

## The Dominant Factors of Underweight Incidence in Children Age 25-30 Months in Gambir and Sawah Besar Districts, Central Jakarta, in 2019

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**Abstract-** Underweight is a nutritional problem that children under five years old generally experience due to some factors, such as energy and nutrient intake, infectious disease, exclusive breastfeeding practices, family characteristics, and others. This study intended to determine the underweight proportion, the relationship between these factors, and the dominant factor in the incidence of underweight. The research was conducted with a cross-sectional design on children aged 25-30 months in Gambir and Sawah Besar District, Central Jakarta. The total sample of the study was 121 children, using secondary data. The results showed that the percentage of children whose nutritional status was underweight was 25.6%. The results of the analysis using the chi-square test indicated that there were significant differences in energy intake (p-value= 0.027), carbohydrate intake (p-value= 0.035), father's education level (p-value= 0.045), family income (p-value= 0.004) towards underweights. The multiple logistic regression analysis results indicated that carbohydrate intake was the dominant factor for underweight (OR= 7.7).

**Keywords--** Carbohydrate Intake, Child Malnutrition, Energy Intake, Underweight

### 1. Introduction

Underweight is acute malnutrition that becomes a health problem as it seriously impacts the growth and development of children. These impacts include decreased endurance, decreased body function, vulnerability to injury, and infectious diseases.(1)(2)In addition, being underweight which does not receive prompt and appropriate treatment can cause other nutritional problems such as wasting or stunting.(3)

According to UNICEF, in 2011, there were 101 million children under five years old (toddlers) in the world, equivalent to 16% of children under five suffering from underweight. In 2011, the largest underweight prevalence was in South Asia, with 59 million or 33% of the total number of children under five years old and followed by Sub-Saharan Africa at 30 million or equivalent to 21%.(4)Based on data from the 2018 Basic Health Research (Riskesdas), 17.7% of children aged 0-59 months were underweight in Indonesia. In the Special Capital City Region of Jakarta (DKI, Jakarta) Province, in 2018, 14.3% of children aged 0-59 suffered from underweight,(5)while in the Central Jakarta area in 2017 it was recorded as much as 18.1%.(6)For the WHO,(7) the cut-off prevalence of underweight was categorized as a health problem, namely low prevalence (< 10%),

moderate prevalence (10-19%), high prevalence (20-29%), very high prevalence (> 30%). The prevalence of underweight in Central Jakarta was categorized as moderate prevalence.

As noted by UNICEF,(8)the causes of underweight consisted of two categories: direct and indirect. The direct cause of being underweight was insufficient nutritional intake (energy intake, carbohydrate intake, protein intake, fat intake). Energy intake was related to nutritional status (underweight)(9)(10) Low energy intake could increase children's risk of being underweight by 2.9 times.(11)Energy intake below its normal requirement for a long time could cause children to suffer from Chronic Energy Deficiency (CED)(12). Carbohydrate intake was related to nutritional status (underweight).(13)There was a relationship between carbohydrate intake and nutritional status (underweight) since carbohydrate intake affects energy intake in the body. Insufficient energy intake could cause weight loss in toddlers to experience underweight. Insufficient protein intake could lead to a higher risk of disease in toddlers, and the risk of being underweight is about 1-3.5 times greater. Protein intake with nutritional status (underweight) was related to protein's function in the immune system. Low protein intake will cause children to have weak immunity, making them susceptible to disease.(14)Diseases that usually occur in toddlers, such as infectious diseases, were direct causes of being underweight.(11)Fat intake and nutritional status (underweight) were associated with energy intake into the body.(15)(12)Low energy intake can also causes insufficient absorption of fat-soluble vitamins (A, D, E, K) and changes can occur in body mass and tissue.(12)Infectious diseases were significantly associated with nutritional status (underweight).(16)Although another study has shown the opposite result,(17)infectious diseases increase the risk of underweight toddlers by 2.8 times. Underweight children had an 8.4 times higher risk of developing Upper Respiratory Infection (URI) and six times higher risk of pulmonary Tuberculosis (TB) disease.(16)

Other than direct factors, there are also indirect factors that cause underweight, namely history of Early Initiation of Breastfeeding (EIBF), history of exclusive breastfeeding, birth weight of the baby, family characteristics (mother's nutritional knowledge, parents' education level, parent's occupation, family income, number of family members). One study on EIBF indicated that EIBF had a relationship with the nutritional status of toddlers,(18)while another study(19)showed the opposite result. The unclear relationship between EIBF and nutritional status (underweight) might be because of other causes that affect children's nutritional status, for example, clean living behavior that is not implemented and an unsanitary home environment.

