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Association between Infection History and Complex Nutrition Intake with Wasting Incidence in Toddlers

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ABSTRACT

Background: Wasting in toddlers is a form of acute malnutrition characterized by rapid weight loss and low weight-for-height z-scores, which can severely impact physical growth and cognitive development. Factors such as a history of infection and inappropriate complementary feeding practices have been identified as potential contributors.
Objective: This study aimed to analyze the relationship between infection history and the provision of complementary feeding (MPASI) with the incidence of wasting among toddlers aged 2–5 years in the working area of Sidomulyo Health Center, Samarinda.
Method: A cross-sectional study with a quantitative correlational approach was conducted. A total of 168 toddlers were selected using stratified random sampling. Data were collected through structured questionnaires and anthropometric measurements, and analyzed using the Chi-Square test.
Results: The results showed that 25.6% of the toddlers experienced wasting. Toddlers with a history of infection were found to be at significantly higher risk, with an odds ratio (OR) of 13.85 (p = 0.000). Additionally, toddlers who received complementary feeding before the age of 6 months were 8.9 times more likely to experience wasting (p = 0.000; OR = 8.9). Both variables showed a statistically significant association with the incidence of wasting.
Conclusion: The study found a significant relationship between infection history and complementary feeding practices with the incidence of wasting among toddlers. Strengthening maternal education, timely feeding, and infection prevention is essential to reduce the risk of wasting in early childhood.

Keywords: complementary feeding, infection, mpasi, toddlers, wasting

Introduction

Nutritional problems remain a major public health concern that directly impacts child growth and development, the quality of human resources, and ultimately the resilience of a nation (Ministry of Health of the Republic of Indonesia, 2020). One of the most urgent forms of malnutrition in children is wasting, defined as a condition in which a child's weight is significantly below the standard for their height (z-score between -3 SD and < -2 SD), indicating acute malnutrition (Ministry of Health, 2019). If it occurs during the golden period of growth (ages 0–5 years), wasting can cause irreversible damage to both cognitive and physical development.

Globally, wasting remains a pressing issue. The World Health Organization (2022) reported that 45 million children under the age of five were affected by wasting. In Indonesia, the 2022 Nutritional Status Study (SSGI) recorded a wasting prevalence of 7.7%, an increase from 7.1% the previous year. In East Kalimantan, the rate reached 9.1%, while in Samarinda City it was even higher at 9.3%. Alarmingly, the Sidomulyo Health Center working area recorded a prevalence of 18.4%, highlighting the urgent need for targeted interventions (SSGI, 2022).

Wasting is a multifactorial condition. According to UNICEF (2020), key contributing factors include inadequate exclusive breastfeeding, inappropriate complementary feeding (MPASI), incomplete immunization, recurrent infections, and poor caregiving practices. Infectious diseases are among the most direct causes. Hastuti (2024) found that a history of infectious diseases significantly influences the risk of wasting ($p = 0.014$). These diseases—including diarrhea, pneumonia, and tuberculosis—not only impair nutrient absorption and metabolism but also account for a large share of toddler mortality in Indonesia (Ministry of Health, 2023). Recurrent diarrhea doubles the risk of wasting (Alebel et al., 2018), while pneumonia can reduce nutritional status by up to 10% (Malwani, 2021).

Another major factor is the timing of complementary feeding. MPASI is ideally introduced at six months of age, when breast milk alone is no longer sufficient to meet the infant's nutritional needs (Ministry of Health, 2022; Denta, 2022). Introducing MPASI too early may cause digestive disturbances, while delaying it may result in nutrient deficiencies. The composition of MPASI should include carbohydrates, proteins (especially from animal sources), fats, and micronutrients such as vitamins and minerals (WHO, 2021).

Despite extensive research on stunting and chronic energy deficiency (e.g., Uga & Wisnuwardani, 2025; Syukur, 2016; Zahro, 2023), there is limited research focusing specifically on the relationship between infection history, complementary feeding, and wasting, particularly in the Sidomulyo Health Center area. Given the high local prevalence and the potential influence of these factors, this study is needed to fill the research gap.

