Jurnal Info Kesehatan
Vol. 22, No. 4, December 2024, pp. 829-843
P-ISSN 0216-504X, E-ISSN 2620-536X
DOI: *10.31965/infokes.Vol22.Iss4.1494*
Journal homepage: *https://jurnal.poltekkeskupang.ac.id/index.php/infokes*

RESEARCH **Open Access**

Risk Factors for Under-Five Children Severe Acute Malnutrition (SAM) in Grobogan Regency

Nuryanto[1a]*, Syaharani Sidhin[1b], Etika Nurul Fala[1c], Choirun Nissa[1d], Aryu Candra[1e], Rachma Purwanti[1f], Deny Yudi Fitranti[1g], Ninik Rustanti[1h], Nur Ahmad Habibi[2i]

[1] Department of Nutrition, Univesitas Diponegoro, Semarang, Central Java, Indonesia
[2] Department of Nutrition, Politeknik Kesehatan Kemenkes Padang, Padang, West Sumatera, Indonesia

[a] Email address: nyt_gizi@yahoo.com
[b] Email address: syanisidhin.work@gmail.com
[c] Email address: nfetika@gmail.com
[d] Email address: nissaeyong@gmail.com
[e] Email address: aryucandra@yahoo.com
[f] Email address: rachmapurwanti@fk.undip.ac.id
[g] Email address: denyyudi@gmail.com
[h] Email address: ninik.rustanti@fk.undip.ac.id
[i] Email address: nahindo2022@gmail.com

Received: 14 May 2024 Revised: 05 October 2024 Accepted: 30 December 2024

Abstract
Severe Acute Malnutrition (SAM) is a major health risk for children under five. Various factors, such as poor food intake, infections, family size, healthcare participation, maternal nutrition knowledge, and parenting practices, contribute to SAM. However, no studies have specifically examined these factors in under-five children in Grobogan Regency. This study aims to analyze the risk factors associated with severe acute malnutrition among children under five years old in Grobogan Regency. The study employed a quantitative case-control design involving children aged 0-59 months in Grobogan Regency, with 11 children with Severe Acute Malnutrition (SAM) as the case group obtained through total sampling, and 11 well-nourished children as the control group selected via matching. Key variables examined included energy, protein, fat, and carbohydrate intake, as well as infectious diseases, family size, participation in posyandu, maternal nutrition knowledge, and parenting practices. Descriptive analysis outlined the subjects and variables, with bivariate analysis using the Chi-Square test at a 95% confidence level (α=0.05). The results study show that the statistical analysis indicated that inadequate energy intake was significantly associated with SAM (p=0.008, OR=26.667), suggesting that children under five with insufficient energy intake are 26.667 times more likely to experience severe acute malnutrition compared to those with adequate energy intake. In contrast, adequate intake of protein, fat, and carbohydrates, as well as factors such as infectious diseases, family size (p=0.080), participation in posyandu (p=1.000), maternal nutrition knowledge (p=0.476), and parenting practices (p=0.198), did not demonstrate significant associations with SAM among these children. The conclusion is adequate energy intake has been identified as a significant risk factor for SAM among under-five children in Grobogan Regency. Conversely, factors such as adequate intake of protein, fat, and carbohydrates, infectious diseases, family size, participation in posyandu, maternal nutrition knowledge, and parenting practices were not recognized as significant risk factors.

Keywords: Severe Acute Malnutrition, Risk Factors, Under-Five Children, Grobogan Regency.

Corresponding Author:
Nuryanto
Department of Nutrition, Univesitas Diponegoro, Semarang,Central Java, Indonesia
Email: nyt_gizi@yahoo.com

1. INTRODUCTION

Severe acute malnutrition is a growth disorder caused by acute nutritional deficiencies in children under five (ages 0–59 months) (Alamsyah et al., 2017). This age group is particularly vulnerable to health and nutritional issues due to the rapid cycles of growth and development during this period (Alamsyah et al., 2017; Pambudi & Christijani, 2017). Children are classified as severely malnourished if their weight-for-height or weight-for-length z-score is below -3 SD, based on the anthropometric standards defined in Indonesia's Ministry of Health Regulation No. 2 of 2020 (Kementerian Kesehatan Republik Indonesia, 2020).

According to the 2018 Riskesdas (Basic Health Research), the prevalence of severe acute malnutrition in Indonesia was 3.9% (Kementerian Kesehatan Republik Indonesia, 2018). In Central Java, the prevalence was slightly lower at 3.07%, but Grobogan Regency exhibited a higher prevalence of 4.98% (Dinas Kesehatan Provinsi Jawa Tengah, 2019; Kementerian Kesehatan Republik Indonesia, 2018). Grobogan has been designated as a priority area for food and nutrition development, with four focus villages targeted for enhanced efforts from 2019–2023 (Gubernur Jawa Tengah, 2019). Despite these efforts, malnutrition remains a strategic issue for Grobogan's Health Department, which has identified it as a critical concern for the period 2016–2021 (Dinas Kesehatan Kabupaten Grobogan, 2016).

Severe acute malnutrition among children under five is influenced by both direct and indirect risk factors. Direct factors include dietary intake and infectious diseases (Almatsier et al., 2011). Adequate macronutrient intake energy, carbohydrates, protein, and fat—is a direct determinant of nutritional status. Insufficient energy and protein intake can lead to chronic energy deficiency (CED), protein-energy malnutrition (PEM), and hindered cognitive and physical development. Research indicates a significant relationship between energy intake and nutritional status (Diniyyah & Nindya, 2017), as well as low protein intake among severely malnourished children (Fadlillah & Herdiani, 2020). Inadequate fat intake can reduce energy absorption and hinder the assimilation of fat-soluble vitamins, further affecting body mass. Studies have also highlighted a significant relationship between fat and carbohydrate intake and nutritional status in children under five (Diniyyah & Nindya, 2017; Helmi, 2013).

Children under five are also vulnerable to infectious diseases due to their underdeveloped immune systems. Infections such as acute respiratory infections (ARIs), diarrhea, and pneumonia have a bidirectional relationship with malnutrition. Malnourished children are less able to fight infections, while infections further compromise nutrient intake and absorption, leading to weight loss and worsened malnutrition (Cono et al., 2021; Aslina & Suryani, 2018; Juhariyah & Mulyana, 2018).

Indirect risk factors include family size, maternal parenting practices, maternal nutritional knowledge, and attendance at integrated service posts (posyandu) (Almatsier et al., 2011; Nurmaliza & Herlina, 2018). Larger families may experience unequal food distribution, reduced parental attention, and an increased caregiving burden (Abas et al., 2018). Maternal parenting practices are influenced by their knowledge of nutrition, which can be enhanced through participation in posyandu activities (Pratiwi et al., 2016). However, growth monitoring in Grobogan remains suboptimal, as evidenced by low attendance rates at posyandu and insufficient weight gain among children. Maximizing the utilization of posyandu has been linked to better nutritional outcomes (Hidayat & Jahari, 2012).

