Determinants of underweight among children under five years in Sungai Malang Community Health Centers

Tri Tunggal[1], Eka Ariyani[1], Rusmilawaty[1], Nurrochmah[1], Mina Yumei Santi[2]*

[1] Department of Midwifery, Poltekkes Kemenkes Banjarmasin
Jalan Mistar Cokrokusumo No. 1A Banjarbaru, South Kalimantan 70714
[2] Department of Midwifery, Poltekkes Kemenkes Yogyakarta
Jalan Mangkuyudan MJ III/304, Mantrijeron, Yogyakarta, Daerah Istimewa Yogyakarta 55143
**E-mail*: mina.yumei@poltekkesjogja.ac.id

Abstract

Background: The most common nutritional problem in Indonesia is malnutrition. Children under five years are the age group that most often suffers from malnutrition. Underweight is a condition when a child's weight is below the normal range, indicated by a weight for age index of <-2 SD. Based on data from the health report for children under five years in North Hulu Sungai Regency in 2022, the percentage of underweight in Sungai Malang Community-Health Centers was 15.38% and in 2023 it will increase to 15.87%.
Objective: The aims of this research to determine the determinants of underweight among children under five years in Sungai Malang Community-Health Centers, North Hulu Sungai Regency, South Kalimantan Province.
Methods: The method used is cross-sectional. The sample used was 106 respondents from a total population of 1745 children under five years using the simple random sampling technique. Univariate data analysis used frequency distribution and bivariate using the Chi-Square statistical test.
Results: Underweight among children under five years as many as 36 respondents (33.96%), mother's education level in basic education (primary and secondary school) as many as 46 respondents (43.40%), family income < City Minimum Wage (IDR3,149,977) as many as 68 respondents (64.15%), history of infectious disease as many as 43 respondents (40.57%). Meals frequency in less category namely 45 respondents (42.45%). The number of large family members (≥ 7 people) is 18 respondents (16.98%). There is a relationship between family income level (p_{value} of 0.006 <0.05), history of infectious diseases (p_{value} of 0.001 <0.05), meals frequency (p_{value} of 0.000 <0.05), and number of family members (p_{value} of 0.023 <0.05) with the incidence of underweight.
Conclusion: There is a relationship between family income level, history of infectious diseases, meals frequency, and number of family members with the incidence of underweight in children under five years at Sungai Malang Community-Health Centers. Meals frequency is the strongest factor associated with being underweight.

Keywords: Underweight; children under five years; mother education; infectious diseases.

Faktor-faktor yang mempengaruhi *underweight* pada anak balita di wilayah kerja Puskesmas Sungai Malang

Abstrak

Latar Belakang: Masalah gizi di Indonesia yang terbanyak adalah gizi kurang. Anak balita merupakan kelompok umur yang paling sering menderita akibat kekurangan gizi. *Underweight* merupakan kondisi saat berat badan anak di bawah rentang normal yang

ditandai dengan indeks Berat Badan terhadap Umur (BB/U) <-2 SD. Berdasarkan data laporan kesehatan balita di Kabupaten Hulu Sungai Utara tahun 2022 persentase *underweight* di Puskesmas Sungai Malang sebesar 15,38% dan pada tahun 2023 naik menjadi 15,87%.
Tujuan: Tujuan penelitian untuk mengetahui faktor-faktor yang berhubungan dengan kejadian *underweight* pada balita di Puskesmas Sungai Malang, Kabupaten Hulu Sungai Utara, Provinsi Kalimantan Selatan.
Metode: Metode yang digunakan adalah *cross-sectional*. Sampel yang digunakan sebanyak 106 responden dari jumlah populasi 1745 balita dengan teknik *simple random sampling*. Analisis data univariat menggunakan distribusi frekuensi dan bivariat menggunakan uji statistik *Chi-Square*.
Hasil: *Underweight* pada anak balita sebanyak 36 responden (33,96%), pendidikan dasar sebanyak 46 orang (43,40%), pendapatan keluarga < Upah Minimum Kabupaten (UMK Rp3.149.977,00) sebanyak 68 orang (64,15%), riwayat penyakit infeksi sebanyak 43 orang (40,57%), frekuensi makan kurang sebanyak 45 orang (42,45%). Jumlah anggota keluarga besar (≥ 7 orang) sebanyak 18 orang (16.98%). Terdapat hubungan antara tingkat pendapatan keluarga (p_{-value} 0,006 <0,05), riwayat penyakit infeksi (p_{-value} 0,001 <0,05), frekuensi makan (p_{-value} 0,000 <0,05), jumlah anggota keluarga (p_{-value} 0,023 <0,05) dengan kejadian underweight.
Kesimpulan: Terdapat hubungan antara tingkat pendidikan ibu, pendapatan keluarga, riwayat penyakit infeksi, frekuensi makan, dan jumlah anggota keluarga dengan kejadian *underweight* pada balita di wilayah kerja Puskesmas Sungai Malang. Frekuensi makan merupakan faktor terkuat yang berhubungan dengan kejadian *underweight*.

