



Determinants of wasting among children aged 2–5 years in Tanjung Priok, Jakarta, Indonesia

Determinan kejadian wasting pada anak usia 2–5 tahun di Tanjung Priok, Jakarta, Indonesia

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Abstract

Wasting contributes to approximately 13% of the global child mortality. In 2022, the prevalence of wasting in Indonesia was 7,7%, declining from 10% in 2013. However, regions such as DKI Jakarta, particularly North Jakarta, still exhibit a high prevalence rate of 9,4%, indicating ongoing challenges in accessing adequate nutrition and healthcare services. This study aimed to examine the determinants of wasting in children aged 2–5 years. This cross-sectional study was conducted in Tanjung Priok, Jakarta, from June to July 2023. A total of 183 children, aged 2–5 years, were selected using purposive sampling. Data were collected through anthropometric measurements and structured interviews, using validated questionnaires covering dietary intake (SQ-FFQ), household socioeconomic status, and maternal nutrition knowledge. Data analysis included chi-squared tests and logistic regression analyses. The results showed that The prevalence of wasting was 8,7%. Although maternal nutrition knowledge was generally high, it was not significantly associated with wasting ($p = 0,171$). Energy ($p = 0,023$) and fat intake ($p = 0,022$) were significantly associated with wasting. Inadequate energy intake emerged as the dominant factor associated with a 3,7-fold increase in risk ($p = 0,032$). In conclusion, the primary determinant of wasting among children aged 2–5 years in Tanjung Priok is inadequate energy intake. Although most mothers had high nutrition knowledge, it did not significantly influence their wasting status. Therefore, interventions to prevent wasting should focus on improving energy and fat intake in children.

Keywords: Child, energy intake, malnutrition, socioeconomic factors, wasting syndrome

Abstrak

Wasting berkontribusi terhadap 13% kematian anak secara global. Prevalensi wasting di Indonesia tahun 2022 mencapai 7,7%, turun 10% dari tahun 2013. Namun, wilayah seperti DKI Jakarta, khususnya Jakarta Utara, memiliki angka prevalensi tinggi sebesar 9,4%. Hal ini menunjukkan adanya tantangan dalam akses terhadap nutrisi dan layanan kesehatan. Penelitian bertujuan untuk menguji determinan wasting pada anak usia 2–5 tahun. Penelitian berdesain crosssectional dilakukan di Tanjung Priok, Jakarta pada Juni-Juli 2023. Sampel sebanyak 183 anak usia 2–5 tahun dipilih purposive sampling. Pengumpulan data melalui pengukuran antropometri, wawancara terstruktur, menggunakan kuesioner tervalidasi yang mencakup asupan makanan (SQ-FFQ), status sosial ekonomi rumah tangga, dan pengetahuan gizi ibu. Analisis data menggunakan uji chi-kuadrat, dan regresi logistik. Hasil, prevalensi wasting adalah 8,7%. Pengetahuan gizi ibu secara umum tinggi namun tidak berhubungan signifikan dengan wasting ($p=0,171$). Energi ($p=0,023$) dan asupan lemak ($p=0,022$) memiliki hubungan dengan wasting. Asupan energi ($p=0,032$) yang tidak memadai merupakan faktor dominan dengan risiko sebesar 3,7 kali lipat. Kesimpulan, faktor utama kejadian

wasting pada anak usia 2–5 tahun di Tanjung Priok adalah asupan energi yang tidak memadai. Meskipun sebagian besar ibu memiliki pengetahuan gizi yang tinggi, namun tidak berpengaruh terhadap wasting. Intervensi untuk mencegah wasting sebaiknya difokuskan pada perbaikan asupan energi dan lemak anak.