The consequences of malnutrition are severe, including delayed brain development, reduced intelligence, impaired physical growth, and metabolic disorders in the short term. Long-term effects include cognitive impairments, decreased academic performance, weakened immunity, increased susceptibility to disease, and a heightened risk of degenerative diseases such as heart disease, diabetes, obesity, and stroke (Kementerian Kesehatan Republik Indonesia, 2018).

Addressing malnutrition requires a multifaceted approach, including improving dietary intake, promoting clean and healthy living practices, and routinely monitoring growth through posyandu services. The Grobogan Regency government plays a critical role in this effort by enhancing posyandu facilities, allocating village budgets for nutritional support, and raising awareness about the importance of clean and healthy living practices.

Given the significant impact of risk factors on severe acute malnutrition, early detection and intervention are crucial. This includes preventive measures, stimulation, treatment, and recovery tailored to specific symptoms (Yuniarti, 2015). Therefore, this study aims to investigate the risk factors for severe malnutrition among children under five in grobogan regency.

2. RESEARCH METHOD

This quantitative case-control study aimed to analyze malnourished children aged 0-59 months in Grobogan Regency during the data collection period of April to May 2022. The study included children who met specific inclusion criteria: aged 0-59 months, residing in Grobogan Regency, with a mother as the primary caregiver who consented to participate, possessing a Mother and Child Health Book (KIA), and able to undergo height and weight measurements. Exclusion criteria included incomplete data, children or mothers who relocated during the study, and children with congenital abnormalities.

The case group was selected using total sampling, and the control group was matched based on gender, age, and place of residence, with controls selected from neighbors with children of good nutritional status. The case-control ratio was 1:1. The Grobogan Regency Health Office provided 37 case samples from April to May 2022, but after validation, 11 cases met the inclusion criteria. Thus, the study included 22 subjects: 11 cases and 11 controls.

The independent variables included energy, protein, fat, and carbohydrate intake, infectious diseases, family size, participation in Posyandu, maternal nutrition knowledge, and maternal parenting practices. The dependent variable was malnutrition in children under five.

Data collection occurred in three stages. In the first stage, secondary data on under-five children with severe malnutrition (defined by weight-for-height or weight-for-length < -3 SD) were obtained from the Grobogan District Health Office, community health centers (Puskesmas), village midwives, and local Posyandu cadres.

In the second stage, the subjects were validated by measuring their height/length and weight. Z-scores were calculated based on the WHZ or WLZ indices. Validation and screening took place in June 2022, with subjects selected according to the inclusion criteria. Excluded were those with incomplete data, who had relocated, or had congenital abnormalities.

In the third stage, mothers who met the inclusion criteria were informed about the study and signed an informed consent form. Primary data were collected through interviews and a structured questionnaire. Interviews with mothers focused on dietary intake using the 3 x 24-hour food recall method (two weekdays and one weekend day). The questionnaire collected data on anthropometric measurements, maternal and child characteristics, household size, Posyandu attendance, maternal nutrition knowledge, and caregiving practices.

Univariate analysis described the characteristics of the subjects and variables, while bivariate analysis was performed using the Chi-Square test ($\alpha = 0.05$) for variables related to energy, protein, fat, carbohydrates, and maternal parenting. Fisher's Exact Test was used for variables such as infectious diseases, family size, Posyandu participation, and maternal nutrition knowledge when the Chi-Square test assumptions were not met. This study also has received approval from the Health Research Ethics Commission of Diponegoro University and RSUP. Dr. Kariadi Semarang as stated in Ethical Clearance No. 156/EC/KEPK/FK-UNDIP/VI/2022.

3. RESULTS AND DISCUSSION

Secondary data obtained from the Grobogan Regency health office, community health centers (Puskesmas), integrated service post (Posyandu) cadres, and local village midwives show that the number of malnutrition children under five in Grobogan Regency fluctuates widely. The average number of cases per month is 24 cases of malnutrition in children under five years. The number of malnutrition under-five children in Grobogan Regency in April - May 2022 was 37 under-five children. However, there were only 11 malnutrition under-five children who met the subject inclusion criteria and 11 well-nutrition under-five children as their partners (controls). The average number of cases per month is 24 cases of malnourished under-five children. The detailed number of cases, new cases, and recovered malnourished under-five children from January to May 2022 can be seen in Figure 1.

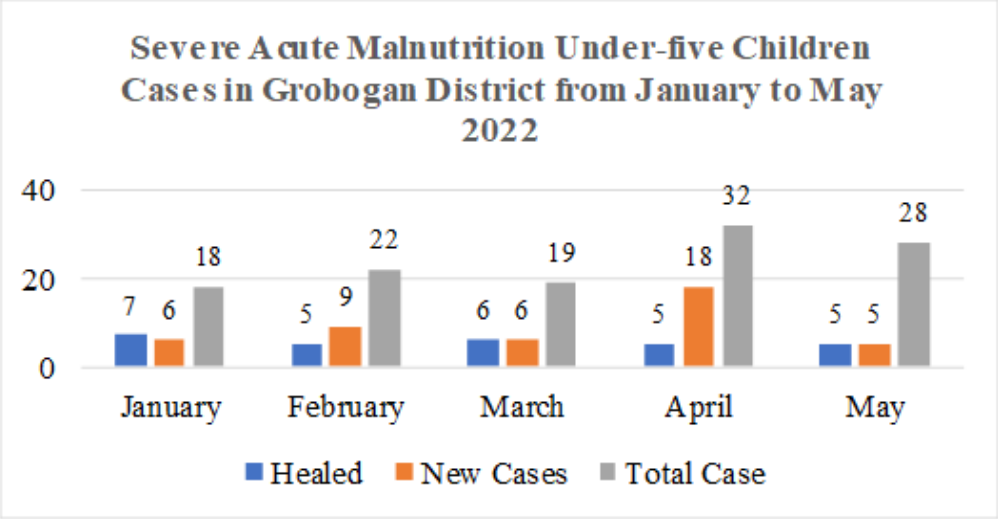

Figure 1. Graph of Severe Acute Malnutrition Under-five Children Cases in Grobogan Regency from January to May 2022.

Table 1. Frequency Distribution of Subject and Respondent Characteristics.

