

# A study of determining factors of underweight among toddlers in Riau, Indonesia

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## Abstract

This study was performed to clarify determining factors related to toddler underweight. Four hundred eleven mothers and toddlers at 124 child health posts in Pekanbaru, Riau, Indonesia, were selected by multistage random sampling. Data regarding sociodemographic status, toddler health and feeding problems, and mothers' behavior regarding toddler feeding practices were collected using a questionnaire. Multiple logistic regression analysis was performed to determine factors contributing to toddler underweight. The average age of the toddlers was  $23.2 \pm 7.2$  months, and 15.1% ( $n=62$ ) were underweight. The most common health problem reported in toddlers in the past 3 months was fever (65.5%). The most common feeding problems were difficulty eating (14.6%) and refusing to eat (8.8%). Although 95.3% of mothers always provided a variety of foods for their toddlers, 61.8% always provided toddlers with a snack at mealtimes, and 58.9% always give their toddlers milk before eating. Among the toddlers included in the study, 53.3% experienced non-exclusive breastfeeding (non-EBF) from 0 to 6 months old. Multivariate analysis indicated that underweight toddlers were most likely to have refused to eat at some point in the previous 3 months ( $OR = 3.76$ ), to have mothers that always gave them milk before eating ( $OR = 1.92$ ), and to have mothers that supplied them with complementary food by their sixth month ( $OR = 1.94$ ). The results of this study will facilitate the design of intervention strategies to prevent toddlers from being underweight based on toddlers' feeding problems and mothers' practices regarding feeding their toddlers.

## KEY WORDS

toddler , underweight , mother's behavior , nutritional status

## Introduction

The problem of under nutrition is still an important focus in developing countries because of its correlation with the next generation of children, which can have a long-term impact on child cognitive and developmental problems<sup>1),2)</sup>. In developing countries, the lack of proper nutrition in children under five still is a top cause of child mortality<sup>3)</sup>. A combination of infection and insufficient nutrient intake is a primary factor causing child under nutrition, which causes the immune system to deteriorate and increasing susceptibility to diseases because children's

nutrient intake is low, which influences nutrient absorption. According to estimates of the World Health Organization (WHO), one-third of the world's cases of under nutrition can be attributed to the inadequate feeding of infants and young children<sup>4),5)</sup>.

The first two years are especially important. For children to attain peak nutrition, it is vital that they receive exclusive breastfeeding (EBF) for the first 6 months, and then sufficient supportive feeding through 23 months of age. Previous studies have shown that children to whom food was introduced early and whose intake of

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complementary food was continuously insufficient were at increased risk of being underweight toddler<sup>(6,7)</sup>. In their first two years of life, children's elevated nutritional needs place them at risk of being underweight; this is particularly true in developing countries, where many children have inadequate diets, and infectious diseases are prevalent<sup>(8,9,10)</sup>. This means that the toddler period can be a risky time for children to be underweight.

Under nutrition in children under five is one of the major national health problem in Indonesia. Although poverty has shown a steady decline since 2007, the percentage of underweight children under five has increased year by year. More than a half of Indonesia's regions have critical numbers of under five underweight above the national under nutrition prevalence rates, including Riau Province<sup>(11)</sup>. The majority of babies in Indonesia and Pekanbaru, Riau Province, have been supported by their mothers in the first six months with complementary foods<sup>(11,12)</sup>. Generally, child feeding practices for Indonesian children over six months of age are not optimal; inadequate knowledge and the inappropriate nutritional practices of mothers are also be one of barriers to improving child nutrition in Indonesia<sup>(13,14)</sup>.

The study of underweight children under five has been explored; however, the prevalence and the determining factors for underweight toddlers in Indonesia, including the behavior of mothers related to feeding practices, have been examined less. The study of underweight toddlers is important because the toddler period carry the most risk of being underweight. The purpose of this study was to clarify determining factors related to underweight toddlers in Riau, Indonesia. This research can contribute to the designing of intervention strategies for future programs to prevent underweight in toddlers and to promote the advance toddlers' health.

## Methods

### 1. Design

This was a cross-sectional study.