Kata Kunci: Asupan energi, malnutrisi, faktor sosial ekonomi, sindrom wasting

Introduction

Wasting, or acute malnutrition, is a critical form of undernutrition that poses a serious threat to the survival of children under five years of age. It is defined as a low weight-for-height or weight-for-length ratio (below -2 standard deviations from the WHO Child Growth Standards median) and typically results from a recent and severe process of weight loss often associated with acute food shortage or disease. Wasting is particularly dangerous due to its rapid onset, strong association with an increased risk of death, and potential for recovery with timely and appropriate intervention (WHO, 2023). Globally, wasting contributes directly to approximately 13% of all deaths among children under five years of age, with over 45 million children affected each year (UNICEF, 2022).

In Indonesia, wasting remains a significant nutritional problem despite various interventional efforts (UNICEF, 2023). Based on the 2022 Indonesian Nutrition Status Survey (INSS), the national prevalence of wasting was 7,7%, which decreased from 10% in 2013. However, several regions, including DKI Jakarta, still have a higher prevalence (8,0 %) than the national average. The city of North Jakarta had the highest figure (9,4%), which reflects the major challenges in access to nutritious food, health education, and adequate health services. (INSS, 2022)

Wasting is caused by various interrelated factors, including inadequate nutritional intake, repeated infections, low socioeconomic conditions, and unsupportive environments such as poor sanitation and limited health services (Hannah Ritchie, 2022; UNICEF, 2021). Research has shown that low intake of energy, protein, fat, and carbohydrates contributes significantly to wasting (Aritonang et al., 2022; Santinus Janis Daramu et al., 2020). In addition, family factors, such as the mother's low level of education and low family income, also influence children's food intake patterns and increase the risk of wasting (Miko & Rahmad, 2017; Roobiati & Poncorini, 2019).

The impact of wasting is not only limited to children's physical health, but also affects their cognitive and motor development. Children who experience wasting are more susceptible to a decrease in the number of neurons, synapses, and brain size, which can inhibit memory function and learning abilities. This risk is greater if wasting occurs simultaneously with stunting, which worsens the long-term effects on children's growth and development (Bundy et al., 2017; Al Rahmad et al., 2020).

In Indonesia, various national interventions have been implemented to reduce waste rates, including increasing the intake of nutritious food, providing nutritional supplements, and controlling infectious diseases. However, in urban areas such as North Jakarta, these initiatives often face significant barriers, such as limited service coverage, inadequate targeting of high-risk groups, and weak community engagement, which ultimately reduces the overall effectiveness of the programs (UNICEF, 2022; GAIN, 2023). Therefore, a more targeted strategy is required to enhance access to nutritious food and nutrition education and to strengthen sustainable health services (Abuka et al., 2017; Purwadi et al., 2023).

Therefore, this study aimed to identify the key determinants of wasting among children aged 2–5 years in northern Jakarta. By identifying these determinants, this study seeks to fill the existing gaps in knowledge regarding the specific factors driving wasting in this urban context. It is hoped that this research will provide input for evidence-based policies and interventions to effectively reduce waste rates.

Methods

This study employed a quantitative cross-sectional design to assess the prevalence of wasting and its determinants at specific points in time. This study design has a limitation in that it

can only show associations between variables, not cause-and-effect relationships. The research was conducted from June to July 2023 in three sub-districts in Tanjung Priok District, North Jakarta, namely, Kebon Bawang, Sunter Jaya, and Warakas. This location was chosen because it is the focal locus of malnutrition in northern Jakarta.

The research population consisted of children aged 2–5 years who lived in Tanjung Priok District. A total of 183 children were selected using a purposive sampling method based on recommendations from a local health center. This sampling method was chosen because of logistical and ethical considerations such as ensuring the safety and accessibility of young children during data collection. However, purposive sampling may limit the generalizability of the results. The involvement of local health centers in participant selection may also introduce selection bias, which is acknowledged as a study limitation.

The minimum sample size was calculated using the formula for comparing two proportions (Nattino et al., 2020), with a 95% confidence level ($\alpha=0,05$) and 80% power ($\beta=0,20$), resulting in a minimum sample size of 83. To account for potential dropout, the sample size was doubled to 166, and an additional 10% was added to prevent data loss, yielding a final sample size of 183.

