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Provision of Complementary Feeding, History of Infectious Diseases with the Incident of Weight Faltering in Toddlers (9-23 Months) at the Parigi Health Center

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Abstract
Background: Weight faltering, characterized by inadequate weight gain, is a critical indicator of malnutrition closely associated with wasting and stunting. This condition poses significant challenges to child health and development, with high prevalence rates observed globally and specifically in West Java, Indonesia. This study aimed to investigate the relationship between complementary feeding (CF) practices and the history of infectious diseases with the incidence of weight faltering in toddlers. **Methods:** This study employed a case-control design. A total of 96 samples were included, consisting of 48 cases and 48 controls, selected using a purposive sampling technique. Data collection was conducted through interviews using a questionnaire that covered complementary feeding practices and the history of infectious diseases. **Results:** The findings revealed that 29 toddlers (60.4%) with weight faltering received inadequate complementary feeding, and 30 toddlers (62.5%) with weight faltering had a history of infectious diseases. Chi-Square statistical tests showed a significant relationship between complementary feeding practices and the incidence of weight faltering (p-value = 0.025; OR = 2.7), and a significant relationship between a history of infectious diseases and the incidence of weight faltering (p-value = 0.004; OR = 3.6). **Conclusion:** Inadequate complementary feeding practices and a history of infectious diseases are significantly associated with the incidence of weight faltering in toddlers aged 9-23 months. These findings underscore the urgency of integrated nutritional and child health interventions in early life, particularly in areas like Puskesmas Parigi, to prevent weight faltering and support optimal growth.

Introduction

Nutritional status during the first thousand days of life (the 1000 HPK), which includes 270 days of pregnancy and 730 days during the first two years of a child's life, is a critical period (1). This period is extremely important for a child's growth and development,

especially brain development, because the consequences are permanent and irreversible, affecting cognitive, physical, and future productivity functions (2,3). *Failure to thrive* (FTT) or *weight faltering* is commonly used to describe inadequate weight gain in pediatric patients (4). *Weight faltering*, which refers to low weight for a given length or height, is closely associated with the conditions *wasting* and *stunting*. Both *wasting* (acute weight loss) and *stunting* (chronic growth retardation) are critical indicators of malnutrition, and both share the same underlying causes, such as poor diet and recurrent infections (5,6). Understanding the relationship between *weight faltering*, *wasting*, and *stunting* is crucial because *wasting* can contribute to *stunting*, and in some cases, *stunting* can also cause *wasting*. The connection between the two is very strong, as episodes of wasting can contribute to subsequent stunting. This is due to the depletion of nutrient reserves during the wasting period; if unresolved, it will disrupt long-term growth (7). Therefore, an integrated approach that includes improving maternal nutrition, enhancing food security, and better sanitation is essential to controlling the cycle of malnutrition (8,7).

The timing, type, and quality of complementary feeding are crucial in developing a diverse gut microbiome, which is essential in regulating immune, metabolic, and neurological functions. However, inadequate complementary feeding significantly contributes to malnutrition, which is a leading cause of child mortality (9). Inappropriate complementary feeding have been linked to significant changes in the infant gut microbiome, which in turn can affect immune function and development. Moreover, improper CF also influences taste preferences and dietary habits that can impact long-term health, being associated with the risk of conditions such as obesity and chronic diseases. Insufficient nutrient intake can disrupt nutritional status and increase the risk of infectious diseases (10). Malnourished children are more susceptible to infections due to their compromised immune systems. Infections in toddlers can inhibit nutrient absorption and growth by reducing appetite, thereby resulting in malnutrition or undernutrition. Children aged 0-24 months have greater nutritional needs and are more vulnerable to infectious diseases compared to other age groups (11). Studies show that children with a history of infectious diseases are 12 times more likely to experience *Stunting* (12).

