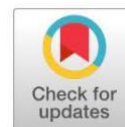


Association Between Maternal Knowledge of Developmental Stimulation and Toddler developmental status Among Toddlers Aged 12–36 Months



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ABSTRACT

Toddlerhood (12–36 months) is a critical period of rapid physical, cognitive, language, and socio-emotional development. Maternal knowledge of developmental stimulation is an important factor associated with children's toddler developmental status, yet evidence from community-based settings in Indonesia remains limited. This study aimed to examine the association between maternal knowledge of developmental stimulation and toddler developmental status among toddlers aged 12–36 months attending the Kasih Ibu Integrated Health Post (Posyandu) in Nisam District, North Aceh. A quantitative analytic study with a cross-sectional design was conducted between December 2024 and June 2025. The study involved 36 mothers with toddlers aged 12–36 months who were recruited using a total sampling approach. Maternal knowledge was measured using a 20-item questionnaire (Cronbach's $\alpha = 0.82$), and toddler development was assessed using the Developmental Pre-Screening Questionnaire (Kuesioner Pra Skrining Perkembangan [KPSP]). Developmental status was categorized as normal or suspected developmental delay (doubtful and delayed). Data were analyzed using the Fisher–Freeman–Halton Exact Test. Most mothers demonstrated good knowledge of developmental stimulation (69.4%), while 16.7% and 13.9% had fair and poor knowledge, respectively. Overall, 69.4% of toddlers had normal developmental status and 30.6% were classified as having suspected developmental delay. The proportion of toddlers with normal developmental status declined from 84.0% among mothers with good knowledge to 50.0% and 20.0% among those with fair and poor knowledge, respectively. A statistically significant association was identified between maternal knowledge and toddler developmental status (exact $p = 0.007$), with a moderate association strength ($C = 0.464$). Maternal knowledge of developmental stimulation was significantly associated with toddler developmental status. Enhancing maternal education through Posyandu-based counseling and routine developmental monitoring may support optimal early childhood development.

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INTRODUCTION

The toddler period between 12 and 36 months of age represents a critical stage of early childhood development during which physical, cognitive, language, social, and emotional



capacities rapidly evolve.(1) Optimal development during this period has long-term implication for motor competence, communication abilities, academic readiness, and social adaptation.(2) Growing evidence indicates that age-appropriate developmental stimulation plays a fundamental role in optimizing children's developmental potential. At the global level, early childhood stimulation is recognized as a fundamental determinant of child well-being, cognitive development, and future human capital. Therefore, ensuring adequate developmental stimulation in early life is not only a family responsibility but also a global public health priority.(3)

Despite increasing recognition of the importance of stimulation, many mothers may have limited access to information regarding age-appropriate stimulation practice. Limited maternal understanding hinders the provision of consistent and developmentally appropriate stimulation practices, thereby increasing the risk of developmental delays in language, motor, and socio-emotional development.(4) Maternal education, socioeconomic status, and access to information are known to influence mothers' ability to provide appropriate stimulation.(5) Previous studies have demonstrated that mothers with better knowledge are more likely to engage in stimulation practices, that support toddler developmental status.(6) However, although educational programs and counseling activities are routinely implemented at Integrated Health Posts (*Posyandu*), empirical evidence regarding their effectiveness remains limited.(7) Little is known how maternal knowledge translates into measurable toddler developmental status at community level. This suggests that the issue extends beyond knowledge deficits to include a lack of context-specific evidence linking knowledge, practice, and toddler developmental status outcomes.

In Indonesia, toddler developmental status problems remain a significant public health concern. The 2025 Indonesia Nutritional Status Survey (SSGI) reported a decline in stunting prevalence to 19.8%; however, developmental delays remain prevalent.(8) Globally, approximately 15%–25% of children under five experience delays in one or more developmental domains.(9) Similar patterns have been reported in North Aceh, where 14% of toddlers experience developmental problems, including 6% in the working area of the Nisam Primary Health Center. A preliminary survey conducted at the Kasih Ibu Posyandu in Paloh Mampree Village further showed that 6 out of 10 assessed toddlers exhibited developmental delays. These findings suggest that current interventions, which primarily focused on general health education and nutrition, may not adequately address developmental stimulation practices within the home environment. Current programs tend to lack practical, hands-on guidance that enables mothers to apply stimulation techniques in daily interactions with their children.