The inclusion criteria were children aged 2–5 years who lived in the research area, whereas the exclusion criteria were children with physical disorders, certain dietary restrictions, or those who were sick at the time of the interview. The selection of areas and respondents was based on the high prevalence of malnutrition in the three sub-districts.

Data were collected directly through anthropometric measurements and structured interviews, using a validated questionnaire. Primary data included body weight, height, family characteristics (income, maternal education, maternal occupation, and nutritional knowledge), dietary intake assessed via a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), and history of infectious diseases.

Anthropometric measurements were performed according to the WHO Child Growth Standards for children under five years of age. Body weight was measured using routinely calibrated digital scales and height was measured using portable stadiometers. All measuring instruments were calibrated according to standard procedures before data collection to ensure measurement accuracy. Each measurement was performed twice, and the average of the two readings was used for analysis (WHO, 2009).

Dietary intake was assessed using a Semi-quantitative Food Frequency Questionnaire (SQ-FFQ) that had been previously validated by comparing its results with three 24-hour dietary recalls to ensure accuracy in estimating habitual food intake (Hartriyanti, 2023). Interviews were conducted directly with the child's mother or primary caregiver to ensure the reliability of the collected data.

The data collection process began with listing eligible children based on the Puskesmas data. Subsequently, written informed consent was obtained from the parents or caregivers as proof of their participation agreement. Anthropometric measurements were conducted door-to-door with assistance from local health cadres, while the interviews were conducted by researchers and trained assistants. Training included anthropometric measurement, interview techniques, and research ethics. Regular supervision was conducted throughout the data collection period to ensure data quality and consistency.

Data obtained through the questionnaires and measurements were processed using SPSS to ensure completeness and consistency. The dependent variable, wasting, was categorized based on the z-score ($< -2SD$ for wasting and $\geq -2SD$ for normal) (WHO 2023). The independent variables included energy and protein intake (adequate if $\geq 100\%$ RDA), carbohydrate and fat intake (adequate if $\geq 90\%$ RDA) (Permenkes, 2019), and history of infectious diseases (ARI/diarrhea). was categorized as either present or absent (Riskseddas, 2018). The family characteristics were differentiated according to income ($<Rp. 4,900,000$ for low and $\geq Rp. 4,900,000$, sufficient) (Kepgub 2022). Maternal education (low if $\leq$ junior high school, high if $>$ high school) (Riskseddas, 2018)), maternal employment status (working or not working) (Aritonang et al., 2022), and maternal nutritional knowledge based on average scores (low if score $< 69,8$, high if score $\geq 69,8$) measured with 30 questions with scores calculated based on correct answers, then divided by 100.

The analysis was carried out in stages, starting with univariate analysis to describe the frequency distribution of the data, followed by bivariate analysis using the chi-squared test to identify relationships between variables. Subsequently, bivariate analysis using the chi-square test was used to identify associations between the independent variables and outcomes. Variables with a p-value less than 0,25 in the bivariate analysis were included in the

multivariate logistic regression model to avoid excluding potentially important predictors.

Multivariate analysis with logistic regression was used to evaluate the independent variables that were most strongly associated with wasting. Multicollinearity among the independent variables was evaluated using appropriate diagnostics to ensure reliability of the regression coefficients. Model fit was examined using the Hosmer-Lemeshow goodness-of-fit test, which assesses the agreement between observed and predicted outcomes (Nattino et al., 2020). A relationship was considered statistically significant if the p-value was less than 0,05. Additionally, 95% confidence intervals (CIs) were reported for the odds ratios to provide a measure of the precision and reliability of the estimates.

This study received ethical approval from the Faculty of Public Health, University of Indonesia (reference number 513/UN2).F10.011/PPM.00.02/2023. The data collection process was carried out by respecting ethical research principles, including providing informed consent to maintain data confidentiality and voluntary consent from respondents. They

were informed that their participation in this study was voluntary and that they had the right to withdraw at any time without any negative consequences.

Additionally, this study complied with Law No. 27 of 2022 on the Protection of Personal Data (PDP Law), which mandates data controllers and processors to maintain the confidentiality and security of participants' personal data. The personal data collected are securely stored and used solely for research purposes for which it was approved (Biro Hukum Kominfo,2022).

