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Factors contributing to undernutrition among children under five years old

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ABSTRACT

Introduction: Basic Health Research in 2018 stated Jember as a district with the third highest incidence of undernutrition in East Java. Undernutrition is a threat to future generations because it has short-term and long-term impacts that can be irreversible. This study aimed to determine the factors associated with undernutrition among children under five in Karangrejo Village, Jember Regency.

Methods: This research used a cross-sectional method involving 94 mothers and children under five years old registered at Posyandu in Karangrejo Village who were selected by purposive sampling. The dependent variable included the sociodemographic factors of mothers and children and was obtained using a demographic questionnaire. The dependent variable, undernutrition, was determined based on weight-for-age and was obtained by plotting the child's weight on the WHO weight-for-age curve: 0-5 years (z score) according to the child's sex. Statistical tests used ordinal logistic regression tests.

Results: There are some factors contributing to undernutrition, including the father's education in elementary school (p=0.002, OR=5.628), the number of children no more than two persons (p=0.038, OR=-2.546), a complete history of immunization (p=0.011, OR=-4.627), history of infection of ARI every month and every two months (p =0.001, OR= -3.897, -7.250) respectively, and the level of mother's knowledge about fulfilling children nutrition (p=0.000, OR= 5.593).

Conclusions: This study suggests that raising parent education, complete immunization, and mothers' knowledge are recommended to prevent undernutrition among children. Furthermore, the outcome of this study re-emphasizes that educational activities regarding children's nutritional needs are still needed to improve mothers' knowledge.

Keywords: children; contributing factors; undernutrition

INTRODUCTION

Children under five years are very vulnerable to disease and nutritional disorders, which result in sub-optimal growth and development (Clark et al., 2020). Adequate nutrition received early in children optimizes body function, prevents infection, and speeds up the healing process of disease. However, nutritional deficiencies in children are still a significant health issue in Indonesia. Inadequate nutritional status during the first 1000 days of life can have irreversible effects. The adverse effects of undernutrition on children include retarded brain development, low cognitive ability and learning achievement, stunted growth, and susceptibility to infections that can threaten the quality of future generations (Govender et al., 2021; Hickson & Julian, 2018). Many determinant factors can contribute to undernutrition in children, and it is crucial to identify which factors can be modified so that the appropriate recommendations or interventions can be given to parents with children under five.

According to the UNICEF report, the percentage of children under five years in the world who experienced stunting (low height-for-age) in 2019 reached 21.3%, while those who experienced wasting (low weight-for-height) reached 6.9%, with most cases occurring in the continent Africa and South Asia (UNICEF, 2020). Based on RISKESDAS (2018), the percentage of children in Indonesia with moderately underweight is 13.8%, and severely underweight is 3.8%. Even though there was a decrease in the RISKESDAS data in 2013, the cases are still higher than in several ASEAN countries. Jember Regency is a district with the third highest prevalence of undernutrition in East Java after Bangkalan and Pamekasan. The number of children under five with undernutrition in Jember Regency reached 263 persons (RISKESDAS, 2018b).

Many factors cause undernutrition in children. Low food intake is the main factor but not the only cause of low nutritional status among them (Hockenberry&Wilson, 2015). Other factors are environmental conditions, including climate and the level of hygiene where the child lives, the child's diet, and the type of food consumed by the child based on beliefs and culture. Sociodemographic factors of children were also known to play an essential role in undernutrition among children, including parents' educational level, family income,

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father's occupation, mother's occupation, number of family members, and parenting style (Handayani, 2017).

Research related to undernutrition has not been widely carried out in the Jember Regency area. The previous research conducted by Septiyono et al. (2019) in Kemuning Lor Village, Arjasa District, Jember Regency, shows a relationship between the mother's attitude and the nutritional status of children. Indarti (2016) research's conducted in Ajung District, Jember Regency, proved that children from families with high economic status and a family income of >1,500,000 would have good nutritional status compared to those from families with low economic status. Many factors that may contribute to undernutrition among children under five in Jember District need to be investigated. Finding additional factors that might impact children's undernutrition in Karangrejo Village, a location within Jember Regency, was of interest to researchers.