Although previous studies have demonstrated association between maternal knowledge of developmental stimulation and toddler development, evidence from community-based primary health care settings in Indonesia remains scarce.(10) Moreover, little is known regarding the extent to which maternal knowledge is associated with measurable toddler developmental status among toddlers attending Posyandu services. Improving maternal knowledge may represent a realistic, low-cost, and modifiable strategy for strengthening early interventions aimed at preventing developmental delays.(11)

Therefore, this study aims to analyze the relationship between maternal knowledge of developmental stimulation and toddler development at the Kasih Ibu Posyandu in 2025. It is hypothesized that higher maternal knowledge of developmental stimulation is significantly associated with more optimal toddler developmental status. The findings of this study are expected to provide a scientific basis for improving health education and intervention strategies, as well as to inform practical applications in midwifery practice, including structured parenting programs, targeted counseling, and routine developmental monitoring at the community level.

METHOD

This study employed a quantitative descriptive-analytic study employing a cross-sectional method. The research was conducted at the Kasih Ibu Integrated Health Post (*Posyandu*), located within the working area of the Nisam Primary Health Center, North Aceh Regency, between December 2024 and June 2025. The study population consisted of all mothers with toddlers aged 12–36 months who attended the Kasih Ibu Posyandu, totaling 36 respondents during the study period. Because the number of eligible participants was limited, all mothers who met the eligibility criteria were recruited using a total sampling approach, resulting in a final sample of 36 respondents. Data were collected during routine Posyandu visits through face-to-face interviews and developmental screening using the Developmental Pre-Screening Questionnaire (*Kuesioner Pra Skrining Perkembangan* [KPSP]) instrument. Each data collection session followed a standardized procedure: participant screening, informed consent, questionnaire administration, and developmental assessment. The inclusion criteria were: (1) mothers with toddlers aged 12–36 months; (2) those present at the Posyandu during the study period; and (3) willingness to participate, indicated by signed informed consent. The exclusion criteria included: (1) mothers or toddlers who were ill or hospitalized; and (2) incomplete questionnaire responses. Socio-demographic data, including maternal age, education, and occupation, were also collected to support descriptive analysis. The independent variable was maternal knowledge of developmental stimulation, while the dependent variable was toddler development. Maternal knowledge was defined as the mother's understanding of developmental stimulation, including its concepts, principles, and methods of application. Knowledge levels were assessed using a structured questionnaire consisting of 20 multiple-choice items, with a total score ranging from 0 to 20. The scores were categorized as good (76%–100%), fair (56%–75%), and poor (<56%). An example item was: "Do you know the benefits of speech stimulation for children aged 12–36 months?" Toddler development was defined as the child's abilities across gross motor, fine motor, speech/language, and social domains, assessed using the standardized KPSP. Toddler developmental status were categorized as normal, doubtful, or delayed. The KPSP instrument is a standardized developmental screening tool validated by the Indonesian Ministry of Health. All developmental assessments were conducted by trained midwives according to the Ministry of Health operational guidelines to promote procedural consistency during data collection. Instrument testing indicated that all items in the maternal knowledge questionnaire were valid ($r\text{-count} > r\text{-table} = 0.329$). Reliability testing yielded a Cronbach's alpha of 0.82, indicating high internal consistency. No intervention was administered because the study was observational in nature, as the study was designed solely to assess existing maternal knowledge and toddler developmental status. Data analysis included editing, coding, scoring, and tabulation. Questionnaires with incomplete responses were excluded from the analysis, and no data imputation procedures were performed. To minimize information bias, all interviews and developmental assessments were performed by trained midwives using standardized procedures. Univariate analysis was used to describe the distribution of respondent characteristics, maternal knowledge, and toddler development. Bivariate analysis was initially planned to use the Pearson chi-square test. However, because several contingency table cells contained expected frequencies below five, the Fisher–Freeman–Halton Exact Test was used to determine the association between maternal knowledge of developmental stimulation and toddler developmental status. Statistical significance was established at $p < 0.05$. The contingency coefficient (C) was calculated to estimate the strength of the observed association. All statistical analyses were conducted using Statistical Package for the Social Sciences (SPSS) version 26. Assumptions for the chi-square test (expected frequency ≥ 5 per cell) were verified prior to analysis. This study received ethical approval from the Health Research Ethics Committee of Poltekkes Kemenkes Aceh (Approval No. DP.04.03/12/7/263/2025). Written informed

consent was obtained from all participants before data collection. Participant confidentiality and anonymity were maintained throughout the study.

RESULTS

A total of 36 mothers with toddlers aged 12–36 months participated in this study. As shown in Table 1, more than half of the respondents were aged 31–40 years (58.3%) and had completed secondary education (47.2%). The majority were housemakers (69.4%). Most toddlers were aged 21–27 months (38.8%), followed by 28–36 months (33.4%) and 12–20 months (27.8%). Most participants were aged 31–40 years, had completed secondary education, and identified themselves as homemakers.

