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ASSOCIATION BETWEEN STUNTING AND ANEMIA AMONG UNDER FIVE YEARS OF AGE: STRATIFIED BY CHARACTERISTIC OF FAMILY AND IMMUNIZATION STATUS IN MLONGGO DISTRICT, JEPARA REGENCY

Arwinda Nugraheni[1*],Muflihatul Muniroh[2], Yora Nindita[3], Firdaus Wahyudi[1], Bambang Haryana[1]
[1]Department of Public Health and Preventive Medicine, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia
[2]Department of Physiology, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia
[3]Department of Pharmacology and Therapeutic, Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia
* Corresponding Author : E-mail: arwindanugraheni@gmail.com

ABSTRACT

Background: The risk of anemia in stunted toddlers is higher than in non-stunting toddlers. There is limited research on anemia in children under 3 years old in the community and there is a need for supporting research to prove the possibility of controlling stunting and anemia together. Previous studies have shown that family characteristics and immunization status are associated with the stunting and anemia. **Objective:** This study aims to analyze the association between anemia and stunting that are stratified by characteristics of family and Immunization status. **Methods:** This study used a cross-sectional design study and was conducted on September-October 2020 in the Mlonggo District, Jepara Regency. One hundred two respondents were selected by cluster random sampling technique. The questionnaire was applied to collect the data on stunting, anemia, immunization status, age, mother's occupation and education status, SCREEM score, and APGAR score. This study used the Chi-Square statistic test. **Results:** The anemia status was measured by the Hb meter. The characteristics of stunting status (stunting = 17.7%, no stunting= 82.3%), anemia status (Yes = 63.7%, No = 36.3%). The association between stunting and anemia was stratified by the child age (6-23 months) (PR=1.667; 95%; CI=1.103-2.519; P=0.123), employed mother (PR=1.593; 95%CI=1.265-2.005; P=0.154), incomplete and inappropriate immunization status (PR=1.636; 95%CI= 1.132-2.366; P=0.133) and functional family (PR=1.512; 95% CI=1.270-1.799; P=0.029). **Conclusion:** There was an association between stunting and anemia on child age of 6-23 months, employed mother, incomplete and inappropriate immunization, and functional family groups.

Keywords: *Anemia, Characteristics of family, Immunization Status, Stunting, Under five years*

INTRODUCTION

Anemia is experienced by a third of the world's population and is common in developing countries, including Indonesia. Anemia is often experienced by children, women, especially those of reproductive age, pregnant women, and the elderly.[1] In addition to age and sex, race is also a factor that affects the occurrence of anemia, especially in the African-American race, which has a fairly high prevalence of the disease. Anemia can have an impact on increasing morbidity and mortality, poor child outcomes, decreased work productivity in adults, and impaired cognitive and behavioral development in children. Anemia has the negative impact on children and women.Iron deficiency is one of the most common causes of anemia, followed by chronic infections such as malaria, hereditary hemoglobinopathies, and folic acid deficiency.[2–4] It should also be noted that several causes of anemia may coexist in individuals or within a population and contribute to the severity of anemia.[5]

In Indonesia, anemia and stunting are health problems, especially in children under five.[6] Based on basic health research data conducted by the Indonesian Ministry of Health in 2013, in Indonesia there were 28.1% of children under five experiencing anemia, and this increased in 2018 to 38.5%. Then, stunting data based on the 2018 Riskesdas showed that 17.7% of children under five experienced stunting, with a prevalence of 6.7% experiencing severe stunting and 16.9% experiencing stunting.[5]

Stunting is growth retardation that occurs in toddlers due to chronic malnutrition, repeated infections, and inadequate parenting, especially in the first 1,000 days of life.[7] Stunting is also caused by a lack of psychosocial stimulation, causing children to be shorter than their age or below minus 2 standard deviations (SD) from the WHO median standard.[7,8]

