

## Under-Two Children Hunger Levels in Indonesia

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### Abstract

**Objective:** To analyze the hunger level of toddlers under 2 years old using the Under-two Children Hunger Index (CHI).

**Methods:** This study used secondary data from the Indonesian Basic Health Survey 2018. This study focused on the development of measurement for under-two children hunger index (CHI) using six indicators of the prevalence of chronic energy deficiency in pregnant women; the prevalence of risk height of pregnant women; the prevalence of under-two children who never being breastfed; the prevalence of malnutrition for under-two children; the prevalence of wasting for under-two children; and the prevalence of stunting for under-two children. These six indicators were weighted differently and were calculated using the Principal Component Analysis (PCA) method.

**Results:** The calculation of CHI using loading factors as weighted indicators has a higher precision with the percentage of 94.12 percent. With a 2018 CHI score of 46.40, Indonesia is at a serious CHI level. From the 34 provinces in Indonesia, 47.06% of provinces are at an extremely alarming level, 8.82% are at an alarming level, 17.65% are at a serious level, 17.65% are at a moderate level, and 8.82% are at a low level. Efforts can be performed by the government to increase the CHI based on the 6 indicators mentioned above.

**Conclusion:** Based on this analysis, 25 provinces need attention in terms of the CHI level with six, three, and sixteen provinces suffered from a serious, alarming, and extremely alarming levels of CHI, respectively. Nevertheless, CHI is dynamic and should be updated annually to assess the province's achievement in eradicating hunger. This time-series data is very important to evaluate government programs and programs to accelerate the eradication of under-two children's hunger should focus on the six indicators in this study.

**Keywords:** Stunting, under-two children hunger index, wasting

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### Introduction

In 2015, all members of the United Nations committed to supporting global initiatives in eradicating poverty, reducing inequality, and protecting the environment. These global commitments produced the Sustainable Development Goals (SDGs) declaration containing 17 Goals and 169 targets that should be achieved in 2030. This paper exclusively

focuses on the second goal of SDGs: end hunger, achieve food security, and improved nutrition for all people in Indonesia, especially for those who are poor and vulnerable, including the baby. The measurement of multidimensional hunger at the national, regional, and global levels indicated that all countries over the world have had positive progress in hunger eradication since 2000, but that is still a big problem because 50 countries are still at a serious level of hunger.

To evaluate progress in hunger eradication, International Food Policy Research Institute (IFPRI) released the Global Hunger Index (GHI) report.<sup>1</sup> This yearly report explained hunger and food insecurity in countries

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over the world. GHI is a composite index produced by three dimensions from four indicators with the same weight. The first dimension is inadequate food supply with undernourishment indicator by FAO: the share of the population that is undernourished, whose caloric intake is insufficient. The second dimension is child under nutrition with two indicators which are child wasting and child stunting WHO. Child stunting is the share of under-five children who are wasted with low weight for their height reflecting acute nutrition and child stunting is the share of under-five children who have low height for their age reflecting chronic under nutrition. The third dimension is child mortality, the mortality rate of under-five children in a part of the reflection of the fatal mix of inadequate nutrition and unhealthy environments. This data was released by United Nations Children's Fund.

However, Aiga said that the same weighting method that was used by IFPRI in calculating GHI did not represent the weight for each dimension and indicator. Aiga suggested using different weighting for different dimensions, 2/3 for the first dimension, 2/9 for the second dimension, and 1/9 for the third dimension.<sup>2</sup> Then, Ibok *et al.*<sup>3</sup> developed GHI measurement to measure the vulnerability to the food insecurity index compiling three dimensions from twelve indicators with the same weighting. Some of those indicators also use in global hunger indicators. Whereas, te Lintelo *et al.*<sup>4</sup> measured the Hunger Reduction Commitment Index for a set of developing countries from nine equally weighted indicators.