METHODS

Design

This research was a quantitative study using a cross-sectional research design.

Sample and Setting

The population of this study was all mothers and children under five years who lived in Karangrejo Village. The population in this study was 628 mothers and children distributed to three Posyandu.

The sample in this study was mothers and children who lived in Karangrejo Village and registered at Posyandu with the inclusion criteria including 1) children under five years old living permanently at the Karangrejo Village; 2) the mother is willing to be a research respondent by signing an informed consent 3) the mother can read and write. Meanwhile, the exclusion criteria in this study were 1) children with physical disabilities; 2) children not cared for by their mothers. To calculate an appropriate sample for the study, the researcher used Slovin's Formula with an e value of 0.1, considering the population number of the study is quite large. According to Slovin's Formula, the minimum sample size was 86. We also set a missing rate of 10% to anticipate the participant's withdrawal. Therefore, the total sample of this study was 94 respondents, which were selected using a purposive sampling technique.

Variables

The independent variable of the study was sociodemographic factors (child's age, mother's age, child's gender), socio-economic factors (last education of father and mother, monthly family income), health history of the children (exclusive breastfeeding, history of immunizations, and history of Acute Respiratory Infection), child's eating pattern (frequency of meals, types of snacks), and mother's knowledge about fulfilling child's nutrition. The dependent variable of the study was undernutrition.

Instruments

According to WHO, undernutrition has been classified into three types, including underweight (low weight for age), stunting (low height for age), and wasting (low weight for height). This study focused on underweight conditions only. The researcher first measured the child's weight using a hanging-type weighing scale to determine undernutrition among children. The weight of each child was then plotted into the WHO weight-for-age: z-score curve by adjusting the sex of the child. The results of the growth curve plot are then classified based on the anthropometric standards of the World Health Organization National Center for Health Statistics (WHO-NCHS), which have been established for use through the Decree of the Minister of Health of the Republic of Indonesia Number: 1995/Menkes/SK/XII/2010 (KEMENKES, 2011). There are four classifications of nutritional status based on weight/age, namely 1) severely underweight (<-3SD); 2) moderately underweight (-3SD to -2SD); 3) good nutrition (-2SD to 2SD); and 4) overnutrition (>2SD).

Sociodemographic, and socio-economic data, children's health history, and eating patterns were obtained through demographic questionnaires with multiple-choice answers. The researcher collected the mothers' knowledge level data regarding the fulfillment of child nutrition using a four-point Likert scale questionnaire—the questionnaire about mothers' knowledge originally compiled by Herlianawati (2017) and then modified by the researcher. The original version of the questionnaire consisted of 23 questions which accommodated three aspects of knowledge about the fulfillment of child nutrition, including balanced nutrition, benefits of adequate nutrition, and food preparation practice. The researcher added three other questions related to food preparation practice. The researcher also conducted a validity and reliability test on 40 mothers with children under five years living in the Jember regency. The validity of the knowledge level questionnaire was done with 26 items using Pearson Product Moment Correlation test. A total of 24 items has an r-value of 0.425-0.746, more significant than the r table (0.229) means that the 24 items are valid. While two items have an r-value of 0.19-0.20, smaller than the r table, it is invalid. The Cronbach Alpha value for each question item of the mother's knowledge questionnaire about fulfilling nutrition in this study was 0.76-0.83, while the overall Cronbach Alpha value was 0.81, which demonstrates the survey's high level of reliability. According to the mean value and standard deviation (SD), the mother's knowledge level was divided into three categories: low, moderate, and high. The formula was as follows: high=X>mean+SD; moderate=mean-SDXMean+D; and low=Xmean-SD.