Currently, stunting is one of the national priority programs for all pigs in Indonesia.[9] Of the 34 provinces in Indonesia, Central Java is included in the 18 provinces with a high prevalence of stunting (30%-<40%).[5] The Jepara Regency is a public health

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education area reported by the Faculty of Medicine, Universitas Diponegoro, consisting of 30–40% of stunting cases. Many studies related to risk factors and the prevention of stunting have been carried out. However, research on other nutritional problems experienced by stunting under five years has not been widely carried out. Previous research in Jepara showed that mothers with stunted children in rural areas were still indifferent to its impact and did not know about different parenting interventions for dealing with stunting.[10] Other studies have shown that severely stunted toddlers have a low average Hb level compared to non-stunting toddlers.[11]

In the long term, anemia in stunting under five years can cause serious implications and become a health burden in developing countries such as Indonesia. In addition, anemia that occurs due to stunting can also be a contributor to morbidity and mortality in children and toddlers.[12–15] In Indonesia, interventions for anemia are focused on preventing it, with a priority target including mothers, pregnant women, breastfeeding mothers, and adolescent girls. However, in under five years, it is still not well established. In handling the nutritional status of children, the family has a very important role because the family environment is a place for children to maximize their growth and development and fulfill their nutritional needs.[15–17] The family has a high level of family function and has good emotional ties, which can support growth and development.[16–18] Therefore, the study to investigate the association between stunting and anemia in under five years stratified by family characteristics was needed.

In addition, the nutritional status of children under five years old can also be caused by vaccination status. Vaccination is introduced into the body through drops or by mouth (oral). Vaccinations included in the Impact Program in Indonesia include BCG, DPT, polio, hepatitis B, and measles.[19,20] The complete basic immunization in Infants 0-11 months of age consist of HB0 1 dose, BCG 1 dose, DPT-HB-Hib 3 doses, Polio drops (OPV) 4 doses, Injectable polio (IPV) 1 dose, Measles Rubella 1 dose and booster immunization for children aged 18-24 months consist of DPT-HB-Hib 1 dose, Measles Rubella 1 dose.[21,22]

METHODS

Participants

This study used a cross-sectional design. The study was conducted in the working area of the Mlonggo Health Center, Jepara Regency, from September to October 2020. The research subjects were aged 10–59 months. The minimum sample obtained with predictions of anemia in the stunting group was 50% with a relationship strength of 1.4 out of 91. A total of 102 children with stunting (height-for-age z score < -2) and non-stunting (height-for-age z score ≥ 2) were studied. The height data per age of the respondent was known by looking at the data on the card to health. The researchers used cluster random sampling. Researchers clustered the samples based on 8 subdistricts. A subdistrict with more people has more proportions to take. Next, respondents were randomly selected from data from the Mlonggo Health Center. Inclusion criteria consisted of mothers of under five years who agreed to participate, lived in the Mlonggo District for at least 6 months, and were able to read and write. Exclusion criteria were mothers of under five years who were not able to communicate well, withdrawal of respondents, and under five years who had infectious diseases such as acute diarrhea and fever at the time of the study.

Data collection Procedures

The variables were stunting status, age, anemia status, employment mother status, immunization status, mother's education, parental income (with a cut of point Minimal Labor Income of IDR 2,040,000)[23], SCREEM (Social, Cultural, Religious, Economic, Educational, and Medical) scores, and APGAR (Adaptation, Partnership, Growth, Affection, and Resolve) scores. The research instrument used was a questionnaire. Data collected by enumerators who have received previous training.

Family function was measured by the APGAR score (internal family function) and the SCREEM score (external family function). The family APGAR questionnaire has five indicators for assessing family function, which have a 1-2 score each. The total score range of the APGAR questionnaire is 1-10, with 7-10 (functional family) and 0-6 (dysfunctional family) categories. The SCREEM questionnaire has six indicators for assessing family function, which have

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0–3 scores each. The SCREEM questionnaire has a score range of 1–18, which is categorized into 0–6 (inadequate family function), 7–12 (moderate family function), and 14–18 (highly adequate family function).