Hunger is very susceptible for children. Jones, *et al.*<sup>5</sup> research suggests that families that are dealing with negative life, inadequate income, and social support are particularly vulnerable to children's hunger. Children's hunger can be affected by bad parenting style, especially for the 1000 first day of life movement. This period consists of 270 days (9 months) during pregnancy and 730 days (24 months) after the baby's birth. Nutritional problems during this period will cause difficulties in optimizing physical and cognitive development.<sup>6</sup> Age 0–24 months is a critical age for children. In this period, children need sufficient nutrition, not only in quantity but also quality, for achieving optimal weight and height of children. Under-two children's development and growth are determined for great children's development in the future.<sup>7</sup> At this age, under-two children's development

and growth can be observed easily because every child has the same development pattern at different velocities.<sup>8</sup>

Children's upbringing in breastfeeding and complementary feeding of the breastfed in the first year of children's life is very important for the development of each child's full human potential.<sup>9</sup> This point of view is the same as Balk *et al.*<sup>10</sup> research to inspect households having children one until three years of age. They concluded that the similarity of the household characteristics is a significant risk factor causing undernourishment, especially in breastfeeding duration and nutritious food. Indonesian awareness of breastfeeding should be increased. In 2018, there were only 67 of 100 babies aged zero until six months who got exclusive breasts. Whereas, Indonesian government regulation number 33 of 2012 concerning exclusive breastfeeding states that every mother should provide exclusive breastfeeding for every baby she had. The center of Data and Information, The ministry of health stated that exclusive breastfeeding is recommended in the first six months of a child's life because breast milk is not contaminated by everything worse for a baby's life and contains many nutrients needed by children at that age.<sup>11</sup>

Insufficient process in breastfeeding and complementary feeding of the breastfeeding for under-two children caused children to live a limited life, such as low height for children's age, slow brain development, and easy to get pain. These characteristics are known as stunting. Stunting is a failure condition in under-two children growth due to chronic malnutrition which has happened for a long time, from infancy until 2 years old. Now, the prevalence of stunting in Indonesia is relatively higher than in other middle-income countries in the world. Although this prevalence decreased in 2018, this prevalence exceeded the WHO stunting threshold amount by 20 points. The prevalence of stunting in 2018 is 30.8% in other words, 31 of 100 under-five children suffered from stunting.<sup>12</sup>

Based on the elucidations above, it concludes that so much research that told about hunger but there are still no studies about the measurement of hunger for under-two children. Is known that hunger in children can be affected by inadequate children up bridging, especially in 9 months during pregnancy and the first 24 months after the baby's birth, so in measuring the level of hunger, it is necessary to include the pregnant women as an indicator to compute the index. Based on these facts,

this study focuses on the development of measurement for CHI using six indicators, they are the prevalence of chronic energy deficiency in pregnant women; the prevalence of risk height of pregnant women; the prevalence of under-two children who never breastfed; the prevalence of malnutrition for under-two children; the prevalence of wasting for under-two children; and the prevalence of stunting for under-two children. These six indicators have different weights which are calculated using the PCA method. The objective of measuring the CHI is to evaluate the performance of all Indonesian provinces to achieve zero hunger. This indicator will be compared with Aiga weighting and IFPRI weighting then will be ranked from the highest index to the lowest one. The CHI measurement is expected to make government intervention can be focused and stay on target.

**Methods**

This study used secondary data from Indonesia Basic Health Survey named Riskesdas which was conducted in 2018. These data were used to evaluate the achievement of health indicators at the national and provincial levels. The targeted sample is 300.000 households within 30.000 census block-based which had done by Statistics of Indonesia with the Probability Proportional to Size (PPS) method using linear systematic sampling and two-stage sampling.

Indicators and variables that were selected in composing the hunger index for under-two children were based on Global Hunger Index by Concern Worldwide and Welthungerlife and growth and development for under-two children. These indicators were the prevalence of chronic energy deficiency in pregnant women ( $X_1$ ); the prevalence of risk height of pregnant women ( $X_2$ ); the prevalence of under-two children who have never been breastfed ( $X_3$ ); the prevalence of malnutrition for under-two children ( $X_4$ ); the prevalence of wasting for under-two children ( $X_5$ ); and the prevalence of stunting for under-two children ( $X_6$ ). All of these indicators are data at the province level.

