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WHY DO INDONESIAN CHILDREN UNDER TWO YEARS OF AGE FAIL TO ACHIEVE MINIMUM DIETARY DIVERSITY?

Mengapa Anak Baduta Indonesia Gagal Mencapai Keragaman Pangan Minimum?

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ABSTRACT

Minimum Dietary Diversity (MDD) is a key Infant and Young Child Feeding (IYCF) indicator that assesses the micronutrient adequacy of diets among children aged 6-23 months by measuring consumption from at least five out of eight defined food groups in the previous day. Inadequate MDD is associated with increased risk of nutritional problems in childhood. This study aimed to identify the determinants of inadequate MDD among children aged 6-23 months in Indonesia. This cross-sectional study used secondary data from the 2018 Indonesian Basic Health Research. The sample comprised 10,800 children aged 6-23 months, selected using total sampling based on inclusion and exclusion criteria. Bivariate analysis revealed significant associations between inadequate MDD and several factors ($p < 0,05$): child's age, mother's age, mother's education level, antenatal care (ANC) frequency, place of delivery, postnatal care (PNC) services, place of residence, and child growth monitoring. In multivariate logistic regression, child's age was the most dominant factor associated with inadequate MDD (adjusted odds ratio [aOR] = 2.762, 95% CI: 2.507–3.043, $p < 0.0005$). These findings provide evidence to inform nutrition policies and programs, particularly those targeting improved IYCF practices and complementary feeding in Indonesia.

Keywords*: children aged 6-23 months; IYCF; minimum dietary diversity*

ABSTRAK

Keragaman Makanan Minimum (Minimum Dietary Diversity/MDD) merupakan indikator utama Pemberian Makanan Bayi dan Anak (PMBA) yang menilai kecukupan mikronutrien pada pola makan anak usia 6–23 bulan melalui konsumsi makanan dari setidaknya lima dari delapan kelompok makanan yang ditentukan pada hari sebelumnya. Ketidakcukupan MDD berhubungan dengan peningkatan risiko masalah gizi pada masa kanak-kanak. Penelitian ini bertujuan untuk mengidentifikasi faktor penentu ketidakcukupan MDD pada anak usia 6–23 bulan di Indonesia. Penelitian ini merupakan studi potong lintang (cross-sectional) yang menggunakan data sekunder dari Riset Kesehatan Dasar Indonesia 2018. Sampel terdiri dari 10.800 anak usia 6–23 bulan, dipilih melalui metode total sampling berdasarkan kriteria inklusi dan eksklusi. Analisis bivariat menunjukkan hubungan signifikan antara ketidakcukupan MDD dengan beberapa faktor ($p<0.05$): usia anak,usia ibu, tingkat pendidikan ibu, frekuensi kunjungan antenatal care (ANC), tempat persalinan, pelayanan postnatal care (PNC), tempat tinggal, dan pemantauan pertumbuhan anak. Pada

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analisis multivariat regresi logistik, usia anak merupakan faktor dominan yang berhubungan dengan ketidakcukupan MDD (adjusted odds ratio [aOR] = 2,762; 95% CI: 2,507–3,043; p < 0,0005). Temuan penelitian ini diharapkan menjadi dasar bukti untuk merumuskan kebijakan dan program gizi, khususnya yang menargetkan peningkatan praktik PMBA dan pemberian makanan pendamping ASI di Indonesia.

Kata Kunci: anak usia 6-23 bulan; keragaman pangan minimum; PMBA

INTRODUCTION

The first 1,000 days of life have long been recognized as a golden period (window of opportunity) as well as a vulnerable period, as this is when a child's growth and development occur very rapidly (Suri *et al.,* 2025). Failure to adequately meet both macronutrient and micronutrient requirements during the first 1,000 days of life can have lifelong consequences for the child (Saavedra and Dattilo, 2022).

