INTEREST: Jurnal Ilmu Kesehatan
Vol. 14, No. 2, November 2025
https://doi.org/10.37341/interest.v14i2.760

Original Research

Exploring the Impact of Exclusive Breastfeeding and Complementary Feeding on Pediatric Feeding and Swallowing

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ABSTRACT

Background: *A child's eating and swallowing abilities depend on physiological readiness, environmental stimulation, and early feeding experiences. Lack of exclusive breastfeeding or inappropriate complementary feeding can hinder oromotor development, leading to difficulties in chewing, swallowing, or self-feeding during the preschool years. This study examines the relationship between exclusive breastfeeding history, complementary feeding practices, and toddlers' eating and swallowing abilities.*

Methods: *This cross-sectional study was conducted in Surakarta, Central Java, from April to August 2025, involving 50 randomly selected participants. The dependent variables were children's swallowing and eating abilities, while the independent variables included exclusive breastfeeding history and complementary feeding practices. Data were gathered using a structured questionnaire and analyzed through path analysis using Stata version 13.*

Results: *Optimal eating ability was significantly influenced by a history of exclusive breastfeeding (b = 2.05; p = 0.048), appropriate complementary feeding (b = 2.50; p = 0.022), and adequate swallowing ability (b = 2.36; p = 0.030). Exclusive breastfeeding and proper complementary feeding also indirectly improved eating ability through their positive effects on swallowing ability.*

Conclusion: *This study highlights the need for maternal education on exclusive breastfeeding and appropriate complementary feeding to promote optimal eating and swallowing development in toddlers, thereby minimizing the risk of related disorders and their potential impact on nutrition and growth.*

ARTICLE HISTORY
Received: September 30th, 2025
Accepted: December 9th, 2025

KEYWORDS
complementary feeding, exclusive breastfeeding, feeding skill, swallowing skill;

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Cite this as: Putri, A. R., & Susanti, N. (2025). Exploring the Impact of Exclusive Breastfeeding and Complementary Feeding on Pediatric Feeding and Swallowing. *Interest: Jurnal Ilmu Kesehatan*, *14*(2), 184–196. Retrieved from https://jurnalinterest.com/index.php/int/article/view/760

INTRODUCTION

In addition to meeting nutritional needs, appropriate complementary feeding also supports the development of eating and swallowing abilities. Introducing foods with suitable textures and gradually increasing their complexity helps stimulate oral motor

skills, promote safe swallowing, and foster positive eating behaviors. Conversely, inappropriate timing, texture, or nutritional content of complementary foods may increase the risk of feeding and swallowing difficulties, which can in turn affect nutritional status, growth, and overall development (Ampow et al., 2025; Hernah Riana et al., 2024; Widowati et al., 2022).

Eating and swallowing abilities in toddlers are crucial indicators of their oromotor as well as cognitive progress. In this process, the muscles of the mouth, tongue, and pharynx develop in tandem with the child's growth. Nutritional problems such as malnutrition, stunting, or obesity may adversely affect the child's overall quality of life and contribute to delays or disorders in eating and swallowing (Fristalia et al., 2024).

Eating and swallowing abilities are significantly influenced by a history of exclusive breastfeeding. Exclusive breastfeeding contributes to both nutritional adequacy and the development of oromotor muscles, which are essential for the progression to chewing and swallowing functions. Moreover, breast milk contains bioactive components that support the growth of muscles and the nervous system involved in the feeding process (Ismarina et al., 2024).

The introduction of complementary feeding that is both timely and nutritionally suitable plays an important role in fostering the growth of children's eating and swallowing functions. Early introduction of complementary feeding (before six months) poses risks such as choking, allergies, and digestive disorders, whereas late introduction (after six months) can lead to nutritional shortages and postponed oromotor maturation. To enhance a child's chewing and swallowing skills, the texture and variety of complementary foods should be adjusted in accordance with their developmental stage (Ismarina et al., 2024).