Procedure

Before participant recruitment, the researcher applied for a research permit from the National Political and Society Protection Board (Badan Kesatuan Bangsa dan Politik/ BAKESBANG) and the Head of Karangrejo Village. After receiving research permits from related parties, the researcher conducted a validity and reliability test of the questionnaire. When all variables were valid and reliable, the researcher contacted the POSYANDU cadres to discuss the study. The researcher and the POSYANDU cadres distributed written information about the study and informed consent to the eligible mothers during POSYANDU. Only mothers who agreed to participate in the study and signed the informed consent received an invitation letter to attend the research on the set date and location. The study was in the POSYANDU Cadre house in Karangrejo Village. Paper-based questionnaires were distributed to the mother after the measurement of the child's weight was done by the researcher

Data Analysis

Data analysis was done using an ordinal logistic regression test with a statistical significance 0.05. The researcher conducted data analysis using IBM SPSS Statistic 25 for Microsoft Windows.

Ethical Considerations

This research has obtained ethical approval from the Ethics Commission of Universitas dr. Soebandi based on ethical license number. 227/ETIK/UDS/V/2022.

RESULTS

As shown in Table 1, most children severely underweight and moderately underweight had mothers aged 26-31 years. Most severely underweight and moderately underweight children were in the age range > 12-36 months and were female. The majority of children who were severely underweight and moderately underweight come from families where: the mother does not work and has low knowledge regarding fulfilling nutrition, the father and mother have a primary school education, the family income per month is <1 million rupiahs, and have more than two children. Most children with severely underweight and moderately underweight had incomplete immunizations, received exclusive breastfeeding, experienced a cold cough once a week, and consumed unhealthy snacks.

The results showed that 8.51% of children experienced severely underweight, and 13.83% of children experienced moderately underweight (Table 2).

Table 2. Frequency Distribution of Children's Nutritional Status Based on Weight/Age (n=94)

Weight /Age	n	%
Severely Underweight	8	8.51
Moderately Underweight	13	13.83
Good Nutrition	73	77.66

The multivariate analysis method of ordinal regression was used in this study to identify the factors linked to undernutrition. The results of ordinal regression analysis showed that there are five factors contributing to the undernutrition in children, such as father's education (p=0.002, OR=5.628), number of children (p=0.038, OR=-2.546), immunization history (p=0.011, OR=- 4.627), history of ARI (p=0.001, OR=-7.250), and level of mother's knowledge about fulfilling child's nutrition (p=0.000, OR= 5.593). Children whose fathers had an elementary school education background are 5.6 times more likely to experience undernutrition than children whose fathers had a higher education. Meanwhile, children whose fathers had

Table 1. Frequency Distribution of Children Nutritional Status based on The Demographic Data Characteristics (n=94)

Demographic Characteristics	Nutritional Status			%
	Moderately Underweight	Severely Underweight	Good Nutrition	
Mother's Age (Year)				
20-25	0 (0%)	2 (2.1%)	34 (36.2%)	38.3
26-31	7 (7.4%)	7 (7.4%)	30 (31.9%)	46.7
>31	1 (1.1%)	4 (4.3%)	9 (9.6%)	15
Child's Age (Month)				
0-12	2 (2.1%)	2 (2.1%)	24 (25.5%)	29.7
>12-36	6 (6.4%)	6 (6.4%)	30 (31.9%)	44.7
>36-59	0 (0%)	5 (5.3%)	19 (20.3%)	25.6
Child's Gender				
Male	0 (0%)	7 (7.4%)	24 (25.5%)	32.9
Female	8 (8.5%)	6 (6.4%)	49 (52.1%)	67.1
Mother's Occupation				
Employed	1 (1.1%)	5 (5.3%)	17 (18.1%)	24.5
Unemployed	7 (7.4%)	8 (8.5%)	56 (59,6%)	75.5
Mother's Education				
Elementary School	4 (4.3%)	6 (6.4%)	28 (29.7%)	40.4
Junior High School	4 (4.3%)	1 (1.1%)	27 (28.7%)	34.1
Senior High School	0 (0%)	5 (5.3%)	16 (17%)	22.3
University	0 (0%)	1 (1.1%)	2 (2.1%)	3.2
Father's Education				
Elementary School	4 (4.3%)	5 (5.3%)	27 (28.6%)	38.2
Junior High School	2 (2.1%)	6 (6.4%)	10 (10.5%)	19
Senior High School	2 (2.1%)	2 (2.1%)	24 (25.5%)	29.7
University	0 (0%)	0 (0%)	2 (2.1%)	2.1