The Infant and Young Child Feeding (IYCF) period, spanning 18 months from the age of 6–23 months, represents the longest phase within the first 1,000 days of life; during this time, children undergo a transition to consuming a variety of food textures and types to meet their high nutritional needs (Lutter *et al.,* 2021). As an effort to prevent and address nutritional problems among children aged 6–23 months, appropriate feeding practices need to be implemented. There are eight indicators of feeding practices developed by WHO, one of which is used to measure minimum dietary diversity (MDD) (WHO, 2021).

MDD is an indicator used to assess the adequacy of micronutrient intake among children aged 6–23 months based on the consumption of foods from at least five out of eight defined food groups on the previous day (WHO, 2021; Menber *et al.,* 2025). Inadequate MDD is also associated with nutritional problems such as stunting, underweight, and wasting (Aboagye *et al.,* 2021; Khura et al., 2024). Based on national survey results in 2018, 2023, and 2024, MDD achievement in Indonesia reached only 46.6%, 60.9%, and 48.3%, respectively (Riskesdas, 2018; Ministry of Health of the Republic of Indonesia, 2023; 2025). In addition to indicating the low achievement of minimum dietary diversity during this critical period, these figures also imply missed opportunities to prevent malnutrition in children.

Considering that IYCF practices are among the most effective interventions to

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reduce the risk of malnutrition during the first 1,000 days of life, this study aims to assess the distribution of dietary diversity; identify factors associated with minimum dietary diversity (MDD); and determine the relationship between these factors and inadequate MDD among children aged 6–23 months in Indonesia.

METHODS

Study design, Location, and Time

This study is a quantitative study with a cross-sectional design using secondary data from the Basic Health Research (Riskesdas, 2018).

Sample Size and Sampling Method/Research Instruments and Materials

The sample in this study consisted of 10,800 children aged 6–23 months in Indonesia, selected according to inclusion and exclusion criteria using a total sampling method. The inclusion criterion was children aged 6–23 months at the time of data collection in the Riskesdas (2018) survey. The exclusion criteria included: (1) children without records of dietary diversity consumption; and (2) children without records related to the study variables. Based on the test of differences in proportions, the statistical power of this study ranged from 88.13% to 99.99%.

Type and Method of Data Collection / Research Procedures

Data processing was carried out in four stages: editing, coding, processing, and cleaning. The MDD variable was categorized as inadequate MDD (<5 of 8 food groups) and adequate MDD (≥5 of 8 food groups). Child age was categorized into 6–11 months and 12–23 months. Child sex was categorized as male and female. Maternal age was categorized as 20 years and >20 years. Maternal education level was categorized as low (no schooling to junior high school completion) and medium & high (senior high school to higher education completion). Maternal employment status was categorized as unemployed and employed. ANC frequency was categorized as inadequate (<6 visits) and adequate (≥6 visits). Place of delivery was categorized as non-health facility and health facility. Postnatal care (PNC) service utilization was categorized as no (<4 visits) and yes (≥4 visits). Place of

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residence was categorized as rural and urban. Child growth monitoring was categorized as not monitored and monitored.

Data Analysis

Frequencies, percentages, and descriptive statistics were used in the univariate analysis. Bivariate analysis employed the chi-square test to examine the association between child age, child sex, maternal age, maternal education level, maternal employment status, ANC frequency, place of delivery, PNC services, place of residence, and child growth monitoring with inadequate MDD among children aged 6–23 months. In addition, multiple logistic regression (determinant model) was conducted to identify the most dominant factors associated with inadequate MDD. Data analysis was performed using SPSS 25.

RESULTS AND DISCUSSION

The proportion of inadequate MDD among children aged 6–23 months in Indonesia was 72.3% of the total 10,800 children (Table 1). Cereals were the most commonly consumed food group. Meanwhile, the consumption of meat, fish, and poultry was only 16.5% among children aged 6–11 months, which is about half compared to children aged 12–23 months, where 33.7% consumed animal-based foods; however, this coverage is still considered very low. Furthermore, children aged 6–11 months and 12–23 months consumed other fruits and vegetables at only 18.5% and 28.9%, respectively. Legumes and nuts were consumed by both age groups at 19.5% and 39.3%, respectively. Meanwhile, breast milk was more commonly consumed by children aged 6–11 months (Figure 1).