Exclusive breastfeeding had a relationship with nutritional status (underweight),(20)(21)but other studies(22)showed the opposite results. The unclear relationship between exclusive breastfeeding and nutritional status might be related to the quantity and quality of breast milk. Exclusive breastfeeding must consider the nutritional status of the mother. Mothers with low nutritional status tend to have less energy, protein, and volume of breast milk than mothers with good nutritional status. Children whose mothers were malnourished only received breast milk within six months will have insufficient nutritional intake, which causes the child to be underweight. (23)Underweight at birth increased the risk of underweight children by 2.9 times.(24)The body resistance of children with low birth weight (LBW) tended to be weaker than normal children, so they are susceptible to infections;(25)there was a relationship between maternal nutritional knowledge and nutritional status (underweight).

There was a clear relationship between maternal nutrition knowledge and children's nutritional status regarding mothers' parenting patterns in feeding their children. Mothers with good nutritional

knowledge could choose and provide food according to their children's nutritional needs.(26)(27)In addition, mothers with good nutrition knowledge generally have good parenting patterns.

The education level of the father and mother had a relationship with nutritional status (underweight) in terms of the method of feeding.(28)(29)Parents with low levels of education tended to provide foods that could not meet their children's nutritional needs(29)Parent's occupation was significantly associated with nutritional status (underweight),(28)(16)however, the different research(30)showed the opposite result. Even though there was no significant relationship, there was a tendency for mothers who do not work to have more babies with underweight nutritional status than working mothers. It might be because working mothers have income that can increase the family's purchasing power in buying food for their children.

On the other hand, housewives could not help with family finances, so they were often unable to meet the nutritional needs of their children. Therefore, family income was significantly related to nutritional intake.(31)meanwhile, another study(29)indicated that family income was related to nutritional status (underweight). The relationship between family income and children's nutritional status (underweight) was related to food purchasing power. Compared to its nutritional value, low-income families tended to buy food from an economic perspective, so that their nutritional intake was insufficient. Compared to families with higher incomes and the Regional Minimum Wage (RMW), families with income <RMW had a 3.2 times higher risk of insufficient nutritional intake for their family members.(25)It was the reason why children with underweight nutritional status were more common in low-income families.

The number of family members had a relationship with nutritional status (underweight). Children with underweight nutritional status were more common among toddlers with many family members.(29)Compared to families with few members, families with many members had a four times higher risk of starvation and a five times higher risk of malnutrition.(32)Therefore, families with many children often resulted in a lack of mother's attention to parenting, especially the food provided can affect the nutritional status of the child.(10)

This study aimed to determine the dominant factor in the incidence of underweight in children aged 25-30 months in Gambir and Sawah Besar Districts, Central Jakarta, in 2019.

## 2. Methods

This study used quantitative methods. The type of research was descriptive with a cross-sectional approach.Primary data in a study entitled "*Hubungan Pemberian Susu dengan Kejadian Stunting pada Anak Usia 25-30 Bulan di Jakarta Pusat* (The Relationship Between Breastfeeding and the Incidence of Stunting in Children Aged 25-30 months in Central Jakarta)"(33) was used in this study, with the independent variables were nutritional intake (energy intake, carbohydrate intake, fat intake, protein intake), infectious diseases, history of EIBF, history of exclusive breastfeeding, birth weight, family characteristics (mother's nutritional knowledge, parents' education level, parents' occupation, family income and the number of family numbers) and the dependent variable was the incidence of underweight in children aged 25-30 months. The research was conducted in Gambir and Sawah Besar Districts, Central Jakarta. The research study population was toddlers aged 25-30 months in 16 Integrated Healthcare Centers and nine selected urban villages in Central Jakarta in 2019. The research sample that has met the inclusion criteria was toddlers aged 25-30 months and biological toddlers from mothers who were willing to be interviewed, while the exclusion criteria (toddlers aged 25-30 months who have physical disorders, such as leg disorders and spinal

disorders), thus the research subjects were under the research needs (eligible subjects), totaling 121 samples.

This study used a questionnaires to obtain information related to infectious disease variables, history of EIBF, history of exclusive breastfeeding, birth weight, family characteristics (knowledge of maternal nutrition, parental education level, parental occupation, family income, the number of family members), and the data contained in the food recall 1x24 hours was used to find out information on nutritional intake (energy intake, carbohydrate intake, fat intake, protein intake). The scale used on the dependent variables was underweight. Whereas, a categorical scale was used on the independent variables, which were nutritional intake (energy intake, carbohydrate intake, fat intake, protein intake), infectious diseases, history of EIBF, history of exclusive breastfeeding, birth weight, family characteristics (mother's nutritional knowledge, parent's education level, parent's occupation, family income and the number of family members).