After selecting the indicators, their value would be standardized by z-score and distance to scale (0–100). The next step is to determine the weight for each indicator by using the factor analysis method. The data should have multivariate normal distribution tested by the Royston method. Based on Korkmaz’s statement, the Royston method is used to

determine the distribution of the multivariate data. Royston test shows that the Royston statistical value is 11.2802 and the p-value is 0, 0852. It concluded that the data have a normal distribution.<sup>13</sup>

A weighting method was used to determine the relative importance of the indicators in forming the under-two children’s hunger index. Good ridge stated that it was necessary to calculate the weight for each indicator if they have some different indicators to compute an index.<sup>14</sup> The CHI index is constructed as follows:

$$CHI_i = \frac{\sum_{j=1}^{34} w_j x_{ji}}{\sum_{j=1}^{34} w_j} \quad (1)$$

Where  $CHI_i$  Under-two children are hunger index for i province and  $w_j$  are weight for indicator j (a result of loading factor enumeration). Weight enumeration for each indicator used the eigenvalue resulting from the principal component analysis method<sup>15</sup>. It used a maximum factor in the factoring process and the weight for each indicator was the proportion of its eigenvalue to the total eigenvalue. Table 1 below gives information about the weight of the indicators:

In Indonesia, there are 34 provinces. They are classified into 5 categories based on composite cut-off points. The composite cut-off point is calculated as follows:

$$K_j = \sum_{k=1}^6 w_j c_{jk} \quad (2)$$

Where  $j = 1, 2... 6$ ;  $k = 1, 2... 34$ ;  $K_j$  is the composite cut-off point of indicators and  $C_{jk}$  is the standardized value of indicator cut-off point.

The under-two Children Hunger Index scale shows the severity of toddlers under two years old hunger, from low to extremely alarming categories. The first category is for the provinces included with low hunger levels, the second category is for the provinces included with moderate hunger levels, the third category is the provinces with serious hunger levels, the fourth category is the provinces with an alarming level of hunger, and the last category is the provinces with extremely alarming hunger level. It is important to affirm that a province that is identified as having an alarming level of under-two children hunger does not mean that all under-two children are vulnerable to hunger. Then, a province that is identified with a low hunger level of under-two children does not mean that all of the under-two children resist hunger. The smaller index, the lower of under-two children’s hunger level.

**Table 1 Weight for Each Indicator**

Code	Indicator	Weight
X <sub>1</sub>	Prevalence of chronic energy deficiency in pregnant women	0.15
X <sub>2</sub>	Prevalence of risk height of pregnant women	0.11
X <sub>3</sub>	Prevalence of under-two children who never being breastfed	0.44
X <sub>4</sub>	Prevalence of malnutrition for under-two children	0.03
X <sub>5</sub>	Prevalence of wasting for under-two children	0.08
X <sub>6</sub>	Prevalence of stunting for under-two children	0.20

**Table 2 Correlation Result between X1, X2, X3, X4, X5, and X6**

Indicators	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>
X <sub>2</sub>	-0.108				
X <sub>3</sub>	0.124	-0.029			
X <sub>4</sub>	0.403*	0.333**	0.601*		
X <sub>5</sub>	0.243	0.345*	0.203	0.530*	
X <sub>6</sub>	0.247	0.112	0.311**	0.551*	0.468*

Note: \* Significant at the 5 percent level, \*\* Significant at the 10 percent level

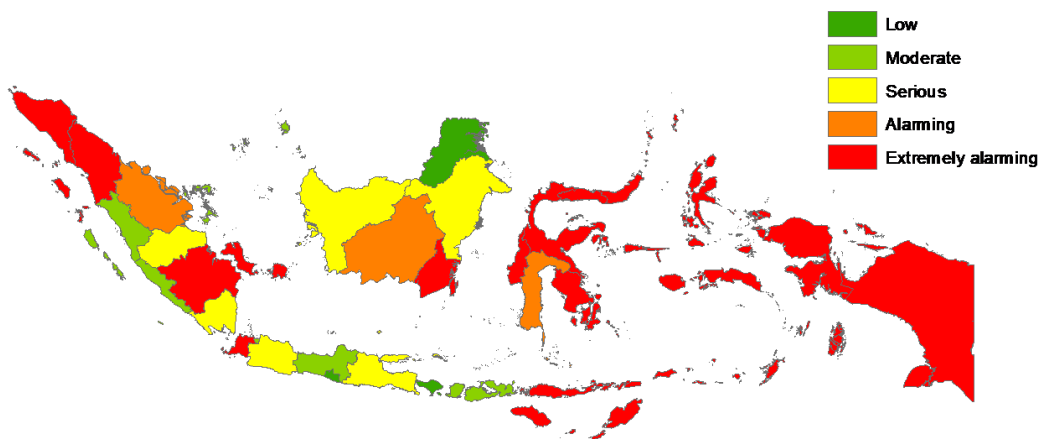
On the other one, the greater index, the more alarming under-two children’s hunger levels.