The study revealed that timely complementary feeding combined with six months of exclusive breastfeeding was associated with improved eating and swallowing abilities in children, compared with those lacking these practices. Despite its importance, exclusive breastfeeding and complementary feeding are often practiced inadequately at the community level, mainly due to gaps in knowledge, lack of support systems, and limited availability of accurate information. Based on the aforementioned background, this study was conducted to assess the effect of exclusive breastfeeding and complementary feeding practices on toddlers' ability to eat and swallow. Understanding this relationship is expected to provide better recommendations for parents, caregivers, and healthcare professionals in supporting optimal child development (Muraglia et al., 2024).

The novelty of this study lies in the use of path analysis to evaluate the direct and indirect effects of feeding practices on eating and swallowing abilities in toddlers. This study uses this analytical approach to provide a more comprehensive understanding of the mechanisms involved. The findings of this study provide a scientific basis for health workers in developing more targeted health education and promotion for parents.

This study was designed to analyse the relationship between exclusive breastfeeding, complementary feeding history, and the eating and swallowing abilities of toddlers. This study assessed the relationship between these three variables during a crucial period of toddler development. The results of this study emphasise the importance of paying attention to feeding practices in order to support children's growth and functioning in the future.

MATERIALS AND METHOD

A cross-sectional analytical design was chosen because it allows for the assessment of the relationship between exclusive breastfeeding history, complementary feeding practices, and toddlers' eating and swallowing abilities at a single point in time. This approach is efficient and capable of evaluating several variables simultaneously without requiring significant time or expense. In addition, this design is suitable for identifying initial associations in a natural context, making it useful for exploratory research on child feeding development.

The study was conducted in Surakarta, with a total of 50 participants. Data collection took place from April to August 2025. In practice, a minimum sample size of 30–50 participants are often considered adequate for preliminary analytical studies to ensure sufficient statistical power when exploring associations using multivariate analysis techniques such as logistic regression or path analysis. Therefore, the sample size of 50 participants in this study meets the minimum requirement to generate reliable and interpretable results.

A simple random sampling technique was applied, following the Law of Statistical Regularity, ensuring that each subject had an equal and independent chance of being selected for the sample. A simple random sampling technique was used in this study. This method ensures that every eligible toddler in the population has an equal and independent chance of being selected as a participant. The technique was chosen to reduce selection bias and to improve the representativeness of the sample. The approach follows the Law of Statistical Regularity, which states that a randomly selected sample tends to reflect the characteristics of the larger population.

The independent variables were exclusive breastfeeding history and complementary feeding history, while the dependent variable was eating and swallowing ability. Data were obtained through a structured questionnaire. Data were collected using a structured questionnaire designed to obtain information on exclusive breastfeeding history, complementary feeding practices, and toddlers' eating and swallowing abilities.

The questionnaire used in this study was the exclusive breastfeeding and complementary foods in toddlers' history questionnaire. Based on the Cronbach's Alpha test, the coefficient value was 0.605. Data were collected through structured interviews with parents or primary caregivers. This approach ensured that all questions were clearly understood, minimized misinterpretation, and enabled researchers to obtain complete and accurate responses.

The analysis involved univariate, bivariate, and multivariate techniques. Logistic regression was used to assess the association between independent and dependent variables, which was then complemented with path analysis. This analysis was then supplemented with path analysis to evaluate the direct and indirect relationships between variables, thereby providing a more comprehensive picture of the factors that influence stunting.

This study uses ethical clearance with the number. KEPK/UMP/143/VII/2025 from Muhammadiyah University of Purwokerto, which was obtained on July 12, 2025. All research procedures followed the principles of health research ethics, including respect for persons (consent and confidentiality of respondents), beneficence (minimising risks and ensuring the benefits of research), and justice (fair and non-discriminatory treatment of all participants).

RESULTS

Characteristics of Study Participants

This study was conducted on 50 research subjects, consisting of children aged 4–6 years, enrolled in kindergartens in Surakarta. Data collection was carried out from April to August 2025.