The analysis carried out in this study was univariate analysis to determine the description of each variable, bivariate analysis using the Chi-Square test with the significance limit of the test used was 0.05, and multivariate analysis with multiple logistic regression tests.

### 3. Findings

Characteristics of respondents based on the study findings showed that the highest frequency of nutritional status of children aged 25-30 monthshad poor nutritional status, as much as 25.6%. Energy intake in the very low category was 44.6%, carbohydrate intake was in the very low category as much as 62%, fat intake in the very low category was 31.4%, and protein intake in the very low was 5.8%. Children with birth weight less than 2500 grams by 5.8% and maternal nutrition knowledge with less value (score > 60) by 6.6%. The parents' education level percentage was low, less than 50%. Father's work history mainly was laborers/employees/private employees (72.7%). The percentage of the work history of mothers who did not work was 79.3%, family income < RMW Jakarta was 60.3%, and the number of family members who were > four people was 29.8%.

**Table 1. Characteristics of the Respondents (n=121)**

<b>Variables</b>	<b>Percentages (%)</b>
<b>Nutritional Status (BB/U)</b>	
<i>Moderate Underweight</i> (Undernourished)	25.6
Not <i>Underweight</i> (Normal)	74.4
<b>Energy Intake</b>	
Very Low (< 70% RDA)	44.6
Low (70 - < 100% RDA)	28.9
Normal (100-130% RDA)	14
High (> 130% RDA)	12.4
<b>Carbohydrate Intake</b>	
Very Low (< 70% RDA)	62
Low (70 - < 89% RDA)	16.5
Normal (90-119% RDA)	17.4
High (> 120% RDA)	4.1
<b>Fat Intake</b>	
Very Low (< 70% RDA)	31.4

Low (70 - < 89% RDA)	20.7
Normal (90-119% RDA)	21.5
High (> 120% RDA)	26.4
<b>Protein Intake</b>	
Very Low (< 80% RDA)	5.8
Low (80 - < 100% RDA)	9.1
Normal (100-120% RDA)	5.8
High (> 120% RDA)	79.3
<b>History of Infectious Disease (URI)</b>	
Yes	22.3
No	77.7
<b>History of Infectious Disease (Diarrhea)</b>	
Yes	11.6
No	88.4
<b>History of EIBF</b>	
Yes	52.1
No	47.9
<b>History of Exclusive Breastfeeding</b>	
Four months	9.9
Five months	5.8
Six months	84.3
<b>Birth Weight</b>	
< 2500 grams	5.8
2500 – 3000 grams	46.3
> 3000 grams	47.9
<b>Maternal Nutrition Knowledge</b>	
Less (score < 60)	6.6
Enough (score 60-80)	76
Good (score > 80)	17.4
<b>Father's Education Level</b>	
Not Completed in Primary School	3.3
Completed Primary School	5.8
Completed Secondary School	23.1
Completed Higher Secondary School	56.2
Completed Diploma	1.7
Completed Bachelor and Higher	9.9
<b>Mother's Education Level</b>	
Not Completed in Primary School	3.3
Completed Primary School	9.1
Completed Secondary School	23.1
Completed Higher Secondary School	52.1
Completed Diploma	7.4
Completed Bachelor and Higher	5
<b>Father's Occupation</b>	
Not Working	4.1
Civil Servant / Army / Police	0
Entrepreneur (own business)	23.1
Labor / Employee / Private Employee	72.7

Freelance	0
<b>Mother's Occupation</b>	
Not Working	79.3
Civil Servant / Army / Police	0.8
Entrepreneur (own business)	5
Labor / Employee / Private Employee	14.9
Freelance	0
<b>Family Income</b>	
Below the RMW Jakarta	60.3
Above or the same as RMW Jakarta	39.7
<b>Number of Family Members</b>	
≥ 4 people	29.8
< 4 people	70.2

The bivariate analysis of the direct effect of underweight results is shown in Table 2. The table shows that the proportion of underweight children was greater in children with lower energy intake (32.8%) than children with sufficient energy intake (9.1%). The bivariate analysis results with chi-square test obtained p-value= 0.027, indicating a significant relationship between energy intake and underweight. The OR (Odd Ratio) results were obtained at 4.4, meaning that children with low energy intake were at risk of experiencing underweight 4.4 times higher than children with sufficient energy intake. Research also showed that the proportion of underweight children was greater in the group of children with low carbohydrate intake or <90% RDA (30.5%), compared to children with sufficient carbohydrate intake or >90% RDA (7.7%). The chi-square test results obtained p-value= 0.035, indicating a significant relationship between carbohydrate intake and underweight. The OR result was 5.2, meaning that children with low carbohydrate intake were at risk of being underweight 5.2 times higher than children with sufficient carbohydrate intake.