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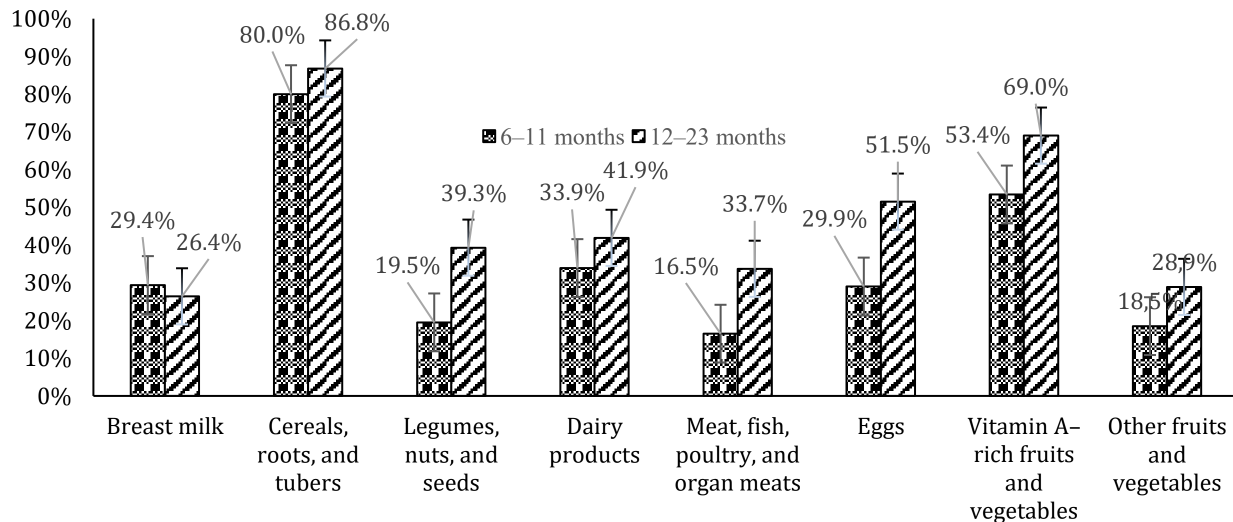

Figure 1. Percentage of Children Fed with Various Food Groups on the Previous Day.

The proportion of male and female children was nearly equal, and more than half were aged 12–23 months. Most mothers of the respondents in this study received adequate ANC services, had a history of delivery in health facilities, and received PNC services. The respondents were also more frequently monitored for growth and predominantly resided in rural areas (Table 1).

Table 1. Distribution of MDD, Child Characteristics, Maternal Factors, Maternal and Child Health (MCH) Services, and Demographics (n = 10,800)

Variable	Frequency (n)	Percentage (%)
MDD		
Inadequate	7,804	72.3
Adequate	2,996	27.7
Child Characteristics		
Child Age		
6–11 months	4,246	39.3
12–23 months	6,554	60.7
Child Sex		
Male	5,501	50.9
Female	5,299	49.1
Child Growth Monitoring		
Not monitored	4,276	39.6
Monitored	6,524	60.4
Maternal Characteristics		
Maternal Age		
≤ 20 years	491	4.5
>20 years	10,309	95.5

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Variable	Frequency (n)	Percentage (%)
MDD		
Inadequate	7,804	72.3
Adequate	2,996	27.7
Maternal Education Level		
Low (≤ junior secondary school)	5,445	50.4
Medium and high (> junior secondary school)	5,355	49.6
Maternal Employment Status		
Not working	6,505	60.2
Working	4,295	39.8
Maternal and Child Health (MCH) Services		
ANC Frequency		
Inadequate (<6)	2,091	19.4
Adequate (≥6)	8,709	80.6
Place of Delivery		
Non-health facility	1,621	15.0
Health facility	9,179	85.0
PNC Services		
No (<4)	3,874	35.9
Yes (>=4)	6,926	64.1
Demographic Characteristics		
Place of Residence		
Rural	6,237	57.8
Urban	4,563	42.3

In the bivariate analysis, child age, child growth monitoring, maternal age, maternal education, ANC frequency, place of delivery, PNC services, and place of residence were significantly associated with inadequate MDD ($p < 0.01$). Meanwhile, child sex and maternal employment were not found to be associated with MDD adequacy among children aged 6–23 months (Table 2).