Table 1. Sociodemographic Characteristics of Parents and Children (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
Parental Education	Elementary School	4	8.0
	Junior High School	6	12.0
	Senior High School	21	42.0
	Diploma/Bachelor	19	38.0
	Total	**50**	**100**
Mother's Age	< 25 years	13	26.0
	25–35 years	18	36.0
	≥ 35 years	19	38.0
	Total	**50**	**100**
Child's Age	< 60 months	24	48.0
	≥ 60 months	26	52.0
	Total	**50**	**100**
Gender	Female	34	68.0
	Male	16	32.0
	Total	**50**	**100**

Table 1 shows that, among the 50 study participants, the majority of parents had completed senior high school education (21 parents; 42%), most mothers were aged ≥ 35 years (19 mothers; 38%), more than half of the children were aged ≥ 60 months (26 children; 52%), and the majority of the children were female (34 children; 68%).

Univariate Analysis

Table 2. Descriptive Statistics of Maternal and Feeding Variables (n = 50)

Variable	Mean ± SD	Min	Max
Child's age (months)	61.1 ± 7.52	48	72
Mother's education	3.1 ± 0.9	1	4
Mother's age (years)	30.64 ± 7.1	20	45
History of exclusive breastfeeding (months)	6.96 ± 1.49	3	10
History of complementary feeding (months)	10.12 ± 1.75	6	14
Feeding skills	4.66 ± 1.18	3	7
Swallowing skills	4.74 ± 1.36	2	7

The average age of children in the sample was 61.18 months. The average level of education of the mothers was 3.1 and the average age of the mothers was 30.64 years. The average duration of exclusive breastfeeding and complementary feeding was 6.96

and 10.12 months, respectively. The children's eating ability had an average score of 4.66, while their swallowing ability had an average score of 4.74.

Table 3. Statistical Description of Categorical Variables (n = 50)

Variable	Category	Frequency (n)	Percentage (%)
History of Exclusive Breastfeeding	Not exclusive breastfeeding	21	42
	Exclusive breastfeeding	29	58
	Total	**50**	**100**
History of Complementary Feeding	Not according to needs	17	34
	According to the needs	33	66
	Total	**50**	**100**
Feeding Skill	Need assistance	21	42
	Good feeding skills	29	58
	Total	**50**	**100**
Swallowing Skills	Need assistance	24	48
	Good swallowing skills	26	52
	Total	**50**	**100**

The results show that most children had a history of exclusive breastfeeding (29 children; 58%) and appropriate complementary feeding (33 children; 66%). In addition, 26 children (52%) demonstrated good swallowing ability, and 29 children (59%) had good eating ability.

Bivariate Analysis

Bivariate analysis was utilized in this research to examine the influence of exclusive breastfeeding and complementary feeding history (independent variables) on swallowing and eating abilities in children (dependent variables). The analysis was performed using the Chi-square test at a 95% confidence level.

Table 4. The Association of Exclusive Breastfeeding and Complementary Feeding History with Children's Feeding Skills Abilities (n = 50)

Variabel	Feeding Skills				OR	*p-value**
	Need assistance		Good			
	n	%	n	%		
History of Exclusive Breastfeeding						
Not exclusive breastfeeding	17	80.9	4	19.1	26.5	<0.001
exclusive breastfeeding	4	13.7	25	86.3		
Historry of Complementary feeding						
Not according to needs	15	88.2	2	11.8	33.7	<0.001
According to the needs	6	18.2	27	81.8		
Swallowing Skills						
Need assistance	19	79.2	5	20.8	45.6	<0.001
Good swallowing skills	2	7.7	24	92.3		

Note: * Chi-Square Test

Analysis shows that a history of exclusive breastfeeding, a history of complementary feeding, and swallowing ability are significantly associated with a child's eating ability. Children with a history of exclusive breastfeeding are 26.5 times more likely to have good feeding ability, while age-appropriate complementary feeding increases this likelihood by up to 33.7 times. In addition, children with good swallowing ability are 45.6 times more likely to demonstrate good feeding ability ($p < 0.001$).

Table 5. The Association Between Exclusive Breastfeeding and Complementary Feeding History and Children's Swallowing Ability (n = 50)

Variabel	Swallowing skills				OR	*p-value**
	Need assistance		Good			
	n	%	n	%		
History of exclusive breastfeeding						
Not exclusive breastfeeding	18	85.7	3	13.3	23	<0.001
exclusive breastfeeding	6	20.6	24	79.3		
Historry of Complementary feeding						
Not according to needs	15	88.2	2	11.8	20	<0.001
According to the needs	6	18.2	27	81.8		

Note: * Chi-Square Test

Table 5 shows that a history of exclusive breastfeeding and a history of complementary feeding are significantly associated with a child's swallowing ability. Children who were exclusively breastfed are 23 times more likely to have good swallowing ability, while children with a history of appropriate complementary feeding are 20 times more likely to develop optimal swallowing ability ($p < 0.001$).