Variable	Nutrition Status (WFL or WFH)			
	Malnutrition		Normal	
	n	%	n	%
Age				
1-3 years	8	72.7	8	72.7
4-5 years	3	27.3	3	27.3
Sex				
Male	5	45.5	5	45.5
Female	6	54.5	6	54.5
Birth Weight				
Low (<2500 gram)	6	54.5	0	0
Normal (≥2.500 gram)	5	45.5	11	100
WFL or WFH *Z-Score Index*				
Malnutrition (< -3 SD)	11	100	0	0
Normal (-2 SD sd +1 SD)	0	0	11	100
Mother's Last Education				
Elementary (elementary/junior high school/equivalent)	6	54.5	5	45.5
Secondary (SMA/SMK/equivalent)	5	45.5	6	54.5
Higher (Diploma/Bachelor/Master/Specialist/Doctor)	0	0	0	0

Variable	Nutrition Status (WFL or WFH)			
	Malnutrition		Normal	
	n	%	n	%
Mother's job				
Self-employed/Businessman	2	18.2	1	9.1
Laborer (Farmer, Factory/Other)	2	18.2	1	9.1
Not Working	7	63.6	9	81.8
Total Family Income				
<Income Grobogan Regency (Rp1.894.032,1)	4	36.4	4	36.4
>Income Grobogan Regency (Rp1.894.032,1)	7	63.6	7	63.6

Table 1 shows the majority of the under-five children were female (54.5%). Most under-five children experiencing severe malnutrition were more likely to have a history of low birth weight (LBW) (54.5%) compared to those with normal nutritional status. Additionally, under-five children with severe acute malnutrition were more likely to have mothers with lower levels of education (54.5%) and unemployed mothers (63.6%) compared to under-five children with good nutritional status.

Table 2. Frequency Distribution of Subjects Based on Research Variables.

Variable	Nutrition Status				*p-value*	OR (95% CI)
	Malnutrition		Normal			
	n	%	n	%		
Adequate Energy Intake						
Inadequate (<80%)	10	90.9	3	27.3	0.008[b]	26.667
Adequate (≥80%)	1	9.1	8	72.7		(2.309–308.00)
Adequate Protein Intake						
Inadequate (<80%)	3	27.3	1	9.1	0.586[b]	3.750
Adequate (≥80%)	8	72.7	10	90.9		(0.325–43.313)
Adequate Carbohydrate Intake						
Inadequate (<80%)	11	100	10	90.9	1[b]	0
Adequate (≥80%)	0	0	1	9.1		(0-0)
Adequate Fat Intake						
Inadequate (<80%)	5	45.5	2	18.2	0.361[b]	3.750
Adequate (≥80%)	6	54.5	9	81.8		(0.540–26.045)
Infection History						
Yes	8	72.7	5	45.5	0.199[a]	4.667
No	3	27.3	6	54.5		(0.765–28.466)
Number of Family						
Big (>4 person)	9	81.8	4	36,4	0.080[b]	7.875
Small (≤4 person)	2	18.2	7	63.6		(1.105–56.123)
Participation in Posyandu						
Less (<8 times)	1	9.1	1	9.1	1.000[b]	1,000
Good (≥8 times)	10	90.9	10	90.9		(0.055–18.304)
Mother's Nutrition Knowledge						
Less (≤75%)	2	18.2	0	0	0.476[b]	0
Good (76-100%)	9	81.8	11	100		(0-0)
Mother's Parenting						
Less (≤75%)	7	63.6	3	27.3	0.087[a]	4.667
Good (76-100%)	4	36.4	8	72.7		(0.765–28.466)

[a]Pearson Chi-Square Test; [b]Chi-Square Fisher's Exact Test

Table 2 shows that adequate energy intake is a significant risk factor for malnutrition in under-five children, with a p-value of 0.008, OR = 26.667, and a 95% confidence interval (CI) of 2.309–308.00. This indicates that under-five children with inadequate energy intake are 26.667 times more likely to experience acute malnutrition compared to those with sufficient energy intake. However, sufficient protein intake (p = 3.750; CI: 0.325–43.313), carbohydrate intake (p = 1.000; CI: 0–0), and fat intake (p = 3.759; CI: 0.540–26.045) were not found to be significant factors for malnutrition in under-five children.

The history of infectious diseases was not identified as a significant risk factor for malnutrition (OR = 4.667; CI: 0.765–28.466). Similarly, a large family size was not a significant risk factor (OR = 7.875; CI: 0.765–28.466). Participation in Posyandu activities was not a direct risk factor for malnutrition (OR = 1.000; CI: undefined). Maternal nutrition knowledge was also not a direct risk factor (OR = 0; CI: 0–0). Lastly, parental caregiving practices were not found to be a direct risk factor for malnutrition in under-five children (OR = 4.667; CI: 0.765–28.466).

Based on the analysis, several confounding variables were identified that may influence the relationship between the risk factors and malnutrition in under-five children. These include protein, carbohydrate, and fat intake; history of infectious diseases; household size; participation in posyandu; maternal nutrition knowledge; and parental caregiving practices. All these variables are considered potential confounders that could affect the primary relationship between energy adequacy and malnutrition in under-five children.

Based on the field data, the study found that 17 out of 37 malnutrition children under five in Grobogan regency had improved their nutritional status, with 13 becoming undernutrition and 4 becoming well-nutrition. This shows that the incidence of malnutrition in Grobogan regency has improved. However, malnutrition under-five childrens who are not treated properly will potentially become malnutrition. Therefore, under-five childrens with malnutrition status also need to be considered so that later they do not become malnutrition. One of the treatments for malnutrition that can be done is by providing additional food or PMT until the under-five children's weight returns to normal according to height. PMT can be obtained from health care facilities, namely Puskesmas and Posyandu (Kulsum & Jahari, 2015).

Risk Factors for Adequate Energy Intake and the Incidence of Severe Acute Malnutrition among Infants. The results of this study demonstrate that adequate energy intake is a significant risk factor for the incidence of malnutrition in Grobogan Regency, with a p-value of 0.008 ($p < 0.05$) and an odds ratio (OR) of 26.667. This indicates that insufficient energy intake in children under five years old increases the risk of malnutrition by 26.667 times compared to those with sufficient energy intake. This finding aligns with research conducted in Donggala Regency, which similarly demonstrated a relationship between energy intake and malnutrition among under-five children (p=0.00 and OR=9.86) (Baculu et al., 2015). Another study in Vellore, South India, also identified a significant association between energy intake and the occurrence of malnutrition in children (p=<0.001 and OR=7.31) (David et al., 2020).

Based on observations during interviews utilizing the food recall method, it was revealed that the daily dietary consumption of under-five children lacked variety and was inadequate according to balanced nutrition guidelines. This was primarily due to poor parental feeding practices, such as discontinuing feeding when a child refuses to eat, even if only a small portion has been consumed. As a result, the child's nutritional intake does not meet their required needs.