**Result**

Indonesia has 34 provinces with a 5.4 million population. The result of descriptive analysis from the indicators which is used to compute the under-two children hunger index showed that the average of chronic energy deficiency in pregnant women prevalence and risk height of pregnant women prevalence is 17.98% and 30.94%. These statistics mean that 18 of 100 pregnant women suffer from chronic energy deficiency and 30 of 100 pregnant women have a risk of height. On average, there are 7.81%

of under-two children who never breastfed, 4.39% of under-two children suffered from malnutrition, 12.17% of under-two children were wasting, and 4.52% of under-two children were stunting.

Table 2 shows the correlation result among the six indicators composed of under-two children’s hunger index. Based on that table, most of all indicators correlate with each other with a positive correlation. However, there are 2 negative correlations, they are the prevalence of chronic energy deficiency to the prevalence of risk height in pregnant women indicator and the prevalence of risk height in pregnant women to the prevalence of under-two children who have never been breastfed.



**Fig. 1 Under-two Children Hunger Index Map of Indonesia**

Table 3 Rank and Score of Under-two Children Hunger Index in Indonesia

Province	CHI <sub>IFPRI</sub> Score	CHI <sub>IFPRI</sub> Rank	CHI <sub>Aiga</sub> Score	CHI <sub>Aiga</sub> Rank	CHI <sub>loading</sub> factor Score	CHI <sub>loading</sub> factor Rank
Aceh	63.53	32	66.04	33	65.50	30
Sumatera Utara	57.56	29	64.34	32	68.81	32
Sumatera Barat	40.17	10	32.24	7	37.35	7
Riau	41.89	13	42.87	15	48.41	16
Jambi	53.06	23	43.78	16	46.28	14
Sumatera Selatan	49.72	22	47.95	22	56.18	23
Bengkulu	32.65	6	29.90	6	38.55	8
Lampung	38.15	8	34.57	11	43.32	11
Bangka Belitung	43.24	14	50.32	24	56.27	24
Kepulauan Riau	27.08	5	28.81	5	36.61	5
Jakarta	23.55	4	20.74	4	32.75	4
Jawa Barat	37.66	7	32.59	9	40.72	10
Jawa Tengah	40.26	11	32.48	8	36.67	6
Yogyakarta	15.14	1	5.65	1	12.17	1
Jawa Timur	46.11	17	39.43	12	44.86	12
Banten	43.66	15	39.90	13	53.90	20
Bali	18.59	3	16.63	2	23.72	3
Nusa Tenggara Barat	38.48	9	34.04	10	39.24	9
Nusa Tenggara Timur	69.87	33	59.24	28	60.62	28
Kalimantan Barat	46.21	18	44.59	17	45.17	13
Kalimantan Tengah	53.48	24	47.94	21	51.27	18
Kalimantan Selatan	48.16	19	46.44	19	53.74	19
Kalimantan Timur	41.39	12	39.95	14	47.02	15
Kalimantan Utara	16.81	2	18.07	3	23.13	2
Sulawesi Utara	49.50	21	63.87	31	64.51	29
Sulawesi Tengah	48.65	20	45.83	18	55.51	22
Sulawesi Selatan	46.08	16	47.73	20	50.53	17
Sulawesi Tenggara	54.79	27	55.78	26	59.68	27
Gorontalo	58.91	31	63.11	29	56.66	25
Sulawesi Barat	57.62	30	54.25	25	57.71	26
Maluku	77.10	34	89.36	34	84.35	34
Maluku Utara	55.77	28	63.49	30	66.16	31
Papua Barat	54.17	26	58.61	27	70.64	33
Papua	53.73	25	48.15	23	54.29	21

Table 4 Children Hunger Index Scale for Each Method

Weight	GHI Severity Scale				
	Low	Moderate	Serious	Alarming	Extremely Alarming
IFPRI's weight	<31.77	31.78-39.59	39.60-46.85	46.86-53.03	>53.04
Aiga's weight	<27.19	27.20-36.60	36.61-44.04	44.05-50.18	>50.19
Loading factor's weight	<31.76	31.77-40.61	40.62-47.28	47.29-53.71	>53.72