Demographic Characteristics	Nutritional Status			%
	Moderately Underweight	Severely Underweight	Good Nutrition	
Family Income (Million)				
<1	5 (5.3%)	11 (11.7%)	29 (30.8%)	47.8
1-1,5	3 (3.2%)	2 (2.1%)	20 (21.4%)	26.7
1,6 -2	0 (0%)	6 (6.4%)	8 (8.5%)	14.9
>2	0 (0%)	0 (0%)	10 (10.6%)	10.6
Number of Children (Person)				
1-2	0 (0%)	5 (5.3%)	34 (36.2%)	41.5
>2	8 (8.5%)	8 (8.5%)	39 (41.5%)	58.5
History of Immunization				
Complete	1 (1.1%)	3 (3.2%)	23 (24.5%)	28.8
Incomplete	7 (7.4%)	10 (10.6%)	50 (53.2%)	71.2
History of Exclusive Breastfeeding				
Yes	8 (8.5%)	10 (10.6%)	44 (46.8%)	65.9
No	0 (0%)	3 (3.2%)	29 (30.9%)	34.1
History of Acute Respiratory Infection (ARI)				
Having a cough and cold every week	3 (3.2%)	5 (5.3%)	12 (12.8%)	21.3
Having a cough and cold every two weeks	4 (4.3%)	3 (3.2%)	17 (18.1%)	25.6
Having a cough and cold every month	0 (0%)	2 (2.1%)	5 (5.3%)	7.4
Having a cough and cold every two months	0 (0%)	0 (0%)	7 (7.5%)	7.5
Rarely having cough and cold	1 (1.1%)	3 (3.2%)	32 (34%)	38.3
Eating Frequency per Day				
1x	0	0	4 (4.2%)	4.2
2x	3 (3.2%)	1 (1.1%)	8 (8.5%)	12.8
3x	5 (5.3%)	10 (10.5%)	40 (42.4%)	58.2
>3x	0	2 (2.6%)	21 (22.2%)	24.8
Mother's Knowledge of Nutritional Fulfillment				
Low	4 (4.3%)	6 (6.4%)	45 (47.9%)	58.6
Moderate	1 (1.1%)	5 (5.3%)	18 (19.1%)	25.5
High	3 (3.2%)	2 (2.1%)	10 (10.6%)	15.9
Type of Snack				
Healthy snack	5 (5.3%)	12 (12.8%)	23 (24.4%)	42.5
Unhealthy snack	3 (3.2%)	1 (1.1%)	50 (53.2%)	57.5

junior high school education have a 2.7 times higher chance of experiencing undernutrition compared to children whose fathers had higher education. Children from families with no more than two children have a 2.5 times lower chance of experiencing undernutrition compared to children from families with more than two children.

Children with a history of complete immunization have a 4.6 times lower chance of experiencing undernutrition than children with incomplete immunizations. Children who get a cough and cold once a month have a 3.9 times lower chance of experiencing undernutrition, while children who get a cough and cold once every two months have a 7.2 times lower chance of experiencing undernutrition than children who experience frequent colds and coughs. Children whose mothers had limited knowledge regarding fulfilling nutrition have a 5.6 times higher chance of experiencing malnutrition than children whose mothers had moderate and high levels of knowledge.

DISCUSSION

According to this study, children with undernutrition were still relatively high, reaching 22.3%. In this study, the number of children under five with undernutrition was higher than that of Septiyono et al. (2019) in Kemuning Lor Village, Arjasa District, Jember Regency, which showed that 19.2% of the 156 children studied experienced underweight. Several factors were significantly related to the nutritional status of children in this study, including the father's education in elementary school, the number of children of no more than two persons, a complete history of immunization, a history of ARI every month, and every two months, and level of knowledge of mothers about fulfilling child's nutrition.