Based on this background, the study aims to examine whether there is a relationship between infection history and complementary feeding practices with the incidence of wasting among toddlers in the Sidomulyo Health Center working area. The specific objectives include identifying the sociodemographic characteristics of respondents, assessing the prevalence of infection and feeding patterns, and measuring wasting rates in the area. It is expected that the findings will contribute to evidence-based interventions to reduce wasting and improve toddler health in the region.

Objective

This study aimed to analyze the relationship between infection history and the provision of complementary feeding (MPASI) with the incidence of wasting among toddlers aged 2–5 years in the working area of Sidomulyo Health Center, Samarinda.

Method

This study applied a quantitative correlational approach with a cross-sectional design to investigate the relationship between infection history and complementary feeding practices with the incidence of wasting among toddlers aged 2–5 years in the Sidomulyo Health Center working area. The case group included toddlers identified as experiencing wasting based on anthropometric indicators (weight-for-height, z-score < -2 SD), while the control group consisted of toddlers with normal nutritional status. This design was chosen to observe the relationships among variables at a single point in time (Afandi, 2020).

The study population comprised all toddlers aged 2–5 years in the working area of Sidomulyo Health Center, totaling 402 toddlers across eight integrated health posts (Posyandu). One Posyandu (Rumbia II) with 30 toddlers was selected for the validity test, leaving 353 toddlers as the population for sample calculation. The Slovin formula was used to determine the sample size, resulting in 188 toddlers, selected through stratified random sampling across seven Posyandu in Samarinda Ilir: Anggrek, Flamboyan, Kenari, Setia, Teratai, Sri Rejeki, and Lestari I.

The following table shows the proportional distribution of samples:

Table 1. Proportional Sample Distribution

Posyandu	Sample Calculation	Number of Samples
Anggrek	38 / 353 × 188 = 20.2	20
Flamboyan	48 / 353 × 188 = 25.5	26
Kenari	37 / 353 × 188 = 19.7	20
Lestari I	71 / 353 × 188 = 37.8	38
Setia	46 / 353 × 188 = 24.4	24
Sri Rejeki	38 / 353 × 188 = 20.2	20
Teratai	75 / 353 × 188 = 39.9	40
Total		**188**

The inclusion criteria were toddlers aged 2–5 years, having a KIA book with complete data, being accompanied by a parent or caregiver willing to participate, and having experienced acute infectious diseases. The exclusion criteria included toddlers with chronic conditions, those living in orphanages, and those who were absent from the Posyandu at the time of data collection.

To ensure the accuracy of the instruments, a validity test was conducted using the Point Biserial Coefficient at Rumbia II Posyandu with 30 toddlers. Out of 10 questions, 8 were valid and 2 were invalid (r-count > 0.361). A reliability test was performed using the Kuder Richardson 20 (KR-20) method to evaluate internal consistency, which is suitable for instruments with dichotomous answers (Singarimbun, 2021). Additionally, a normality test

was performed using the Kolmogorov–Smirnov test to ensure that the data were normally distributed (Ningrum et al., 2024).

The research procedure began with data acquisition from the Sidomulyo Health Center, followed by field visits to the selected Posyandu. After identifying toddlers who met the criteria, parents or caregivers were approached to obtain informed consent. Data collection was conducted using a structured questionnaire that included demographic details, infection history (e.g., diarrhea, pulmonary tuberculosis, pneumonia), and complementary feeding practices. Anthropometric data were collected through direct measurement. All data were entered into Microsoft Excel and processed for analysis.

Data analysis was conducted in two stages. Univariate analysis was used to describe the distribution of each variable, including wasting incidence, infection history, and feeding patterns. Bivariate analysis was then conducted using the Chi-Square test to examine the relationship between the independent variables (infection history and complementary feeding) and the dependent variable (wasting). A p-value < 0.05 was considered statistically significant.

Result

General Overview of Research Location

Posyandu Anggrek, Posyandu Flamboyan, Posyandu Kenari, Posyandu Setia, Posyandu Teratai, Posyandu Sri Rejeki and Posyandu Lestasi 1 are health posts under the auspices of the Sidomulyo Health Center in Samarinda City which are located on Jln. Jelawat, Gg 6, RT.08, Samarinda Ilir.