The calculations show that the average energy intake of under-five children was 982 kcal, compared to the recommended energy requirement of 1350-1400 kcal. This indicates that the average energy intake is only about 70% of the required amount, which is categorized as insufficient. Prolonged and continuous inadequate energy consumption depletes the body’s energy reserves, ultimately leading to malnutrition. Under-five children with inadequate energy intake are at risk of growth delays, cognitive and psychological development issues, and

stunting (Helmi, 2013). To address this issue, efforts should focus on increasing parental knowledge about nutrition and promoting proper and effective caregiving practices in providing family meals and meeting the nutritional needs of under-five children. Furthermore, routine monthly monitoring of growth and development is essential to prevent nutritional problems.

Risk Factors of Adequate Protein Intake with the Incidence of Severe Acute Malnutrition. The findings of this study indicate that sufficient protein intake is not a significant risk factor for the occurrence of severe malnutrition in Grobogan Regency, as evidenced by a p-value of 0.586 ($p > 0.05$) and an odds ratio (OR) of 3.750. This implies that adequate protein intake in under-five children does not present a 3.750 times greater risk of severe malnutrition. These results are in line with previous research conducted on malnutrition and well-nutrition under-five childrens in Donggala Regency, Central Sulawesi Province, which showed that protein intake was not associated with the incidence of malnutrition (p=0.09) (Baculu et al., 2015). However, this study contradicts research conducted on malnutrition and well-nutrition under-five childrens at the Puskesmas of Balaesang Tanjung Regency, Donggala Regency, which states that protein intake has a relationship with malnutrition ($p = 0.04$ and OR = 7.36) (Baculu & Jufri, 2017). Another study in Terengganu, Malaysia conducted on undernutrition and well-nutrition under-five childrens resulted in a significant relationship between protein intake and the incidence of undernourishment (p=0.035 and OR=1.06) (Wong et al., 2014).

Based on observations conducted during interviews using the food recall method, the majority of under-five children were found to have sufficient protein intake and a history of infectious diseases within the past three months, accounting for 83.3%. This indicates that in this study, adequate protein intake was utilized to protect the body from infections and aid in the healing of infection-related wounds. As a result, the body lacked sufficient protein reserves, and if this condition persists over an extended period, it may lead to nutritional problems (Baculu et al., 2015). Furthermore, the average protein intake among under-five children was 29 grams, compared to the recommended dietary allowance of 20 grams for their age group. This suggests that protein intake among under-five children was adequate. However, the average energy intake remained below the required levels.

If the body lacks energy, the body will convert protein into glucose to produce energy. So that the protein reserves in the body will decrease and can cause kwashiorkor if it happens for too long (Baculu et al., 2015). In addition, the small number of samples may be the cause of the insignificant results between the adequacy of protein intake and the incidence of malnutrition in Grobogan Regency. Although there was no significant association, under-fives with inadequate protein intake had a 3.75 times risk of becoming malnutrition (OR=3.75). In addition, the proportion of inadequate protein intake was higher among malnutrition children (27.3%) than well-nutrition children (9.1%).

This study shows that the majority of under-five childrens have adequate protein intake and have experienced a history of infectious disease in the last 3 months, which is 83.3%. Based on this, it is possible to prove that in this study, adequate protein intake has been used to protect the body from infection and heal infectious wounds. So that the body does not have adequate protein reserves and if it happens for too long, it will cause nutritional problems (Baculu et al., 2015). Protein has a role in building, maintaining, and repairing cells and tissues. Protein also plays a role in helping the immune system metabolize. Lack of protein intake can lead to decreased immunity, making you more susceptible to infectious diseases (Diniyyah & Nindya, 2017). Protein is closely related to the body's immune function, especially amino acids. In addition, protein also functions in forming the body's antibodies, where the amount of protein will affect the amount of antibodies formed. Antibodies are part of the immune system that protects the body from bacteria, viruses, and other microorganisms (Wanty et al., 2017). Protein also plays a role in wound healing from fibroblast proliferation, collagen synthesis, angiogenesis, and immune function. Protein as a wound healer by maintaining muscle and body tissue (Lestari & Kusumaningrum, 2021).

Risk Factors of Adequate Carbohydrate Intake with the Incidence of Severe Acute Malnutrition Children. The findings of this study indicate that adequate carbohydrate intake is not a significant risk factor for the incidence of severe malnutrition in Grobogan Regency, with a p-value of 1.000 ($p > 0.05$) and an OR value of 0. This means that sufficient carbohydrate intake in under-five children does not pose a risk of severe malnutrition. These results align with a study conducted on under-five children with severe malnutrition, moderate malnutrition, and normal nutritional status in Suwari Village, Bawean, Gresik, which concluded that there was no relationship between carbohydrate intake and severe or moderate malnutrition in under-five children ($p = 0.666$) (Fitriyah & Setyaningtyas, 2021). However, the results of this study contradict research conducted on undernutrition and well-nutrition under-five childrens in Panorama Village, Bengkulu City which states that there is a relationship between carbohydrate intake and undernutrition in under-five childrens ($p=0.027$ and $OR=8.000$) (Febriani et al., 2019).

Based on observations conducted through interviews using the 24-hour recall method, the average carbohydrate intake in both groups malnourished under-five children and well-nourished under-five children was 117 grams, which is below the daily requirement of 215–220 grams. This has an impact on the absence of a relationship between carbohydrate intake and the incidence of malnutrition. The lack of carbohydrate intake consumed by the subjects may be due to inaccurate calculation of carbohydrate intake, one of which is thought to be due to the use of the 24-hour recall method which depends on the subject's memory, the subject's ability to describe the estimated portion consumed, the subject's level of motivation, and the interviewer's persistence in the recall interview (Sirajuddin et al., 2018). In addition, the small number of samples may be the cause of the insignificant results between the adequacy of carbohydrate intake and the incidence of malnutrition children under five in Grobogan Regency. Although there was no significant association, the proportion of inadequate carbohydrate intake was more prevalent among malnutrition children (100%) than among well-nutrition children (90.9%).

Carbohydrates are the most important source of energy. Carbohydrates play a role in providing glucose which will then be converted into energy. Glucose will be flowed by the blood to all organs that need it, such as the heart, brain, nervous system, and other organs (Almatsier, 2009). Based on the recommended daily energy needs, 60 - 70% of which comes from carbohydrate sources (Puspasari & Andriani, 2017). If under-five childrens have less carbohydrate intake, it will cause a lack of energy in the body, so that under-five childrens will experience weight loss, then it will affect their nutritional status. In addition, it will also cause inhibition of growth and development of under-five childrens (Puspasari & Andriani, 2017).