Multivariate Analysis

Model Specification

The model specification describes the relationships among the variables studied. This research includes four measured variables: exclusive breastfeeding history, complementary feeding history, swallowing ability, and eating ability. Figure 1 below presents the relationship between exogenous variables (exclusive breastfeeding history and complementary feeding history) and the endogenous (Figure 1).

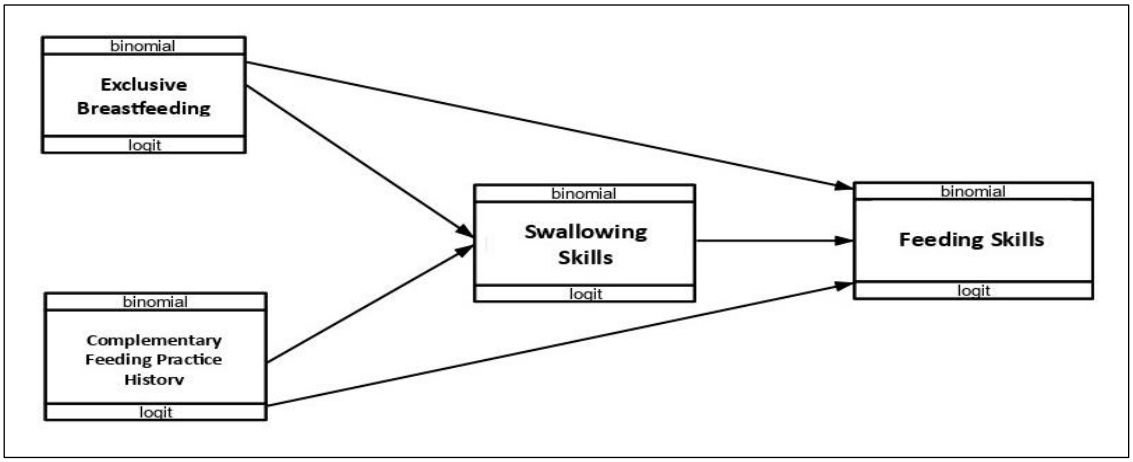

Figure 1. Analysis Model Specification - Analysis of Exclusive

Breastfeeding History and Complementary Feeding on Eating and Swallowing Ability in Children

Model Identification

The path analysis model included the variables of swallowing ability and eating ability. Model identification involved determining the counts of observed, endogenous, and exogenous variables along with the parameters to estimate. The degree of freedom (df) was calculated as follows: (1) Number of observed variables: 4; (2) Endogenous variables: 2; (3) Exogenous variables: 2; and (4) Number of parameters: 3.

The formula for calculating the degree of freedom is:

$$df = (\text{observed variables} \times (\text{observed variables} + 1) / 2) - (\text{endogenous} + \text{exogenous} + \text{parameters})$$
$$df = (4 \times (4 + 1) / 2) - (2 + 3 + 3) = 10 - 8 = 2$$

Path analysis is applicable when $df \geq 0$. In this study, the degree of freedom was calculated as df = 2, indicating that the model is overidentified and therefore estimable.

Parameter Estimation

Table 6. Path Analysis Results Between Feeding History and Pragmatic Skills in Children (n = 50)

Dependent Variable	Independent Variable	b	95% CI Lower	95% CI Upper	p-value
Direct Effect					
Good feeding skill	History of exclusive breastfeeding	2.05	0.01	4.09	0.048
	History of complementary feeding	2.50	0.33	4.63	0.022
	Good swallowing skills	2.36	0.23	4.53	0.030
Indirect Effect					
Good swallowing skills	History of exclusive breastfeeding	2.62	0.97	4.27	0.002
	History of complementary feeding	2.36	0.49	4.23	0.013

Log likelihood = -33.3
Number of observations = 50

Path analysis shows that a child's ability to eat and swallow is significantly influenced by a history of exclusive breastfeeding, provision of complementary foods according to need, and swallowing ability. Direct effects indicate that a history of exclusive breastfeeding (p = 0.048), provision of complementary foods according to need (p = 0.022), and good swallowing ability (p = 0.030) increase the likelihood of children having good eating ability. The indirect effect through swallowing ability was also significant, both for exclusive breastfeeding history (p = 0.002) and provision of complementary foods according to need (p = 0.013).

