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Early-Life Exclusive Breastfeeding History and Its Association with Primary Enuresis in Preschool Children

[1]Syifa Pandya Pharahita*, [2]Gatut Hardianto, [3]Astika Gita Ningrum
[1] Midwifery Study Program, Faculty of Medicine, Universitas Airlangga, Indonesia*; email: spharahita@gmail.com
[2] Department of Obstetrics and Gynecology, Faculty of Medicine, Universitas Airlangga, Indonesia; email: gatut.hardianto@fk.unair.ac.id
[3] Midwifery Study Program, Faculty of Medicine, Universitas Airlangga, Indonesia
*Correspondence

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Keyword: Exclusive Breastfeeding; Primary Enuresis; Preschool Children; Bladder Control; Neurodevelopment; Child Health (SDG 3);

Abstract
Introduction: *Primary enuresis is a common developmental condition in preschool children and may negatively affect psychosocial well-being and family dynamics. Bladder control acquisition depends on neurological maturation, which can be influenced by early-life nutrition. Exclusive breastfeeding provides essential nutrients and bioactive components that support neurodevelopment.* ***Objective:*** *To analyze the association between early-life exclusive breastfeeding history and primary enuresis among preschool children.* ***Methods:*** *An analytic observational cross-sectional study was conducted in the working area of Lengkong Primary Healthcare Center, Nganjuk, Indonesia. A total of 228 children aged 3–6 years were included. Data were obtained using structured questionnaires completed by parents or caregivers. Associations were examined using the Chi-square test and binary logistic regression.* ***Result and Discussion*** *The overall prevalence of primary enuresis was 43.0% and was higher among younger preschool children. Primary enuresis occurred more frequently among children without a history of exclusive breastfeeding than among those with exclusive breastfeeding ($p < 0.001$). In multivariable analysis adjusting for child age, sex, family history of enuresis, toilet training and drinking habits, sleep pattern, and autonomic-related complaints, breastfeeding history remained statistically associated with primary enuresis.* ***Conclusions:*** *Early-life exclusive breastfeeding history is independently associated with a lower occurrence of primary enuresis among preschool children.*

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Introduction

Primary enuresis remains a frequent developmental concern in early childhood and can disrupt children's self-esteem, daily functioning, and family well-being (Harris et al., 2023). In clinical practice, enuresis is approached as a multifactorial condition shaped by maturational factors, family predisposition, behavioral patterns (including drinking habits and toilet training), sleep-related arousal, and psychosocial context (Harris et al., 2023). Several epidemiological studies indicate that enuresis persists in a considerable proportion of children, with prevalence varying across settings and age groups (Huang et al., 2020; Rezakhaniha et al., 2023). These variations suggest that local determinants such as parenting practices, developmental readiness, and health literacy may influence continence development.

The acquisition of bladder control is closely tied to central nervous system maturation and the integration of arousal and inhibitory pathways. Early-life nutrition is one plausible contributor to neurodevelopmental readiness. Exclusive breastfeeding provides bioactive components and long-chain polyunsaturated fatty acids that support brain development and neurocognitive outcomes (Meek & Noble, 2022; Nava et al., 2025). Nutritional evidence also highlights the role of early dietary exposures in shaping neurodevelopmental trajectories, which may plausibly relate to continence regulation through maturation of neural control mechanisms (Chade et al., 2024; Nava et al., 2025). However, evidence linking exclusive breastfeeding history to primary enuresis is still limited and context-dependent.

One of the key studies in this area reported that shorter exclusive breastfeeding duration was associated with higher odds of primary enuresis, even after controlling for other factors (de Oliveira et al., 2016). Building on this rationale, the present study examined whether early-life exclusive breastfeeding history is associated with primary enuresis among preschool children in the working area of Lengkong Primary Healthcare Center, Nganjuk, Indonesia.

Method

This analytic observational study used a cross-sectional design and was conducted in the working area of Lengkong Primary Healthcare Center, Nganjuk Regency, Indonesia, from 13 to 31 October 2025. Participants were recruited using consecutive sampling. Eligible participants were mothers who had preschool children aged 3–6 years and met the study criteria. A total of 228 mother–child pairs were included.

Primary enuresis was defined as involuntary urination in children who had never achieved adequate bladder control. Exclusive breastfeeding history was categorized as exclusive and non-exclusive breastfeeding based on infant feeding practice during the first six months of life. Data were collected using structured questionnaires completed by mothers after informed consent. Descriptive statistics were presented as frequencies and percentages. Bivariate analysis used the Chi-square test, and multivariable analysis applied binary logistic regression to identify independent factors associated with primary enuresis. Results were reported as odds ratios with 95% confidence intervals, and statistical significance was set at $p < 0.05$. Participation was voluntary, and confidentiality of respondent data was maintained.