Risk Factors of Adequate Fat Intake with the Incidence of Severe Acute Malnutrition. The results of this study indicate that sufficient fat intake is not a significant risk factor for the incidence of malnutrition in Grobogan Regency, with a p-value of 0.361 ($p > 0.05$) and an OR of 3.750. This means that sufficient fat intake in under-five children does not present a 3.750 times greater risk of malnutrition. This study is similar to research conducted on undernutrition, malnutrition, and well-nutrition under-five childrens in Suwari Bawean Village, Gresik which states that there is no significant relationship between fat intake with undernutrition and malnutrition in under-five childrens ($p=0.256$) (Fitriyah & Setyaningtyas, 2021). However, the results of this study contradict research conducted on undernutrition and well-nutrition under-five childrens in Panorama Village, Bengkulu City which states that fat intake is associated with the incidence of undernutrition under-five childrens ($p=0.020$ and $OR=7.429$) (Febriani et al., 2019).

Based on observations conducted through interviews using the food recall method, the average fat intake among malnourished under-five children was 48 grams, which is considered sufficient compared to the daily requirement of 45–50 grams. Meanwhile, the average energy

intake is still inadequate, so the body will convert fat into glucose to produce energy. As a result, fat cannot function properly. This causes disruption of the body's metabolism, which will have an impact on growth disorders (Baculu et al., 2015). Fat is the largest contributor of energy compared to other macro substances. In addition, fat plays a role in protecting the body's internal organs, regulating body temperature, and absorbing fat-soluble vitamins. If fat intake is less than needed, it will lead to reduced energy intake in the body that will be used for body metabolism and physical activity (Diniyyah & Nindya, 2017). In addition, the small number of samples may be the cause of the insignificant results between the adequacy of fat intake and the incidence of malnutrition in Grobogan Regency.

Risk Factors for Infectious Diseases with the Incidence of Severe Acute Malnutrition. This study found that adequate fat intake is not a risk factor for direct determinants of the incidence of malnutrition in Grobogan Regency (p=0.199). This study is similar to a study in Vellore, South India conducted on malnutrition and well-nutrition under-five childrens which resulted in no association between the history of infectious diseases and the incidence of malnutrition under-five childrens (p=0.169) (David et al., 2020). However, the results of this study contradict previous research conducted on children aged 7-12 months with malnutrition and good nutrition status in Kelapa Lima Regency, Kupang City which shows that the history of infectious diseases is associated with malnutrition in children (p=0.024 and OR=2.38) (Namangboling et al., 2017). Another study conducted on malnutrition under-five childrens and well-nutrition under-five childrens in Donggala Regency, Central Sulawesi Province stated that infectious diseases were associated with the incidence of malnutrition (p=0.05 and OR=2.88) (Baculu et al., 2015).

Infectious diseases that have been suffered by under-five childrens are ARI, diarrhea, and pulmonary TBC. Under-five childrens who experience diarrhea disease in both groups have the same number of 1 person per group. Based on interviews with respondents, it is known that well-nutrition under-five childrens experience acute diarrhea (<2 weeks), while malnutrition under-five childrens experience chronic diarrhea (>2 weeks). This is in accordance with the theory that children with malnutrition experience diarrhea with a longer and more frequent frequency. The worse the nutritional status, the more severe the diarrhea disease. In malnutrition under-five childrens there is bacterial contamination in the upper small intestine, causing diarrhea, fluid loss, and impaired absorption (Alim et al., 2021). The proportion of under-five childrens who experienced ARI was greater in the malnutrition under-five children group (36.3%) than in the well-nutrition under-five children group (27.3%). Under-five childrens with ARI experience symptoms of fever, cough and runny nose for <2 weeks. Malnutrition under-five childrens who experienced severe or chronic infectious diseases, namely pulmonary TBC, were 3 people (27.3%). Malnutrition can aggravate pulmonary TBC and develop latent TBC into active TBC (Musuenge et al., 2020).

There is no association between infectious diseases and the incidence of malnutrition is likely because both groups have almost the same tendency to experience infectious diseases. So that this causes infectious diseases not to be associated with the incidence of malnutrition. Infectious diseases and nutritional status have a reciprocal relationship. Malnutrition under-five childrens are more susceptible to infectious diseases because of their decreased immunity. Vice versa, infectious diseases will result in increased nutritional needs, but decreased appetite. This can cause nutritional disorders in under-five childrens (Cono et al., 2021). Infectious diseases occur due to a lack of awareness of parents in applying hygiene when preparing and processing food. Lack of environmental hygiene and sanitation can also cause infections in children (Namangboling et al., 2017). Based on data in the field, it is known that there are still stagnant waterways around the subject's residence. This can be a cause of infectious diseases.

Risk Factors of Number Family Members with the Incidence of Severe Acute Malnutrition Children. This study found that the number of family members did not emerge as a significant indirect risk factor for the incidence of malnutrition in Grobogan Regency (p=0.080). This result is consistent with findings from research conducted in Purwakarta

Regency in 2018, which similarly concluded that the number of children in the family was not associated with the risk of malnutrition among under-five children aged 1-59 months (p=0.393) (Widiya et al., 2018). Similarly, a study in Jhapa, Nepal in 2021 also indicated that the number of family members did not contribute to the indirect risk factors for malnutrition among under-five children (p=0.168) (Dahal et al., 2021). Despite the statistical findings in this study showing that the number of family members was not a significant factor, a higher proportion of malnourished under-five children came from families with larger numbers of members (>4 people) compared to well-nourished children (81.8% vs. 36.4%).

In contrast, another study conducted in Semarang City found that under-five children from families with more than four members were 12.1 times more likely to experience malnutrition (p=0.001) (Suyatman et al., 2017). Similarly, research in Kurigram, Bangladesh in 2019 identified the number of family members as a significant risk factor for underweight under-five children (p=0.011) (Hoq et al., 2019). Severe and chronic undernutrition in children under five years old (0-59 months) can lead to malnutrition (Alamsyah et al., 2017). Therefore, despite the non-significant statistical result in this study, the number of family members remains an important consideration.

The number of family members can influence the amount of attention parents are able to give to their children (Sulistyawati, 2019). Larger families may experience reduced parental attention and affection towards individual children (Abas et al., 2018). Moreover, a greater number of children in a family can increase the overall burden of childcare responsibilities (Budiana & Supriadi, 2021). Additionally, larger families may face challenges in providing adequate portions of food for each family member, potentially leading to increased vulnerability to malnutrition among under-five children in such households (Budiana & Supriadi, 2021).