Kata kunci: Berat badan kurang; balita; pendidikan ibu, penyakit menular.

INTRODUCTION

One of the health parameters assessed in the Sustainable Development Goals (SDGs) in Indonesia is the nutritional status of children under five years. The most common nutritional problem in Indonesia is malnutrition. Children under five years are the age group that most often suffers from malnutrition or among the most nutritionally vulnerable groups. In the developing countries, children aged 1-5 years are the most vulnerable to malnutrition. Children usually suffer from various infections and low nutritional status (1). By 2025, the prevalence of underweight in children is one of the targets to be achieved in eliminating all forms of malnutrition. The nutritional status of children under five years can be assessed through anthropometric measurements. In children's anthropometric standards, underweight is a condition when a child's weight is below the normal range marked by a weight-to-age index of < -2 standard deviations (SD) (1).

Based on the results of the 2022 Indonesian Nutrition Status Study, it is known that the prevalence of underweight increased every year, in 2022 to 17.1% which was previously 17% in 2021, and in 2019 it was 16.3% (1). The prevalence of underweight children under five years in South Kalimantan Province in 2021 was 24.3%, decreasing

by 21.7% in 2022. However, this figure is still above the average prevalence of underweight in children under five years nationally (17.1%). The prevalence of underweight in North Hulu Sungai Regency in 2021 was 23.5% and increased in 2022 by 32.5%, and this figure is the highest incidence rate of underweight in South Kalimantan Province, so cross-sectoral cooperation efforts are still needed to reduce the number of underweight children under five years (1).

Based on the Health Profile of South Kalimantan Province, the percentage of underweight among children under five years based on weight/age by regency in 2023, the highest percentage is found in 3 regencies, namely North Hulu Sungai Regency (23.5%), Banjar Regency (17.9%), and Balangan Regency (17.7%) (2). Based on health reports for children under five years in North Hulu Sungai Regency in 2023, the Sungai Malang Community Health Centers is ranked third as the largest contributor to the number of underweight cases, namely 380 children under five years (3). In addition, the percentage of underweight among children under five years in the work area of the Sungai Malang Community Health Centers has increased in the last 2 years, in 2022 the percentage of underweight is 15.38% and in 2023 it will increase to 15.87% while the target underweight indicator in 2023 in North Hulu Sungai Regency is 13%. The problem of malnutrition in children under five years can be influenced by two factors, namely direct and indirect factors. The direct causative factors that affect malnutrition are the food intake of children under five years and infectious diseases such as upper respiratory tract infection and diarrhea. Meanwhile, indirect factors are the level of education, family income, maternal nutritional knowledge, number of family members, food availability, and environmental sanitation hygiene (4). The aims of the study was to find out the factors related to the incidence of underweight in children under five years at the Sungai Malang Community Health Centers, North Hulu Sungai Regency, South Kalimantan.

MATERIALS AND METHODS

The research design is observational analytic with a cross-sectional approach. The sampling technique uses probability sampling technique with simple-random sampling. The population of children under five years at Sungai Malang Community Health Centers is 1745 people. The number of samples is determined based on Slovin tolerance formula with an error of 10%, a minimum sample size of 95 children under five years is obtained. The estimated drop-out proportion is 10%, so the number of samples taken is 106 respondents.