**Table 5 The APPER Value and the Accuracy of These Three CHI Calculations**

Weight	APPER (%)	Accuracy (%)
IFPRI's weight	14.71	85.29
Aiga's weight	11.76	88.24
Loading factor's weight	5.88	94.12

The next step is doing a CHI calculation using the IFPRI's weight, Aiga's weight, and the loading factor weight.<sup>2</sup> The weight that is used by IFPRI in CHI calculation is  $IKB_{IFPRI} = 1/6(X_1 + X_2 + X_3 + X_4 + X_5 + X_6)$  and the Aiga's one is  $IKB_{Aiga} = 1/18(X_1 + X_2) + 3/9(X_3 + X_4) + 1/9(X_5 + X_6)$ . Whereas, the weight resulting from principal component analysis is  $IKB_{loading\ factor} = 0,15X_1 + 0,11X_2 + 0,43X_3 + 0,03X_4 + 0,08X_5 + 0,2X_6$ . The result of these three methods is shown in Table 3.

The CHI from these three methods is classified into 5 categories based on the cutting point of each index calculation method. The higher level the higher hunger happened for each province. CHI scale for each method is explained in Table 4. After all of this step, the discriminant analysis method is used to test the accuracy of these three index calculations. Based on that classification, the *Apparent Error Rate* (APPER) is calculated to know about the accuracy of these three index methods (Table 4)

Based on Table 5, the method which is the highest accuracy is the loading factor's weight using the principal component analysis method. The percentage of accuracy is 94, 12% and on the other side, the percentage of the wrong classification is small, which is 5, 88%. These statistics values mean that 32 provinces are classified in the right classification. The APPER value and the accuracy calculation proved that the indicator weight calculated by the loading factor of the component principal analysis method is the best method because the weight of each indicator is different. This method is more objective and conscientious.

## Discussion

Based on index calculation using component principal analysis, Indonesia's Under-two Children Hunger Index is 46.40, which stays at a serious level. There are 5 provinces with the lowest score index: Yogyakarta (12.17), Kalimantan Utara (23.13), Bali (23.72), Jakarta (32.75), and Kepulauan Riau (36.61). On the other hand, 5 provinces with the highest score index are Maluku (84.35), Papua Barat (70.64),

Sumatera Utara (68.81), Maluku Utara (66.16), and Aceh (65.50). Fig. 1 shows the spread of under-two children hunger in Indonesia.

Of 34 provinces in Indonesia, there are three provinces (8.82%) suffered from a level of CHI that is low, six provinces (17.65%) suffered from a moderate level of CHI, six provinces (17.65%) suffered from a serious level of CHI, three provinces (8.82%) suffered from an alarming level of CHI and sixteen provinces (47.96%) suffered from an extremely alarming level of CHI. All provinces suffering from hunger in under two children are indicated by the prevalence of chronic energy deficiency in pregnant women, the prevalence of under-two children who never breastfed, and the prevalence of wasting and stunting for under-two children are high. The mean prevalence of chronic energy deficiency in pregnant women from all provinces suffering from extremely alarming CHI is 20.8%. It is different than the provinces which have a low and moderate levels of CHI. So, the policies can be focused on chronic energy deficiency in pregnant women. It is very important to reduce hunger both in under-two children and under-five children in Indonesia. For sure, children's growth and development are started when the baby is still in the womb. The result of this research is paralleled with the Balk *et al.*<sup>10</sup>

Another indicator that is very influential for CHI is the prevalence of under-two children who never breastfed with a mean is 9.9%. Breastfeeding is very important to support children's growth and development because it contains nutrition which is very important for the baby. This is paralleled with the previous research stating that the impacts of chronic energy deficiency on a fetus are stunted fetal growth, miscarriage, stillbirth, neonatal mortality, congenital defects, anemia on the infant, asphyxia intrapartum, and low birth weight.<sup>16,17,18,19</sup> The prevalence of wasting and stunting for under-two children will be getting worst if this indicator has never been eradicated. Based on these facts above, the treatment for pregnant women, children lactating, and under-two children malnutrition should be a major concern of the government,

especially in the provinces that are suffering from the extremely alarming level of CHI.