Furthermore, based on the multivariate analysis, child age, child growth monitoring, maternal education level, ANC frequency, place of delivery, and place of residence were associated with inadequate MDD ($p < 0.01$) after controlling for other variables. Meanwhile, PNC services were associated with inadequate MDD ($p < 0.05$) after adjustment for other variables. Child age was identified as the most dominant factor in achieving MDD, with an OR of 2.762 (95% CI: 2.507–3.043). This indicates that children aged 6–11 months were 2.76 times more likely not to achieve MDD compared to those aged 12–23 months after controlling for other variables (Table 2).

Table 2. Determinants of MDD among Children Aged 6–23 Months

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Variable	MDD				Chi-square test p-value	Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	B
	Inadequate		Adequate					
	n	%	n	%				
Child Age								
6-11 months	3,531	83.2	715	16.8	0.0005	2.64	2.762**	1.016
12-23 months	4,273	65.2	2,281	34.8		(2.4–2.9)		
Sex								
Male	3,969	72.2	1,532	27.8	0.814	0.99		
Female	3,835	72.4	1,464	27.6		(0.9–1.1)		
Child Growth Monitoring								
Not monitored	3,208	75.0	1,068	25.0	0.0005	1.26	1.226**	0.204
Monitored	4,596	70.4	1,928	29.6		(1.1–1.4)		
Maternal Age								
≤ 20 years	87	78.8	104	21.2	0.001	1.451		
>20 years	7,417	72.3	2,892	28.1		(1.2–1.8)		
Maternal Education								
Low	4,197	77.1	1,248	22.9	0.0005	1.63	1.256**	0.228
Medium & high	3,607	67.4	1,748	32.6		(1.5–1.8)		
Maternal Employment								
Not working	4,735	72.8	1,770	27.2	0.135	1.07		
Working	3,069	71.5	1,226	28.5		(0.9–1.2)		
ANC Frequency							1.334**	0.288
Inadequate	1,634	78.1	457	21.9	0.0005	1.47		
Adequate	6,170	70.8	2,539	29.2		(1.3–1.6)		
Place of Delivery								
Non-health facility	1,328	81.9	293	18.1	0.0005	1.89	1.498**	0.404
Health facility	6,476	70.6	2,703	29.4		(1.7–2.2)		
PNC Services								
No	2,707	69.9	1,167	30.1	0.0005	0.83	0.905*	-0.099
Yes	5,097	73.6	1,829	26.4		(0.7–0.9)		
Place of Residence								
Rural	4,829	77.4	1,408	22.6	0.0005	1.83	1,517**	0.417
Urban	2,975	65.2	1,588	34.8		(1.7–1.9)		

AOR (*) *p-value* <0.01, (**) *p-value* <0.05

Dietary Diversity Distribution

This study identified that the achievement of MDD was only 27.7%, with the cereal group being the most frequently consumed food group (6–11 months: 80%; 12–23 months: 86.8%). Cereals serve as staple foods that are easily accessible and energy-dense, supporting children's growth and development during this period (Oyet *et al.,* 2025). This is consistent with findings showing that the majority of children under five in Indonesia most frequently consume carbohydrates in the form of rice, noodles, or other cereal-based foods (Arini *et al.,* 2022).

Meanwhile, meat, fish, and poultry were the least consumed food group among

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children aged 6–11 months (16.5%), whereas animal-source foods contain essential amino acids required for optimal growth. Various studies have shown a positive association between animal protein intake during complementary feeding and weight-for-age, weight-for-height, and BMI-for-age indicators (Kittisakmontri *et al.,* 2022).