From the research population, the samples used in the research were children under five years who met the following inclusion criteria:

1) Children aged 24-59 months who live in the research area.
2) Mothers of children under five years are willing to be respondents in the study.

Exclusion criteria from the research sample are as follows:

1) Children under five years who are sick during the study.
2) Children under five years who do not come during the study.
3) Children under five years who do not live permanently in the research area.
4) Children under five years who experience poor nutritional status and obesity.

This study analyzes the relationship between independent variables (mother's education level, income level, infectious diseases, meals frequency, and household size or number of family members) and dependent variables (underweight) where measurements are taken simultaneously. Underweight is one of three malnutrition criteria that reflect growth failure either in the past or in the present (5). Based on the Regulation of the Minister of Health Number 2 of 2020 concerning Children's Anthropometric Standards, an underweight which has a calculation a weight-to-age index as its indicator (6). Based on the weight index according to age, children aged 0-60 months are categorized into four nutritional statuses, namely:

1) Severely underweight with threshold <-3 SD.
2) Underweight with threshold -3 SD until <-2 SD.
3) Normal body weight with threshold -2 SD until +1 SD.
4) Overweight with threshold >+1 SD.

Underweight indicates a condition of acute malnutrition. Underweight that is not treated early will cause the body to experience a continuous deficiency of energy or protein intake. If this continues for a long time, the body will fall into a more chronic malnutrition such as stunting (7).

RESULTS AND DISCUSSION

RESULTS

The results in this study consisted of univariate, bivariate, and multivariate analysis. **Table 1** explains the general characteristics of the study sample. Among all respondents participated in this study, 33.96% of the children were being underweight. The predictors involved into the analysis found more than half of the children were aged 0 to 42 months (55.66%) and were male children (51.89%). Additionally, the majority of the mothers graduated from primary or secondary school (43.40%) and the family had income less than 3 million Indonesian rupiah per month (64.15%). The

family income less than the City Minimum Wage (IDR3,149,977). In terms of household size, most of the households were small with less than or equal four members (58.49%). Less than half of the children did not experienced infectious diseases (59.43%), and children were reported had enough meals per day (57.55%). The general characteristics of respondents can be seen in **Table 1**.

Table 1. General characteristics of the respondents

Independent variables (N = 106)	Frequency	Percentage (%)
Underweight		
No	70	66.04
Yes	36	33.96
Children's age		
0 to 42 months	59	55.66
43 to 59 months	47	44.34
Sex		
Female	51	48.11
Male	55	51.89
Mother's education level		
University (Postgraduate, Undergraduate, diploma)	22	20.75
High school (Senior high school)	38	35.85
Primary and secondary school (Elementary and Junior high school)	46	43.40
Income level		
≥ 3 million IDR	38	35.85
< 3 million IDR	68	64.15
Household size		
Small (≤ 4 people)	62	58.49
Medium (5-6 people)	26	24.53
Large (≥ 7 people)	18	16.98
Infectious diseases		
No	63	59.43
Yes	43	40.57
Meals frequency		
Enough (≥ 3 times a day of main meals and ≥ 2 times a day of snacks)	61	57.55
Less (< 3 times a day of main meals and < 2 times a day of snacks)	45	42.45

The bivariate analysis using Chi-square statistical test in this study can be seen in **Table 2**. It revealed that the factors including children's age, mother's education level, income level, household size, having infectious diseases, and meals frequency were statistically significant associated with incidence of underweight. However, children's sex was found insignificantly associated with being underweight.

Table 2. Relationship between each predictor and incidence of underweight

Independent variables	No underweight (%)	Underweight (%)	Total	Chi-square (p-$_{value}$)
Children's age				
0 to 42 months	57.63	42.37	59	**4.20***
43 to 59 months	76.60	23.40	47	
Sex				
Female	62.75	37.25	51	0.47
Male	69.09	30.91	55	
Mother's education level				
University	77.27	22.73	22	**6.97***
High school	76.32	23.68	38	
Primary and secondary school	52.17	47.83	46	
Income level				
≥ 3 million IDR	81.58	18.42	38	**6.38***
<3 million IDR	57.35	42.65	68	
Household size				
Small	67.74	32.26	62	**8.85***
Medium	46.15	53.85	26	
Large	88.89	11.11	18	
Infectious diseases				
No	84.13	15.87	63	**22.66*****
Yes	39.53	60.47	43	
Meals frequency				
Enough	91.80	8.20	61	**42.53*****
Less	31.11	68.89	45	