Risk factors of participation in posyandu with the incidence of severe acute malnutrition children. This study determined that participation in posyandu was not found to be an indirect risk factor for the occurrence of malnutrition among under-five children in Grobogan Regency (p=1.000). This finding is supported by the fact that a significant majority of under-five children (90.9%) had actively participated in posyandu sessions, attending at least eight consecutive visits. These results are consistent with a study conducted in Banyumas Regency in 2016, which found that both case group respondents (under-five children with malnutrition) and controls showed similar adherence to routine weighing of under-five children at posyandu, categorized by age (Purwanti et al., 2016). Similarly, research in Cangkiran Village, Mijen Regency, Semarang City in 2012 concluded that there was no significant correlation between maternal participation in posyandu activities and the nutritional status of under-five children based on weight-for-length (p=0.998) (Asdhany & Kartini, 2012).

A qualitative descriptive study conducted in Banda Aceh City in 2020 identified several factors influencing maternal participation in posyandu visits, including the roles of nutritionists, cadres, government initiatives, and the availability of facilities (Fatimah et al., 2020). Posyandu represents a government initiative aimed at assisting mothers in monitoring the monthly growth of under-five children, facilitating early detection of developmental deviations (Diagama et al., 2019; Pratiwi et al., 2016; Umijati et al., 2012). These findings align with the secondary data obtained in this study, which indicated that the majority of mothers of malnourished under-five children had good knowledge related to nutrition (81.8%).

Risk Factors of Mother Knowledge of Nutrition with the Incidence of Severe Acute Malnutrition. This study found that mother's knowledge related to nutrition was not included in the indirect risk factors for the occurrence of malnutrition in Grobogan Regency (p=0.476). This is because most under-five children with malnutrition status have mothers with good nutrition-related knowledge (81.8%). Contrary to these findings, research conducted in Rumbai Pesisir Regency, Pekanbaru City in 2017 indicated that mothers with inadequate knowledge were four times more likely to have under-five children with malnutrition compared to those

with good knowledge (p=0.006) (Nurmaliza & Herlina, 2018). Another study conducted in Banyumas Regency also stated that under-five childrens with poor mother's nutrition knowledge were 3.875 times at greater risk of being malnutrition (p=0.002) (Purwanti et al., 2016).

Mothers who possess good nutrition knowledge are typically expected to apply their knowledge in caring for their children. However, the results of this study show that there are still under-five children with poor nutritional status despite having mothers with good nutrition-related knowledge. This is thought to be because the results of good knowledge does not guarantee that the mother has a under-five children with good nutritional status as well because the mother's behaviour may be influenced by other factors. Knowledge can be obtained from formal and informal education (Ni'mah & Muniroh, 2015). Food consumption in under-five childrens which can ultimately affect nutritional status, can be influenced by education and nutritional knowledge (Purwanti et al., 2016). Knowledge or insight into nutrition can also be obtained through cadres or local health workers when participating in posyandu activities (Pratiwi et al., 2016).

Risk factors of mother's parenting with the incidence of severe acute malnutrition children. this study found that parenting was not included in the indirect risk factors for the incidence of malnutrition in Grobogan Regency (p=0.087). The results of this study are not in line with the results of research conducted in Semarang City which states that under-five childrens who have poor health parenting are 35 times more likely to be malnutrition than under-five childrens who have good health parenting (p=0.001) (Suyatman et al., 2017). Although the results of statistical tests in this study found that mother's parenting was not included in the risk factors for the incidence of malnutrition under-five childrens in Grobogan Regency, the proportion of under-five childrens with poor mother parenting was found to be more in malnutrition under-five childrens (63.6%) than in well-nutrition under-five childrens (27.3%).

The assessment of mother parenting patterns in this study was carried out using a questionnaire instrument which included parenting statements related to food intake, responsive feeding, and sanitation hygiene. Based on the data obtained in the field, mother parenting patterns in malnutrition under-five childrens still need attention in terms of food intake. It is known that the energy intake of under-five childrens in this study shows that the majority (90.9%) of under-five childrens with malnutrition status, their energy intake (<80%) is still in the deficient category. Some mothers admitted that their children only like to eat rice with clear vegetable soup without vegetables and side dishes or prefer to snack on snacks and leave them alone. Inadequate intake of nutrients can interfere with growth and development, and risk causing death if not handled properly (Septikasari, 2018). Nutrients needed by the body for the growth and development process can be obtained by under-five childrens through feeding. As the age of the child increases, the food provided must be nutritionally balanced and diverse (Putri, 2019). Lack of energy intake for a long time will inhibit growth and can reduce energy reserves in the body so that it can cause malnutrition (Helmi, 2013).In addition, the health of children under five is also indirectly influenced by environmental sanitation which in turn can affect the condition of the nutritional status of children under five. Under-five childrens who grow up in an unhealthy environment are at 1 times greater risk of being malnutrition compared to under-five childrens with good nutritional status (Hidayat & Fuada, 2011).

4. CONCLUSION

The conclusion is adequate energy intake has been identified as a significant risk factor for SAM among under-five children in Grobogan Regency. Conversely, factors such as adequate intake of protein, fat, and carbohydrates, infectious diseases, family size, participation in posyandu, maternal nutrition knowledge, and parenting practices were not recognized as significant risk factors. Further research can be done to look at other risk factors such as the

number of children, as well as the quality of diet and intake of micronutrients such as vitamins and minerals to the incidence of malnutrition.

ACKNOWLEDGMENTS

The authors would like to thank the research subjects and respondents, the Grobogan Regency Health Office, and the health centers involved. The authors would also like to thank the village midwives and posyandu cadres who participated in the primary data collection.

REFERENCES

Abas, T., Abdurrahman, F., & Ichwansyah, F. (2018). Hubungan Karakteristik Ibu dengan Status Gizi Kurang Baduta dalam Seribu Hari Pertama Kehidupan di Puskesmas Baitussalam Kabupaten Aceh Besar Tahun 2017. *Jurnal Kedokteran Nanggroe Medika*, 1(3), 27-38. Retrieved from: https://www.jknamed.com/jknamed/article/view/89

Alamsyah, D., Mexitalia, M., Margawati, A., Hadisaputro, S., & Setyawan, H. (2017). Beberapa Faktor Risiko Gizi Kurang dan Gizi Buruk pada Balita 12-59 Bulan (Studi Kasus di Kota Pontianak). *Jurnal Epidemiologi Kesehatan Komunitas*, 2(1), 46-53. https://doi.org/10.14710/jekk.v2i1.3994

Alim, M. C., & Mariska, N. U. E. (2021). Hubungan Diare dengan Status Gizi pada Balita di Rumah Sakit Umum Daerah Dr. H. Chasan Boesoirie. *Kieraha Medical Journal*, 3(1), 1-6. https://doi.org/10.33387/kmj.v3i1.3262

Almatsier, S. (2009). Prinsip Dasar Ilmu Gizi. Jakarta: *Gramedia Pustaka Utama*.