Respondent Characteristics

Table 2. Distribution of Characteristics of Respondents

Characteristics	Frequency	(%)
Toddler Age		
23 years	40	23.8
3.1 – 4 Years	94	56.0
4.1 – 5 Years	34	20.2
Toddler Gender		
Man	72	42.9
Woman	96	57.1
Mother's Age		
<20 years	8	4.8
21 - 35 years	139	82.7
>35 years	21	12.5
Mother's Education		
Elementary- High School	153	91.1
D3-S1	15	8.9
Mother's Occupation		
Housewife	128	76,2
Entrepreneur	23	13,7
Private Sector Employee	5	3,0
Civil Servant	12	7,1

From table 2, the results of the characteristics of the respondents show that out of 168 respondents, the majority of toddlers aged 3.1 - 4 years were 94 respondents (56.0%), toddlers aged 2 - 3 years were 40 respondents (23.8%), and toddlers aged 4.1 - 5 years were 34 respondents (20.2%). Most of the respondents were female, namely 96 (57.1%) respondents, and male gender as many as 72 (42.9%) respondents. Most of the respondents' ages of mothers of toddlers were 21-35 years old as many as 139 people (82.7%) respondents, ages >35 years were 21 people (12.5%) respondents, and ages <20 years were 8 people (4.8%) respondents. The highest maternal education was elementary school, junior high school, high school, namely 153 people (91.1%) respondents, while education D3, D4, S1 was 15 people (8.9%). Most of the mothers' jobs are housewives with a total of 128 people (76.2%) respondents, entrepreneurs as many as 23 people (13.7%) respondents, civil servants as many as 12 people (7.1%) respondents, and private sector 5 people (3.0) respondents.

Univariate analysis is used to describe the data conducted on each variable from the research results, the collected data is presented in the form of a frequency distribution table. In this study, the independent variables are the history of infection and the provision of MPASI, and the dependent variable is the incidence of wasting. The frequency distribution of infection history and provision of complementary feeding to toddlers at the Sidomulyo Health Center, Samarinda City can be seen in tables 3 and 4 below:

Table 3. Analysis of Independent Variables of Infection History in Toddlers

Category	Frequency	(%)
There is	65	38.7
There isn't any	103	61.3

Table 3 above shows that of the 168 respondents, the majority were toddlers with no history of infection, amounting to 103 toddlers (61.3%) respondents, and toddlers with a history of infection, amounting to 65 toddlers (38.7%) respondents. In table 3, the results of the univariate analysis on the social support variable (Parents and Peers) show that most respondents received social support, 55 respondents with a percentage of (50.9%), and 53 respondents received less support, with a percentage of (49.1%).

Table 4. Analysis of Independent Variables of Providing Complementary Food to Toddlers

Category	Frequency	(%)
<6 Months	49	29.2
>6 Months	119	70.8

Table 4 above shows that out of 168 respondents, 49 (29.2%) of the respondents were given complementary feeding for toddlers aged <6 months, and 119 (70.8%) of the respondents were given complementary feeding for toddlers aged >6 months. In table 4, univariate analysis of the anxiety variable showed that 24 respondents had No Anxiety with a percentage of (22.2%), Mild Anxiety 30 respondents with a percentage of (27.8%), the most were Moderate Anxiety 48 respondents with a percentage of (44.4%), Severe Anxiety 6 respondents with a percentage of (5.6%). The frequency distribution of wasting incidents in toddlers at the Sidomulyo Health Center, Samarinda City can be seen in table 5 below:

Table 5. Analysis of Dependent Variables of Wasting Incidents in Toddlers

Category	Frequency	(%)
Waste	43	25.6
No Wasting	125	74.4

Table 5 above shows that out of 168 respondents, 43 toddlers (25.6%) had wasting, and 125 toddlers (74.4%) of respondents had non-wasting.