Table 3. Binary logistic regression of factors associated with underweight

Independent variables	Adj. OR	Standard errors	z	p-$_{value}$	95% conf. interval	
Children's age						
0 to 42 months						
43 to 59 months	0.56	0.4270751	-0.76	0.449	0.13	2.49
Sex						
Female						
Male	1.42	1.097651	0.45	0.650	0.31	6.46
Education level						
University						
High school	0.66	0.6233843	-0.44	0.662	0.10	4.19
Primary and secondary school	0.87	0.8017118	-0.15	0.882	0.14	5.29
Income level						
≥3 million IDR						
<3 million IDR	**12.74**	11.80835	2.75	**0.006****	2.07	78.34
Household size						
Small						
Medium	**7.98**	7.310745	2.27	**0.023***	1.33	48.04
Large	0.08	0.1055082	-1.86	0.062	0.01	1.14
Infectious diseases						
No infectious						
Yes	**13.84**	11.3831	3.2	**0.001****	2.76	69.37
Meals frequency						
Enough						
Less	**47.19**	43.59444	4.17	**0.000*****	7.72	288.53
_cons	0.00	0.0036403	-3.66	0.000	0.00	0.06

*p-$_{value}$<0.05, **p-$_{value}$<0.01, ***p-$_{value}$<0.001,* Log likelihood = -28.883155, Pseudo R^2 = 0.5748.

Table 3 shows the binary logistic regression result of correlation of all independent variables and incidence of underweight. Before tested by this multivariate analysis, the multi-collinearity test was checked to ensure the correlation between each independent variable. The results revealed each independent variable is independent each other. Among 106 children under five years olds employed to this study, the factors associated with being underweight were family income, household's size, having infectious diseases, and frequency of meals. In detail, compared to children from family with income IDR3 million or higher per month, children from family with lower than IDR3 million per month were 12.74 times more likely to be underweight after adjusted to all predictors. Additionally, compared to small household's size, children from medium household's size were 7.98 times more likely to be underweight. Compared to children without infectious diseases, children having infectious diseases were 13.84 times more likely to be underweight. Moreover, children with less daily meals were 47.19 times more likely to be underweight compared to their counterparts having enough daily meals. The predictors found insignificantly associated with incidence of underweight were children's age and sex and mother's educational level which showed $p_{\text{-value}}$ less than 0.05. The model in **Table 3** reflected the 57.48% (based on pseudo R^2) factors associated with being underweight and the rest are other variables not included in this study.

DISCUSSION

Incidence of underweight among children under five years in the working area of Sungai Malang community health centers based on the findings of this study was 36 out of 106 children (33.96%). It was in line with the results of the Indonesian Basic Health Survey in 2018, where most children under five years (86.2%) in Indonesia are well-nourished but each province experienced malnutrition (8). Underweight is defined as nutritional status based on the weight-for-age index which is a combination of the terms malnutrition and under nutrition with Z-score <-2 standard deviations (9). Underweight can be caused by two factors: direct factors and indirect factors. Direct factors causing nutritional problems are due to lack of illness (infectious diseases), exclusive breastfeeding, and indirect factors such as maternal knowledge, number of family members, and socio-economic factors (10). Under nutrition that takes place very quickly during growth will lead to abnormal child behavior and poor learning ability and can be carried over into adulthood. Previous research revealed the impact of malnutrition on children has short-term and long-term effects (11). Short-term effects include problems with body metabolism, physical growth, and brain intelligence. Long-

term effects include decreased immunity, which leads to illness, and decreased productivity and work capacity.

Various studies have shown that half of child deaths caused by poor nutritional status. The risk of child mortality among poor nutritional status's children is 13 times greater compared to their counterpart. World Health Organization estimates that 54% of infant and under-five deaths are caused by poor child nutrition (12). Existing research underweight among children under five years reported that the caused can be direct and indirect causal factors (13). Most children under five years are malnourished because they do not receive adequate nutritional intake or experience infectious diseases. Nutritional intake is a nutrient that is very important for children's immunity so that they can maintain their immunity (14). The strongest factor associated with being underweight based on the multivariate analysis results among children under five years in community health centers of Sungai Malang is frequency of meals. Other factors that also contributed to being underweight are low-income level, medium household's size, and having infectious diseases.

