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Determinant of Non-pregnant Women's Anemia in Banggai Regency

Dian Kurniasari Yuwono[1*], Yustianty Monoarfa[2], Anang S. Otoluwa[3], Nitro Galenso[1], Mulyani[2], Marlinne Tiwow[2], Rita Kartika Dewi[2], Ni Ketut Narsi[2], Erni Yusnita Lalusu[4]
[1]Health Polytechnic of Palu, North Palu 94148, Indonesia
[2]Banggai Regency Health Office, Luwuk 94711, Indonesia
[3]Gorontalo Province Health Office, Kota Utara 96128, Indonesia
[4]Faculty of Public Health, Tompotika Luwuk University, Luwuk 94711, Indonesia

ABSTRACT

This study purpose is to seek the determinant factors of anemia in non-pregnant women in Banggai Regency. With a cross-sectional design, we collect data from 308 non-pregnant women through non-probability sampling. Variables collected were age, Body Mass Index (BMI), Middle Upper Arm Circumference (MUAC), abdominal circumference, education, ownership of a healthy latrine, water source for cooking, and daily consumption of iron-source food such as legumes, green vegetables, also fish or meat. Bivariate and logistic regression was used to identify variables that correlate with anemia. The mean age and hemoglobin levels were 30±6.2 years and 12.7±1.5 g/dL, respectively. About 80 (25.97%) of the subjects were anemic. Bivariate analysis shows that water from standardized sources/ facilities for cooking, ownership of a healthy latrine, MUAC, daily consumption of legumes, and daily consumption of fish or meat were variables that significantly correlated with anemia ($p<0.05$). Moreover, after we performed logistic regression, non-pregnant women who did not use standardized clean water for cooking (OR 2.19; $p=0.09$) and did not consume fish or meat daily (OR 2.28; $p=0.02$) were at higher risk of having anemia. Determinant factors that significantly correlate with anemia in Banggai Regency's non-pregnant women were water utilization from not-standardized sources/facilities for cooking and not consuming of fish or meat daily. Local governments should include these variables in their new reformulated and innovative stunting-reducing programs. Thus, perhaps they can achieve their expected targets, such as non-anemic pregnant women, which, in the long run, can reduce stunting.

Keywords:anemia, Banggai Regency, non-pregnant women

INTRODUCTION

Stunting in Indonesia is called "*pendek*" or "kerdil". This is one form of malnutrition caused by repeated illness/infection and or inadequate nutrition for a long time, usually from early life. Stunting not only can burden billions to a nation's economy (Renyoet *et al.* 2016; Akseer *et al.* 2022) but also has a long-term effect on the individual such as increasing morbidity and mortality due to the elevated risk of non-communicable diseases in later life and lower productivity, thus in the end will affect their family's welfare and health (Soliman *et al.* 2021).

According to a previous study, the prominent determinants of stunting in Indonesia are unexclusive breastfeeding, preterm delivery, short birth length, being born in a family with low socio-economic status, and maternal factors such as having short stature and low educational level. The risk of stunting also increases when the family living in a rural area do not have optimal access to health facilities and poor access to improved latrine and drinking water (Beal *et al.* 2018). In addition to that, maternal anemia is also reportedly leads to poor pregnancy outcomes such as preterm labor, incidence of caesarian section, low birth weight, small for gestational age (Shah *et al.* 2022), and short birth length (WHO 2020). The risk factors of anemia itself are multifactorial (Owais *et al.* 2021).

For years, Indonesia has been struggling with stunting problems. Indonesia even ranks 108th out of 132 countries in stunting prevalence by the Global Nutrition Report in 2016 (IFPRI 2016). Basic Health Research 2018 shows that

[*]**Corresponding Author:** email: dian_ywno@yahoo.com
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the national prevalence of stunting was 30.8%, and in Banggai Regency was 31.9%. However, preventing stunting has always been a challenging task. From 2007 to 2013, only a 6% reduction in National stunting prevalence. It seems that doing business as usual did not tremendously affect stunting reduction.

Therefore, in 2017, Indonesia's Government launched a program to accelerate the stunting prevalence reduction called National Strategy to Accelerate Stunting Prevention (TP2AK 2020). The goal is to reduce stunting prevalence by up to 14% by the year 2024 in children under 5 years of age (Peraturan Presiden Republik Indonesia 2020). For that purpose, in 2018, Indonesia's Government appointed 10 villages within 100 regencies/cities as a focus-location (locus), and Banggai Regency was among the 100 regencies/ cities.