The results of this study are supported by previous studies, which found that a father's education significantly affects the nutritional status of children. Akhter & Haque (2018), in their research involving 600 children in Bangladesh, found that the number of children with undernutrition decreased as the level

Table 3. Logit Ordinal Regression Estimation Result

Demographic Characteristics	OR	Std. Error	Wald	Df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Nutritional Status							
Severely Underweight	-2.478	4577.750	0.000	1	1.000	-8974.703	8969.746
Moderately Underweight	1.110	4577.750	0.000	1	1.000	-8971.115	8973.334
Mother's Age (Year)							
20-25	0.630	0.972	0.420	1	0.517	-1.275	2.534
26-31	-1.079	0.668	2.608	1	0.106	-2.389	0.231
>31	0a	.	.	0	.	.	.
Child's Age (Month)							
0-12	-0.634	0.877	0.523	1	0.469	-2.353	1.084
>12-36	-0.376	0.674	0.310	1	0.577	-1.697	0.946
>36-59	0a	.	.	0	.	.	.
Child's Gender							
Male	0.899	0.600	2.246	1	0.134	-0.277	2.074
Female	0a	.	.	0	.	.	.
Mother's Occupation							
Employed	0.307	0.571	0.289	1	0.591	-0.812	1.426
Unemployed	0a	.	.	0	.	.	.
Mother's Education							
Elementary School	0.680	1.437	0.224	1	0.636	-2.137	3.496
Junior High School	0.666	1.472	0.205	1	0.651	-2.220	3.552
Senior High School	0.715	1.498	0.228	1	0.633	-2.221	3.650
University	0a	.	.	0	.	.	.
Father's Education							
Elementary School	5.628	1.822	9.544	1	0.002	2.058	9.199
Junior High School	2.694	1.420	3.598	1	0.058	-0.089	5.478
Senior High School	1.502	0.000	.	1	.	1.502	1.502
University	0a	.	.	0	.	.	.
Family Income (Million)							
<1	-22.857	3804.241	0.000	1	0.995	-7479.031	7433.318
1-1,5	-18.379	3804.240	0.000	1	0.996	-7474.553	7437.795
1,6 -2	5.234	4577.751	0.000	1	0.999	-8966.992	8977.460
>2	0a	.	.	0	.	.	.
Number of Children (Person)							
1-2	-2.546	1.227	4.306	1	0.038	-4.952	-0.141
>2	0a	.	.	0	.	.	.
History of Immunization							
Complete	-4.627	1.824	6.432	1	0.011	-8.202	-1.051
Incomplete	0a	.	.	0	.	.	.
History of Exclusive Breastfeeding							
Yes	-1.902	2.061	0.852	1	0.356	-5.942	2.138
No	0a	.	.	0	.	.	.
History of Acute Respiratory Infection (ARI)							
Having a cough and cold every week	34.746	3776.361	0.000	1	0.993	-7366.786	7436.277
Having a cough and cold every two weeks	17.245	2546.280	0.000	1	0.995	-4973.372	5007.863
Having a cough and cold every month	-3.897	1.864	4.370	1	0.037	-7.551	-.243

Having a cough and cold every two months	-7.250	2.164	11.229	1	0.001	-11.491	-3.010
Rarely having cough and cold	0a	.	.	0	.	.	.
Eating Frequency per Day							
1x	34.894	4409.865	.000	1	0.994	-8608.284	8678.071
2x	22.606	2546.281	.000	1	0.993	-4968.014	5013.226
3x	24.652	2546.281	.000	1	0.992	-4965.967	5015.272
>3x	0a	.	.	0	.	.	.
Mother's Knowledge of Nutritional Fulfillment							
Low	5.593	1.575	12.613	1	0.000	2.506	8.680
Moderate	1.838	1.688	1.185	1	0.276	-1.471	5.147
High	0a	.	.	0	.	.	.
Type of Snack							
Healthy snack	0.395	1.189	0.110	1	0.740	-1.935	2.725
Unhealthy snack	0a	.	.	0	.	.	.