Underweight among children under five years of age remains a concern in low- and middle-income countries because long-term impact for children development. There are several factors might influence the incidence of underweight which need a comprehensive understanding of the various determinants that contribute to this condition. Socio-economic status (SES) is one of the most significant determinants of underweight in children under five. Numerous studies have established a strong correlation between low SES and higher rates of underweight. Supporting the findings of this study, the study in Ethiopia found that children from economically disadvantaged households were 65% more likely to be underweight compared to those from wealthier families (15). This relationship is often attributed to limited access to nutritious food, healthcare, and education, which are more readily available to families with higher income levels (16). This also related to the frequency of meals provided in the family. Poorer households' income tends to limit the frequency and even the portion of the meals. Countries with good economic conditions will have a high value on the health status of each individual (17).

This study found insignificant association between mother's educational level and being underweight of children under five years. It was not in line with a study in Bangladesh that highlighted that children of mothers with secondary education were 31% less likely to be severely underweight compared to those whose mothers had no formal education (18). Research consistently shows that higher levels of mother

education correlate with lower rates of underweight among children. Educated mothers are more likely to understand the importance of nutrition and healthcare, which directly affects their children's dietary practices (19). Moreover, one study in Sangihe, Indonesia noted that mothers with higher education levels were more likely to initiate breastfeeding efficiently and provide appropriate complementary foods, thereby reducing the risk of underweight (16). Another study found that incidence of underweight among children under five years tends to occur among mothers with low education (20) (21) (22).

Increasing maternal education will have an impact on investing in quality human resources, because maternal education will improve the nutritional status of children under five years. This is mainly related to their parenting responsibilities, which include organizing meal plans, buying groceries, cooking, preparing food, and serving food. However, mothers' level of education does not necessarily hinder their ability to prevent child underweight. Even with a low level of education, curious mothers can still obtain information related to maintaining optimal nutritional status for their children. Knowledge on how to meet optimal nutritional conditions can also be obtained from various other sources, such as through daily activities, community health center activities at integrated service posts or *posyandu*, midwives counselor (23), and other health agencies. These sources provide information that is easy to understand and can be comprehended by the general public, regardless of their level of education.

Dietary practices might also play a role in determining the incidence of underweight among children. Exclusive breastfeeding for the first six months of life is vital for preventing malnutrition, yet many children do not receive this essential nutrition (24). A study in Tanzania found that dietary diversity is a protective factor against underweight, indicating that a varied diet can help meet the nutritional needs of growing children (25). Conversely, late initiation of complementary feeding has been associated with increased risk of underweight (16). Health-related factors, particularly the prevalence of infectious diseases, also contribute significantly to underweight among children as supporting the finding of this study. Illnesses such as diarrhea and respiratory infections can lead to malnutrition by reducing appetite and nutrient absorption (26). Additionally, children who experienced diarrhea had significantly higher odds of being underweight (19). This highlights the importance of ensuring access to healthcare and preventive measures, such as vaccinations and clean water, to mitigate the impact of diseases on child nutrition. Moreover, environmental factors, including sanitation and hygiene practices, are critical in preventing infections that can

exacerbate malnutrition (25). Infectious diseases are symptoms that arise or immunological responses due to the entry and development of disease seeds or parasites (agents) into the human or animal body (host). The microorganisms that enter the body, the body's reaction to microorganisms, and the general characteristics of the disease are some of the factors that greatly affect infectious diseases. Any damage to a person's body structure and function will cause the disease to show clinical symptoms. Illness can cause loss of appetite, so the child does not want to eat, and can become weight loss, which can lead to malnutrition (27).

