These results suggest that baby swimming can be considered an effective form of early stimulation to support optimal motor development in infancy. However, given the limitations of the pre-experimental design and small sample size, further research with larger samples and controlled study designs is recommended to strengthen the evidence and generalizability of these findings.

REFERENCES

- Abusleme-Allimant, R., Hurtado-Almonacid, J., Reyes-Amigo, T., Yáñez-Sepúlveda, R., Cortés-Roco, G., Arroyo-Jofré, P., & Páez-Herrera, J. (2022). Effects of Structured and Unstructured Physical Activity on Gross Motor Skills in Preschool Students to Promote Sustainability in the Physical Education Classroom. *Sustainability*, *15*(13), 10167. <https://doi.org/10.3390/su151310167>
- Borioni, F., Biino, V., Tinagli, V., & Pesce, C. (2022). Effects of Baby Swimming on Motor and Cognitive Development: A Pilot Trial. *Perceptual and Motor Skills*. https://doi.org/10.1177_00315125221090203
- Burnay, C., Anderson, D. I., Button, C., & Cordovil, R. (2023). Effect of baby swimming lessons on infants' avoidance of bodies of water. *Developmental psychobiology*, *65*(8), e22434. <https://doi.org/10.1002/dev.22434>
- Chen, B., Liu, Y., Tang, J., Wang, J., Hong, F., & Ye, W. (2024). Cross-sectional survey of gender differences in gross motor skills among preschool children in Jinhua City, China. *Heliyon*, *10*(21), e39872. <https://doi.org/10.1016/j.heliyon.2024.e39872>
- Dumuids-Vernet, M. V., Provasi, J., Anderson, D. I., & Barbu-Roth, M. (2022). Effects of Early Motor Interventions on Gross Motor and Locomotor Development for Infants at-Risk of Motor Delay: A Systematic Review. *Frontiers in Pediatrics*, *10*, 877345. <https://doi.org/10.3389/fped.2022.877345>
- Dumuids-Vernet, M. V., Forma, V., Provasi, J., Anderson, D. I., Hinnekens, E., Soye, E., Strassel, M., Guéret, L., Hym, C., Huet, V., Granjon, L., Calamy, L., Dassieu, G., Boujenah, L., Dollat, C., Biran, V., & Barbu-Roth, M. (2023). Stimulating the motor development of very premature infants: Effects of early crawling training on a mini-skateboard. *Frontiers in Pediatrics*, *11*, 1198016. <https://doi.org/10.3389/fped.2023.1198016>
- Fu, T., Zhang, D., Wang, W., Geng, H., Lv, Y., Shen, R., & Bu, T. (2022). Functional Training Focused on Motor Development Enhances Gross Motor, Physical Fitness, and Sensory Integration in 5–6-Year-Old Healthy Chinese Children. *Frontiers in Pediatrics*, *10*, 936799. <https://doi.org/10.3389/fped.2022.936799>
- Hua, J., Williams, G. J., Jin, H., Chen, J., Xu, M., Zhou, Y., Gu, G., & Du, W. (2022). Early Motor Milestones in Infancy and Later Motor Impairments: A Population-Based Data Linkage Study. *Frontiers in Psychiatry*, *13*, 809181. <https://doi.org/10.3389/fpsy.2022.809181>
- Jakobowicz, O., & Ogonowska-Slodownik, A. (2023). Supporting Infants' Motor Development through Water Activities: A Preliminary Case–Control Study. *Healthcare*, *12*(16), 1556. <https://doi.org/10.3390/healthcare12161556>
- Kano, H., Ebara, T., Matsuki, T., Tamada, H., Yamada, Y., Kato, S., ... & Kamijima, M. (2024). Effect of swimming initiation period and continuation frequency on motor competence development in children aged up to 3 years: the Japan environment and children's study. *BMC Sports Science, Medicine and Rehabilitation*, *16*(1), 192. <https://doi.org/10.1186/s13102-024-00980-9>
- Leisman, G., & Alfasi, R. (2025). Emotional Brain Development: Neurobiological Indicators from Fetus Through Toddlerhood. *Brain Sciences*, *15*(8), 846. <https://doi.org/10.3390/brainsci15080846>

- Leo, I., Leone, S., Dicataldo, R., Vivenzio, C., Cavallin, N., Taglioni, C., & Roch, M. (2022). A non-randomized pilot study on the benefits of baby swimming on motor development. *International Journal of Environmental Research and Public Health*, 19(15), 9262. <https://doi.org/10.3390/ijerph19159262>
- Lin, L. Y., Hwang, I. T., Hsu, C. F., Yu, W. H., Lai, P. C., Chen, Y. W., & Tu, Y. F. (2024). Comparing fine motor performance among young children with autism spectrum disorder, intellectual disability, attention-deficit/hyperactivity disorder, and specific developmental disorder of motor function. *Frontiers in Pediatrics*, 12, 1372980. <https://doi.org/10.3389/fped.2024.1372980>
- Lowes, L. P., Reash, N. F., Iammarino, M. A., Connolly, A. M., Pietruszewski, L., Smith, M. A., Peng, J., Steiner, C. L., Tsao, C. Y., Waldrop, M. A., Flanigan, K. M., Chagat, S., Meyer, A. P., Mendell, J. R., & Alfano, L. N. (2024). Gross motor delays in infants and young boys with Duchenne muscular dystrophy. *Journal of Neuromuscular Diseases*. <https://doi.org/10.1177/22143602241289223>
- Luby, J. L., Rogers, C., & McLaughlin, K. A. (2022). Environmental Conditions to Promote Healthy Childhood Brain/Behavioral Development: Informing Early Preventive Interventions for Delivery in Routine Care. *Biological Psychiatry Global Open Science*, 2(3), 233-241. <https://doi.org/10.1016/j.bpsgos.2021.10.003>
- Pratt, N. A., Duncan, M. J., & Oxford, S. W. (2023). The Effects of a 6-Week Swimming Intervention on Gross Motor Development in Primary School Children. *Children*, 11(1), 1. <https://doi.org/10.3390/children11010001>
- Ramesh, S. (2022). Cognitive development and childhood learning. In *The Political Economy of Human Behaviour and Economic Development: Psychology and Economic Development* (pp. 181-219). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-031-12666-6_5
- Sangkarit, N., & Tapanya, W. (2024). Factors influencing on gross motor skills in infants: Implications for walking development. *Early Human Development*, 195, 106076. <https://doi.org/10.1016/j.earlhumdev.2024.106076>
- Santos, C., Burnay, C., Button, C., & Cordovil, R. (2022). Effects of Exposure to Formal Aquatic Activities on Babies Younger Than 36 Months: A Systematic Review. *International Journal of Environmental Research and Public Health*, 20(8), 5610. <https://doi.org/10.3390/ijerph20085610>
- Sinclair, L., & Roscoe, C. M. (2023). The Impact of Swimming on Fundamental Movement Skill Development in Children (3–11 Years): A Systematic Literature Review. *Children*, 10(8), 1411. <https://doi.org/10.3390/children10081411>
- Tan, J. S., & Lim, C. B. (2025). The development of gross motor skills in children: Insights from the Motor Assessment Test for Children. *Journal of Experimental Child Psychology*, 256, 106255. <https://doi.org/10.1016/j.jecp.2025.106255>
- Zorlular, R., Akkaya, K. U., & Elbasan, B. (2024). The relationship between home environment affordances and motor development and sensory processing skills in premature infants. *Infant Behavior and Development*, 75, 101944. <https://doi.org/10.1016/j.infbeh.2024.101944>