Previous study showed that the Apgar family has good validity with social support. The study had shown a relationship between the APGAR and social support surveys with a P value of less than 0.05. The Cronbach's alpha of 0.88 with a range of 0.96 to 0.98, which can be interpreted as good reliability. The study with the aim of assessing families of children with cancer in terms of family functions on 2011 showed that the SCREEM tool had a Cronbach's alpha of 0.80 which means good reliability.[24,25]

The respondents were categorized as complete and appropriate immunization if the results of the interview or the card to healthy data showed that subject received complete basic immunization (0-11 months) and booster immunization (18-24 months).

Hemoglobin measurement

The measurement of hemoglobin (Hb) levels used the portable Hb meter with Family Dr Brand®. A hemometer consists of a ready-to-use microcuvette that contains dry reagents and a photometer. Blood is placed in a microcuvette that reacts with sodium deoxycholate and lyses erythrocytes so the hemoglobin can be released. Sodium nitrite converts hemoglobin to methemoglobin, which, together with sodium azide, forms azidamethemoglobin. Absorbance is measured at two wavelengths (565nm and 880nm) to compensate for the turbidity that arises in the reagent-specimen mixture. The Hb meter system consists of a portable device, a battery-activated photometer, and a number of cuvettes for blood collection. The portable Hb meter is designed for rapid surveys in the field because there is no need to add reagent solution for one-time blood collection and measurement of Hb.[18] The portable Hb Meter testing study showed a specificity rate of 87.7% and a sensitivity of 50.7%. The test results show that the Hb Meter has good and reasonable reproducibility.[26] The respondents were categorized as anemic if the hemoglobin level was less than 11 gr/dL.

Data Analysis

Data analysis was carried out in four stages. 1) Input data: The researcher input data using SPSS software, 2) Coding: The researcher performed categorization on the variables that need to be grouped according to the operational definition and research objectives. 3) Cleaning data: Researchers carried out activities to re-check the data after it has been entered and coded. 4) The data were analyzed by univariate and stratification analysis. A univariate analysis was used to determine the characteristics of the respondents. Stratification analysis used to determine the relationship between anemia and stunting in each independent category.

Stratification analysis used the Chi-square test and Mantel-Haenszel test. Mantel-Haenszel was used to determine the significance of the relationship between anemia and stunting after controlling for one confounding variable. There was a association if 95% Confidence Interval of Prevalence Ratio was not include 1.

The mother's education level, family income, mother's occupation, immunization status, SCREEM score, and APGAR score stratify the relationship between anemia and stunting.

Ethics

This research obtained a research permit from the Health Research Ethics Commission (KEPK) at the Faculty of Medicine, Universitas Diponegoro, number 231/EC/KEPK/FK-UNDIP/X/2020.

RESULTS

This study involved 102 participants; SCREEM score means are 13.10 (adequate family resources), and APGAR score means are 8.13 (high family function). Based on Table 1, the respondents consisted of 51.9% boys and 48.1% girls. Most of the respondents had a mother's education level below senior high school (56.2%) and family income above the minimum labor income (68.6%). Most respondents had complete and appropriate immunization status (75.5%). The mean age of the respondents is 34 months. Table 2 shows that most respondents had non-stunting height for their age. There were 17.7% of stunting respondents, with severe stunting at 5.9%. Most of the respondents were anemic (63.7%). Table 3 shows that 72.6% of stunting under five years are anemic. The results of the bivariate analysis showed that there was no association between stunting and anemia in under five

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years in the working area of the Mlonggo Health Center (95%CI of PR included 1).