There is a reciprocal relationship between the incidence of infectious diseases and malnutrition. Children who are malnourished will experience a decrease in appetite which can lead to a decrease in endurance, making them vulnerable to infectious diseases and vice versa children under five years who often suffer from infectious diseases can cause malnutrition. Supporting the result of this study, 155 out of 279 respondents had a history of infectious disease which led the high incidence of underweight (28). Infectious diseases are diseases caused by the entry of micro-organisms into the body that cause abnormal reactions to the body. Infectious diseases can cause a decline in appetite/difficulty swallowing and digesting food, resulting in a decrease in food consumption in body, which can lead to malnutrition. Infections can cause nutrients to be used to repair damaged tissues or cells, which makes infectious diseases a direct contributing factor. A child suffering from an infectious disease can experience an average of 8 cm of reduced growth and a drop in IQ points by the age of 7 to 9 years. This shows that infectious diseases can stunt a child's growth.

The number of family members is the number of individuals who live and stay in one house. The number of family members is related to the availability of food in the household. If the number of family members is inversely proportional to the amount of family income, it can lead to a lack of food availability in the household (29). This is in line with previous study that found of 49 families with more than 2 children experienced malnutrition (30). Another study stated that the fulfillment of food needs will be easier in families with fewer members, so that food for their children, every day given varied and nutrient-rich food by paying attention to the composition of 4 healthy 5 perfect, which in effect children can have a good nutritional status (31). Families that have many members will find it difficult to fulfil children's daily nutritional needs for good physical growth. As a result, when the number of family members increases, the amount of money spent by the household increases especially for food and health care, which will eventually lead to delayed growth. In line with (31) that obtained the results of research

from 48 respondents who obtained a large family with a nutritional status of under five years of 16 (33.3%) respondents. The number of family members is defined as the number or number of people who usually live in one household and whose food management is managed in the same kitchen. National Family Planning Coordination Board Republic of Indonesia categorizes families with less than four members as small families. Meanwhile, families with more than 4 members are categorized as large families (32). The number of family members affects the level of food consumption, which is then related to nutritional status. If the number of family members is large but not accompanied by a high income, food distribution will be uneven. The more family members, the more food needs that must be met. Meanwhile, if the number of family members is relatively small, the needs that must be met are also reduced so that the family can allocate more income to buy more nutritious food ingredients (32). A large number of family members will affect food insecurity in the family.

The age of the child is another significant factor associated with underweight, even though in this study was found insignificant association. Previous study indicates that older children within the under-five age group are at a higher risk of being underweight, possibly due to increased nutritional needs as they grow and the challenges of transitioning to solid foods (33). Additionally, the number of children under five years in a household can exacerbate the risk of under nutrition, as resources may be stretched thinner in larger families (26). A study in Ethiopia found that households with more children under five years had a higher prevalence of underweight, emphasizing the need for targeted interventions that consider family dynamics and resource allocation (26).

CONCLUSION AND RECOMMENDATION

The results showed that there was a relationship between the family income level ($p_{\text{-value}}$ of 0.006 <0.05), history of infectious diseases ($p_{\text{-value}}$ of 0.001 <0.05), frequency of meals ($p_{\text{-value}}$ of 0.000 <0.05), and number of family members ($p_{\text{-value}}$ of 0.023 <0.05). The strongest factor associated with being underweight based on the multivariate analysis results is frequency of meals. Other factors that also contributed to being underweight are having low-income level, medium household's size, and having infectious diseases.

The further research examines the variables of genetic factors, parenting patterns, knowledge, and food intake. The community health centers can provide information widely, either through counseling or training, to community or health cadres regarding the nutritional status of children under five years, especially underweight.