Table 2. also shows that the indirect effect of underweight incidence was greater in the group of children whose fathers have a low education level (38.5%) compared to children whose fathers have a high education level (19.5%). Bivariate analysis with chi-square test obtained p-value= 0.045, indicating a significant relationship between father's level of education and underweight. The OR result was 2.5, meaning that children who have a father with low levels of education were at risk of being underweight 2.5 times higher than children whose fathers have a high level of education.

This study also showed that the proportion of underweight children was greater in the group of children with family income < RMW (35.6%), compared to children with family income ≥ RMW (10.4%). The chi-square test results obtained p-value= 0.004, indicating a significant relationship between family income and underweight. The OR result was 4.7, meaning that children with family income < RMW were at risk of being underweight 4.7 times higher than children with family income ≥ RMW.

**Table 2. Characteristics of Respondents based on Underweight Nutritional Status of Children**

Variables	Underweight				Total		OR (95% CI)	P-value
	Yes		No		n	%		
	n	%	n	%				
<b>Energy Intake</b>								
Low (< 100% RDA)	28	31.8	61	68.5	89	100	4.4 (1.246 – 15.801)	0.027*

Sufficient (> 100% RDA)	3	9.1	29	90.6	32	100		
<b>Carbohydrate Intake</b>								
Low (< 90% RDA)	29	30.5	66	69.5	95	100		
Sufficient (> 90% RDA)	2	7.7	24	92.3	26	100	5.2 (1.168 – 23.80)	0.035*
<b>Fat Intake</b>								
Low (< 90% RDA)	21	33.3	42	66.7	63	100		
Sufficient (> 90% RDA)	10	17.2	48	82.8	58	100	2. (41.016 – 5.668)	0.069
<b>Protein Intake</b>								
Low (< 100% RDA)	7	38.9	11	61.1	18	100		
Sufficient (> 100% RDA)	24	23.3	79	76.7	103	100	2.1 (0.732 – 5.998)	0.239
<b>Infectious Disease (URI)</b>								
Yes	8	29.6	19	70.4	27	100		
No	23	24.5	71	75.5	94	100	1.3 (0.502 – 3.363)	0.771
<b>Infectious Disease (Diarrhea)</b>								
Yes	4	28.6	10	71.4	14	100		
No	27	25.2	80	74.8	107	100	1.1 (0.343 – 4.091)	0.753
<b>Birth Weight</b>								
LBW (< 2500 grams)	4	57.1	3	42.9	7	100		
Not LBW (> 2500 grams)	27	23.7	87	76.3	114	100	4.2 (0.905 – 20.404)	0.070
<b>Father's Education Level</b>								
Low	15	38.5	24	61.5	39	100		
High	16	19.5	66	80.5	82	100	2.5 (1.107 – 6.003)	0.045*
<b>Mother's Education Level</b>								
Low	16	37.2	27	62.8	43	100		
High	15	19.2	63	80.8	78	100	2.5 (1.078 – 5.744)	0.051
<b>Family Income</b>								
< RMW Jakarta	26	35.6	47	64.4	73	100		
≥ RMW Jakarta	5	10.4	43	89.6	48	100	4.7 (1.677 – 13.496)	0.004*

\*Significant (p-value < 0,05)

The results of bivariate selection showed that the variables included in the multivariate modeling (p-value < 0.25) were energy intake, carbohydrate intake, fat intake, protein intake, birth weight, father's education level, mother's education level, and family income. The variables that allow multicollinearity to occur were excluded (energy intake). After conducting the confounding test, the final modeling of the multiple logistic regression analysis was obtained in Table 3.

**Table 3. Multiple Logistic Regression Analysis Modeling Results**

Coef Variables	B	P-value	OR	95% CI
Carbohydrate Intake	2.046	0.012	7.7	1.563 – 38.314
Birth Weight	1.850	0.053	6.3	0.977 – 41.387
Father’s Education Level	0.675	0.203	1.9	0.695 – 5.542
Mother’s Education Level	0.536	0.295	1.7	0.627 – 4.653
Family Income	1.623	0.006	5.0	1.610 – 15.956

Based on the results of the multivariate analysis shown in Table 3, it was found that the variable carbohydrate intake was the dominant factor in the incidence of underweight with an OR of 7.7, after controlling for variables, such as birth weight, family income, father’s education level, and mother’s education level as confounding variables.