### 2. Subjects

Toddlers between the ages of 12 and 36 months, along with their mothers, were taken as a sample. The sample size was estimated using a 95% confidence interval with 109,574 children under five years in Pekanbaru, based on Pekanbaru's health profile report in 2014. The calculated sample size was 347, and 15% was added. Thus, the final sample size was 411. Subjects were chosen using the

multistage random sampling technique. In the first stage, three districts (20%) were randomly selected based on the Pekanbaru district total. In the second stage, four Public Health Centers/PHCs (20%) of these district were chosen from 20 PHCs areas in Pekanbaru, and in the third stage, 124 Posyandu (children's health posts) in 4 PHCs were randomly selected as research areas. In each PHC area, 31 Posyandu and 3–4 respondents per each Posyandu were taken randomly as research samples. Criteria for exclusion of toddlers were overweight and congenital diseases.

### 3. Data Collection

This study was conducted from January through March 2015 in Pekanbaru. Pekanbaru is an urban area and the capital city of Riau Province on Sumatera Island, Indonesia. Prior to the data collection, nursing research staff members were trained as data surveyors in all aspects of the questionnaires. After obtaining a consent form, the data surveyor assessed the weight of the toddler and then guided the mothers to fill out the questionnaire. After completing it, the mother gave the questionnaire to the data surveyor. Data on various sociodemographics, including toddler's age, toddler's gender, mother's education, mother's occupation, and family income, were collected using questionnaires. Questions about toddlers' health problem related to respiratory and gastrointestinal symptoms, which were adopted from the integrated management of childhood illness book<sup>(15)</sup>, were assessed based on mothers' reports of their toddlers' health symptoms and eating problems in the past three months before the data were collected. A questionnaire regarding mothers' behaviors, adaptable from knowledge, attitude, and practice (KAP) model questionnaires<sup>(16)</sup>, was also modified based on the situation in Indonesia to fit the purpose of this research. Questions regarding mothers' behaviors tested by validity and reliability testing were regarded as the real questionnaire (Cronbach  $\alpha$ :0.67). The weight of toddlers was measured with digital scales.

### 4. Data Analysis

The WHO growth standard for toddlers was used to classify the anthropometric parameters. The weight-for-age z-score (WAZ) was calculated using WHO Anthro 2006 software. To determine a toddler's nutritional status, a cut-off point z-score <-2.00 SD indicated underweight whereas z-scores >+2.00 SD, indicating overweight toddlers<sup>(11,17)</sup>. All variables were tested using normality testing to choose the kinds of data analysis before

analyzing the data. Categorical data was determined using Chi-square and Fisher's exact tests, while differences between the proportions and the means were measured by the Mann-Whitney U test for nonparametric testing.

The analysis of multiple logistic regression was used to assume the odds ratios (OR) and the 95% confidence interval (CI) for the OR of a set of predictors, was performed to determine the factors that contributed to underweight in toddlers. All sociodemographic variables, toddler health and feeding problem variables, and mother's behavior variables that have p values <0.1 have already been selected as candidates of predictors entered in logistic regression models as covariates by forward stepwise conditional method. Model fit was determined using the Hosmer-Lemeshow test. Statistical significance was defined as p<0.05. The Statistical Package for Social

Sciences (SPSS-PC version 22, Chicago IL) was used to analyze all data.

#### 5. Ethical considerations

This study was approved by the Ethical Review Board for Medicine and Health Research, Faculty of Medicine, Riau University, Indonesia (No. 143). A signed and oral consent form was also obtained from the parents of all participants.

#### Results

Table 1 shows the sociodemographics of respondents. The average age of toddlers was  $23.2 \pm 7.2$  months, and 15.1% of toddlers (n=62) were underweight. It was observed that 58.2% of the toddlers whose data were collected were boys. There were no significant differences on age and gender between two toddlers groups. Furthermore, the majority of mothers had low education

Table 1. Socio Demographic Characteristics of Respondents in Relation to Nutritional Status of Toddler n (%)