The National Strategy to Accelerate Stunting Prevention assign the focus location must integrate nutrition-specific and nutrition-sensitive intervention programs. Responding to the national strategy, in late 2018, they established a multisectoral task force focusing on 1,000 first days of life, held stunting seminars to raise awareness about stunting, and signed a memorandum of understanding with universities in research about stunting. The activities resulted in a plan to reformulate and converge the existing programs with new programs. In consequences, studies about health determinants must be conducted before establishing new reformulated and innovative programs in focus-location villages.

Similarly for anemia, efforts in reducing anemia prevalence have been accelerated globally and locally. Data analyzes on determinants and anemia prevalence, research on innovative prevention and intervention, collaboration with all sectors at all levels, commitment strengthening in anemia reduction (WHO 2023), and providing health service with life-course approach (Sungkar *et al.* 2022), are the key programs in anemia reduction acceleration. Regarding this and since anemia in non-pregnant women could affect the outcome of pregnancy, a study about the determinant of anemia is important. This study aims to determine the risk factors correlating with anemia in non-pregnant women in Banggai Regency.

METHODS

Design, location, and time

This study is a cross-sectional study held in April 2019 in Banggai Regency at 10 Community Health Center (CHC) areas, with recruitment focusing on respondents from 10 stunting prevention locus villages. The 10 CHCs are Pagimana, Lobu, Toima, Simpang Raya, Bunta, Nuhon, Saiti, Hunduhon, Tangeban and Teku. These are all located in rural areas of Banggai Regency, with the closest CHC being 1.5 hours away from the regency's capital. Data collection approval was obtained from Banggai Regency Health Office (Letter of Approval's number:400/2742/Dinkes) on 8 April 2019.

Sampling

With non-probability sampling method, 308 non-pregnant women were chosen from 450 women in childbearing age. These 308 respondents are the total number of women who met the study's criteria: bride-to-be, women in pregnancy program, domiciled in mentioned CHCs, also willing to participate in the study. The non-pregnant women were chosen to be the respondents because the Government needs information about health determinants of this group. This group's health and nutritional status are believed to significantly affect the success of the Government's 1,000 Days of Life program.

The respondents were recruited through an announcement in the CHCs and disseminated in villages by midwives and health cadres. Non-pregnant women who were married and responding to the announcement were then asked about their utilization of contraceptives in the last month. They are then included if they did not use contraceptives at least 1 month before the study. The 1 month cut-off point were chosen because ovulation could begin shortly after contraceptive cessation (Britton *et al.* 2020) and due to conception can happen within 12 month after contraceptive cessation (Girum & Wasie 2018). This 1-month cut-off point not only can confirm their readiness in pregnancy programming, but also can give mother-to-be a chance to improve their nutritional status and knowledge about healthy pregnancy by participating in preconception program held by CHC. As for the exclusion criteria were women who were sick at the time of the study.

Data collection

We use a questionnaire and perform an anthropometric measurement to collect independent variables. Anthropometric measurement was conducted using microtoise to measure height in centimeters, SECA flat scale to measure weight in kilograms and SECA 201 measuring tape to measure the respondent's MUAC in centimeters. And for the dependent variable, anemia status as determined by hemoglobin level, we use HemoCue Hb 301 to measure it. The outcome of independents variables was categorized into two categories. The age of respondents was categorized as teenagers (≤21 years old) and adults. The last education completed by respondents was categorized as completed 12 years of compulsory education. Ownership of healthy latrine was categorized as YES for respondents who have a healthy latrine and NO for respondents who did not. Water sources/facilities for cooking activities from protected dug well, public piped water into yards or houses, tube well, protected springs, refilled drinking water, and protected rainwater collection are classified as standardized. Other than that, are categorized as not standardized.

Moreover, daily consumption of iron-source food, such as legumes, green vegetables, and fish or meat, was categorized as daily and non-daily consumption for those who consume less than 7 days a week. Body Mass Index (BMI) and Middle Upper Arm Circumference (MUAC) are categorized as normal and not normal for those who have BMI or MUAC under or above the normal range.