On the other hand, dietary diversity in households with under-five children is more often centered on plant-based foods, including cereals and tubers, with relatively low consumption of animal-source foods (Oyet *et al.,* 2025). This pattern reflects the economic and accessibility factors influencing infant and young child feeding practices (IYCF).

The WHO states that breastfeeding should continue up to 2 years of age alongside complementary feeding starting at 6 months. However, this study found that only 1 in 4 children aged 6–23 months received breast milk (6–11 months: 29.4%; 12–23 months: 26.4%). Several factors influencing this situation include maternal employment, lack of partner support, and maternal education level. Working mothers have been identified as a significant barrier to continued breastfeeding after six months due to the challenge of balancing work demands with breastfeeding needs (Yimer *et al.,* 2021; Hong *et al.,* 2023). Lack of support from husbands or partners also plays a critical role. In some communities, mothers who do not receive support from fathers show much lower rates of exclusive breastfeeding. In addition, traditional beliefs may negatively influence breastfeeding practices, such as misconceptions about colostrum or the early introduction of complementary foods, which can lead to early cessation of breastfeeding (Yimer et al., 2021).

Determinants of Inadequate MDD

Dietary diversity increases with age; however, it is important to note that the 6–11 months stage is a critical period for the introduction of various food groups. Bivariate analysis showed a significant association ($p = 0.0005$, OR 95% CI: 2.761) between child age and MDD, indicating that children aged 6–11 months were 2.762 times more likely not to achieve MDD compared to children aged 12–23 months. Multivariate analysis identified child age as the most dominant factor affecting MDD achievement ($p < 0.01$). These findings are consistent with a study in Mongolia, which reported that the

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likelihood of not achieving dietary diversity was higher among children aged 6–11 months compared to those aged 12–23 months (Janmohamed et al., 2020). Younger children (6–11 months) are often in the transition from exclusive breastfeeding to complementary feeding, resulting in limited dietary diversity due to delayed food introduction or more cautious feeding practices compared to older children (Sisay et al., 2022; Opoku Agyemang et al., 2023). In addition, a lack of parental or caregiver knowledge regarding early introduction of diverse foods also contributes to lower dietary diversity. Feeding practices are significantly associated with dietary diversity, and insufficient knowledge can lead to monotonous diets dominated by staple foods such as cereals and porridge, which are low in micronutrient diversity (Keno et al., 2021; Opoku Agyemang et al., 2023). Consumption of a diverse diet is also known to be associated with reduced stunting, where children who meet MDD have an 83% lower risk of experiencing stunting (Ahmad et al., 2018).

From the multivariate analysis, it was found that children who did not receive growth monitoring were 1.22 times more likely not to achieve adequate MDD. Other studies have shown that children who received growth monitoring and promotion services had 2.74 times higher chances of achieving dietary diversification compared to those who did not receive growth monitoring. Mothers who are regularly involved in monthly growth monitoring are more likely to provide the recommended dietary diversity, as such services increase both the frequency and mothers' understanding of how to prepare and feed children with diverse foods (Worku et al., 2020).

An increase in maternal age reflects greater experience in child-rearing practices and awareness of appropriate feeding practices, thereby contributing to a reduction in the prevalence of inadequate MDD among their children (Rai et al., 2022). This is consistent with the bivariate analysis results of this study, which showed that mothers aged >20 years were 1.451 times more likely to achieve dietary diversity in IYCF practices compared to mothers aged ≤20 years. Young mothers, particularly adolescent mothers, tend to have lower knowledge and less optimal complementary feeding practices due to limited education and experience (Dhami et al., 2021).

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In the multivariate test, an OR of 1.256 (95% CI: 1.129–1.399) was obtained, indicating that mothers with low education had a 1.256 times higher risk of not achieving MDD compared to mothers with medium and higher education levels. Mothers with formal education are significantly and positively associated with dietary diversity practices compared to mothers without formal education (Sema *et al.,* 2021). Educated mothers tend to have greater access to information, are more likely to obtain information disseminated through various media, participate in valued employment, and may have learned about child feeding through formal education programs at school. This highlights the fact that maternal education level is crucial for child health status, growth and development, and good child feeding practices, and has a positive impact on mothers in building confidence, decision-making within the household, and implementing IYCF practices in accordance with recommendations (Mamiro *et al.,* 2014; Mekbib *et al.,* 2014; Gautam *et al.,* 2016).