Variables	N 411 (100)	Nutritional Status <sup>a</sup>				P- value
		Underweight 62 (15.1)		Non Underweight 349 (84.9)		
		Mean± SD (Median)	n (%)	Mean± SD (Median)	n (%)	
Toddler's age	23.2±7.2 (23.0)	24.0 ± 7.5 (26.0)		23.0 ± 7.2 (23.0)		0.33 <sup>†</sup>
12-24 month	235 (57.2)	29 (46.8)		206 (59.0)		0.07 <sup>†</sup>
25-36 month	176 (42.8)	33 (53.2)		143 (41.0)		
Toddler's gender						0.79 <sup>†</sup>
Boys	239 (58.2)	37 (59.7)		202 (57.9)		
Girls	172 (41.8)	25 (40.3)		147 (42.1)		
Mother's education <sup>b</sup>						
Low	330 (80.3)	53 (85.5)		277 (79.4)		0.26 <sup>†</sup>
High	81 (19.7)	9 (14.5)		72 (20.6)		
Mother's occupation						
No Work <sup>c</sup>	341 (83.0)	55 (88.7)		286 (81.9)		0.19 <sup>†</sup>
Work	70 (17.0)	7 (11.3)		63 (18.1)		
Family monthly income (Rp) <sup>d</sup>	2874209.2 ±1186028.0 (3000000)	2700000.0 ±1232251.0 (2500000)		2905157.5 ±1176751.2 (3000000)		0.13 <sup>†</sup>
Low	153 (37.2)	29 (46.8)		124 (35.5)		0.09 <sup>†</sup>
High	258 (62.8)	33 (53.2)		225 (64.5)		

<sup>a</sup> Based on WAZ (weight-age z score) by WHO

SD; standard deviation

<sup>b</sup> Low education: elementary school, junior high school, Senior high school; High education: Diploma, bachelor and more

<sup>c</sup> Housewife

<sup>d</sup> Low income if Rp 2100000 as minimum salary standard; high income if > 2100000 as minimum salary standard

<sup>†</sup> Chi- Square test

<sup>‡</sup> Mann-Whitney U test

levels (80.3%), and 83.0% of mothers did not work outside the home. Sixty-two point eight percent of respondents had high family incomes, which were above the minimum salary standard per month in Pekanbaru, Riau. The mother's education and occupation, as well as the family's income, were not significantly different as related to toddler underweight.

As shown in Table 2 about toddler health problems in the past 3 months, fever was the most common morbidity among toddlers (65.5%) followed by symptoms of respiratory problems, such as coughs (61.1%) and

runny noses (54.0%). Furthermore, mothers reported that only 2.4% of toddlers had incidences of rapid breathing as another symptom of respiratory problems. However, toddlers with reported rapid breathing problems were significantly more likely to be underweight ( $p=0.04$ ). The majority of toddlers had not had gastrointestinal problems, but 15.1% of toddlers had experienced diarrhea. The percentage of toddlers with diarrhea in the past three months who were undernourished was higher than that of the toddlers who had not had diarrhea. The diarrhea was significantly associated with toddler underweight ( $p=0.03$ ).

Table 2. Toddler Health and Feeding Problem in The Past Three Months n (%)