Table 1. Sociodemographic Characteristics of Participants (n = 36)

Characteristics	Category	Frequency (n)	Percentage (%)
Maternal age (years)	20–30	9	25.0
	31–40	21	58.3
	>40	6	16.7
Education level	Primary	6	16.7
	Secondary	17	47.2
	Higher	13	36.1
Occupation	Housemakers	25	69.4
	Private employee	6	16.7
	Entrepreneur	5	13.9
Toddler age (months)	12–20	10	27.8
	21–27	14	38.8
	28–36	12	33.4

Table 2 shows the distribution of maternal knowledge levels regarding developmental stimulation (69.4%), followed by fair (16.7%) and poor (13.9%) levels. Most respondents were categorized as having good knowledge of developmental stimulation for toddler developmental status.

Table 2. Maternal Knowledge Levels of Developmental Stimulation (n = 36)

Knowledge Level	Frequency (n)	Percentage (%)
Good (76–100%)	25	69.4
Fair (56–75%)	6	16.7
Poor (<56%)	5	13.9
Total	36	100.0

The distribution of toddler developmental status based on the KPSP assessment is shown in Table 3. Based on KPSP assessment, 75.0% of toddlers had normal developmental status, whereas 13.9% and 11.1% were classified as doubtful and delayed, respectively.

Table 3. Developmental Status of Toddlers Aged 12–36 Months Based on KPSP Assessment (n = 36)

Developmental Category	Frequency (n)	Percentage (%)
Normal	27	75.0
Doubtful	5	13.9
Delayed	4	11.1
Total	36	100.0

Table 4 presents the association between maternal knowledge of developmental stimulation and recategorized toddler developmental status. Because several contingency table cells had small, expected frequencies, the Fisher–Freeman–Halton Exact Test was used instead of the Pearson chi-square test. The analysis demonstrated a statistically significant association between maternal knowledge of developmental stimulation and toddler developmental status (exact $p = 0.007$). The contingency coefficient ($C = 0.464$) indicated a moderate association. The proportion of toddlers with normal developmental status decreased as maternal knowledge levels declined, from 84.0% among mothers with good knowledge to 50.0% and 20.0% among those with fair and poor knowledge, respectively.

Table 4. Association Between Maternal Knowledge of Developmental Stimulation and Recategorized Toddler Developmental Status ($n = 36$)

Maternal Knowledge	Normal Developmental Status n (%)	Suspected Developmental Delay n (%)	Total n (%)	p-value	Contingency Coefficient (C)
Good	21 (84.0)	4 (16.0)	25 (100.0)	0.007	0.464
Fair	3 (50.0)	3 (50.0)	6 (100.0)		
Poor	1 (20.0)	4 (80.0)	5 (100.0)		
Total	25 (69.4)	11 (30.6)	36 (100.0)		

Overall, the findings indicate that higher maternal knowledge of developmental stimulation is associated with better toddler toddler developmental status. Mothers with good knowledge were more likely to have children with normal developmental status, suggesting the important role of maternal knowledge in supporting optimal early childhood development.

DISCUSSION

This study found a statistically significant association between maternal knowledge of developmental stimulation and toddler developmental status based on the Fisher–Freeman–Halton Exact Test (exact $p = 0.007$). The contingency coefficient ($C = 0.464$) indicated a moderate association between the variables in which mothers demonstrating higher knowledge levels were more likely to have toddlers who achieved age-appropriate developmental status. In practical terms, these findings position maternal knowledge as a modifiable proximal determinant of early childhood development in this Posyandu population, suggesting that improvements in caregiver understanding may translate into meaningful gains in toddler developmental status.

These findings are consistent with previous studies which reported that higher maternal knowledge is associated with better toddler developmental status in children.(12,13) Mothers who possess adequate knowledge of developmental stimulation are generally more likely to engage in age-appropriate caregiving practices, provide responsive interactions, and create supportive home environments that facilitate toddler developmental status.(14) However, evidence from resource-limited rural settings has demonstrated weaker or non-significant associations when structural barriers, including poverty, food insecurity, and limited access to health services, predominate.(15) This discrepancy highlights the importance of contextual factors in shaping the effectiveness of maternal knowledge. Notably, the present study extends the literature by providing evidence from a community-based primary health care setting (*Posyandu*) in North Aceh, where

maternal education is integrated into routine services. This context-specific contribution strengthens understanding of how maternal knowledge operates within Indonesia's decentralized primary health care system.

The present findings also align with growing evidence indicating that parent-focused, community-delivered early stimulation and parenting interventions improve toddler developmental status across cognitive, language, and motor domains.(14) Community- and health worker-led interventions appear particularly effective when developmental guidance is integrated into routine maternal and child health services.(16) Large implementation studies have further demonstrated that adequate training, supportive supervision, and health system integration are essential for achieving sustained developmental benefits.(17) These findings are directly relevant to strengthening Posyandu-based interventions in Indonesia.