#### 4. Discussions

##### 4.1. Underweight

Based on the research’s findings, it was shown that 25.6% of children aged 25-30 months were underweight, in the category of undernourished. The analysis results showed that the percentage of underweight was greater when compared to the 2018 Riskesdas data. According to the 2018 Riskesdas data, DKI Jakarta Province recorded as many as 14.3% of children aged 0-59 months suffering from underweight.(5) Using the WHO classification, the prevalence of underweight of 25.6% was high. Underweight was caused by inadequate nutritional intake and infectious diseases that lasted for a short period.(8) Underweight problems need to be treated quickly and appropriately because they can cause other nutritional problems such as wasting or stunting.(3) Another negative impact was impaired child development, such as decreased immune system, decreased pituitary gland function, thyroid, gonads, susceptibility to injury and infectious diseases, and more impacts (disability and death). (1)(2)(34)(35) Furthermore, inadequate energy intake that lasts a long time can cause children to suffer from chronic energy deficiency (CED).(12)

##### 4.2. Carbohydrate Intake as a Dominant Factor for Underweight

The results of multivariate analysis showed that carbohydrate intake had the highest OR of 7.7, so it can be concluded that carbohydrate intake was the dominant factor in the incidence of underweight in children aged 25-30 months in Gambir and Sawah Besar, Central Jakarta. Children with low carbohydrate intake are at risk of being underweight by 7.7 times higher than children with sufficient carbohydrate intake.

Carbohydrates, the primary glucose source is the body’s main energy source. Carbohydrates are the first energy source for all cells, especially the brain, quickly broken down and ready to be used. Adequate carbohydrate intake affects energy intake. Based on the recommendation, 45-65% of energy needs should be met from carbohydrate sources. The largest sources of carbohydrates are in plant-based foods such as rice, cassava, potatoes, wheat flour, sugar, honey, nuts, vegetables, fruits, and others, both in pure form and in processed products. Carbohydrates can also be obtained from animal sources such as dairy products or their derivatives in milk sugar called lactose; by consuming this milk, two benefits will be obtained, both intake of protein and carbohydrates sources. Processed food products that are a source of carbohydrates in a certain amount can be obtained easily and at affordable prices. Children can easily like these products by modifying and adding favorite flavorings. The portion size can be adjusted according to the age and development

of the child. The range of 3-4 servings of carbohydrate sources per day as a staple food can meet the percentage requirement.

Besides being a source of energy, carbohydrates also prevent protein from being used as an energy reserve. When the body gets low carbohydrate intake, it will find it difficult to produce energy. It is because glycogen reserves as energy producers are depleted, causing the body to convert protein into glucose. Moreover, the body will break down internal protein stores (muscle tissue) before fat stores if carbohydrate intake is inadequate. Therefore, it is essential to maintain carbohydrate intake to prevent protein breakdown so that protein can be used to grow and repair body tissues. Accordingly, it can be concluded that maintaining adequate carbohydrate intake can prevent the breakdown of fat and protein stores so that fat and protein can be used as its functions, namely dissolving some vitamins, protecting body tissues and organs forming body tissues (muscle tissue), producing immunity and others.(36)

#### **4.3. Relationship between Parents' Education Level and Nutritional Status (Underweight)**

The father's education was associated with family income based on previous studies. In that study, it was proven that there was a significant relationship between a father's work and family income ( $p$ -value= 0.018). Therefore, fathers with higher education had greater opportunities to work and improve the family economy to meet the family's nutritional needs. Furthermore, if the father who acts as the head of the family have a higher education could make the right decisions regarding understanding child care, using health service facilities, and maintaining a clean environment.(37)

#### **4.4. Relationship between Family Income and Nutritional Status (Underweight)**

In this study, family income was assessed from the total income of all family members based on the RMW DKI Jakarta (Rp 3,940,973). The bivariate analysis results showed a significant relationship between family income and underweight. Children who have families with income < RMW had a 4.7 times higher risk of being underweight. These results were in line with other studies(31) that stated a significant relationship between the level of family income and nutritional intake. Another study also showed that malnutrition was more prevalent in children under five from families with income < RMW.(29) Moreover, family income led to differences in purchasing power in meeting the nutritional needs of children and members of the same family.