Table 1. Characteristics of Respondent

Characteristics	N	%	Mean (SD)	Min-Max
Sex				
Male	53	51.9		
Female	49	48.1		
Age (Month)			34 (7.36)	10-58
Immunization status				
Incomplete and inappropriate	25	24.5		
Complete and appropriate	77	75.5		
Child Intake				
Inadequate	30	29.4		
Adequate	72	70.6		
Mother's Age (year)			31.1(5.95)	18-50
Mother's Education				
<Senior High School	58	56.9		
≥Senior High School	44	43.1		
Mother's Occupation				
Employee	48	47.1		
Unemployed	54	52.9		
Family Income				
< Minimal Labor Income	32	31.4		
≥ Minimal Labor Income	70	68.6		
Family members			4.04 (1.168)	2-8
Child weight at birth (gram)			3124.31 (560.172)	1800-4800
SCREEM Score			13.10 (2.28)	9-18
APGAR Score			8.13 (1.79)	5-10

Table 2. The Status of Stunting and Anemia

Characteristic	n=102	%
Status Stunting		
Severely stunting	6	5.9
Stunting	12	11.8
Non-stunting	83	81.3
Tall	1	1.0
Status Anemia		
Yes	65	63.7
No	37	36.3

Table 3. Correlation Between Stunting and Anemia

Variable		Anemia Status				PR	95%CI	*P*
		Yes		No				
		N	%	N	%			
Stunting status	Yes	13	72.2	5	27.8	1.140	0.837-1.626	0.409
	No	52	61.9	32	38.1			

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Table 4. Stratification Analysis of the Correlation Between Stunting and Anemia

Variable	Anemia		PR	95%CI	*P*	*Mantel-Haenszel*
	Yes	No				*P*
Sex						
Male						
Stunting	6 (66.7%)	3 (33.3%)	0.946	0.574-1.560	1.000	
Non-stunting	31 (70.5%)	13 (29.5%)				0.563
Female						
Stunting	7 (77.8%)	2 (22.2%)	1.481	0.938-2.340	0.267	
Non-stunting	21 (52.5%)	19 (47.5%)				
Child age						
6-23 months						
Stunting	6 (100%)	0 (0.0%)	1.667	1.103-2.519	0.123	
Non-stunting	9 (60.0%)	6 (40.0%)				0.660
≥ 24 months						
Stunting	7 (58.3%)	5 (41.7%)	0.936	0.561-1.562	1.000	
Non-stunting	43 (62.3%)	26 (37.7%)				
Child weight at birth						
< 2500						
Stunting	4 (66.7%)	2 (33,3%)	0.833	0.407-1.705	1.000	
Non-stunting	4 (80.0%)	1 (20.0%)				0.723
≥ 2500						
Stunting	9 (75.0%)	3 (25.0%)	1.234	0.851-1.790	0.524	
Non-stunting	48 (60.8%)	31 (39.2%)				
Immunization status[#]						
Incomplete and Inappropriate						
Stunting	7 (100%)	0 (0%)	1.636	1.132-2.366	0.133	
Non-stunting	11 (61.1%)	7 (38.9%)				0.683
Complete and appropriate						
Stunting	6 (64.3%)	5 (35.7%)	0.878	0.496-1.555	0.742	
Non-stunting	41 (62.1%)	25 (37.9%)				
Employment Mother Status						
Unemployed						
Stunting	8 (61.5%)	5 (38.5%)	1.009	0.615-1.655	0.971	
Non-stunting	25 (61.0%)	16 (39.0%)				0.508
Employed						
Stunting	5 (100%)	0 (0%)	1.593	1.265-2.005	0.154	
Non-stunting	27 (62.8%)	16 (37.2%)				
Mother's age						
≤ 20 years						
Stunting	1 (100.0%)	0 (0.0%)	2.000	0.500-7.997	1.000	
Non-stunting	1 (50.0%)	1 (50.0%)				0.616
21-35						
Stunting	9 (69.2%)	4 (30.8%)	1.172	0.774-1.773	0.552	