Before we conducted the study, we trained college students from a local university as enumerators to use the questionnaire and to perform anthropometric measurements. In contrast, the hemoglobin level was measured by nurses from the CHCs. As for the consent from respondents, we collected the informed consent between the time the research was announced and before it began, with the help of health workers in CHC.

Data analysis

Each location of the study was supervised by one of the researchers. Every questionnaire was checked the completeness and entered in Microsoft Excel, then transferred to a statistical software to perform the statistical analyses. Bivariate analysis using chi-square was employed to validate the effect between the dependent and independent variables. Variables with a significancy level of $p<0.25$ were then included in logistic regression. The results were presented as Odds Ratio (OR) and 95% Confidence Interval (95% CI).

RESULTS AND DISCUSSION

Characteristic of respondents

Banggai Regency is located in the eastern part of Central Sulawesi Province and is divided into 23 subdistricts and 337 villages. Twenty-seven Community Health Centers (CHCs) were built and operated in all 23 subdistricts for health services. Only 3 subdistricts can be categorized as urban areas, while the rest are in rural areas in which the study areas are located.

Table 1 displays the characteristic of respondents. About 80 (25.97%) of the respondents were anemic. The mean age and hemoglobin levels were 30±6.2 years and 12.7±1.5 g/dL, respectively. The majority of respondents were adults (n=224, 74.4%), had not completed the 12 years of compulsory education (n=159, 51.6%), had abdominal circumference above 80 cm (n=208, 67.5%), have BMI under and above the normal range (n=240, 77.9%) but have normal range of MUAC (n=165, 53.5%). Most of them consume legumes less than 7 days a week (n=240, 77.9%) and consume green vegetables (n=188, 61%) and fish or meat daily (n=178, 57.8%). The majority also have their own healthy latrine (n=159, 51.6%) but use water from not-standardized sources/facilities for cooking activity (n=200, 64.9%).

Factors associated with anemia in non-pregnant women

Respondents of this study are non-pregnant women who are in the state of preparing to be a mother, or in another term, they are preconception women. Women's health and nutritional status in this period significantly affect maternal nutritional status and even the pregnancy outcome (Stephenson *et al.* 2018). Specifically, anemia status could determine the anthropometric of newborns via intrauterine growth restriction led by chronic hypoxia due to low level of hemoglobin which then cause restriction of oxygen amount in body circulation (Naoko *et al.* 2012; Ganju

Table 1. Characteristic of respondents

Variable	n	%
Age*	30	6.2
Hemoglobin level, g/dL*	12.7	1.5
Anemia status		
Anemia	80	25.97
Non-anemia	228	74.03
Education		
≥12 years	149	48.4
<12 years	159	51.6
Abdominal circumference		
>80 cm	208	67.5
≤80 cm	100	32.5
Age		
Teenager	79	25.6
Adult	229	74.4
BMI		
Normal	68	22.1
Not-normal	240	77.9
Legumes consumption		
Daily	68	22.1
Non-daily	240	77.9
Fish and or meat consumption		
Daily	178	57.8
Non-daily	130	42.2
Green Vegetables		
Daily	188	61
Non-daily	120	39
MUAC		
Normal	165	53.5
Not-normal	143	46.4
Healthy latrine ownership		
Yes	159	51.6
No	149	48.4
Standardized water utilization for cooking		
Yes	108	35.1
No	200	64.9

*Value presented as (X±SD)
MUAC: Middle Upper Arm Circumference
BMI: Body Mass Index

2020). Moreover, nutritional status, especially anemia status in non-pregnant women, is affected by various factors such as age, anthropometric markers, food consumption and sanitation.

Table 2 describes the bivariate analysis results using chi-square. Independent variables that had a significant association with anemia status in non-pregnant women were consumption of fish or meat, legumes consumption, MUAC, and water utilization for cooking ($p<0.05$). Meanwhile, the signification level of the other independent variable, such as the last completed education level, abdominal circumference, age, and BMI, did not report any association with anemia status.

