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The Relationship of Maternal Stimulation and Fine Motor Development in Children Age 1-2 Years

A Cross sectional Study

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SUMMARY

IMPORTANCE Growth and development constitute fundamental aspects in pediatric nursing that require continuous monitoring by parents and healthcare professionals to facilitate early identification of developmental abnormalities. Fine motor skills represent a critical domain of child development, as they are essential for supporting independence in performing daily activities. However, evidence indicates that problems associated with fine motor development in children persist.

AIMS To analyze the relationship between maternal stimulation and fine motor development in children aged 1–2 years.

METHOSDS This study employed an analytic correlational design with a cross-sectional approach. Maternal stimulation was the independent variable, while children's fine motor development was the dependent variable. A purposive sampling technique was used to recruit participants from a population of 68 mother–child pairs aged 1–2 years in Tambaan Village, Camplong District, Sampang Regency, Indonesia. A total of 58 mother–child pairs were included in the study. Data were collected using a maternal stimulation questionnaire, while children's fine motor development was assessed using the Denver II instrument. The association between maternal stimulation and children's fine motor development was analyzed using the Spearman rank correlation test.

FINDINGS Most respondents reported moderate maternal stimulation (30 respondents, 51.7%), while 43 children (74.1%) demonstrated normal fine motor development. Among children receiving moderate maternal stimulation, 29 (96.7%) had normal fine motor development. Maternal stimulation was significantly associated with fine motor development ($p < 0.001$).

CONCLUSION Maternal stimulation was significantly associated with fine motor development in children aged 1–2 years. Children receiving moderate maternal stimulation were more likely to have normal fine motor development.

ETHICS APPROVAL AND FUNDING: Health Research Ethic Committee of the Ngudia Husada Madura College of Health Science (approval number: 2117/KEPK/STIKES-NHM.EC/V/2024). Authors receive no specific funding support for this study.

RELEVANCE TO CLINICAL PRACTICE This study highlights the importance of maternal stimulation in supporting children's fine motor development. Pediatric nurses should provide parents with education on age-appropriate stimulation and conduct early developmental screening to identify potential delays and promote optimal child development.

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1. INTRODUCTION

Early childhood, particularly from birth to 5 years of age, is often described as a “golden period” because growth and development occur rapidly during this stage. Parents and healthcare professionals therefore need to monitor children’s development to identify potential abnormalities early (Munir et al., 2019). Child development includes several domains, including gross motor, fine motor, language, and social development. Fine motor skills are particularly important because they support children’s independence in daily activities, such as grasping objects, feeding, drawing, and manipulating small items (Khoerunnisa et al., 2023).

Developmental difficulties remain an important concern. The World Health Organization has reported a substantial burden of developmental disorders among children, including in Southeast Asia (WHO, 2018, as cited in Ariani & Nooratri, 2022). In Indonesia, developmental delay has also been reported among children in several regions. For example, a study in East Java reported delayed development in 38.6% of children and global developmental delay in 24.6% (Kusparlina & Ardhianningtyas, 2020). A preliminary assessment in Tambak’an Village, Camplong District, Sampang Regency, found that 5 of 10 children aged 1–2 years showed suspected fine motor developmental delay.

Child development is influenced by multiple internal and external factors. Internal factors include age, sex, genetics, family characteristics, and chromosomal abnormalities. External factors may occur during the prenatal, perinatal, and postnatal periods and include maternal nutrition, infection, exposure to toxins, birth complications, chronic illness, socioeconomic conditions, caregiving practices, environmental factors, and stimulation (Rantina et al., 2021). Fine motor difficulties may limit children’s ability to explore their environment and perform age-appropriate daily activities. Persistent motor difficulties may also affect school participation, learning engagement, confidence, and social adjustment (Kharisma, 2016, as cited in J et al., 2021). Therefore, early identification and support for fine motor development are essential.