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Non-stunting	39 (59.1%)	27 (40.9%)				
> 35						
Stunting	3 (75.0%)	1 (25.0%)	1.000	0.531-1.882	1.000	
Non-stunting	12 (75.0%)	4 (25.0%)				
Mother's Education						
< Senior High School						
Stunting	7 (77.8%)	2 (22.2%)	1.191	0.795-1.785	0.703	
Non-stunting	32 (65.3%)	17 (34.7%)				0.544
≥ Senior High School						
Stunting	6 (66.7%)	3 (33.3%)	1.167	0.677-2.010	0.716	
Non-stunting	20 (57.1%)	15 (42.9%)				
Family Income						
<Minimal labor income						
Stunting	6 (75.0%)	2 (25%)	1.125	0.689-1.836	1.000	
Non-stunting	16 (66.7%)	8 (33.3%)				0.642
≥Minimal Labor income						
Stunting	7 (70.0%)	3 (30.0%)	1.167	0.740-1.839	0.730	
Non-stunting	36 (60.0%)	24 (40.0%)				
Family member						
≤ 4 people						
Stunting	10 (66.7%)	5 (33.3%)	1.158	0.766-1.751	0.574	
Non-Stunting	38 (57.6%)	28 (42.4%)				0.522
> 4 people						
Stunting	3 (100.0%)	0 (0.0%)	1.286	1.004-1.646	1.000	
Non-Stunting	14 (77.8%)	4 (22.2%)				
External Family Function (SCREEM Score)						
Moderate adequate family resource						
Stunting	7 (77,8%)	2 (22.2%)	1.037	0.705-1.525	1.000	
Non-Stunting	36 (75%)	12 (25%)				0.469
Highly adequate family resource						
Stunting	6 (66,7%)	3 (33.3%)	1.500	0.832-2.703	0.284	
Non-Stunting	16 (44.4%)	20 (55.6%)				
Internal Family Function (APGAR score)[#]						
Dysfunctional Family						
Stunting	3 (37.5%)	5 (62.5%)	0.792	0.288-0.598	0.696	
Non-Stunting	9 (47.4%)	10 (52.6%)				0.299
Functional Family						
Stunting	10 (100%)	0 (0%)	1.512	1.270-1.799	0.029*	
Non-Stunting	43 (66.2%)	22 (33.8%)				

*P≤0,05 [#]homogeneity test results/Breslow-day ≤0.05

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The results of the statistical tests with Mantel-Haenszel showed that all the results of stratification analysis obtained a P value of more than 0.05, which means that there is no association between stunting and anemia after controlling each confounding variables. The association between anemia and stunting stratified based on maternal education shows that there was no relationship in the education group less than high school and more or the same as senior high school (95%CI of PR included 1). The relationship between anemia and stunting is also not statistically related after being stratified based on family income and SCREEM score.

The results of the stratification analysis based on employment mother status showed that 95%CI showed the strength of the anemia and stunting relationship did not include 1 in the employed mother group PR=1.593 (95%CI=1.265-2.005), while in the unemployed mother group there was no relationship with a 95%CI included 1. The association of anemia and stunting in the group of under five years with immunization is incomplete and inappropriate by 1.636 (95%CI 1.132-2.366), and in under five years, the complete and appropriate immunization group is not connected to the 95%CI included 1. Then, the correlation of anemia and stunting in the group of children aged 6–23 months was 1.667 (95% CI: 1.103–2.519) and in the subject >23 months group was not connected to 95% CI of PR included 1. Table 4 shows that there is a significant association between stunting and anemia in the functional family group (PR 1.512, 95% CI 1.270–1.799).

DISCUSSIONS

Stunting occurs in under five years due to chronic malnutrition, repeated infections, and inadequate parenting, which influence them especially during the first 1,000 days of life and among people of low socioeconomic status. The body length or height of stunted toddlers is less than that of non-stunting under five years. Based on the WHO, the body length or height of stunted under five years is < -2SD.[7,8] In this study, there were 5.9% severely stunted under five years and 11.8% stunted under five years. The results of this study showed that 72.2% of stunting under five years have anemia. This is in line with previous research, which stated that the prevalence of anemia was higher in stunted under five years than in non-stunting under five years.[27]

This study shows that the prevalence of anemia was 63.7%. This prevalence is more than 1.5 times the prevalence of children under five in the world. The prevalence of anemia in this study is almost the same as the prevalence of anemia in Africa.[28] The prevalence of anemia in Indonesia is 38.4%. This figure is lower than the prevalence of anemia in this study. The authors did not find references to anemia in children under five at the provincial or city level.