Result and Discussion

This study included 183 children aged 2–5 years old. Participant characteristics included the incidence of wasting, age, sex, energy intake, protein intake, fat intake, carbohydrate intake, infectious diseases, family income, maternal education level, maternal employment status, and maternal nutritional knowledge. The results of the univariate analysis are presented in Table 1.

Table 1. Description of univariate analysis of research variables

Variable	Category	n	%
Wasting Incident	Wasting	16	8,7
	No wasting	168	91,3
Child Age	24 – 36 months	66	35,9
	37 – 59 months	118	64,1
Child's Gender	Boy	84	45,7
	Girl	101	54,3
Children's Energy Intake	Inadequate	88	47,8
	Adequate	96	52,2
Children's Protein Intake	Inadequate	3	1,6
	Adequate	181	98,4
Children's Fat Intake	Inadequate	57	31
	Adequate	127	69
Children's Carbohydrate Intake	Inadequate	116	63
	Adequate	68	37
Pediatric Infectious Diseases	Yes	78	42,4
	No	106	57,6
Family Income	Low	123	65,4
	High	65	34,6
Mother's Education Level	Low	71	38,6
	High	113	61,4
Mother's Employment Status	≤ Middle School/equivalent	45	24,5
	≥ High school/equivalent	139	75,5
Maternal Nutrition Knowledge	Low	74	40,2
	High	110	59,8

Sixteen (8,7%) children experienced wasting. The majority of children were aged 37–59 months

(64,1%) and female (54,3%). Most children had adequate energy (52,2%) and protein (98,4%)

intake; however, 63% did not have sufficient carbohydrate intake. Infectious diseases were experienced by 42,4% of children, while 65,4% came from low-income families (<Rp. 4,900,000). The majority of mothers had a high level of education (61,4%), but most did not work (75,5%). Most mothers had a high nutritional knowledge (59,8%).

The results of bivariate analysis using the chi-square test showed a significant

relationship between energy intake ($p=0,023$), fat intake ($p=0,022$), and the incidence of wasting (Table 2). The odds ratios (ORs) presented in Table 2 are crude odds ratios, which were derived from bivariate analysis. These values did not account for potential confounders. To adjust for confounding factors, multivariate analysis was required to calculate the adjusted OR.

Table 2. Bivariate analysis of risk factors for wasting

Variable	Wasting		Normal		OR (95% CI)	P-value
	n	%	n	%		
Child Age						
24 – 36 months	6	9,1	60	90,9	0,926 (0,32-2,673)	0,887
37 – 59 months	10	8,5	108	91,5		
Child's Gender						
Boy	6	7,1	78	92,9	0,692 (0,241-1,991)	0,493
Girl	10	10	90	90		
Energy Intake						
Inadequate	12	13,6	76	86,4	3,63 (1,125-11,720)	0,023*
Adequate	4	4,2	92	95,8		
Protein Intake						
Inadequate	0	0	3	100	-	1,000
Adequate	16	8,8	165	91,2		
Fat Intake						
Inadequate	9	15,8	48	84,2	3,214 (1,133-9,120)	0,022*
Adequate	7	5,5	120	94,5		
Carbohydrate Intake						
Inadequate	11	9,5	105	90,5	1,32 (0,438-3,975)	0,621
Adequate	5	7,4	63	92,6		
Pediatric Infectious Diseases						
Yes	10	12,8	68	87,2	2,451 (0,851-7,060)	0,088
No	6	5,7	100	94,3		
Family Income						
Low (< Rp. 4,900,000)	13	10,7	108	89,3	2,407 (0,660-8,785)	0,178
High ($\geq$ Rp. 4,900,000)	3	4,8	60	95,2		
Mother's Education Level						
Low ($\leq$ Junior High School Graduate/equivalent)	4	5,6	67	94,4	0,502 (0,155-1,625)	0,243
High ($\geq$ High school graduate/equivalent)	12	10,6	101	89,4		
Mother's Employment Status						
Work	5	11,1	40	88,9	1,455 (0,477-4,436)	0,508
Not Working	11	7,9	128	92,1		
Maternal Nutrition Knowledge						
Low (Score < 69,8 (Mean))	9	12,2	65	87,8	2,037 (0,723-5,738)	0,171
High (Score $\geq$ 69,8 (Mean))	7	6,4	103	93,6		

*Significant at $p < 0,05$.