DISCUSSION

Exclusive breastfeeding for the first six months, in line with WHO and UNICEF recommendations, supplies complete and readily absorbable nutrition that supports the growth and health of toddlers (Hapsari et al., 2021). In addition, the range of flavors in

breast milk plays a role in sensory stimulation, aiding the growth of eating and swallowing skills and preventing picky eating tendencies (Khotimah et al., 2024) (Pratiwi et al., 2023). Skills such as chewing, controlling food, and swallowing constitute essential aspects of feeding in toddlers (Lameky & Wakanno, 2025).

Although exclusive breastfeeding influences oral motor development, the effect is not consistently significant. Maternal interaction and the surrounding environment are additional key contributors to the development of eating and swallowing abilities in toddlers. Exclusive breastfeeding lowers the risk of digestive issues and diarrhea, supporting gastrointestinal health, immune function, and the development of eating and swallowing skills (Mariam, 2020; Nababan et al., 2024; Ningsih et al., 2023).

Variations in breast milk flavor familiarize infants with different tastes and textures, aiding solid food acceptance and decreasing the risk of picky eating in toddlers (Arisandi, 2019; Cerdasari et al., 2017; Muryani et al., 2024). Exclusive breastfeeding is positively correlated with good nutritional status in toddlers, which supports oral motor development as well as muscle and nerve functions related to eating and swallowing (Danefi et al., 2024; Daradinanti et al., 2025). Exclusive breastfeeding contributes to the development of eating and swallowing skills via multiple mechanisms, including nutritional support, sensory stimulation, and gastrointestinal health. Nevertheless, motor development, the infant's readiness for complementary feeding, and environmental factors also influence these outcomes.

The complementary feeding (MPASI) period is crucial not only for fulfilling nutritional needs but also for training oromotor skills that support eating and swallowing (Mildiana & Sulistyawati, 2022; Rahmisyah et al., 2024; Suryani et al., 2023). Complementary feeding that follows age-appropriate texture progression stimulates jaw, tongue, and oral muscles, facilitating effective chewing and swallowing. Delay in providing proper textures may disrupt feeding skill development and raise the likelihood of feeding difficulties (Lameky & Wakanno, 2025).

Feeding difficulties in toddlers is often associated with non-guideline-compliant complementary feeding. Anggraheny, (2023) found that delayed or inappropriate complementary feeding, as well as suboptimal application of Basic Feeding Rules, increased the risk of feeding difficulties in children aged 24–36 months in Banyumanik. These findings underscore the importance of complementary feeding quality and method in supporting children's eating skills.

Introducing complementary foods either too early or too late can interfere with oromotor development and increase the likelihood of feeding and gastrointestinal problems in toddlers (Apriliani et al., 2023; Aritonang et al., 2021; Faustine et al., 2021). Oromotor stimulation through the variety and texture of complementary foods is essential in transitioning from the sucking reflex to chewing and swallowing skills, which supports nutrient absorption and establishes healthy eating habits from an early age (Daro et al., 2023; Khiriyah, 2024).

Eating and swallowing abilities are influenced by physical readiness, neurological development, and the child's curiosity in trying new foods, which are key to successful age-appropriate complementary feeding (Putri et al., 2025). A structured and guideline-compliant complementary feeding history plays a major role in the development of toddlers' eating and swallowing skills. Progressive complementary feeding combined with oromotor stimulation helps children overcome feeding difficulties, improve nutritional intake, and promote optimal growth and development.