The results of the analysis showed that there was no relationship between stunting and anemia based on the sex of subject. The same results were also obtained in the stratification analysis based on maternal age, the number of families, and external family function. This result could be due to the under-five sex was not being strong confounding factors and the homogeneity of the relationship between each category in the study population.

In this study, there was no association between sex and stunting to anemia in children under five. This is different from previous studies, which stated that there was a relationship between anemia and sex where girls were less likely to have anemia than boys.[2,29] A possible explanation for this is increased iron requirements in males due to rapid growth and gains in muscle mass in male children.[2,30] Moreover, some of the inherited causes of anemia are X-linked, such as G6PD deficiency and X-linked sideroblastic anemia, which are most common in males and can be caused by anemia in male children.[29,30] Meanwhile, in the case of stunting, previous studies found a relationship between stunting and children's sex, with boys being more likely to experience stunting than girls.[31–33]

Based on the results of the Mantel-haenszel test, it was found that there were no relationship in all stratification results. The absence of statistical can be due to the lack of sample size. The study showed that the 95%CI of PR stunting to anemia did not pass 1 (1.103–2.519) in the child age group of 6–23 months, even though the p-value was >0.05. In previous studies, it was found that the age of the child was associated with the incidence of anemia in children aged 6–23 months. The prevalence of anemia will decrease with age.[34] In the previous study, children aged 6–11 and 12–17 months were found to have a higher risk of anemia than children aged 18–23 months in the previous study.[15,34] In addition, the insufficiency and lack of diversity in children's intake

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due to the refusal of infants when introducing complementary foods at the age of more than 6 months increases the possibility of anemia in under five years.[29] Based on previous research, there was an increase in the risk of stunting with increasing age.A previous study found that children aged 6 to 23 months were less at risk than those aged 24-59.[15,33] The incidence of stunting in children older than 6 months may be caused by the manifestation of inadequate food intake for children due to their increased needs, which doubled at the age of 4 months after birth.[29,34]

The stratification analysis showed that there was no association between stunting and anemia in under five years in the family income group for both more and less than the minimum wage, for both more than four members and less than that, and for external family function (SCREEM) for both adequate and highly adequate. These results are also obtained from the stratification analysis based on the mother's education. The amount of PR for stunting with anemia in each group has almost the same value. Socio-economics is one of the important factors in preventing stunting and anemia in under five years. These results weren't in line with previous research, which stated that the highest prevalence of anemia, stunting, and severe stunting was found in the group with the lowest socioeconomic status.[11] Family income affects the family's purchasing power, including its ability to buy food. When the family income increases, the prevalence of anemia, iron deficiency, and stunting decreases, and hemoglobin and ferritin levels increase.[4] The absence of a relationship between stunting and anemia in all family income groups may be due to other confounding factors that have a stronger influence on the relationship between stunting and anemia. Anemia in under five years can be prevented by consuming foods high in iron, especially sources of meat containing heme iron, which is easier to digest. However, in families with low socioeconomic status, it is often difficult to buy meat and consume more plant foods, some of which contain iron absorption inhibitors.[11,16]

The results showed that the 95% CI for stunting due to anemia in employed mother group did not include 1. The under-five years with stunting has 1.6 higher risk for anemia than non-stunting in the group of employed mothers. The study that proves the relationship between stunting and anemia among under five years with stratification analysis has never existed before. The relationship of working mother status to nutritional status is evident in previous studies in Surabaya and Jatinangor Health Center, Indonesia.[35,36] Working mothers have less time for childcare and inadequate parenting compared to housewives.[7,35,36]