Table 3. Multivariate analysis of research variables

Variable	Coefficient (B)	P-value	OR	95% CI
Energy Intake	1,311	0,032*	3,711	1,121–12,282
Family Income	1,060	0,126	2,887	0,743–11,218
Level of education	1,167	0,064	3,213	0,934–11,046

Table 3 presents the results of the binary logistic regression analysis used to identify factors influencing nutritional status, categorized as wasting or normal. The criteria for including variables in the model included statistical significance ($p < 0,05$ in the bivariate analysis), completeness of data, and clinical relevance. This model enables the analysis of factors affecting nutritional status, while controlling for potential confounders.

Multivariate analysis showed that energy intake was the dominant risk factor for wasting, after controlling for other variables. Children with insufficient energy intake had a 3,7 times higher risk of wasting than children with sufficient energy intake ($p = 0,032$).

This study found that 8,7% of children in Tanjung Priok District, North Jakarta, experienced wasting. Although it is not the biggest problem among respondents, this prevalence still needs attention because wasting reflects a poor nutritional status, which increases the risk of disease and death in children. The World Health Organization (WHO) (WHO, 2023) emphasizes that wasting requires immediate treatment because it is associated with acute malnutrition and can have long-term health impacts if not treated. In the long term, children who experience wasting face cognitive impairment, decreased academic achievement, behavioral disorders, and an increased risk of death (Abidin et al., 2019).

Bivariate analysis using the chi-square test showed a significant relationship between energy intake ($p = 0,023$), fat intake ($p = 0,022$), and the incidence of wasting. Multivariate analysis showed that energy intake was the dominant risk factor for wasting, after controlling for other variables. Children with insufficient energy intake had a 3,7 times higher risk of wasting than children with sufficient energy intake ($p = 0,032$).

Low energy intake can disrupt optimal metabolic processes in the body. Similar studies have shown that a combination of adequate energy and protein intakes is important for reducing the risk of wasting. Fat provides high-density energy needed to support a child's metabolic activity and growth. A lack of fat intake can cause energy imbalance, which leads to wasting. Fat also plays a role in protecting organs, absorbing vitamins, and supporting the development of the nervous system and immune functions (Soedarsono & Sumarmi, 2021; Syarfaini et al., 2022).

As many as 63% of the children had inadequate carbohydrate intake, and statistical tests showed an insignificant relationship.

Carbohydrate deficiency reduces energy reserves in the body, causing weight loss and wasting. Other factors, such as infection and malnutrition, also influence the incidence of wasting, although adequate carbohydrate intake remains important in preventing wasting in children (Al Rahmad, 2023; Widyawardani et al., 2024).

Research by Azmia and Triyanti (2024) in Cimpaeun Village, Depok City, shows that as children age, their energy intake tends to decrease. Children aged 4–5 years consume only 78% of their daily nutritional needs, compared to children aged 1–3 years who consume 84% and children aged 6–11 months who consume 91% of their nutritional needs. As many as 30,1% of toddlers aged 6–59 months in Cimpaeun Village had insufficient energy intake ($< 80\%$ RDA), whereas 69,9% had sufficient energy intake ($\geq 80\%$ RDA). Statistical tests showed a significant relationship between energy intake and the incidence of wasting ($p = 0,021$), with an Odds Ratio (OR) of 4,4. This means that toddlers with insufficient energy intake have a 4,4 times higher risk of wasting than those with sufficient energy intake (Azmia and Triyanti, 2024).