Based on data from e-PPGBM (Community-Based Nutrition Recording and Reporting) in West Java in 2023, a number of toddlers did not experience weight gain, or experienced *weight faltering*. This figure highlights significant challenges in efforts to improve nutrition in the region. In Pangandaran District, the proportion of toddlers who failed to gain weight in 2023 was the second highest in West Java, with the number continuing to rise up to the third quarter of 2024. The high prevalence of *weight faltering* indicates a serious nutritional problem that requires immediate intervention at the community level. Specifically, Puskesmas Parigi, one of the community health centers in Pangandaran District, reported a very high prevalence of *weight faltering*, especially among children aged 6-23 months. These

figures highlight the urgency to understand the underlying factors behind *weight faltering* in this area.

Based on the background described above, the author is interested in conducting research on the relationship between complementary feeding practices (CF) and history of infectious diseases with the incidence of *weight faltering* among toddlers aged 9-23 months. This study is expected to reveal the specific contribution of inappropriate CF practices and infection history to *weight faltering* at Puskesmas Parigi, which has not been fully clarified by previous studies. The results of this study may provide important information for formulating more effective health programs or interventions at Puskesmas Parigi and at a broader level to address the issue of *weight faltering* in toddlers.

Materials and Methods

This study used an observational design with a *case-control* approach, chosen for its effectiveness in investigating risk factors for conditions with varying prevalence such as *weight faltering* and its ability to simultaneously explore multiple risk factors (CF practices and history of infectious diseases). The research was conducted at Parigi Community Health Center, Pangandaran Regency, in February - March 2025, after obtaining ethical approval from the Ethics Committee of Immanuel Institute of Health Sciences Bandung (No.020/KEPK/IKI/II/2025 – the ethical approval date needs to be corrected for consistency with the research timeline). The study population included all children aged 9–23 months within the Parigi Community Health Center's service area. The sample consisted of 96 children, comprising 48 *weight faltering* cases and 48 controls (1:1 ratio), determined through *case-control* sample size calculations based on specific statistical assumptions, and selected using a *purposive sampling* technique based on strict inclusion and exclusion criteria (e.g., no chronic medical conditions) to minimize selection bias.

Weight faltering was operationally defined by a decline in growth curve, no weight gain, or a decrease in weight-for-age Z-score based on the Child Health Handbook/Community Health Center records. Data on the characteristics of samples and respondents were collected. CF practices were assessed through *food and beverage recall* interviews for the previous 24 hours using an CF questionnaire (although not formally validated, the questions were compiled based on WHO indicators), conducted by trained enumerators to minimize *recall bias*, and classified as "good CF" or "poor CF" based on fulfillment of key WHO indicators. History of infectious diseases in the past month was also collected via interview questionnaire. The collected data will be analyzed using SPSS version 23 with a significance level of α=0.05.

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Results

Table 1 presents the distribution of demographic and socioeconomic characteristics of toddlers and mothers, based on their weight status.

Table 1. Distribution of Respondent Characteristics by Weight Faltering Status in Toddlers Aged 9-23 Months at Puskesmas Parigi, 2024

Characteristics	Weight Faltering			
	Case		Control	
	n	%	n	%
Child's Age				
9-11 Months	9	18.75	9	18.75
12-23 Months	39	81.25	39	81.25
Mother's Age				
19-29 Years	21	43.75	22	45.84
30-49 Years	27	56.25	26	54.16
Education				
Elementary school	11	22.91	5	10.42
Junior high school	15	31.25	17	35.41
High school	17	35.42	21	43.75
Bachelor	5	10.42	5	10.42
Job				
housewife	37	77.1	41	85.4
trader	7	14.6	4	8.4
civil servant	4	8.3	3	6.2
Total	**48**	**100**	**48**	**100**

The distribution of child's age and mother's age showed high similarity between the case and control groups, with the majority of toddlers (81.25% in both groups) falling within the 12-23 months age bracket and most mothers (56.25% of cases and 54.16% of controls) being 30-49 years old. This similarity in age characteristics indicates no obvious age-related bias that might influence the results, suggesting that both groups are comparable in these basic demographic aspects, which is important for interpreting causal relationships later on.