One of the indicators of antenatal care (ANC) services is the provision of counseling to pregnant women. According to the Indonesian Minister of Health Regulation No. 97 of 2014, such counseling includes balanced nutrition intake, early initiation of breastfeeding, and exclusive breastfeeding. From the bivariate and multivariate analyses, ANC frequency was found to be positively associated with MDD achievement among children aged 6–23 months (p = 0.0005), and the multivariate analysis showed an OR of 1.334 (95% CI: 1.185–1.501). Mothers who had four or more ANC visits during pregnancy had a protective association against failure to achieve MDD (Paramashanti *et al.,* 2021). The explanation underlying this positive association includes the fact that ANC visits often involve counseling on the consumption of diverse food groups, the importance of vitamins and minerals, and budgeting or access to diverse foods. Pregnant women who attend ANC more frequently have greater exposure to this knowledge, which leads to better dietary behaviors during and after pregnancy (Ahmed *et al.,* 2022; Rai *et al.,* 2022).

In the multivariate test, an OR of 1.498 (95% CI: 1.300–1.727) was obtained, indicating that mothers who delivered in health facilities were 1.498 times more likely to achieve MDD compared to those who

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delivered in non-health facilities after controlling for other variables. A possible explanation for this is that counseling provided during delivery increases mothers' awareness of dietary diversity practices and food preparation for their children (Sema *et al.,* 2021). Nevertheless, MDD achievement during the complementary feeding period is strongly influenced by socioeconomic factors, nutritional education, feeding practices, and the health service system. This multidimensional approach is essential to improve dietary diversity among children after delivery in health facilities (Seid & Cherie, 2022; Teferi *et al.,* 2023).

Postnatal Care (PNC) services must be provided to postpartum mothers and newborns with a total of four visits. One of the objectives of PNC services is to deliver communication, information, and education (CIE) to postpartum mothers, including personal hygiene and genital hygiene, nutritional needs of postpartum mothers, breast care and breastfeeding techniques, rest, management of anxiety, strengthening family involvement in monitoring maternal and child health, and postpartum family planning.

The bivariate analysis showed an OR value of 0.9, indicating that PNC services acted as a protective factor for achieving MDD. This can be interpreted as mothers who received PNC having a 1.1 times (1/OR) higher risk of not achieving MDD compared to mothers who received complete PNC services. The CIE provided during PNC is related to correct breastfeeding practices and exclusive breastfeeding for six months, as stated in the Maternal and Child Health (MCH) handbook (Ministry of Health & JICA, 2020). In addition, postpartum visits also aim to assess the health condition of mothers and newborns to prevent and detect health problems, diseases, and postpartum complications, as well as to provide family planning services (Reinissa & Indrawati, 2017; Ministry of Health, 2019). Therefore, there is a possibility that postpartum visits are not specifically related to complementary feeding education (MPASI), particularly messages on dietary diversity.

The multivariate analysis in this study found that children living in rural areas had a 1.517 times higher risk of not achieving MDD after controlling for other variables. In Southeast Asia, urbanization trends show that 47% of the population lived in urban areas in

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2014, and this is projected to increase to 64% by 2050. Urbanization, along with rising income, employment opportunities, and lower food prices, may provide advantages compared to rural areas (Harvey *et al.,* 2018).

CONCLUSION

The adequacy of dietary diversity among children aged 6–23 months in Indonesia is relatively low, with food consumption dominated by the cereal group, while the intake of animal-source foods remains low. Overall, this study found that inadequate MDD among children aged 6–23 months is influenced by a combination of individual, household, and health service access factors. Efforts to improve dietary diversity in children need to be implemented through a multidimensional approach, including strengthening nutrition education for parents during ANC and PNC services, enhancing maternal and child health services, and improving access to nutritious foods to support more optimal infant and young child feeding practices.

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