REFERENCES

1. Ministry of Health Republic of Indonesia. Hasil Survei Status Gizi Indonesia (SSGI) 2022. Ministry of Health Republic of Indonesia 2022:1-150.
2. Dinas Kesehatan Provinsi Kalimantan Selatan. Profil Kesehatan Provinsi Kalimantan Selatan. 2023.
3. Dinas Kesehatan Kabupaten Hulu Sungai Utara. Profil Kesehatan Kabupaten Hulu Sungai Utara. 2023.
4. Andayani RP and Afnuhazi R. Faktor-faktor yang berhubungan dengan status gizi pada balita. Jurnal Kesehatan Mercusuar 2022;5(2):41-48. https://doi.org/10.36984/jkm.v5i2.309.
5. Djaiman SPH, Wardhani NK, Sihadi, Sari K, Putri DSK, Rachmalina R, Utami NH, Susilawati MD, Chitijani R, Febriani. Disparitas Balita Kurang Gizi di Indonesia. Media Litbangkes 2018;28(3):201-210. https://doi.org/10.22435/mpk.v28i3.219.
6. Ministry of Health Republic of Indonesia. Peraturan Menteri Kesehatan Nomor 2 tahun 2020 tentang Standar Antropometri Anak. 2020.
7. Dipasquale V, Cucinotta U, Romano C. Acute malnutrition in children: Pathophysiology, clinical effects and treatment. Nutrients 2020;12(8):1-9. https://doi.org/10.3390/nu12082413.
8. Ministry of Health Republic of Indonesia. Report of National Basic Health Research or Riskesdas 2018. 2018. http://www.depkes.go.id/resources/download/info-terkini/hasil-riskesdas-2018.pdf.
9. Irawan IR. Risk Factors for Underweight among Children Aged 6-59 Months in Indonesia. Developing a Global Pandemic Exit Strategy and Framework for Global Health Security 2021;161. https://doi.org/10.26911/AB.Maternal.ICPH.08.2021.35.
10. Arianty N. Household Industry Business Analysis in Improving Family Revenues. Proceedings of AICS-Social Sciences 2017;7:90.
11. Calista VP, Larasati TA, Sayekti WD. Kejadian *Stunting* dengan Perkembangan Motorik Halus Pada Balita. Jurnal Ilmiah Kesehatan Sandi Husada 2021;10(2):617-623. https://doi.org/10.35816/jiskh.v10i2.667.
12. de Onis M, Garza C, Onyango AW, Rolland-Cachera MF. WHO growth standards for infants and young children. Archives de Pediatrie 2009;16(1):47-53. https://doi.org/10.1016/j.arcped.2008.10.010.
13. Abimayu AT, Rahmawati ND. Analisis Faktor Risiko Kejadian *Stunted*, *Underweight*, dan *Wasted* pada Balita di Wilayah Kerja Puskesmas Rangkapan Jaya, Kota Depok, Jawa Barat Tahun 2022. Jurnal Biostatistik, Kependudukan,

dan Informatika Kesehatan (Bikfokes) 2023;3(2):88-101. https://doi.org/10.51181/bikfokes.v3i2.6820.

14. Aziza NA, Mil S. Pengaruh pendapatan orang tua terhadap status gizi anak usia 4-5 tahun masa pandemi Covid-19. Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini 2021;6(3):109-120. https://doi.org/10.14421/jga.2021.63-01.
15. Fenta SM, Fenta HM. Risk Factors of Child Mortality in Ethiopia: Application of Multilevel Two-Part Model. Plos One 2020;15(8):e0237640. https://doi.org/10.1371/journal.pone.0237640.
16. Mahihody AJ, Hinonaung JSH. Factors Influencing the Incident of Underweight Children Under Five Years in Sangihe Regency. Jurnal Info Kesehatan 2020;18(1):40-49. https://doi.org/10.31965/infokes.vol18.iss1.323
17. Mawardani S, Sariyati S, Wijayanti I. The relationship between education level, occupation, income and parity with efforts to manage symptoms in menopausal women in Banguntapan Urban Village Yogyakarta. Jurnal Ners dan Kebidanan Indonesia (Indonesian Journal of Ners and Midwifery) 2025;13(1):1-14. http://dx.doi.org/10.21927/jnki.2025.13(1).1-14
18. Chowdhury TR, Chakrabarty S, Rakib M, Saltmarsh S, Davis K. Socio-Economic Risk Factors for Early Childhood Underweight in Bangladesh. Globalization and Health 2018;14(54):1-12. https://doi.org/10.1186/s12992-018-0372-7.
19. Gebre A, Reddy PS, Mulugeta A, Sedik Y, Kahssay M. Prevalence of Malnutrition and Associated Factors among under-Five Children in Pastoral Communities of Afar Regional State, Northeast Ethiopia: A Community-Based Cross-Sectional Study. Journal of Nutrition and Metabolism 2019;187609:1-13. https://doi.org/10.1155/2019/918760.
20. Basri H, Nurdin N, Fahmi A, Albetris A. Faktor-Faktor yang Mempengaruhi Pendapatan Masyarakat di sekitar Kawasan Kurma Indonesia. Ekonomis: Journal of Economics and Business 2022;6(1):359-363. https://doi.org/10.33087/ekonomis.v6i1.525.
21. Budiana TA, Supriadi D. Hubungan Banyaknya Anggota Keluarga, Pendidikan Orangtua dan Kepesertaan Jaminan Kesehatan Anak dengan Kejadian Berat Badan Kurang pada Balita 24-59 bulan di Puskesmas Cimahi Selatan. Jurnal Ilmu Kesehatan Bhakti Husada: Health Sciences Journal 2021;12(1):38-50. https://doi.org/10.34305/jikbh.v12i1.256.
22. Haryani W, Setiyobroto ISI. Research Ethics Module. 2022.