More notable differences were observed in the mothers' education levels. The proportion of mothers with elementary school education was higher in the case group (22.91%) compared to the control group (10.42%). Conversely, mothers in the control group had a slightly higher proportion of high school education (43.75%) compared to mothers in the case group (35.42%). The proportion of mothers with junior high school education was

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also higher in the control group (35.41%) compared to the case group (31.25%), while the proportion of mothers with Bachelor's degrees was identical in both groups (10.42%).

Regarding mothers' occupation, the most common occupation in both groups was housewife (77.1% among cases' mothers and 85.4% among controls' mothers). A smaller proportion of mothers were traders (14.6% in cases, 8.4% in controls) or civil servants (8.3% in cases, 6.2% in controls).

Table 2. Relationship between Complementary Feeding (CF) and the Incidence of Weight Faltering in Toddlers Aged 9-23 Months

Complementary Feeding Practices	Weight Faltering				p-Value	OR
	Case		Control			
	n	%	n	%		
Poor	29	60.4	17	35.4	0.025	2.7
Good	19	39.6	31	64.6		
Total	**48**	**100**	**48**	**100**		

Table 2 presents the distribution of toddlers based on complementary feeding practices and weight faltering status, along with the results of the bivariate analysis. It was observed that the proportion of toddlers with weight faltering (case group) who had poor complementary feeding practices was higher (60.4%) compared to toddlers without weight faltering (control group) (35.4%). Statistical analysis revealed a statistically significant association between complementary feeding practices and the incidence of weight faltering (p=0.025). Furthermore, the Odds Ratio (OR) of 2.7 indicates that toddlers receiving poor complementary feeding practices were 2.7 times more likely to experience weight faltering compared to those receiving good complementary feeding practices. This finding supports the hypothesis that inadequate complementary feeding practices are a significant risk factor for weight faltering.

Table 3. Relationship between History of Infectious Diseases and the Incidence of Weight Faltering in Toddlers Aged 9-23 Months

Infectious Diseases	Weight Faltering				p-Value	OR
	Case		Control			
	n	%	n	%		
Infection	30	62,5	15	31,2	0,004	3,6
Not infected	18	37,5	33	68,8		
Total	**48**	**100**	**48**	**100**		

Table 3 illustrates the distribution of toddlers based on their history of infectious diseases and weight faltering status, along with the results of the bivariate analysis. It was

found that a considerably higher proportion of toddlers with weight faltering (cases) had a history of infection (62.5%) compared to toddlers without weight faltering (controls) (31.2%). Conversely, a larger percentage of controls (68.8%) had no history of infection, compared to cases (37.5%). Statistical analysis revealed a statistically significant association between a history of infectious diseases and the incidence of weight faltering (p=0.004). The calculated Odds Ratio (OR) of 3.6 indicates that toddlers with a history of infectious diseases were 3.6 times more likely to experience weight faltering compared to those without such a history. This finding highlights the important role of a history of infectious diseases as a risk factor for weight faltering.

DISCUSSION

This study shows that poor complementary feeding practices (CF) are significantly associated with the incidence of *weight faltering* in toddlers aged 9-23 months at Parigi Health Center. It was found that 60.4% of toddlers in the case group (experiencing *weight faltering*) had poor CF practices, compared to 35.4% in the control group. Chi-Square analysis yielded a p-value of 0.025, which is statistically significant, indicating a relationship between CF practices and *weight faltering*. The *Odds Ratio* (OR) of 2.7 indicates that toddlers receiving inadequate CF have a 2.7 times higher risk of experiencing *weight faltering* compared to those receiving adequate CF. These findings are consistent with research by Wandini, et al (2021), which also found a relationship between CF provision and nutritional status in infants aged 6-18 months, where respondents with inadequate CF were 4.760 times more likely to experience malnutrition.