Central Bureau of Statistics of DKI Jakarta points out the data that the Number of Beneficiaries (head of household) and the Food Social Assistance Budget in DKI Jakarta Province 2018 was 188,101 recipients of heads of family and the realization of the budget was Rp 20,691,110,000.00; while in Central Jakarta where this research was conducted, 18,605 recipient families have been distributed and the budget realization was Rp 2,046,550.00. It means that each household received Rp 110,000.00 to help procure food for their families. This food social assistance was expected to help ease the burden of food expenditure. However, considering that the percentage of children with family income < RMW who were underweight was greater than the percentage of children with family income  $\geq$  RMW who are underweight, it seems that this assistance had not been enough to help overcome the problem of food shortages in the region. Still from the same data source, the poverty line data in Central Jakarta was the income indicator of rupiah/capita/month of Rp 580,080.00 in 2018, Rp 625,177.00 in 2019, and Rp 672,328.00 in 2020. The percentage of Central Jakarta's population living below the poverty line was 3.50% in 2018, 3.68% in 2019, and 4.51% in 2020, a number that continues increasing every year.

## 5. Conclusion

The proportion of underweight in children aged 25-30 months in Gambir and Sawah Besar, Central Jakarta in 2019 was 25.6%, with the most descriptions of very low energy intake (44.6%) and very low carbohydrate intake (62%). Carbohydrate intake is the dominant factor for underweight (OR= 7.7) after controlling for family income, birth weight, father's education level, and mother's education level as confounding variables.

## 6. Suggestions

The evidence from this study suggests that related parties to provide education to the community through health workers and cadres about the importance of fulfilling nutritious food for toddlers as needed. Based on the Balanced Nutrition Message, this fulfillment should be a modification of various foods that are sources of carbohydrates, proteins, and fats. The diversity of carbohydrate sources from food can be adjusted according to purchasing power according to the ability of family income. This menu can then be combined with protein sources such as fish, eggs, milk, or others selected according to toddlers' preferences.

It is hoped that the Central Jakarta Regional Government can give better attention to families with incomes < RMW or below the poverty line so that this underweight problem can be immediately eradicated.

## 7. References

- [1] Mahan LK, Raymond JL. Krause's food & the nutrition care process. 14th ed. Elsevier; 2017.
- [2] Ali SM, Lindström M. Socioeconomic, psychosocial, behavioural, and psychological determinants of BMI among young women: differing patterns for underweight and overweight/obesity. *Eur J Public Health* [Internet]. 2006 Jun 1;16(3):324–30. Available from: <https://doi.org/10.1093/eurpub/cki187>
- [3] WHO. Interpretation guide [Internet]. Nutrition landscape information system (NLIS) Country Profile. 2017. 50 p. Available from: [www.who.int/nutrition](http://www.who.int/nutrition)
- [4] Bruns a, Turnbull CHS and D, Dolnicar S, Chapple A, Adorno T, Horkheimer M, et al. Scholar (10) [Internet]. Vol. 3, Mass Communication and Society. 1974. p. 349–83. Available from: <http://www.sciencedirect.com/science/article/pii/S0160738315000444>
- [5] Kemenkes RI. Profil Kesehatan Indonesia Tahun 2018. Jakarta: Kementerian Kesehatan Republik Indonesia; 2019.
- [6] Kemenkes RI. Hasil Utama Riskesdas 2018 | Badan Penelitian dan Pengembangan Kesehatan [Internet]. Jakarta: Kementerian Kesehatan Republik Indonesia; 2019. Available from: <https://www.litbang.kemkes.go.id/hasil-utama-riskesdas-2018/>
- [7] Turnbull CHS and D, Dolnicar S, Chapple A, Adorno T, Horkheimer M, Negus K, et al. Scholar (11) [Internet]. Vol. 10, Why We Need the Journal of Interactive Advertising. 2004. p. 349–83. Available from: <http://www.sciencedirect.com/science/article/pii/S0160738315000444>
- [8] UNICEF. UNICEF conceptual framework of malnutrition. 2015; Available from: [www.unicef.org](http://www.unicef.org)
- [9] Asrar M, Hadi H, Boediman D. Pola asuh, pola makan, asupan zat gizi dan hubungannya dengan status gizi anak balita masyarakat Suku Nuaulu di Kecamatan Amahai Kabupaten Maluku Tengah Provinsi Maluku. *J Gizi Klin Indones* [Internet]. 2009;6(2):84–94. Available from: <https://jurnal.ugm.ac.id/jgki/article/view/17716>
- [10] Diniyyah SR, Nindya TS. Asupan energi, protein dan lemak dengan kejadian gizi kurang pada balita usia 24-59 bulan di Desa Suci, Gresik. *Amerta Nutr* [Internet]. 2017;1(4):341–