The findings of the study in Tanjung Priok are consistent with those of a study conducted in Cimpaeun Village, Depok, which demonstrated a strong association between wasting and low energy intake. However, notable differences in the regional characteristics should be considered. Cimpaeun is a suburban area with relatively better access to local food sources, whereas Tanjung Priok is a densely populated urban area facing various urban challenges, such as limited open space, high poverty rates, and restricted access to nutritious food. These contextual differences may significantly influence the dietary patterns and nutritional status of children.

Multivariate analysis showed that energy intake was significantly related to the incidence of wasting after controlling for other variables ($p < 0,05$). The odds ratio value (OR = 3,711) shows that children whose energy intake is insufficient have a 3,7 times higher risk of experiencing wasting than children whose energy intake is sufficient. This finding is in line with the research by Soedarsono and Sumarmi (2021), which states that when food intake does not meet energy needs, the body uses fat in adipose tissue to produce energy. If this occurs repeatedly, the child's weight decreases.

In addition, Werdani and Utari (2020) showed that insufficient energy intake has a

significant relationship with the incidence of wasting in children aged 6–23 months, with an Odds Ratio (OR) of 5,785 (95% CI 1,269–26,382). This shows that children whose energy intake is insufficient have an almost six-fold greater risk of experiencing wasting than children whose energy intake is sufficient. This finding is in line with basic nutritional theory, which states that wasting occurs because of an imbalance between energy intake and the body's energy needs (Azrimaidaliza et al., 2020; Werdani & Utari, 2020).

Family income plays a role in children's nutritional status; however, this study showed that the relationship with wasting is not significant ($p > 0,05$), although children from low-income families are more at risk of experiencing wasting (OR = 2,887). Other factors such as diet and nutritional education also influence the incidence of wasting. (Santinus Janis Daramu et al., 2020; Sianturi et al., 2023).

Although this study found no statistically significant relationship between family income and wasting, previous studies have suggested that low family income can still contribute to poor nutritional status in children. For example, a study in the Mamajang Health Center in Makassar found a significant link between family income and malnutrition in children (Kartini, 2021). These findings highlight that, while this study did not show a significant relationship, the observed trend is consistent with the existing literature, warranting further research to explore this association more deeply.

The mother's educational level also contributes to the child's nutritional status. Mothers with low educational levels had a higher risk of having children who experienced wasting (OR = 3,213), although this relationship was not statistically significant ($p > 0,05$). A previous study found that the children of mothers who had no formal education had a 2,48 times higher risk of wasting than those of literate mothers (Habtamu et al., 2022). Therefore, nutritional education for mothers is an important step in preventing wasting in their children (Prasetyo et al., 2023).

The limitations of this study include its cross-sectional design, which did not allow us to determine cause-and-effect relationships. Additionally, the study was subject to biases due to purposive sampling and self-reported dietary intake, which may have affected the accuracy of the data. The representativeness of the sample is also limited by the urban setting of the study, which may not be generalizable to rural areas or

different socioeconomic contexts. Furthermore, other potentially influential factors such as parenting patterns and access to health services were not measured. Therefore, further research with a longitudinal design and a broader, more representative sample is needed to explore socioeconomic factors and their impact on improving children's nutritional status.

Conclusion

This study aimed to examine the determinants of wasting among children aged 2–5 years in Tanjung Priok. Wasting, caused by poor nutrition and recurrent infections, is an important problem in North Jakarta. This study found that the prevalence of wasting in Tanjung Priok was 8,7% in children aged 2–5 years.

The dominant factor associated with wasting is insufficient energy intake, which increases the risk of wasting up to 3,7 times. Other factors, such as fat intake, showed a significant relationship. Preventing wasting requires a focus on meeting children's energy needs by increasing access to nutritious food. To overcome this problem, nutritional education is needed for parents to provide foods that are high in energy and fat, according to their children's needs.

Nutritious food assistance programs, including milk, healthy fats, and high-quality protein sources, can help improve the energy intake of children. Routine growth monitoring at Posyandu, along with collaboration between the government, health workers, and community, is essential for effective waste prevention and intervention.

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