Based on the bivariate analysis, we included variables that had a significance level of $p<0.25$ in logistic regression analysis (Table 3). Variables that seemingly could decrease anemia are non-daily consumption of legumes (COR=0.54, 95% CI:0.29–1.00; p=0.05) also under and above the normal range of MUAC (COR=0.55, 95% CI:0.32–0.96; p=0.03). Conversely, non-daily consumption of fish and or meat increases the risk of anemia (COR=2.16, 95% CI:1.25–3.71; p=0.00). This increased risk was also shown in respondents who did not use clean water from standardized facilities/sources for cooking (COR=2.13, 95% CI:1.17–3.89; p=0.01).

After adjustment using stepwise regression with backward elimination (Table 3), elevated odds of anemia were significantly associated with non-daily consumption of fish or meat (AOR=2.27, 95% CI:1.34–3.85; p=0.002) and utilization of water from non-standardized sources/facilities for cooking (AOR=2.19, 95% CI:1.21–3.95; p=0.009).

Many studies explored the correlation of anthropometric markers with anemia status with various results (Qin *et al.* 2013; Choma *et al.* 2015; Virginia & Fenty 2017; Cepeda-Lopez & Baye 2020; Kerkadi *et al.* 2021; Jeong *et al.* 2022). Among three anthropometric markers measured in this study, only MUAC significantly correlates with anemia status. Respondents who have MUAC fall under and above the normal range (53.5%) are less likely to be anemic (COR=0.55, 95% CI:0.32–0.96; p=0.03) compared to those who have normal nutritional status. The findings here do not align with those of a prior study in Indonesia that report higher odds of anemia in women who are underweight

Table 2. Bivariate analysis of independent variables based on respondents' anemia status

Variable	Anemia status		X^2	*p*
	Non-anemia 228 (74.02%)	Anemia 80 (25.97%)		
Legumes consumption				
Daily	44	24	3.94	0.047*
≤6 times/week	184	56		
Fish and or meat consumption				
Daily	143	35	8.73	0.003*
≤6 times/week	85	45		
Green vegetables				
Daily	139	49		
≤6 times/week	89	31	0.53	0.76
MUAC				
Normal	114	51	4.5	0.034*
Not-normal	114	29		
Healthy latrine ownership				
Yes	124	35	2.68	0.101
No	104	45		
Standardized water utilization for cooking				
Yes	89	19	6.07	0.014*
No	139	61		
Education				
≥12 years	118	41	0.006	0.938
<12 years	110	39		
Abdominal circumference				
>80 cm	156	52	0.31	0.574
≤80 cm	72	28		
Age				
Teenager	59	20	0.02	0.877
Adult	169	60		
BMI				
Normal	48	20	0.53	0.464
Not-normal	180	60		

*significant value ($p<0.05$); BMI: Body Mass Index; MUAC:Middle Upper Arm Circumference

Table 3. Logistic regression

Variable	Anemia status		COR (95% CI)	*p*	AOR (95% CI)	*p*
	Non-anemia	Anemia				
Legumes consumption						
Daily	44	24	1		1	
≤6 times/week	184	56	0.54 (0.29–1.00)	0.05*	2.27 (1.34–3.85)	0.002*
Fish and or meat consumption						
Daily	143	35	1			
≤6 times/week	85	45	2.16 (1.25–3.71)	0.00*		
MUAC						
Normal	114	51	1			
Not-normal	114	29	0.55 (0.32–0.96)	0.03*		
Healthy latrine ownership						
Yes	124	35	1			
No	104	45	1.50 (0.87–2.59)	0.14		
Standardized water utilization for cooking						
Yes	89	19	1		1	
No	139	61	2.13 (1.17–3.89)	0.01*	2.19 (1.21–3.95)	0.009*

*significant value ($p<0.05$); MUAC: Middle Upper Arm Circumference

or have low MUAC scores (Nainggolan *et al.* 2022) but in accordance with another study (Sari *et al.* 2022). The categorization of MUAC's group in this study variable might be the reason for the opposite result in another study. In this study, the group of respondents who were categorized as not having a normal range of MUAC consisted of those who were underweight and those who were overweight, even obese. Obese women tend to have a lower risk of anemia, as reported in a previous study (Utami *et al.* 2020), due to the allegedly biological mechanism which is hypoferremia led by the elevation of low-grade chronic inflammation and hepcidin level (Alshwaiyat *et al.* 2021), and given the complexity of anemia etiology, this contradictive result is unsurprising.