At the same time, contextual constraints remain important. Studies conducted in resource-limited rural settings have reported attenuated or non-significant associations between parental knowledge and toddler developmental status when structural barriers such as poverty, food insecurity, and limited-service access are predominant.(7) This heterogeneity suggests that maternal knowledge is necessary but not always sufficient; it must be supported by enabling environments to translate into consistent and effective stimulation practices.(18) Therefore, the present study contributes context-specific evidence by demonstrating this association within the Posyandu setting of Nisam District, providing a locally relevant empirical basis for policy and program adaptation.

Importantly, this study demonstrates that improving maternal knowledge is not merely a theoretical construct but a feasible and scalable intervention within existing community health platforms.(19) In the Posyandu context, where midwives and community health workers routinely engage with mothers, strengthening maternal knowledge represents a low-cost and sustainable strategy to promote early childhood development.(4) These findings thus support the integration of structured developmental guidance and stimulation education into routine maternal and child health services.

From a theoretical perspective, these findings can be interpreted within ecological–developmental frameworks. Developmental Niche Theory posits that caregiver beliefs, daily routines, and the home environment collectively shape children's development.(20) Similarly, ecological models emphasize that parental knowledge interacts dynamically with environmental and socioeconomic conditions to influence developmental trajectories. Within this framework, maternal knowledge functions as a proximal (microsystem-level) determinant that directly shapes day-to-day parent–child interactions and stimulation practices.(21) This relationship can also be understood through Bronfenbrenner's ecological systems perspective, which situates maternal knowledge within nested systems (family, community/Posyandu, and broader socioeconomic context). Interventions targeting maternal knowledge at the microsystem level are more likely to be effective when supported by mesosystem factors (e.g., family involvement and Posyandu activities) and macrosystem enablers (e.g., policies, funding, and service integration). Operationally, this framework supports multi-level strategies: (1) strengthening caregiver education and practical skill-building at the individual level; (2) enhancing family and community support systems; and (3) aligning health policies and resources to ensure sustainability.(22)

Early intervention through community-based maternal education represents a critical leverage point for preventing developmental delays, particularly in resource-limited settings. Based on these findings, several practical implications emerge. First, midwives should integrate developmental stimulation education into routine services, such as immunization and growth monitoring sessions, to ensure continuous reinforcement. Second, Posyandu programs should incorporate structured mother toddler classes and hands-on demonstrations to enhance practical caregiving skills. Third, public health strategies should integrate early stimulation with nutrition and stunting prevention programs,

recognizing the multidimensional nature of toddler developmental status. Finally, future research should employ longitudinal designs and stratified analyses (e.g., by maternal education or occupation) to better identify target populations and optimize intervention effectiveness.

This study has several limitations. The cross-sectional design precludes causal inference between maternal knowledge and toddler developmental status. In addition, toddler developmental status was assessed using the KPSP instrument, which may be subject to reporting bias. Because of the small sample size and community-based recruitment from a single Posyandu, the findings should be generalized cautiously to other populations. Other potentially influential factors such as nutritional status, parenting style, and environmental conditions were not included in the analysis. Future studies using longitudinal or experimental designs and incorporating a broader range of variables are needed to provide a more comprehensive understanding of the determinants of toddler development.

CONCLUSION

This study demonstrated a significant association between maternal knowledge of developmental stimulation and toddler developmental status. Mothers demonstrating higher knowledge levels tended to have toddlers with normal developmental status more frequently than mothers demonstrating lower knowledge levels. These findings suggest that maternal knowledge is an important factor associated with developmental outcomes during the critical developmental period of 12–36 months and may represent a modifiable target for early childhood interventions.

From a practical perspective, the findings support the integration of maternal education into primary health care services. Midwives and community health workers should be strengthened as frontline educators to provide continuous counseling, practical demonstrations, and follow-up regarding developmental stimulation during Posyandu services and mother–toddler sessions. Enhancing maternal knowledge through structured and culturally appropriate education may support more favorable developmental outcomes and complement ongoing efforts to address stunting and early childhood disparities in Indonesia.

Future studies should employ longitudinal designs to clarify the temporal relationship between maternal knowledge and toddler developmental status and should incorporate additional variables, including nutritional status, parenting practices, family support, and socioeconomic conditions. Further implementation research evaluating midwife-led educational interventions is needed to inform program integration and scale-up. The findings also support consideration of developmental stimulation education as an integral component of maternal and child health programs to improve access to developmental guidance for mothers and caregivers.

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DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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