23. Santi MY. Implementation of exclusive Breastfeeding Policy based on Counseling by Midwives Counselor. Kesmas-National Public Health Journal 2014;8(8):346-352. https://doi.org/10.21109/kesmas.v8i8.403.
24. Roy RK, Matubbar MS, Kamruzzaman Md, Ud-Daula A. Determination of Nutritional Status of Under-Five Year Children Employing Multiple Interrelated Contributing Factors in Southern Part of Bangladesh. International Journal of Nutrition and Food Sciences 2015;4(3):264-273. https://doi.org/10.11648/j.ijnfs.20150403.13.
25. Mshida HA, Kassim N, Mpolya E, Kimanya M. Water, Sanitation, and Hygiene Practices Associated With Nutritional Status of Under-Five Children in Semi-Pastoral Communities Tanzania. American Journal of Tropical Medicine and Hygiene 2018;98(5):1242-1249. https://doi.org/10.4269/ajtmh.17-0399.
26. Asmare AA, Agmas YA. Multilevel Multivariate Modeling on the Association Between Undernutrition Indices of Under-Five Children in East Africa Countries: Evidence From Recent Demographic Health Survey (DHS) Data. BMC Nutrition 2023;9(1). https://doi.org/10.1186/s40795-023-00741-w.
27. Dipasquale V, Cucinotta U, Romano C. Acute malnutrition in children: Pathophysiology, clinical effects and treatment. In Nutrients MDPI AG 2020;12(8):1-9. https://doi.org/10.3390/nu12082413.
28. Syafriani. Hubungan Status Gizi dan Umur *Menarche* dengan Kejadian Dismenore pada Remaja Putri di SMAN 2 Bangkinang Kota 2020. Jurnal Ners 2021;5(1):32-37. https://doi.org/10.31004/jn.v5i1.1676
29. Ertiana D, Zain SB. Pendidikan dan Pengetahuan Ibu tentang Gizi Berhubungan dengan Status Gizi Balita. Jurnal ILKES (Jurnal Ilmu Kesehatan) 2023;14(1):2087-12877. https://ilkeskh.org/index.php/ilkes/article/view/279/180.
30. Sadikin IS, Lubis L, Djais JTB. Short-term memory comparison between stunted and non-stunted groups. Althea Medical Journal 2018;5(3):111-115. https://doi.org/10.15850/amj.v5n3.1607
31. Jaya WH, Anto A, Alam MS. Relationship between Type of Family and Nutritional Status of Toddlers. An Idea Health Journal 2022;2(02):102-105. https://doi.org/10.53690/ihj.v2i02.97.
32. Wedayanti NLPA, Wirdiani A, Purnawan A. Evaluation of usability aspects in the Simalu Application using the usability Testing Method. Jurnal Ilmiah Merpati (Menara Penelitian Akademika Teknologi Informasi 2019;7(2):113-124. https://doi.org/10.24843/JIM.2019.v07.i02.p03.

33. Bekele SA, Fetene MZ. Modeling Non-Gaussian Data Analysis on Determinants of Underweight among under Five Children in Rural Ethiopia: Ethiopian Demographic and Health Survey 2016 Evidences. Plos One 2021;16(5):e0251239. https://doi.org/10.1371/journal.pone.0251239.