Iron-deficiency anemia is the most common anemia in the world in all age groups, including in Indonesia (WHO 2015; Manikam 2021). However, other nutrient deficiencies such as zinc (Jeng & Chen 2022), folate, vitamin B12, vitamin A (Finkelstein *et al.* 2020), and protein (Brittenham *et al.* 2023) also contribute to anemia. Legumes and green vegetables are iron and other micronutrients source of food. However, iron from this plant-based food is non-heme iron which is only absorbed 10%, and the absorption is highly affected by dietary factors such as the consumption of coffee, tea, and phytates (Piskin *et al.* 2022). This bioavailability of iron from plant-based food might be the reason why no significant correlation between the consumption of legumes and green vegetables with anemia can be found in this study.

Fish and meats are food rich in iron and protein and contain other nutrients such as zinc and riboflavin that affect the hemoglobin level.

The odds of anemia in non-pregnant women who did not consume fish or meat daily in this study are higher compared to women who did (AOR=2.27, 95% CI:1.34–3.85; p=0.002). Considering the nutrient content of fish and meat, it is inevitable that consumption in sufficient amount will prevent anemia, as shown in a study of Japan's elderly (Imai & Nakade 2019). However, the irony of this result is that most of these research locations are coastal areas, and the main source of protein in Banggai Regency is fish (BPS-Statistic of Banggai Regency 2020), yet not everyone consumes fish daily.

According to Robert N. *et al.* (2022), in a fishing community, fish from open-water fishing only consumed about 5–10% of the total catch, and the rest of it was sold to the market. The high fish price in certain seasons also makes the community prefer to sell the catch than consume it directly (Roberts *et al.* 2022). This condition also may occur in our research community. Even though many of the respondents are consumers, high prices in certain seasons can be an obstacle to fish consumption (Fiandari *et al.* 2019). Meat (beef, goat, and poultry) consumption is less frequent than fish consumption in Banggai's rural area, especially in low-economic families, because of the price and the culture. Thus, make meat is often only consumed on certain occasions. Data from Banggai's Central Statistical Agency (BPS) confirmed that people at the bottom 40% of the economic level do not consume adequate calories and protein and only spend about 52,000 Rupiah of meat per capita per month (BPS-Statistic of Banggai Regency 2018; 2020).

World Health Organization (WHO) pointed out that inadequate access to Water, Sanitation and Hygiene (WASH) is among the intermediate determinants of anemia in women of reproductive age (WHO 2020). The adjusted OR in non-pregnant women who did not use water from standardized facilities/sources to suffer from anemia is two times higher compared to those who did. This comes in agreement with previous studies in other parts of the world (Teshale *et al.* 2020; Talukder *et al.* 2022) and the odds of anemia being elevated if access to healthy latrine is limited (Kothari *et al.* 2019). The direct pathways between not-standardized water to anemia are diarrhea, intestinal parasitic infection (WHO/USAID/UNICEF 2015) and environmental enteropathy (Regassa *et al.* 2023).

This study has limitations. Consumption of all food groups only assessed using food frequency weekly. We planned to use 24hr recall method to assess the consumption, but due to the lack of preparation times, we could not train the enumerator to perform the method as well as it should.

Another limitation is the characteristic homogeneity of the community where respondents belong to. To give perspective, the common characteristic of rural areas in Banggai District is that people in one village or even subdistrict usually come from the same ethnic group, farmer and fisherman are the main occupations, with fewer people being civil servants and traders, the majority of women are housewives and did not have permanent work. Moreover, traditional markets in most rural areas did not operate 7 days a week, so the community relied on greengrocer peddlers daily. This homogeneity is more visible because the stunting locus areas are close to each other. Therefore, the results might be generalized to only some parts of the regency

CONCLUSION

Not using water from standardized sources/ facilities for cooking activity and not consuming fish or meat daily are the determinant factors that significantly correlate with anemia in Banggai Regency's non-pregnant women. However, further research, especially about the quantity of iron-source food consumption and its inhibitor, together with individual access to a healthy latrine, and infection frequency, is needed to gain a deeper understanding of the incidence of maternal anemia in Banggai Regency.

Local governments should include these variables in their new reformulated and innovative stunting-reducing programs, thus perhaps they can achieve their expected targets such as reducing anemia in pregnant women and reducing stunting in the long run.

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DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

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