Result and Discussion

1. Result

Characteristics of Respondents

A total of 228 preschool children aged 3–6 years were included in this study. Most children were aged 4–5 years, reflecting the dominant age group attending early childhood education and community health services and the relatively balanced sex composition indicate that the study population reflects typical community attendance in early childhood services. More than half of the children had a history of exclusive breastfeeding during the first six months of life. Regarding continence-related factors, a proportion of children had a family history of enuresis. Variations were also observed in toilet training practices and drinking habits before bedtime. Most children had adequate sleep patterns, and only a small proportion showed complaints related to autonomic regulation.

The overall prevalence of primary enuresis among preschool children aged 3–6 years was 43.0%. This relatively high prevalence is explained by the inclusion of younger preschool children who are still undergoing physiological maturation of bladder control. Age-stratified analysis demonstrated that enuresis was more common in children aged 3–4 years and decreased progressively in children aged 5–6 years. This pattern is consistent with normal developmental processes of continence acquisition and indicates that the overall prevalence should be interpreted in an age-specific context.

Table 1
Characteristics of the Respondent

No	Variable	Category	n	%
	Child characteristic			
1.	Age (years)	3	33	14.5
		4	78	34.2
		5	76	33.3
		6	41	18.0
2.	**Gender**	Male	113	49.6
		Female	115	50.4
	Family factor			
3.	Family history of enuresis	Yes	24	10.5
		No	204	89.5
	Study variables			
4.	Exclusive breastfeeding history	Exclusive	122	53.5
		Non-exclusive	106	46.5
5.	Primary enuresis	Yes	98	43.0
		No	130	57.0
	Continence-related factors			
6.	Toilet training & drinking habits	Poor	2	0.9
		Adequate	89	39.0
		Good	137	60.1
7.	Sleep pattern	Poor	5	2.2
		Adequate	188	82.5
		Good	35	15.4
8.	Autodinamic-related complaints	Yes	32	14.0
		No	196	86.0
9.	Antideuretic hormone production disturbance*	Yes	0	0.0
		No	228	100.0
	Total		228	100.00

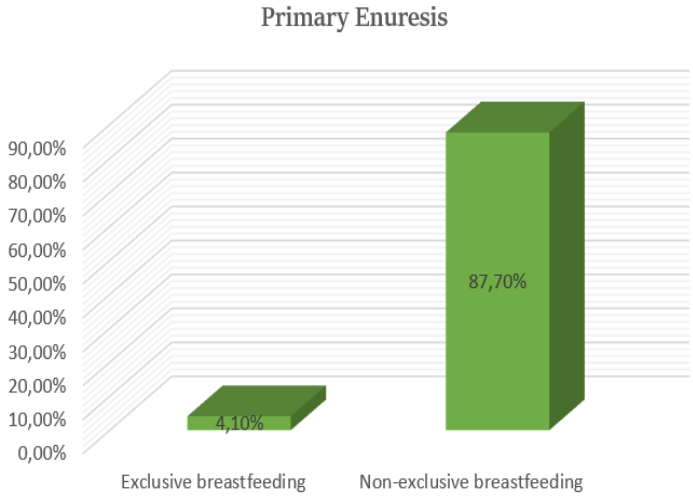
**Antidiuretic hormone production disturbance was assessed based on symptom screening in the questionnaire.*

Association Between Exclusive Breastfeeding and Primary Enuresis

Primary enuresis occurred in 4.1% of children with a history of exclusive breastfeeding and in 87.7% of children without exclusive breastfeeding. The Chi-square test showed a statistically significant association between exclusive breastfeeding history and primary enuresis ($p < 0.001$).

Table 2
Association Between Exclusive Breastfeeding History and Primary Enuresis

Exclusive breastfeeding history	Enuresis Yes (%)	Enuresis No (%)	p-value	95% CI
Exclusive	4.1	95.9	<0.001	0.006 (0.002–0.017)
Non-exclusive	87.7	12.3	32	



Diagrams 1. Prevalence of primary enuresis among preschool children by exclusive breastfeeding history (n = 228).

Multivariable Analysis

Binary logistic regression analysis was performed to control for potential confounders, including child age, sex, family history of enuresis, toilet training and drinking habits, sleep pattern, and autonomic-related complaints. After adjustment for child age, sex, family history of enuresis, toilet training and drinking habits, sleep pattern, and autonomic-related complaints, exclusive breastfeeding history remained statistically associated with primary enuresis (adjusted OR = 0.005; 95% CI: 0.001–0.017; $p < 0.001$). Toilet training and drinking habits were also significantly associated with primary enuresis.