Exclusive breastfeeding for the first six months provides complete nutrition while stimulating oromotor muscles, supporting eating and swallowing skills. Moreover, exclusive breastfeeding has been shown to enhance motor, communication, and social development related to independent feeding readiness (Dwiantini et al., 2024). Complementary feeding introduced before the infant is physiologically ready (e.g., before six months) can increase the risk of swallowing difficulties, choking, and digestive problems, as the infant's gastrointestinal and oromotor systems are not yet mature enough to handle solid or semi-solid textures (Andrian et al., 2021; Hidayat et al., 2023; Lestiarini & Sulistyorini, 2020). Lack of exclusive breastfeeding or premature complementary feeding may impair eating and swallowing skills, increase the risk of digestive and nutritional problems, and lead to feeding difficulties. Exclusive breastfeeding provides a nutritional foundation and serves as a physiological and swallowing reflex base for the child (Anggraheny, 2023; Apriasih et al., 2024).

The introduction of complementary feeding around six months is a critical period for developing eating and swallowing skills. Applying Basic Feeding Rules such as texture variation, gradual portion sizes, and self-feeding stimulation helps children adapt to chewing and swallowing processes and prevents feeding problems like picky eating and dysphagia (Fiana et al., 2024; Firdaus, 2023). Studies indicate that proper complementary feeding practices reduce the risk of feeding difficulties in children aged 2–3 years (Anggraheny, 2023).

Beyond skill development, delays or errors in introducing complementary feeding affect long-term nutritional status. National studies report that toddlers who received exclusive breastfeeding and timely complementary feeding were 7.8 times more likely to achieve normal nutritional status than those who did not (Boy et al., 2023). Poor early-life nutritional status increases the risk of growth and cognitive impairments, as well as compromised eating and swallowing function. Breastfeeding provides immunological protection, while nutrient-rich complementary feeding fulfills the child's growth requirements (Pratiwi et al., 2023; Suryani et al., 2023).

Evidence shows that a history of exclusive breastfeeding combined with timely and appropriate complementary feeding positively impacts toddlers' eating and swallowing abilities. Oromotor skills, safe swallowing, and adequate nutrition interact synergistically, as recommended by WHO and child development specialists. These findings underscore the need for ongoing education for mothers and families on optimal breastfeeding and guideline-based complementary feeding to enhance toddlers' feeding skills and nutritional status during critical growth periods.

This study has several limitations that should be considered when interpreting the findings. First, cross-sectional design restricts the ability to establish causal relationships between exclusive breastfeeding, complementary feeding practices, and toddlers' eating and swallowing abilities. The results reflect associations at one point in time only. Second, although random sampling was attempted, practical constraints may have introduced elements of purposive selection, which could lead to selection bias and limit the representativeness of the sample. Third, the study was conducted in a single geographic area with a relatively small sample size of 50 participants, thereby reducing the generalizability of the findings to broader or more diverse populations.

This study demonstrates that exclusive breastfeeding and appropriate complementary feeding practices are significantly associated with optimal eating and swallowing abilities in toddlers. These findings highlight the importance of early feeding behaviors in supporting healthy oromotor development. Based on these results,

several recommendations can be made. First, parental education on exclusive breastfeeding and proper complementary feeding should be strengthened to promote optimal feeding skills in early childhood.

Second, routine clinical monitoring of toddlers' eating and swallowing abilities is recommended, particularly for children with suboptimal feeding histories, to ensure early detection and intervention. Third, community-based programs that support breastfeeding and provide practical guidance on complementary feeding should be expanded. Finally, future research should employ larger samples and longitudinal designs to enhance generalizability and establish clearer causal relationships.

CONCLUSION

This study examined the association between exclusive breastfeeding and complementary feeding (MPASI) with children's eating and swallowing abilities. The findings revealed a significant relationship, showing that timely and guideline-based complementary feeding plays a critical role in supporting oral motor development and preventing feeding difficulties such as picky eating, food refusal, and choking. While exclusive breastfeeding contributes to nutritional foundations, its influence on eating and swallowing abilities is less pronounced compared to complementary feeding. Ensuring appropriate timing, texture, and nutritional quality of complementary feeding, alongside optimal exclusive breastfeeding, is therefore essential to enhance toddlers' eating and swallowing skills.

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