Anyhow, CHI was dynamic and should be updated every year to know about the achievement of every province in eradicating hunger. This time-series data is very important to evaluate government programs. The government can focus on six indicators to eradicate under-two children's hunger. The recommendation for the next research is to add other indicators which could be relevant to CHI. The research suggestion is for the

government who can increase the CHI value based on the 6 indicators that were used to calculate CHI. Then, CHI can be guidance in making policy and government programs.

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### References

1. IFPRI, Welthungerhilfe & Concern Worldwide. Global Hunger index: the inequalities of hunger; 2017.
2. Aiga H. Hunger measurement complexity: is the global hunger index reliable?. *Public Health*. 2015;129(9):1288-90.
3. Ibok OW, Osbahr H, Srinivasan C. Advancing a new index for measuring household vulnerability to food insecurity. *Food Policy*. 2019;84:10-20.
4. te Lintelo DJH, Haddad LJ, Leavy J, Lakshman R. Measuring the commitment to reduce hunger: A hunger reduction commitment index. *Food Policy*. 2014;44:115-28.
5. Jones SJ, Draper CL, Bell BA, Whitt O, Casey C, Draper C, et al. Child hunger from a family resilience perspective. *J Hunger Environmental Nutr*. 2018;13(3):340-61.
6. Kemenkes RI. Hasil Utama Riset Kesehatan Dasar (RISKESDAS). Jakarta: Kemenkes RI; 2018. Available from: <http://repository.bkpk.kemkes.go.id/3514/1/Laporan%20Riskasdas%202018%20Nasional.pdf>.
7. Prasetyawati AE. Kesehatan ibu dan anak (KIA) dalam millenium development goals (MDGs). Yogyakarta: Nuha Medika; 2012.
8. Soetjningsih GRIN, editor. Tumbuh kembang anak. Jakarta: EGC; 2013.
9. Wood CT, Witt WP, Skinner AC, Yin HS, Rothman RL, Sanders LM, et al. Effects of breastfeeding, formula feeding, and complementary feeding on rapid weight gain in the first year of life. *Acad Pediatr*. 2021;21(2):288-96.
10. Balk D, Storeygard A, Levy M, Gaskell J, Sharma M, Flor R. Child hunger in the developing world: An analysis of environmental and social correlates. *Food Policy*. 2005;30(5-6):584-611.
11. Kemenkes RI. Profil Kesehatan Indonesia Tahun 2019. Jakarta: Kemenkes RI; 2020.
12. Kemenkes RI. Kesehatan keluarga. In: Hardhana B, Sibuea F, W Winne, editors. Profil Kesehatan Indonesia Tahun 2019. Jakarta: Kemenkes RI; 2020. p. 97-150.
13. Korkmaz S, Goksuluk D, Zararsiz G. MVN: An R Package for Assessing Multivariate Normality. *The R Journal*. 2014;6(2):151.
14. Goodridge P. Methods explained: Index numbers. *Economic Labour Market Rev*. 2007;1(3):54-7.
15. Permatasari A, Notodiputro KA, Sadik K. Mengukur indeks kebahagiaan mahasiswa IPB menggunakan analisis faktor. *Xplore: J Statistics*. 2018;2(1):1-8.
16. Aubert AM, Chen LW, Shivappa N, Cooper C, Crozier SR, Duijts L, et al. Predictors of maternal dietary quality and dietary inflammation during pregnancy: an individual participant data meta-analysis of seven European cohorts from the ALPHABET consortium. *Clin Nutr*. 2022;41(9):1991-2002.
17. Wang T, Li L, Wu C, Cao R, Li Q, Yu L, et al. Body mass index and gestational weight gain are associated with maternal and neonatal outcomes based on Chinese Women. *J Diabetes Res*. 2021;2021:4542367.
18. Hautier S, Capmas P, Houllier M. Evaluation of the impact of body mass index <18.5 kg/m<sup>2</sup> in early pregnancy on obstetric and neonatal outcomes. *J Gynecol Obstet Hum Reprod*. 2022;51(8):102438.
19. Alfarisi R, Nurmalasari Y, Nabilla S. Status gizi ibu hamil dapat menyebabkan kejadian stunting pada balita. *Jurnal Kebidanan Malahayati*. 2019;5(3):271-8.