Maternal stimulation is a potentially modifiable factor that may support fine motor development during early childhood. Through regular, age-appropriate activities, mothers may help children develop coordination, hand control, and independence in daily activities. This study aimed to examine the relationship between maternal stimulation and fine motor development among children aged 1–2 years.

2. METHODS

2.1 Study Design and Participants

This study employed an analytic correlational design with a cross-sectional approach. Maternal stimulation of fine motor development was the independent variable, while children’s fine motor development was the dependent variable. The study was conducted at the Tambaan Village community health post (Posyandu) in Camplong District, Sampang Regency, Indonesia, during scheduled Posyandu activities in March 2024. Data were collected at a single time point through maternal self-administered questionnaires and direct assessment of children’s fine motor development using the Denver II instrument.

The target population comprised mothers and their children aged 1–2 years who were registered at the Tambaan Village Posyandu, with a total population of 68 mother–child pairs. The minimum sample size was determined using the finite population proportion formula proposed by Lemeshow et al. (1990), based on a 95% confidence level, an estimated proportion of 5%, and a 5% margin of error, resulting in a minimum required sample of 58 mother–child pairs. A purposive sampling technique was subsequently used to recruit eligible participants.

Eligible participants were mothers with children aged 12–24 months who attended the Posyandu during the data-collection period and were willing to participate. Children were required to be present and able to undergo the fine motor developmental assessment. Mother–child pairs were excluded if the child was ill at the time of data collection, the pair did not attend the Posyandu during the study period, the child’s developmental assessment was incomplete or untestable, or the mother declined participation. During the scheduled Posyandu activities, eligible mothers were informed about the study and invited to participate. Those who provided consent completed the maternal stimulation questionnaire, while their children underwent fine motor developmental assessment using the Denver II. Following the eligibility screening and data collection, 58 mother–child pairs were included in the final analysis.

2.2 Features

Variables, Measurement, and Outcomes

The study assessed two main variables: maternal stimulation and children's fine motor development. Maternal stimulation was the independent variable, whereas fine motor development was the dependent variable.

2.2.1 Maternal Stimulation

Maternal stimulation was defined as activities provided by mothers to support their children's developmental progress. It was measured using a structured questionnaire covering age-appropriate play activities, parent–child interaction, and daily stimulation practices that support fine motor development. The total questionnaire score was categorized as low, moderate, or high maternal stimulation based on the scoring criteria used in the study.

2.2.2 Fine Motor Development

Fine motor development was defined as a child's ability to perform coordinated movements involving small muscles, particularly those of the hands and fingers. Fine motor development was assessed using the Denver II developmental screening test in accordance with standard administration and interpretation guidelines. The fine motor–adaptive domain of the Denver II was evaluated. Assessment results were classified according to standard Denver II criteria, such as normal, suspect, or untestable. For the analysis, the authors should clearly state whether these categories were retained or combined.

2.3 Data Management and Statistical Analysis

Data preparation was conducted before statistical analysis and included editing, coding, data entry, and data cleaning. All completed questionnaires and developmental assessment forms were reviewed for completeness and consistency. Where feasible, missing responses were clarified with participants during data collection. Records with incomplete or untestable outcome assessments were excluded according to the predefined eligibility criteria.

Participant characteristics and study variables were coded numerically and entered into IBM SPSS Statistics for Windows, version 28.0 (IBM Corp., Armonk, NY, USA). Data cleaning was performed to identify duplicate entries, missing values, out-of-range values, and inconsistencies before analysis. Descriptive statistics were used to summarize participant characteristics and study variables. Categorical variables, including maternal stimulation level and fine motor development status, were presented as frequencies and percentages. Because the study variables were analyzed as ordinal categories, the association between maternal stimulation and fine motor development was examined using Spearman's rank correlation test. A two-sided p value of < 0.05 was considered statistically significant.