Almatsier, S., Soetardjo, S., & Soekatri, M. (2011). *Gizi Seimbang dalam Daur Kehidupan*. Jakarta: Gramedia Pustaka Utama.

Asdhany, C., & Kartini, A. (2012). Hubungan Tingkat Partisipasi Ibu dalam Kegiatan Posyandu dengan Status Gizi Anak Balita (Studi di Kelurahan Cangkiran Kecamatan Mijen Kota Semarang). *Journal of Nutrition College*, *1*(1), 11–20. https://doi.org/10.14710/jnc.v1i1.424

Aslina, A., & Suryani, I. (2018). Hubungan Status Gizi terhadap Kejadian Infeksi Saluran Pernapasan Akut (ISPA) pada Balita di Wilayah Kerja Puskesmas Payung Sekaki Kota Pekanbaru Tahun 2018. *Ensiklopedia of Journal*, *1*(1), 147–152. Retrieved from: https://jurnal.ensiklopediaku.org/ojs-2.4.8-3/index.php/ensiklopedia/article/view/47

Baculu, E. P. H., Juffrie, M., & Helmyati, S. (2015). Faktor Risiko Gizi Buruk pada Balita di Kabupaten Donggala Provinsi Sulawesi Tengah. *Jurnal Gizi Dan Dietetik Indonesia*, *3*(1), 51–59. https://doi.org/10.21927/ijnd.2015.3(1).51-59

Baculu, E. P. H., & Jufri, M. (2017). Faktor Risiko Gizi Buruk pada Balita Pesisir Pantai. *Jurnal Kesehatan Masyarakat*, 7(2), 123-130. https://doi.org/10.31934/promotif.v7i2.85

Budiana, T. A., & Supriadi, D. (2021). 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*, 12(1), 38-50. https://doi.org/10.34305/JIKBH.V12I1.256

Cono, E. G., Nahak, M.PM., & Gatum, A.M. (2021). Hubungan Riwayat Penyakit Infeksi dengan Ststus Gizi Pada Balita Usia 12-59 Bulan di Puskesmas Oepoi Kota Kupang. *CHMK Health Journal*, 5(1), 236-241. Retrieved from: https://cyber-chmk.net/ojs/index.php/kesehatan/article/view/856

Dahal, K., Yadav, D. K., Baral, D., & Yadav, B. K. (2021). Determinants of severe acute malnutrition among under 5 children in Satar community of Jhapa, Nepal. *PloS one*, 16(2), e0245151. https://doi.org/10.1371/journal.pone.0245151

David, S. M., Pricilla, R. A., Paul, S. S., George, K., Bose, A., & Prasad, J. H. (2020). Risk factors for severe acute malnutrition among children aged 6–59 months: A community-

based case-control study from Vellore, Southern India. *Journal of family medicine and primary care*, 9(5), 2237-2243. https://doi.org/10.4103/jfmpc.jfmpc_211_20

Diagama, W., Amir, Y., & Hasneli, Y. (2019). Hubungan Jumlah Kunjungan Posyandu Dengan Status Gizi Balita (1-5 Tahun). *Jurnal Ners Indonesia*, 9(2), 97-108.

Dinas Kesehatan Provinsi Jawa Tengah. (2019). *Profil Kesehatan Provinsi Jateng Tahun 2019*. Semarang: Dinas Kesehatan Provinsi Jawa Tengah.

Dinas Kesehatan Kabupaten Grobogan. (2016). *Rencana Strategis (Renstra) Dinas Kesehatan Kabupaten Grobogan Tahun 2016-2021*. Grobogan: Dinas Kesehatan Kabupaten Grobogan.

Diniyyah, S. R., & Nindya, T. S. (2017). Asupan energi, protein dan lemak dengan kejadian gizi kurang pada balita usia 24-59 bulan di Desa Suci, Gresik. Amerta Nutrition, 1(4), 341-350. https://doi.org/10.20473/amnt.v1i4.7139

Fadlillah, A. P., & Herdiani, N. (2020). Literature Review: Asupan Energi Dan Protein Dengan Status Gizi Pada Balita. *Prosiding National Conference for Ummah*, 1(1). Retrieved from: https://conferences.unusa.ac.id/index.php/NCU2020/article/view/637

Fatimah, S., Abdullah, A., & Harris, A. (2020). Analisis Partisipasi Ibu Balita dalam Pemanfaatan Posyandu di Wilayah Puskesmas Kota Banda Aceh. *Jurnal SAGO Gizi Dan Kesehatan*, *1*(2), 185–194. https://doi.org/10.30867/gikes.v1i2.414

Febriani, E., Wahyudi, A., & Haya, M. (2019). Pengetahuan Ibu dan Asupan Zat Gizi Makro Berhubungan dengan Kejadian Gizi Kurang pada Anak Usia 12-24 Bulan. *Jurnal Ilmu dan Teknologi Kesehatan*, *7*(1), 77–89. Retrieved from: https://ejurnal.poltekkesjakarta3.ac.id/index.php/jitek/article/view/224

Fitriyah, N., & Setyaningtyas, S. W. (2021). Hubungan Asupan Energi, Makronutrien, Zink dan Fe dengan Underweight pada Ibu dan Balita di Desa Suwari Bawean, Gresik Relationship of Energy Intake, Macronutrient, Zinc and Fe with Underweight in Mothers and Toddlers in Suwari Bawean Village, Gresik. *Media Gizi Kesmas*, 10(1), 56-62. https://doi.org/10.20473/mgk.v10i1.2021.56-62

Gubernur Jawa Tengah. (2019). *Peraturan Gubernur Jawa Tengah Tahun 2019 tentang Rencana Aksi Daerah Pangan dan Gizi Provinsi Jawa Tengah Tahun 2019-2023*. Semarang: Gubernur Jawa Tengah.

Helmi, R. (2013). Faktor-Faktor yang Berhubungan dengan Status Gizi pada Balita di Wilayah Kerja Puskesmas Margototo Kecamatan Metro Kibang Kabupaten Lampung Timur. *Jurnal Kesehatan*, *IV*(1), 233–242. Retrieved from: https://ejurnal.poltekkes-tjk.ac.id/index.php/JK/article/view/6

Hidayat, T. S., & Jahari, A. B. (2012). Perilaku Pemanfaatan Posyandu Hubungannya dengan Status Gizi dan Morbiditas Balita. *Buletin Penelitian Kesehatan*, *40*(1), 1–10.