Variables	N 411 (100)	Nutritional Status <sup>a</sup>		P-value
		Underweight 62 (15.1)	Non Underweight 349 (84.9)	
<b>Fever</b>				
Yes	269 (65.5)	43 (69.4)	226 (64.8)	0.48 <sup>†</sup>
No	142 (34.5)	19 (30.6)	123 (35.2)	
<b>Cough</b>				
Yes	251 (61.1)	39 (62.9)	212 (60.7)	0.74 <sup>†</sup>
No	160 (38.9)	23 (37.1)	137 (39.3)	
<b>Runny noses</b>				
Yes	222 (54.0)	38 (61.3)	184 (52.7)	0.21 <sup>†</sup>
No	189 (46.0)	24 (38.7)	165 (47.3)	
<b>Difficult breathing</b>				
Yes	22 (5.4)	4 (6.5)	18 (5.2)	0.75 <sup>†</sup>
No	389 (94.6)	58 (93.5)	331 (94.8)	
<b>Rapid breathing</b>				
Yes	10 (2.4)	4 (6.5)	6 (1.7)	<b>0.04<sup>‡</sup></b>
No	401 (97.6)	58 (93.5)	343 (98.3)	
<b>Add sound of breath</b>				
Yes	26 (6.3)	5 (8.1)	21 (6.0)	0.57 <sup>†</sup>
No	385 (93.7)	57 (91.9)	328 (94.0)	
<b>Diarrhea</b>				
Yes	62 (15.0)	15 (24.2)	47 (13.5)	<b>0.03<sup>†</sup></b>
No	349 (84.9)	47 (75.8)	313 (86.5)	
<b>Vomit</b>				
Yes	28 (6.8)	7 (11.3)	21 (6.0)	0.12 <sup>†</sup>
No	383 (93.2)	55 (88.7)	328 (94.0)	
<b>Stomach ache</b>				
Yes	15 (3.6)	2 (3.2)	13 (3.7)	1.00 <sup>†</sup>
No	396 (96.4)	60 (96.8)	336 (96.3)	
<b>Difficult to eat</b>				
Yes	60 (14.6)	15 (24.2)	45 (12.9)	<b>0.02<sup>†</sup></b>
No	351 (85.4)	47 (75.8)	304 (87.1)	
<b>Refuse to eat</b>				
Yes	36 (8.8)	12 (19.4)	24 (6.9)	<b>0.01<sup>†</sup></b>
No	375 (91.2)	50 (80.6)	325 (93.1)	

<sup>a</sup> Based on WAZ (weight-age z score) by WHO

<sup>†</sup> Chi-Square

<sup>‡</sup> Fisher exact test

This table also explains toddlers' feeding problems, where approximately 14.6% of toddlers had difficulty eating, and 8.8% of toddlers refused to eat at some point in the previous three months. The proportion of underweight was twice to three times as high among toddlers who experienced difficulty eating and refused to eat as compared to others; these differences were significant toddler underweight ( $p=0.02$  and  $p=0.01$ , respectively).

The behaviors of mothers regarding toddler feeding were analyzed as related to toddler underweight (Table 3). Although only 4.6% of mothers never varied their

toddlers' food daily, the percentage of toddlers who were underweight was higher for mothers who never varied their children's food. This correlated significantly with toddler underweight ( $p=0.04$ ). A majority (as much as 61.8%) of mothers always gave their toddlers snacks at mealtime. Table 3 also shows that more than half of mothers (58.9%) always gave milk to their toddlers before eating, and 53.3% of mothers have already given their toddlers complementary food in the first 6 months of life. These behaviors make toddlers more likely to be underweight. There were correlations between toddler

Table 3. Mother's Behavior to Toddler Feeding-Practice n (%)

Behavior items	N 411 (100)	Nutritional Status <sup>a</sup>		P-value
		Underweight 62 (15.1)	Non Underweight 349 (84.9)	
<b>Giving complete food</b>				
Never	15 (3.6)	3 (4.8)	12 (3.4)	0.58 <sup>†</sup>
Always	396 (96.4)	59 (95.2)	337 (96.6)	
<b>Varying food every day</b>				
Never	19 (4.6)	6 (9.7)	13 (3.7)	<b>0.04 <sup>†</sup></b>
Always	392 (95.4)	56 (90.3)	336 (96.3)	
<b>Replacing main food with snacks</b>				
Never	271 (65.9)	38 (61.3)	233 (66.8)	0.40 <sup>†</sup>
Always	140 (34.1)	24 (38.7)	116 (33.2)	
<b>Giving snacks in meal time</b>				
Never	157 (38.2)	17 (27.4)	140 (40.1)	<b>0.05 <sup>†</sup></b>
Always	254 (61.8)	45 (72.6)	209 (59.9)	
<b>Giving milk before eating</b>				
Never	169 (41.1)	17 (27.4)	152 (43.6)	<b>0.01 <sup>†</sup></b>
Always	242 (58.9)	45 (72.6)	197 (56.4)	
<b>Providing complementary food before 6 months of age</b>				
Never	192 (46.7)	21 (33.9)	171 (49.0)	<b>0.02 <sup>†</sup></b>
Always	219 (53.3)	41 (66.1)	178 (51.0)	
<b>Washing hands with soap</b>				
Never	13 (3.2)	2 (3.2)	11 (3.2)	1.00 <sup>‡</sup>
Always	498 (96.8)	60 (96.8)	338 (96.8)	
<b>Monitoring Toddler nutritional status in KMS chart <sup>b</sup></b>				
Never	85 (20.7)	10 (16.1)	75 (21.5)	0.33 <sup>†</sup>
Always	326 (79.3)	52 (83.9)	274 (78.5)	
<b>Carrying Toddler to Posyandu <sup>c</sup></b>				
Never	73 (17.8)	12 (19.4)	61 (17.5)	0.72 <sup>†</sup>
Always	338 (82.2)	50 (80.6)	288 (82.5)	