3. RESULTS

3.1 Participant Characteristics

A total of 58 mothers of children aged 1–2 years were included in the study. Most mothers were aged 26–35 years (n = 30, 51.7%). Regarding education, the largest proportion had completed elementary school (n = 24, 41.4%). Most participants were housewives (n = 49, 84.5%).

Table 1. Maternal demographic characteristics of participants (N = 58)

	Characteristic	Frequency	Percentage
Age	19–25 years (late adolescence)	14	24.1
	26–35 years (early adulthood)	30	52.7
	36–45 years (late adulthood)	14	24.1
Education	Elementary school	24	41.4
	Junior high school	15	25.9
	Senior/vocational high school	16	27.6
	Higher education	3	5.2
Occasion	Housewife	49	84.5
	Entrepreneur	1	1.7
	Farmer	8	13.8

3.2 Maternal Stimulation and Fine Motor Development

3.2.1 Overview of Maternal Stimulation

More than half of mothers provided moderate levels of stimulation for their children's fine motor development (n = 30, 51.7%). Poor stimulation was reported by 23 mothers (39.7%), whereas only 5 mothers (8.6%) reported good stimulation.

Table 2. Distribution of maternal stimulation for children's fine motor development (N = 58)

No.	Characteristic	Frequency	Percentage
1	Good	5	8.6
2	Moderate	30	51.7
3	Poor	23	39.7

3.2.2 Overview of Fine Motor Development

Most children demonstrated normal fine motor development (n = 43, 74.1%). However, 15 children (25.9%) were classified as having suspected fine motor developmental delay based on the Denver II assessment.

Table 3. Frequency distribution of respondents' characteristics based on children's fine motor development, May 2024 (n = 58)

No.	Characteristic	Frequency	Percentage
1	Normal	43	74.1
2	Suspect	15	25.9

3.2.3 Association Between Maternal Stimulation and Fine Motor Development

Fine motor development status differed across maternal stimulation categories. Among children whose mothers reported poor stimulation, 14 of 23 children (60.9%) were classified as having suspected fine motor developmental delay. In contrast, 29 of 30 children (96.7%) whose mothers provided moderate stimulation demonstrated normal fine motor development. All children whose mothers reported good stimulation were classified as having normal fine motor development (n = 5, 100.0%).

Spearman's rank correlation analysis showed a statistically significant positive association between maternal stimulation and fine motor development ($r = 0.621$, $p < 0.001$). This finding indicates that higher maternal stimulation scores were associated with more favorable fine motor development status among children aged 1–2 years.

Table 4. Association between maternal stimulation and fine motor development (N = 58)

Characteristic		Suspect, n %	Normal, n %	Total, n %
		n = 15	n = 43	n = 58
Fine motor development	Poor	14 (60.9)	9 (39.1)	23 (100)
Stimulation	Moderate	1 (3.3)	29 (96.7)	30 (100)
	Good	0 (0)	5 (100)	5 (100)
Spearman's rank correlation				$r = 0.621$; $p < 0.001$

4. DISCUSSION

This study found that maternal stimulation was significantly associated with fine motor development among children aged 1–2 years. Higher maternal stimulation was associated with more favorable fine motor development status ($r = 0.621$, $p < 0.001$). Children whose mothers reported poor stimulation were more frequently classified as having suspected fine motor developmental delay, whereas most children whose mothers reported moderate or good stimulation demonstrated normal fine motor development. These findings suggest that regular, age-appropriate stimulation may be an important component of early childhood developmental support.

Fine motor development involves coordinated movements of the hands and fingers that enable children to perform daily activities such as grasping objects, placing items into containers, drawing, turning pages, and self-feeding. These skills develop through maturation as well as repeated opportunities for play, interaction, and practice. Maternal stimulation may support this process by providing children with developmentally appropriate activities, encouragement, and responsive interaction. In the present

study, mothers commonly reported activities involving inserting and removing objects, placing one object into another, and drawing simple shapes. Such activities may help children practice hand–eye coordination, grasping, manipulation, and control of small muscles.