However, in other studies, there was no relationship between working mothers and their children's nutritional status. The insignificant relationship between working mothers and their children's nutritional status may be influenced by the socioeconomic status of the family, which can support access to fulfill children's nutritional needs and become a more dominant factor in children's nutritional status.[11,13,32,37,38]

The results of this study found that there was no relationship between maternal age and the incidence of stunting or anemia. This is different from previous studies, which stated that maternal age was associated with both stunting and anemia.[6,39] Young mothers are at risk of having poor childbirth due to immature biological maturity, limited resources, and limited experience with children. This may also be due to the low education of the mother, which generally occurs in young mothers.[2,6,17,34] In previous studies, it was found that a very young mother's age during pregnancy could result in the incidence of low birthweight in children. In mothers who are older, it is possible for the mother to have comorbidities during pregnancy that can cause a poor birth outcome of a child.[6,40]

This study found an association between anemia and stunting in the incomplete or inappropriate immunization. The magnitude of the relationship (PR) between stunting and anemia in the incomplete or inappropriate group with 95% confidence is 1.132–2.366, and this result showed that under five years with stunting were at higher risk for anemia. PR of 1.6 means under five years with stunting are at 1.6 times higher risk for anemia than those without stunting in the incomplete or inappropriate immunization group. There is a modifying effect between immunization status and stunting on anemia The results of the heterogeneity test showed a different relationship in each stratification. There was no association between stunting and anemia in the complete and appropriate immunizations group. Immunization is a process to

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increase the body's immune system by inserting a vaccine, namely a virus or bacteria that have been weakened, killed, or parts of the bacteria (virus) that have been directed.[20]

The stratification analysis on internal family function (based on categories based on APGAR scores) found an association between stunting and anemia in the functional family group. There was no relationship between stunting and anemia in the dysfunctional family group. The prevalence ratio of stunting under five years was 1.5 times more likely to have anemia in families in the functional family group. The results of the heterogeneity test showed a different relationship in each stratification. This means that there was a modifying effect between internal family function and stunting on anemia. These results were from a systematic review that showed that family characteristics were related to stunting, one of which was family welfare.[41] This was not in line with previous research, which states that family function was not related to the nutritional status of toddlers in the Soreang Bandung Regency.[42] Research in Tapalang, Indonesia, also showed that the biopsychosocial family was not associated with stunting.[43] This may be due to differences in dominant influencing factors on nutritional status and differences in data analysis methods. The study by Hanifah et al. (2016) in Soreang District used bivariate analysis with the Spearman correlation statistic test, while this study used stratification analysis by each confounding with the Chi-square test.[42] In this study, anemia was associated with stunting in groups with functional family. This could be due to homogeneous intake and parenting pattern in respondents with functional family, so that the strength of the relationship between anemia and stunting can be identified.

The limitation of this study was that by chance there were very small number of study samples in several categories that show a p value of more than 0.05 even though the 95%CI does not exceed 1.

CONCLUSION

There was association between stunting and anemia in under-five years in the functional family, employed mothers, incomplete and inappropriate immunization, and child age of 6–23 months group in Mlonggo District, Jepara Regency. There was a modifying effect between stunting and immunization; stunting and internal family function on anemia. The results of this study indicate that stunting and anemia control can be done simultaneously in groups with functional family, children under five years with employed mother, incomplete or inappropriate immunization, and a child age of 6–23 months.

ETHICAL APPROVAL

This research obtained a research permit from the Health Research Ethics Commission (KEPK) at the Faculty of Medicine, Universitas Diponegoro, number 231/EC/KEPK/FK-UNDIP/X/2020.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceptualization, Arwinda Nugraheni; methodology, Arwinda Nugraheni and Bambang Hariyana; software, Arwinda Nugraheni, Muflihatul Muniroh and Yora Nindita; formal analysis, Arwinda Nugraheni; writing—review and editing, Firdaus Wahyudi, Muflihatul Muniroh; supervision, Bambang Hariyana, Arwinda Nugraheni.

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