of the father's education increased. In that study, the odds ratios or the likelihood of undernutrition in children whose fathers did not attend school had elementary school, high school, and university education were 1.00, 0.96, 0.92, and 0.79, respectively. It concluded that the potential for undernutrition in children will decrease as the father's education level increases. Akhter & Haque (2018) added that to improve the long-term anthropometric status of children, at least the father must have graduated from high school. The importance of the father's education level to children's nutritional status is also supported by research by Vollmer et al. (2017) stated that the father's education level is very fundamental in reducing the incidence of undernutrition in children. Fathers with higher education tend to pay more attention to the food intake given to their children and are more involved in meeting children's nutritional needs. With a higher level of education, fathers will receive more information regarding their child's health so that they make more efforts to optimize the growth and development of their children.

Although several previous studies have proven that a mother's education is very crucial to the growth and development of children, including children's nutritional status (Azizah et al., 2022; Dewi et al., 2022; Rukiyah et al., 2021), this study did not find a relationship between mother's education level with the undernutrition among children. It happens because Indonesia is a country where most of its tribes adhere to patrilineal customs, including in the Jember Regency, where this research was conducted. In families that adhere to patrilineal customs, the father is more dominant than the mother, so the father's role influences negative and positive aspects of life, including children's health. Fathers with a higher level of education will have a higher awareness of playing a role in improving their children's nutrition, such as providing nutritious food to their children and making decisions that positively impact their children's health status. However, in this study, most of the fathers had elementary school education, so awareness to pay attention to the adequacy of nutrition for children was also still low and impacted the still high rates of undernutrition in children.

This study proves that the number of children is significantly related to the undernutrition status of children. In line with previous research, most children with malnutrition came from families with more than five family members (Galgamuwa et al., 2017). Ziliwu et al. (2020) also stated that mothers with more than two children are 2,836 times more likely to have children with malnutrition than mothers with less than or equal to two children. A large number of children means the need for more food availability. The large number of children, followed by low food availability, has an impact on the inability of parents to distribute food to each child evenly. A large number of children also causes parents to have more limited time to care for and feed each child, which can cause children to suffer from undernutrition. Conversely, families with fewer children can provide nutritious food for each child.

Immunization status is significantly related to undernutrition. Based on the results of ordinal regression, children with complete immunization status have a 4.6 times lower chance of experiencing undernutrition compared to those who get incomplete immunizations. Previous research involving children aged 12-24 months from 16 countries on various continents proved that wasting and stunting were more common in children with incomplete immunizations. The study also found that malnutrition (adjusted odds ratio, aOR 1.21, 95% CI 1.11–1.31), wasting (aOR 1.18, 95% CI 1.05–1.33), and stunting (aOR 1.07, 95% CI 1.00–1.14) associated with poor child immunization status (Solis-Soto et al., 2020). According to Ignis & Tomini (2022), complete immunization positively affects a child's weight, height, and body mass index. In other words, complete immunization can improve the child's anthropometric status. Immunization aims to enable the body to produce antibodies to prevent certain diseases and reduce the morbidity and mortality caused by dangerous infectious diseases. If a child gets complete immunization, the child has immunity against various infectious diseases.

Conversely, children who do not receive complete immunizations will more often experience infectious diseases such as diarrhea and acute respiratory infections. Ibama et al. (2019) found that children who did not receive immunization were twice as likely (OR = 1.97, p<0.0001, 95% CI=1.495-2.604) to experience recurrent acute respiratory infections compared to those who were fully immunized. Repeated infections will cause the child to lose more calories and protein that should be used for growth.