The findings are consistent with previous studies reporting an association between parental or maternal stimulation and children's motor development (Fernando et al., 2020; Astuti et al., 2019; Suwardi, 2021; Rahmadhani et al., 2021). Early stimulation may provide children with opportunities to explore their environment, strengthen motor coordination, and develop confidence in performing age-appropriate tasks. However, fine motor development is multifactorial. In addition to stimulation, child development may be influenced by nutritional status, prematurity, birth history, health conditions, family socioeconomic circumstances, caregiving practices, and access to developmental services. These factors were not examined in the present study and should be considered in interpreting the findings.

Most children in this study were classified as having normal fine motor development. However, approximately one-quarter were classified as suspect on the Denver II screening assessment. This finding highlights the importance of routine developmental monitoring in community settings, including Posyandu. A "suspect" Denver II result should not be interpreted as a definitive diagnosis of developmental delay. Rather, children with suspect findings should receive repeat screening and, when indicated, further developmental assessment or referral to appropriate health professionals.

4.1 Implications for Practice

The findings have implications for pediatric and community health nursing practice. Nurses can support parents by providing education and demonstrations of simple, low-cost, age-appropriate stimulation activities that can be incorporated into daily routines. These may include supervised play with safe household objects, transferring objects between containers, stacking blocks, scribbling with crayons, turning pages, and practicing self-feeding. Posyandu activities may also be used to strengthen parental knowledge of developmental milestones and encourage early consultation when parents have concerns about their child's development.

4.2 Strengths and Limitations

A key strength was the use of direct developmental screening with the Denver II, rather than relying solely on maternal reports of children's development. The study also provides locally relevant evidence on maternal stimulation and fine motor development among children aged 1–2 years attending a community health post. However, the cross-sectional design does not allow causal conclusions; therefore, maternal stimulation cannot be considered to cause normal fine motor development. The study used purposive sampling and involved a small sample from one community, which limits generalizability. Maternal stimulation was measured using self-reported responses and may have been influenced by recall or social-desirability bias. In addition, potential confounding factors, including child nutritional status, prematurity, birth complications, paternal involvement, socioeconomic conditions, and caregiving environment, were not examined. Future studies should include larger and more diverse samples, assess relevant confounding variables, and use longitudinal or intervention designs to evaluate whether parent-focused stimulation programs improve children's fine motor development over time.

5. CONCLUSION

Maternal stimulation was significantly associated with fine motor development among children aged 1–2 years. Children who received moderate or good levels of maternal stimulation were more likely to demonstrate normal fine motor development than those who received poor stimulation. These findings support the importance of promoting age-appropriate stimulation and routine developmental screening through community-based services such as Posyandu. However, the cross-sectional design does not establish a causal relationship between maternal stimulation and fine motor development. Therefore, longitudinal and intervention studies are needed to clarify the findings.

Author Contributions

RP: Conceptualization; Methodology; Investigation; Data Curation; Formal Analysis; Visualization; Writing – Original Draft. HE: Conceptualization; Methodology; Validation; Writing – Review & Editing; Supervision. Both authors contributed to the study design, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

Ethical Approval and Consent

This study was approved by the Health Research Ethics Committee of Ngudia Husada Madura College of Health Sciences (approval no. 2117/KEPK/STIKES-NHM.EC/V/2024). Written informed consent was obtained from the parents or legal guardians of all participating children before data collection. Participation was voluntary, and parents or guardians could withdraw their child from the study at any

time without consequences. Participant confidentiality and anonymity were maintained throughout the study.

Generative AI Transparency Statement

The author used generative AI tools (e.g., chatGPT) to assist with language editing and translation. All content was critically reviewed and revised by the authors, who take full responsibility for the final version of the manuscript.

Conflict of Interest Disclosure

The authors declare no conflicts of interest.

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Data Availability Statement

The data that support the finding of this study are available from the corresponding author upon reasonable request.

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