<sup>a</sup> Based on WAZ (weight-age z score) by WHO

<sup>b</sup> Kartu Menuju Sehat Chart (growth child chart)

<sup>c</sup> Child health monitoring post in Indonesia Community

Never: no activity; Always: rarely and always

<sup>†</sup> Chi-Square

<sup>‡</sup> Fisher exact test

underweight and giving milk before eating and supplying complementary foods before 6 months of age ( $p=0.01$  and  $p=0.02$  respectively).

The logistic regression analysis in Table 4 showed that three variables were statistically significant predictors of underweight in toddlers. Selected by forward stepwise conditional method shows that refusing to eat in the past three months is the highest predictor (OR=3.76), followed by supplying a child with complementary food before the age of 6 months (OR=1.94), and giving milk to a toddler before eating (OR=1.92).

### Discussion

This study identified that toddler underweight rate on this study result was lower (15.1%) than Indonesia underweight rate of underfive children (19.6%)<sup>11)</sup>. It was not easy to compare both of them because the setting sample on this study only takes 1 Province and urban area from all provinces in Indonesia. However, research results about the prevalence of underweight toddlers are not in Indonesia, this study is an important result for children's health.

Toddler eating problems such as difficult and refuse to eat as a significant factor in toddler underweight were the main variable in this research. Toddlers who have difficulty eating and refuse to eat for three months are more likely to be underweight, whereas refusing to eating associated to toddler underweight by 3.76 times. This result shows that toddlers' eating problems cause food insufficiency because food intake is low and the contribution of meals to their daily nutritional needs was decreased. The highest rates of toddler under nutrition was not only because nutritional needs are increasing due to growth and development until 3 years of age, but also result from a reduction in the frequency of supplementary feedings per day, which causes a sharp decline in adequate nutrition<sup>18),19),20)</sup>. Moreover, one of the

causes of child under nutrition was the lack of nutrition intake, such as less than adequate quantities and qualities of calories and protein continuously. Child under nutrition also indicated that some nutrients, such as protein and fats, were missing from children's diets<sup>7),21)</sup>.

Picky eaters as feeding problems are common among toddlers, increased 50% between 19 and 24 months. However, previous studies have shown that some factors, such as parental practices, have contributed to toddler feeding problems<sup>22),23)</sup>. The practice of mothers who always give milk to their toddlers before eating as one of parental practices is associated with toddler underweight 1.92 times in this research. Giving toddler milk before eating has a negative effect on adequate feeding because toddlers' appetites decrease after drinking milk. Milk significantly suppresses the appetite, and studies have shown that mothers' use of supplemental formula milk is associated with their children's picky eating and a significantly lower percentage of daily energy intake from food<sup>24),25)</sup>. Furthermore, some nutrients required for toddlers' growth and development will be inadequate because the percentage of energy and all nutrients provided by milk declines steadily as children age, from 88% at 4–5 months to 24% at 12–24 months<sup>26)</sup>. Mothers who always provide toddlers with milk before they eat demonstrate less skill in feeding practices, causing toddler feeding problems and its significant contribute to under nutrition toddler.