50. Available from: <https://www.e-journal.unair.ac.id/AMNT/article/view/7139>
- [11] Rahim FK. Faktor risiko underweight balita umur 7-59 bulan. *KEMAS J Kesehat Masy* [Internet]. 2014;9(2):115–21. Available from: <https://journal.unnes.ac.id/nju/index.php/kemas/article/view/2838>
- [12] Barasi ME, Halim H. At a glance: ilmu gizi [Internet]. Erlangga; 2007. Available from: [https://www.worldcat.org/title/at-a-glance-ilmu-gizi-mary-e-barasi-alih-bahasa-hermin-halim/oclc/1027448993&referer=brief\\_results](https://www.worldcat.org/title/at-a-glance-ilmu-gizi-mary-e-barasi-alih-bahasa-hermin-halim/oclc/1027448993&referer=brief_results)
- [13] Puspasari N, Andriani M. Hubungan pengetahuan ibu tentang gizi dan asupan makan balita dengan status gizi balita (bb/u) usia 12-24 bulan. *Amerta Nutr* [Internet]. 2017;1(4):369–78. Available from: <https://www.e-journal.unair.ac.id/AMNT/article/view/7136>
- [14] Wong, H. J. et al. (2014). B public health 14(1): 1-10. Risk factors of malnutrition among preschool children in Terengganu, Malaysia: a case control study. 2014;
- [15] Nurcahyo K, Briawan D. Konsumsi pangan, penyakit infeksi, dan status gizi anak balita pasca perawatan gizi buruk. *J Gizi dan pangan* [Internet]. 2010;5(3):164–70. Available from: <https://journal.ipb.ac.id/index.php/jgizipangan/article/view/4565>
- [16] Pratiwi RH, Suyatno S, Aruben R. Faktor-faktor yang berhubungan dengan berat-kurang (underweight) pada balita di perkotaan dan perdesaan Indonesia berdasarkan data Riskesdas tahun 2013. *J Kesehat Masy* [Internet]. 2015;3(2):127–37. Available from: <https://ejournal3.undip.ac.id/index.php/jkm/article/view/11878>
- [17] Glenn JC, Walden HS, Guzmán-Marín E, del Refugio Gonzalez-Losa M, McIntosh A, Young AG, et al. Assessment of child, mother, and environmental factors associated with undernutrition in children less than five years old in a maya community in Yucatan, Mexico. *Int J Child Heal Nutr* [Internet]. 2014;3(4):204–12. Available from: <https://lifescienceglobal.com/pms/index.php/ijchn/article/view/2582>
- [18] Kartiningrum ED. Faktor risiko kejadian gizi kurang pada balita di Desa Gayaman Kecamatan Mojoanyar Mojokerto. *Hosp Majapahit (JURNAL Ilm Kesehat Politek Kesehat MAJAPAHIT MOJOKERTO)* [Internet]. 2015;7(2):67–80. Available from: <http://ejournal.stikesmajapahit.ac.id/index.php/HM/article/view/112>
- [19] Ridzal M, Hadju V, Rochimiwati S. Hubungan pola pemberian ASI dengan status gizi anak usia 6-23 bulan di Wilayah Pesisir Kecamatan Tallo Kota Makassar. *J MKMI*. 2013;1:1–12.
- [20] Widyastuti E. Hubungan Riwayat Pemberian ASI Eksklusif dengan Status Gizi Bayi 6–12 Bulan di Provinsi Nusa Tenggara Barat (NTB) Tahun 2007. [Depok]: Depok: Fakultas Kesehatan Masyarakat Universitas Indonesia; 2009.
- [21] Andriani R, Wismaningsih ER, Indrasari OR. Hubungan pemberian asi eksklusif dengan kejadian status gizi kurang pada balita umur 1–5 tahun. *J Wiyata Penelit Sains dan Kesehat* [Internet]. 2017;2(1):44–7. Available from: <http://www.ojs.iik.ac.id/index.php/wiyata/article/view/35>
- [22] Badriyah L, Syafiq A. The association between sanitation, hygiene, and stunting in children under two-years (an analysis of Indonesia’s Basic Health Research, 2013). *Makara J Heal Res* [Internet]. 2017;21(2):35–41. Available from: <https://scholarhub.ui.ac.id/mjhr/vol21/iss2/1/>
- [23] Fikawati S, Syafiq A, Karima K. Gizi ibu dan bayi. 2015; Available from: <http://litbang.kemkes.go.id:8080/handle/123456789/74852>
- [24] Gewa CA, Yandell N. Undernutrition among Kenyan children: contribution of child, maternal and household factors. *Public Health Nutr*. 2012;15(6):1029–38.
- [25] Septikasari M, Septiyaningsih R. Faktor yang mempengaruhi orang tua dalam pemenuhan nutrisi balita gizi kurang. *J Kesehat Al-Irsyad* [Internet]. 2016;9:25–30. Available from: <http://jka.stikesalirsyadclp.ac.id/index.php/jka/article/view/55>