Table 6. Bivariate Analysis of the Relationship between Infection History and Provision of Complementary Foods with the Incidence of Wasting in Toddlers

Variables	Wasting Incident				*pValue*	OR
	Waste		No Wasting			
	n	%	n	%		
There is a History of Infection	35	53.8	30	46.2	0.000	13.85
No History of Infection	8	7.8	95	92.2		
MPASI <6 bulan	31	52.5	28	47.5	0.000	8.94
MPASI >6 bulan	12	11.0	97	89.0		

The analysis in Table 6 shows that among the 168 toddlers studied, 35 children (53.8%) with a history of infection were identified as experiencing wasting, while 30 children (46.2%) with a history of infection were not wasted. In contrast, among toddlers without a history of infection, only 8 children (7.8%) were classified as wasted, while 95 children (92.2%) were not wasted. Regarding complementary feeding practices, 31 toddlers (52.5%) who were introduced to MPASI before the age of six months experienced wasting, compared to 28 toddlers (47.5%) who did not. Among those who received MPASI at or after six months, only 12 children (11.0%) were wasted, while 97 children (89.0%) were not.

The Chi-Square test results revealed a statistically significant association between both infection history and early MPASI with the incidence of wasting. The p-value for infection history was 0.000, and for MPASI timing also 0.000 (both $p < 0.05$). Therefore, the null hypothesis (H_o) is rejected and the alternative hypothesis (H_a) is accepted, indicating that both a history of infection and the early provision of MPASI are significantly associated with wasting among toddlers in the Sidomulyo Health Center area, Samarinda City.

Discussion

Children aged 2–5 years are in a transitional phase from exclusive breastfeeding to solid food. During this period, insufficient nutritional intake may increase the risk of wasting and susceptibility to infection (Trihayuningtyas et al., 2021). This study found that toddlers with a history of infection were predominantly aged 2–3 years (22 respondents), supporting findings from Ghe et al. (2023) that children in this age group are highly vulnerable to infections such as diarrhea and pneumonia. The underdeveloped immune system at this stage makes them especially susceptible to infectious diseases (Trihayuningtyas et al., 2021).

This study also revealed that most toddlers who received complementary feeding (MPASI) before the age of 6 months were aged 2–3 years (20 respondents), consistent with

findings by Imansari et al. (2024). Early introduction to MPASI is often linked to maternal lack of knowledge regarding appropriate feeding practices (Imansari et al., 2024).

Gender was also associated with nutritional outcomes. Masruroh et al. (2023) found that boys are more susceptible to wasting due to higher energy and nutritional needs. This study supports that conclusion, as 23 out of the 43 wasted children were boys. Additionally, Wulandari (2023) and Wangsa (2024) noted that boys tend to have a higher infection rate due to behavioral and biological factors. In the present study, 19 male toddlers had a history of infection. Moreover, Sumiayin (2022) found that boys are more likely to be given MPASI before six months, which this study also confirms (18 male toddlers received early MPASI). This behavior may stem from parental perceptions that boys require more nutrition than girls, leading to premature feeding (Sumiayin, 2022).

From the maternal side, this study found that the majority of wasted children had mothers aged 21–35 years (34 respondents), aligning with Ghe et al. (2022). The assumption is that younger mothers may lack sufficient knowledge of appropriate feeding techniques (Maria, 2024). In terms of education, 34 mothers with wasted children had education levels ranging from elementary to high school, supporting the findings of Masruroh et al. (2023) and Cholifatun (2023) that education level influences parenting knowledge and health-related decision-making. Similarly, most mothers of wasted children were housewives (34 respondents), which may impact the time and attention they can dedicate to child health (Cholifatun, 2023).

In terms of health status, while the majority of toddlers in this study did not have a history of infection (61.3%), 38.7% did. According to Samiati et al. (2023), diarrhea is a common infection that contributes to wasting. This study found that many wasted toddlers had a history of diarrhea, which aligns with the findings of Alebel et al. (2018) but differs from Krishna (2021), who found no significant relationship between diarrhea and wasting. Krishna instead identified pulmonary tuberculosis as a stronger determinant. Both conditions can impair nutrient absorption and weaken the child's immune system, increasing the risk of wasting.