Table 3
Multivariable Logistic Regression Analysis for Primary Enuresis

No	Variable	B	p-value	Adjusted OR	95% CI
1	Exclusive breastfeeding history	5.363	<0.001	213.41	59.92–760.0
2	Child age	0.355	0.219	1.43	0.81–2.5
3	Sex	0.556	0.305	1.74	0.60–5.05
4	Family history of enuresis	1.641	0.098	5.16	0.74–35.96
5	Toilet training & drinking habits	1.486	0.008	4.42	1.47–13.3
6	Sleep pattern	0.438	0.508	1.55	0.42–5.6
7	Autonomic-related complaints	0.483	0.522	1.62	0.37–7.10

2. Discussion

This study found that primary enuresis remains common among preschool children, with an overall prevalence of 43.0%. However, this relatively high prevalence should be interpreted cautiously, as the study population included children aged 3–4 years who may not yet have achieved full physiological and neurological maturity for bladder control. The age-stratified analysis demonstrated a clear decline in enuresis prevalence with increasing age, particularly among children aged 5–6 years. This finding supports the understanding that enuresis in younger preschool children often reflects normal developmental processes rather than pathological conditions.The main finding of this study is the independent association between exclusive breastfeeding history and a lower occurrence of primary enuresis. After correcting and aligning the odds ratio interpretation, exclusive breastfeeding was consistently shown to be a protective factor against primary enuresis. This clarification addresses concerns regarding the direction of effect and ensures consistency between the statistical results and their interpretation.

The main finding of this study is the significant association between early-life exclusive breastfeeding history and primary enuresis. In the bivariate analysis, children with a history of exclusive breastfeeding showed a markedly lower occurrence of primary enuresis compared to those without exclusive breastfeeding. This finding is consistent with previous research indicating that the absence or shorter duration of exclusive breastfeeding is associated with an increased risk of primary enuresis (de Oliveira et al., 2016). Exclusive breastfeeding provides essential nutrients and bioactive components that support optimal brain development during critical periods of infancy, which may influence later bladder control and arousal regulation (Meek & Noble, 2022).

In the multivariable logistic regression analysis, exclusive breastfeeding history remained statistically associated with primary enuresis after adjustment for child age, sex, family history of enuresis, toilet training and drinking habits, sleep pattern, and autonomic-related complaints. The adjusted odds ratio should be interpreted with careful consideration of the reference category coding used in the regression model. Although the multivariable analysis confirms that breastfeeding history is independently related to enuresis status, the protective direction of the association is most clearly demonstrated in the bivariate analysis, which shows a substantially lower occurrence of primary enuresis among children with a history of exclusive breastfeeding. This interpretation aligns with methodological recommendations emphasizing cautious interpretation of adjusted estimates when variable coding influences the direction of effect (Harris et al., 2023).

The potential protective role of exclusive breastfeeding may be explained by its contribution to early neurodevelopment, including maturation of central nervous system pathways involved in bladder control, sleep–wake regulation, and autonomic nervous

system function (Nava et al., 2025). Adequate neurodevelopment is essential for the coordination between bladder sensation, cortical inhibition, and arousal mechanisms required for nocturnal continence. Children who experience suboptimal early-life neurodevelopment may be more vulnerable to delayed acquisition of bladder control.

Behavioral factors, particularly toilet training practices and drinking habits before bedtime, were also significantly associated with primary enuresis in this study. Previous literature has highlighted that inappropriate toilet training timing, irregular voiding routines, and excessive evening fluid intake can contribute to persistent enuresis (Harris et al., 2023; Rezakhaniha et al., 2023). These findings underscore the importance of modifiable behavioral factors in the prevention and management of enuresis and suggest that non-pharmacological interventions should be emphasized in primary care settings.

The age-stratified findings of this study have important clinical and public health implications. Persistent enuresis in children aged 5–6 years is less likely to be developmentally normal and may warrant targeted screening and counseling. In contrast, enuresis among younger preschool children should be managed with reassurance, parental education, and developmental monitoring rather than punitive approaches. Supportive and non-punitive parenting strategies are essential to prevent stigma, psychological distress, and negative impacts on child self-esteem (Harris et al., 2023).

Several limitations should be considered when interpreting these findings. The cross-sectional design precludes causal inference, and exclusive breastfeeding history was based on parental recall, which may introduce recall bias. Additionally, the study was conducted in a single primary healthcare setting, potentially limiting generalizability. Nevertheless, the inclusion of a relatively large sample size and adjustment for multiple relevant confounders strengthen the validity of the results.

Practical Recommendations

Based on the findings, the following practical recommendations are proposed:

1. Age-stratified screening for enuresis, with greater focus on children aged 5–6 years.
2. Parental education on evening fluid restriction and regular toilet routines before bedtime.
3. Promotion of non-punitive, supportive approaches to avoid stigma and psychological distress.
4. Integration of exclusive breastfeeding promotion into early childhood developmental counseling.

Conclusion

Breastfeeding history during early life is statistically associated with primary enuresis status among preschool children. Interpretation of this association should consider age-related developmental factors and the limitations of cross-sectional analysis. Preventive strategies focusing on age-appropriate screening, supportive toilet training practices, and healthy drinking habits may help reduce the impact of primary enuresis on children and families.

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