Providing complementary food before 6 months of age is another maternal factor that associated to toddler underweight (1.94 times) in this study. In a previous study in Pekanbaru, Indonesia, a majority of mothers supplied their babies with many kinds of complementary foods before the age of 6 months, not only formula milk but also other foods<sup>27)</sup>. Improper feeding practices, such as non-EBF for the first 6 months, may be responsible for

Table 4. Predictors of Toddler Underweight (n=411)

Predictor	OR	95% CI	P-value
Refusing to eat in the past three months	3.76	1.71; 8.25	0.01
Providing complementary food before 6 months of age	1.94	1.08; 3.51	0.02
Giving milk before toddler eat	1.92	1.04; 3.53	0.03

reference groups were: no refusing to eat; EBF; never giving milk

OR, odds ratio; 95% CI, 95% confidence interval

Logistic Regression Analysis

the higher prevalence of under nutrition among children from 1–3 years of age<sup>28)</sup>. Some study results also reported that the prevalence of malnutrition was high among children who had never been breastfed and who no longer received continued breastfeeding, and children who were introduced to food early had an increased risk of being underweight<sup>7),6)</sup>. These studies showed that non-EBF before 6 months is one associated factor for toddler under nutrition.

In this study, mothers' inappropriate behaviors in feeding their toddlers started early, probably because of the mother' level of education. The majority of mothers in this research had low levels of education, and lower levels of mothers' education lead to a higher proportion of underweight toddlers than nonunderweight toddler. A mother's lack of a good education is a barrier to healthy dietary practices, while high levels of education tend to equip mothers with the health knowledge necessary to feed their children in accordance with recommended feeding practices<sup>29),30)</sup>. A mother's education level was associated with better health-promoting behavior.

Last, this study has accomplished its objective of determining the prevalence and factors associated with underweight toddlers in Riau, Indonesia. Toddlers who have trouble eating for three months were more associated with toddler underweight, followed by a non-EBF history before 6 months of age, and also giving milk to toddlers before eating was significantly correlated with toddler underweight. These study results demonstrate the importance of mothers identifying the causes of

toddler eating problems and implementing better feeding practices from infancy.

However, this study has some limitations. First, the recall bias for collecting retrospective data is limited as it relates to breastfeeding history, toddler health problems, and toddler feeding practices by mothers (0.67 with Cronbach's alpha). Second, information regarding some confounding variables such as toddlers' birth histories (birth weights) was absent and no smoking condition information in family, which could cause problems in interpreting the results. Third, study results were somewhat hard to generate for toddler underweight in all of Indonesia area because only one province in Indonesia was surveyed. However, this data presents some useful information, and further nutritional studies and intervention for children in similar areas are urgently needed. In the next study, it will be important to explore the frequency of toddler eating problems each day and to consider toddler birth history as variables to toddler underweight. A qualitative study to find the reasons for mothers' practices of feeding toddlers should be explored.

#### **Conflict of interest**

The authors declare that they have no conflicts of interest.

#### **Acknowledgments**

We would like to thank the study participants for their cooperation in this study and all data collectors. We also appreciate DIKTI Indonesia for their sponsorship of this research.

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## リアウ州における幼児の低体重に関連する要因

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### 要 旨

目的：インドネシアリアウ州における幼児の低体重に関連する要因を明らかにすること。  
方法：インドネシアリアウ州ペカンバル市にある124の幼児保健施設を訪れた3才未満の幼児とその親を対象に体重測定及び質問紙調査を実施した。対象は多段階無作為抽出法にて選定した。調査項目は基本属性、幼児の過去の健康問題、現在までの栄養摂取状況、幼児の食に関する母親の育児行動で、低体重予測因子の同定にはロジスティック重回帰分析を用いた。  
結果：幼児の平均年齢は $23.2 \pm 7.2$ ヶ月で、15.1% (n=62)が低体重であった。過去3ヵ月間の健康問題は発熱 (65.5%)、摂食障害 (14.6%)、摂食拒否 (8.8%)であった。母親の95.3%は様々な食品を幼児に日常的に提供している一方で、食事時にスナック類を与えている者が61.8%、食事前にミルクを与える習慣のある者が58.9%いた。生後6か月までの完全母乳 (exclusive breastfeeding, EBF)を行っていない者は53.3%であった。解析の結果、幼児の低体重に有意な関連がみられた要因は、過去3ヶ月間に摂食拒否があったこと (OR=3.76)、食事前にミルクを与える習慣があること (OR=1.92)、生後6か月までに補完食品を与えたことがあること (OR=1.94)であった。従って、幼児の低体重予防には授乳期からの介入が重要であると考えられる。