This study found that 29.2% of toddlers received MPASI before the age of six months. Triveni & Hasnita (2021) confirmed that early MPASI increases the risk of wasting, a finding consistent with this study's results. In contrast, Imansari et al. (2024) reported no significant relationship between early MPASI and wasting. Nonetheless, WHO (2020) highlights that inappropriate timing of MPASI may cause digestive issues, ultimately leading to nutritional deficiencies and wasting.

This study recorded a wasting prevalence of 25.6%. This is consistent with Triveni (2022), who emphasized that improper timing of MPASI and infection history, particularly diarrhea, are significant contributors to wasting. Wasting can impair immune function, physical growth, and brain development, and in severe cases, may lead to death.

The current study found a significant relationship between infection history and wasting, with a p-value of 0.000 and an odds ratio (OR) of 13.85 (95% CI: 5.799–33.098), suggesting that toddlers with a history of infection are approximately 14 times more likely to experience wasting. This aligns with findings by Sitoayu et al. (2021) ($p = 0.001$; OR = 21.2), but contrasts with Ningsih (2020), who reported no such relationship ($p = 0.913$). In this study, toddlers with a history of infection accounted for 53.8% of wasting cases, while only 7.8% of children without infection were wasted. Infections contribute to energy and nutrient loss and suppress

appetite, which together deteriorate nutritional status (Rahma et al., 2024). Similarly, Aritomang et al. (2021) reported that 79.1% of wasted children had a history of infection.

It is important to note, however, that not all toddlers with infections became wasted. Some maintained normal nutritional status, possibly due to mild infections, strong immunity, or good post-illness recovery practices. Conversely, a small percentage of toddlers (7.8%) with no infection history still experienced wasting, possibly due to inadequate food intake, low socioeconomic status, or undiagnosed chronic conditions such as metabolic disorders or food allergies (WHO, 2022).

This study also confirmed a significant relationship between complementary feeding practices and wasting, with a p-value of 0.000 and an OR of 8.94 (95% CI: 4.07–19.67), indicating that toddlers who received MPASI before six months were nine times more likely to be wasted. This is consistent with Triveni & Hasnita (2021) (p = 0.000; OR = 4.452), but contrasts with Simamora et al. (2024) (p = 0.555), who found no significant relationship. This study showed that 52.5% of toddlers who received MPASI <6 months experienced wasting, compared to 11.0% among those fed after 6 months.

Interestingly, 47.5% of toddlers given MPASI <6 months did not become wasted, likely due to the nutritional adequacy of the foods provided. This suggests that while timing is important, the quality and balance of nutrients in MPASI are also critical. Since breast milk alone becomes insufficient after six months, complementary foods must contain complete macronutrients (carbohydrates, proteins, fats) and micronutrients (vitamins, minerals) to support optimal growth and prevent wasting.

Conclusion

This study confirms a significant relationship between infection history and complementary feeding practices with the incidence of wasting among toddlers in the Sidomulyo Health Center working area. Toddlers with a history of infectious diseases and those who received complementary feeding before the recommended age were found to be at greater risk of experiencing wasting. These findings underscore the importance of timely and appropriate complementary feeding, along with effective infection prevention strategies, to reduce the risk of acute malnutrition. Public health interventions should prioritize education for mothers and caregivers, strengthen Posyandu capacity, and promote clean and healthy living behaviors. Future research is encouraged to apply multivariate analysis to better understand the influence of various confounding factors and to explore additional determinants of wasting, including feeding quality, maternal health, and environmental conditions.

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Authors' contribution

Each author contributed equally in all the parts of the research. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

Conflict of interest

The researchers stated that there is no conflict of interest related to the implementation and publication of the results of this research. The entire research process, from planning, data collection, analysis, to report preparation, was carried out independently without any influence or pressure from any third party. A commitment to research ethics is upheld throughout the research process, ensuring transparency, accuracy and honesty in reporting results. Respondents' participation was voluntary with informed consent, and their confidentiality and privacy were maintained in accordance with applicable research ethics standards. With this statement, researchers hope that the research results can be trusted and used as a valid reference for the development of science and health practices related to ethnomedicine and reproductive health.

Ethical consideration

Not applicable.

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