In this study, ARI is significantly related to undernutrition. Most severely or moderately underweight children experienced colds and coughs once a week. It can be said

these children often experience repeated respiratory tract infections. The ordinal logistic regression test results showed that children who got a cough and cold once a month had a 3.9 times lower chance of experiencing undernutrition. In comparison, children who got a cough and cold once every two months had a 7.2 times lower chance of experiencing undernutrition compared to children who had a cold and cough more often. Previous research stated that there was a significant relationship between infectious diseases (ARI and diarrhea) and the incidence of undernutrition according to the weight-for-age index (Muhammad, 2018). Himawati & Laila (2020) also proved that ARI contributed to the incidence of stunting with an OR value of 3,148. ARI is one of the most common infectious diseases in children, with symptoms that can include cough, runny nose, stuffy nose, and fever. ARI and undernutrition are very closely related.

All types of infection, no matter how mild the degree, can increase the loss of nutrients in the body through several mechanisms, including decreased absorption of food nutrients by the intestine, loss of nutrients directly in the intestine, inadequate intake of nutrients that enter the body due to decreased appetite, internal diversion metabolic response of the body, as well as an increase in the basal metabolic rate during fever. So, protein, energy, and most other nutrients will be lost during infection. The infection triggers an inflammatory process, where during inflammation, the body secretes hsRC protein (High-sensitivity C-reactive Protein) which causes resistance to the growth hormone GH (Growth Hormone). The inflammatory mechanism also inhibits the work of IGF-1 (Insulin Growth Factor-1), which mediates GH and the growth of muscle and bone cells in humans (DeBoer et al., 2017). Under five years is called the golden period because growth and development occur rapidly. Because after entering school age, the process of growth and development will begin to decline. If a child has frequent infections or recurrent ARI, the process of growth and development will be disrupted.

Most of the mothers in this study needed more knowledge regarding fulfilling a child's nutrition. The low level of mothers' knowledge can attribute to the educational background of mothers; most of them only graduated from elementary school. Mothers' knowledge of fulfilling a child's nutrition is significantly related to children's undernutrition, with an OR value of 5,593. Several previous studies have proven that the level of a mother's knowledge regarding nutrition, nutritional status, and serving of food is significantly related to the nutritional status of children (Aprilina et al., 2021; Kareem, 2021; Phyo & Aung, 2021). Mothers are the primary care providers for children. Sufficient information and knowledge about nutrition affect children's eating patterns positively and can encourage mothers to increase their children's food intake. Low knowledge of mothers about food choices, feeding, and healthcare-seeking behavior significantly affects poor nutritional status in children (Fadare O et al., 2019). Conversely, a mother's good knowledge can change the attitude and behavior of mothers in providing food for their children so that mothers pay more attention to the essential elements in food that children must get while consuming food and can serve varied, clean, and hygienic food.

This research still has some limitations. First, the data obtained only came from 94 children living in one sub-district in Jember Regency, so it cannot represent the undernutrition prevalence among children in Jember Regency. Second, undernutrition is determined only based on weight-for-age. Future research is expected to identify other undernutrition indicators, such as height-for-age and height-for-weight, so that prevalence and determinant factors of undernutrition among children under five in the Jember Regency are known more comprehensively.

CONCLUSION

The percentage of children severely underweight was 8.5%, while that children with moderately underweight were 13.8%. The number of children with undernutrition identified in this study is high. These findings indicate the need for more in-depth identification of undernutrition prevalence by the government and local health workers to determine nutrition interventions for children in Karangrejo Village, Jember Regency in particular. Factors related to undernutrition among children in this study were the father's education in elementary school, the number of children of no more than two persons, a complete history of immunization, a history of infection every month and every two months, and the mother's knowledge of nutritional fulfillment. This study suggests that raising parent education, complete immunization, and mothers' knowledge are recommended to prevent undernutrition among children. Furthermore, the outcome of this study re-emphasizes that educational activities regarding children's nutritional needs are still needed to improve mothers' knowledge.

Declaration of Interest

All authors declare that they have no conflicts of interest.

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None.

Author Contribution

LF: Study concept, methodology, data collecter, write and edit manuscript.
US: Collect and data analyse, writing manuscript.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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