Hoq, M., Ali, M., Islam, A., & Banerjee, C. (2019). Risk Factors of Acute Malnutrition Among Children Aged 6-59 Months Enrolled in a Community-Based Programme in Kurigram, Bangladesh: A Mixed-Method Matched Case-Control Study. *Journal of Health, Population and Nutrition*, *38*(36), 1–7. https://doi.org/10.1186/s41043-019-0192-2

Juhariyah, S., & Mulyana, S. A. S. F. (2018). Hubungan Status Gizi dengan Kejadian Diare pada Balita di Puskemas Rangkasbitung. *Jurnal Obstretika Scientia*, *6*(1), 219–230. Retrieved from: https://ejurnal.latansamashiro.ac.id/index.php/OBS/article/view/359

Kementerian Kesehatan Republik Indonesia. (2018). *Laporan Provinsi Jawa Tengah Riskesdas 2018*. Jakarta: Kementerian Kesehatan Republik Indonesia.

Kementerian Kesehatan Republik Indonesia. (2020). Peraturan Menteri Kesehatan Nomor 2 Tahun 2020 tentang Standar Antropometri Anak. Jakarta: Kementerian Kesehatan Republik Indonesia

Kalsum, U., & Jahari, A. B. (2015). Strategi menurunkan prevalensi gizi kurang pada balita di Provinsi Jambi. *Jambi Medical Journal: Jurnal Kedokteran dan Kesehatan*, 3(1), 45–59. Retrieved from: https://online-journal.unja.ac.id/kedokteran/article/view/2719

Lestari, M. P., & Kusumaningrum, N. S. D. (2021). Gizi untuk Proses Penyembuhan Luka pada Pasien dengan Diabetic Foot Ulcer (DFU): Literature Review. *Journal of Nutrition College*, *10*(1), 39–46. https://doi.org/10.14710/jnc.v10i1.29825

Musuenge, B. B., Poda, G. G., & Chen, P. C. (2020). Nutritional Status of Patients with Tuberculosis and Associated Factors in the Health Centre Region of Burkina Faso. *Nutrients*, *12*(9), 1–13. https://doi.org/10.3390/nu12092540

Namangboling, A. D., Murti, B., & Sulaeman, E. S. (2017). Hubungan Riwayat Penyakit Infeksi dan Pemberian ASI Eksklusif dengan Status Gizi Anak Usia 7-12 Bulan di Kecamatan Kelapa Lima Kota Kupang. *Sari Pediatri*, *19*(2), 91-96. https://doi.org/10.14238/sp19.2.2017.91-6

Ni'mah, C., & Muniroh, L. (2015). Hubungan tingkat pendidikan, tingkat pengetahuan dan pola asuh ibu dengan wasting dan stunting pada balita keluarga miskin. Media Gizi Indonesia, 10(1), 84-90.

Nurmaliza, & Herlina, S. (2018). Hubungan Pengetahuan dan Pendidikan Ibu terhadap Status Gizi Balita. *Jurnal KESMARS*, *1*(1), 44–48. https://doi.org/10.31539/kesmars.v1i1.171

Pambudi, J., & Christijani, R. (2017). Praktek Penyapihan Dini Serta Hubungannya Dengan Keadaan Sosial Ekonomi Dan Wilayah Tempat Tinggal. *Penelitian Gizi dan Makanan (The Journal of Nutrition and Food Research)*, 40(2), 87-94.

Pratiwi, T. D., Masrul, M., & Yerizel, E. (2016). Hubungan Pola Asuh Ibu dengan Status Gizi Balita di Wilayah Kerja Puskesmas Belimbing Kota Padang. *Jurnal Kesehatan Andalas*, *5*(3), 661–665. https://doi.org/10.25077/jka.v5i3.595

Purwanti, R., Wati, E. K., & Rahardjo, S. (2016). Karakteristik Keluarga yang Berhubungan dengan Status Gizi Balita Umur 6- 59 Bulan. *Jurnal Gizi Indonesia (The Indonesian Journal of Nutrition)*, *5*(1), 50–54. https://doi.org/10.14710/jgi.5.1.50-54

Puspasari, N., & Andriani, M. (2017). Hubungan Pengetahuan Ibu tentang Gizi dan Asupan Makan Balita dengan Status Gizi Balita (BB/U) Usia 12-24 Bulan. *Amerta Nutrition*, *1*(4), 369–378. https://doi.org/10.20473/amnt.v1.i4.2017.369-378

Putri, M. R. (2019). Hubungan Pola Asuh Orang Tua dengan Status Gizi pada Balita di Wilayah Kerja Puskesmas Bulang Kota Batam. *Jurnal Bidan Komunitas*, *2*(2), 107-116. https://doi.org/10.33085/jbk.v2i2.4334

Septikasari, M. (2018). *Status Gizi Anak dan Faktor yang Mempengaruhi*. Yogyakarta: UNY Press.

Sirajuddin, Surmita, & Astuti, T. (2018). *Survey Konsumsi Pangan*. Jakarta: Kementerian Kesehatan Republik Indonesia.

Sulistyawati, A. (2019). Faktor Risiko Kejadian Gizi Buruk pada Balita di Dusun Teruman Bantul. *Jurnal Kesehatan Madani Medika*, *10*(1), 13–19. https://doi.org/10.36569/jmm.v10i1.52

Suyatman, B., Fatimah, S., & Dharminto. (2017). Faktor Risiko Kejadian Gizi Kurang pada Balita (Studi Kasus di Wilayah Kerja Puskesmas Bandarharjo Kota Semarang). *Jurnal Kesehatan Masyarakat*, *5*(4), 778 - 787. https://doi.org/10.14710/jkm.v5i4.18778

Umijati, S., Kardjati, S., & Ismoedijanto. (2012). Model Pengasuhan Gizi Anak Balita Berdasarkan Pendekatan Faktor Risiko. *JBP*, *14*(1), 30–39.

Wanty, Widyastuti, N., & Probosari, E. (2017). Asupan Zat Gizi Makro, Status Gizi, dan Status Imun pada Vegetarian dan Non-Vegetarian. *Journal of Nutrition College*, *6*(3), 234–240. https://doi.org/10.14710/jnc.v6i3.16915

Widiya, I., Yani, A., & Aminarista. (2018). Hubungan Karakteristik Ibu dengan Status Gizi Kurang pada Balita di Puskesmas Pasawahan Kabupaten Purwakarta 2017. *Journal of Holistic and Health Sciences*, *2*(1), 24–29. https://doi.org/10.51873/jhhs.v2i1.21

Wong, H. J., Moy, F. M., & Nair, S. (2014). Risk Factors of Malnutrition Among Preschool Children in Terengganu, Malaysia: A case Control Study. *BMC Public Healthublic Health*, *14*(785), 1–10. https://doi.org/10.1186/1471-2458-14-785

Yuniarti, S. (2015). *Asuhan Tumbuh Kembang Neonatus Bayi-Balita dan Anak Pra-Sekolah*. Bandung: Refika Aditama.