Lack of diet diversity in CF intake can increase the risk of nutrient deficiency, which can ultimately lead to growth disturbances in children, such as weight loss. Nutrient deficiency occurs when food intake is less than the child's needs. At the Parigi Health Center, poor CF practices may be influenced by various socio-economic and cultural factors, such as lower maternal education levels, which were found to be higher in the case group, limited access to affordable diverse foods, or lack of parental understanding of the importance of quality CF. This condition may be exacerbated by a lack of comprehensive education from health workers regarding proper CF guidelines. The age period 0-24 months is crucial for a child's cognitive and physical growth and development, thus requiring adequate CF intake (14). If CF is not given appropriately at this age, there can be a significant decline in nutritional status after 6 months of age. The WHO Global Strategy for Infant and Young Child Feeding (IYCF) recommends that children aged 6-23 months receive diverse food intake to meet optimal nutritional requirements, as consumption of various food groups also contributes to increased linear growth.

Interestingly, this study found 17 toddlers (35.4%) who did not experience *weight faltering* despite receiving inadequate CF. This unexpected finding may be influenced by other factors such as high-calorie but low-nutrient snack consumption by toddlers or other individual variations. Although such snacks can meet toddlers' daily calorie needs for short-term energy and prevent accidental weight loss, this type of weight gain does not reflect healthy growth and can pose various long-term health (15). Consistent high-calorie intake from poor nutritional sources can lead to obesity, which is a significant risk factor for chronic diseases such as type 2 diabetes and cardiovascular issues (16). Furthermore, excess calorie intake can paradoxically occur alongside micronutrient deficiencies due to diets lacking essential vitamins and minerals, potentially causing issues such as immune dysfunction or anemia (17).

This study also reveals a statistically significant relationship between the history of infectious diseases and the incidence of *weight faltering* in toddlers. A total of 62.5% of toddlers in the case group had a history of infectious diseases, much higher compared to 31.3% in the control group. Chi-Square analysis showed a p-value of 0.004, and an *Odds Ratio* (OR) of 3.6, meaning toddlers with a history of infectious diseases have a 3.6 times greater risk of experiencing *weight faltering*. This finding aligns with research by Dewi and Widari (2018), indicating that infectious diseases increase the risk of stunting by 3,071 times in children under two years old. Infectious diseases affect weight decline by influencing nutritional status and increasing metabolic demands due to illness. In low- and middle-income countries, the burden of infectious diseases often exacerbates the prevalence of malnutrition, which in turn contributes to growth faltering (16). The high prevalence of infections in the study area may reflect issues of inadequate sanitation, limited access to safe clean water, or poor hygiene practices at the household level. The public health implications of these findings are the need for interventions targeting improvements in environmental sanitation and hygiene education to reduce the burden of infectious diseases in toddlers. Nevertheless, there are 15 toddlers (31.2%) who did not experience *weight faltering* despite having a history of infectious diseases. This may be influenced by the frequency and duration of infectious diseases. If infections occur sporadically and are well-managed, children can recover quickly, and adequate food intake during recovery can prevent *weight faltering*. Toddlers with good nutritional status before illness will have sufficient nutritional reserves to fight infections, thereby preventing *weight faltering*.

This study has several limitations. The case-control design employed only shows association, not direct causality. The potential for recall bias or information bias exists because data on complementary feeding (CF) practices and history of infectious diseases were collected through recall-based interviews. There is also a potential for confounding factors that were not comprehensively measured or controlled, such as responsive feeding

practices and specific household environmental hygiene. These limitations need to be considered when interpreting the results and can serve as directions for future research.

Conclusion

This study found that inadequate Complementary Feeding (MP-ASI) practices and a history of infectious diseases are significantly associated with the incidence of weight faltering in toddlers aged 9-23 months, increasing the risk by 2.7 and 3.6 times, respectively. This finding re-emphasizes the urgency of nutritional and child health interventions in early life, particularly within the context of Puskesmas Parigi, which shows a high prevalence of weight faltering.

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