- [26] Khotimah NN, Siregar R, Mardiana M. Hubungan pengetahuan gizi ibu dan pola makan balita dengan status gizi balita (12-59 bulan) di wilayah kerja puskesmas gandum kecamatan gandum - Palembang tahun 2010. *Publ Penelit Terap dan Kebijak* [Internet]. 2012;6(2). Available from: <https://www.ejournal.sumselprov.go.id/pptk/article/view/234>
- [27] Nurmaliza N, Herlina S. Hubungan pengetahuan dan pendidikan ibu terhadap status gizi balita. *J Kesmas Asclepius* [Internet]. 2019;1(2):106–15. Available from: <https://journal.ipm2kpe.or.id/index.php/JKA/article/view/578>
- [28] Muljati S, Budiman B. Risiko underweight pada balita terakhir di rumah tangga. *J Kedokt Yars*. 2008;16(2):141–8.
- [29] Sartika RAD. Analisis pemanfaatan program pelayanan kesehatan status gizi balita. *Kesmas J Kesehat Masy Nas (National Public Heal Journal)* [Internet]. 2010;5(2):90–6. Available from: <https://journal.fkm.ui.ac.id/kesmas/article/view/152>
- [30] Triatmaja NT. Status gizi bayi usia 6-12 bulan di kota Bogor tahun 2015 ditinjau dari pemberian makan dan sosiodemografi ibu. *Indones Bull Heal Res* [Internet]. 2017;45(1):37–44. Available from: <https://www.neliti.com/publications/74857/status-gizi-bayi-usia-6-12-bulan-di-kota-bogor-tahun-2015-ditinjau-dari-pemberia>
- [31] Afriyani R, Malahayati N, Hartati H. Faktor-faktor yang mempengaruhi kejadian wasting pada balita usia 1-5 tahun di puskesmas Talang Betutu Kota Palembang. *J Kesehat* [Internet]. 2016;7(1):66–72. Available from: <https://ejurnal.poltekkes-tjk.ac.id/index.php/JK/article/view/120>
- [32] Studdert LJ, Frongillo Jr EA, Valois P. Household food insecurity was prevalent in Java during Indonesia's economic crisis. *J Nutr* [Internet]. 2001;131(10):2685–91. Available from: <https://academic.oup.com/jn/article/131/10/2685/4686570>
- [33] Putri MSW. Pengaruh konsumsi susu dengan kejadian stunting pada anak usia 24 bulan di Kecamatan Duren Sawit tahun 2018= Influence of milk consumption with stunting event in 24-month child in District Duren Sawit East Jakarta year 2018. 2018;
- [34] Mamhidir AG, Ljunggren G, Kihlgren M, Kihlgren A, Wimo A. Underweight, weight loss and related risk factors among older adults in sheltered housing--a Swedish follow-up study. *J Nutr Health Aging* [Internet]. 2006;10(4):255–62. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/16886095>
- [35] Pahlevi AE. Determinan status gizi pada siswa sekolah dasar. *KEMAS J Kesehat Masy* [Internet]. 2012;7(2):122–6. Available from: <https://journal.unnes.ac.id/nju/index.php/kemas/article/view/2807>
- [36] Lutz CA, Mazur E, Litch N. *Nutrition and diet therapy* [Internet]. 6th ed. Philadelphia: FA Davis; 2014. Available from: [https://books.google.co.id/books?hl=en&lr=&id=bsBEBAQAQBAJ&oi=fnd&pg=PR3&dq=Nutrition+and+Diet+Therapy+6th+Ed&ots=3wQyhCIUrL&sig=x9rD4leVKqnhPjvf6l8LRAiZ4Rk&redir\\_esc=y#v=onepage&q=Nutrition+and+Diet+Therapy+6th+Ed&f=false](https://books.google.co.id/books?hl=en&lr=&id=bsBEBAQAQBAJ&oi=fnd&pg=PR3&dq=Nutrition+and+Diet+Therapy+6th+Ed&ots=3wQyhCIUrL&sig=x9rD4leVKqnhPjvf6l8LRAiZ4Rk&redir_esc=y#v=onepage&q=Nutrition+and+Diet+Therapy+6th+Ed&f=false)
- [37] Rosha BC, Hardinsyah H, Baliwati YF. Analisis determinan stunting anak 0-23 bulan pada daerah miskin di Jawa Tengah dan Jawa Timur. *Nutr Food Res* [Internet]. 2012;35(1):34–41. Available from: <https://www.neliti.com/publications/223475/analisis-determinan-stunting-anak-0-23-bulan-pada-daerah-miskin-di-jawa-tengah-d>

