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FACTORS ASSOCIATED WITH IRON ANEMIA DEFICIENCY IN CHILDREN AGED 12 TO 36 MONTHS IN PUBLIC HEALTH CENTER JATILAWANG, BANYUMAS CENTRAL JAVA

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ABSTRACT

Background: *According to the WHO, anemia prevalence in preschool children in the world obtained 47.4% from the total population of anemia sufferers. Indonesia collected 44.5%, therefore, it was included in the prone region to anemia cases in pre-school children. Iron Deficiency Anemia (IDA) was closely related to low birth weight babies and premature age, nutritional status, socio-economic and low maternal education. Children who experienced anemic iron deficiency (ADB) in infancy at risk of barriers to growth and development*
Method: *This was a cross sectional study. The population covered all healthy children aged from 12 to 36 months. The sample on the study determined by consecutive sampling, 152 subjects were selected. Examination conducted by the method Hb and serum ferritin cyanmethemoglobin using ELISA method. Data analysis used chi-square and Logistic Regression.*
Results: *The prevalence of IDA in Puskesmas Jatilawang Banyumas regency was 28 cases (18.4%). Malnutrition status, maternal education and family income contributed a significant relationship to the incidence of iron deficiency anemia in infants. Children with malnutrition status collected 10.5 higher risk than children with good nutrition. Children with mother education backgrounds were only at Elementary School or Junior High School supported 12 times greater iron deficiency anemia (95% CI: 12,16- 202.5), and children who came from families with incomes <Rp 1.100.000,- obtained 7.08 times iron deficiency anemia(95% CI: 1,70- 29.3).*
Conclusions: *The prevalence of iron deficiency anemia was 18.4%. Malnutrition status, maternal education and family income were risk factors of anemic iron deficiency in children aged 12 to 36 months in Puskesmas Jatilawang Banyumas.*

Keywords: *Iron DeficiencyAnemia, Nutritional Status, Age Children 12 to 36 Months.*

INTRODUCTION

Iron deficiency anemia is a major problem that occurs in the world. IDA is the most common anemia, especially in developing countries. Based on estimates from the World health Organization (WHO), most of the children suffered from iron deficiency andone third suffered from IDA. The combination of high iron requirements with a low diet in iron causes of early childhood is the period most susceptible to iron deficiency with or without anemia [1]. According to WHO, the prevalence of anemia in school children (0- 5 years) in the world reached 293 million (47.4%) of the total population of anemia sufferers. The highest prevalence in Southeast Asia was 115.3 million (65.5%) and Indonesia obtained 21.59% (44.5%) [2]. The incidence of anemia at the age of 0- 5 years in 2009 in Surakarta, Central Java, 57.9% [3].

Based on the results of several studies, it suggested that IDAwas closely related to low birth weight babies and premature, sex, age, nutritional status, socio-economic and low maternal education [4]. Consumption of foods containing low iron was still a major cause of IDA among many contributing factors. Rapid growth of children before 24 months in conjunction with unmet demand for iron put children into the largest risk group for IDA across all age groups [5]. Children who experience IDAin infancy may have more serious risk of long-term developmental disorder, such as cognitive impairment. Results of research Olney, *et. al* (2007) revealed that children who were malnourished obtained obstacles in motor development such as children who had anemic iron deficiency [6].

The incidence of IDA is an important health indicator. The diagnosis of IDA is confirmed by the findings of history, physical examination and laboratory tests to support clinical symptoms which was not typical [7]. Measurement of iron status and hemoglobin levels can provide information about the severity of iron deficiency. If children under five shows Hb<110 g/l and decreased levels of serum ferritin (<12 Ug /dl), it can be concluded that he is IDA sufferer [1].

In Indonesia, screening and program prevention on the incidence of IDA has not reached the toddler group. Up to now, the program only focused on the group of pregnant women. In 2015, in the region of Puskesmas Jatilawang Banyumas during January-October 2015, there were 3243 children under five. These areas have a bigger population of children under five in Banyumas and have not been carried out blood tests for the detection of IDA. The purpose of this study was to determine the prevalence of IDA in children aged 12- 36 months and determine the factors associated with anemia in Puskesmas Jatilawang Banyumas.

METHODS

This study was a cross sectional study held in April 2016 in four villages in Puskesmas Jatilawang Banyumas covered Tinggarjaya, Kedungwringin, Tunjung and Bantar villages. Population and study subjects were 12 to 36-month-old baby who came to *posyandu* (neighborhood health center). The sample selected by health baby criteria and parents willingness to become respondents. Population and study subjects were 12 to 36-month-old babyamounts 1235 baby. The number of samples in this study were 152 children under five. Calculated based on the prevalence abbreviation and the prevalence of IDA in research before conducted by Nugrohowati (2010) in Surakarta (57,9%) [3]. Sampling technique applied consecutive. The independent variables in this study were the nutritional status, age, maternal education, and family income. The dependent variable was anemic iron deficiency in infants.

Data on the age of the baby, maternal education and family income were collected from questionnaires given to parents. Parents obtained an explanation about the purpose and the benefits of research, then the respondent would sign an informed consent and filled out a questionnaire that was guided by a research assistant. A research assistant was a village midwife and had been explained and confirmed of the research that would be conducted. Nutritional status assessment procedure was done by calculating the weight for age of the children and recorded in the WHO growth curves based on gender. The procedure to collect Hb through *cyanmethemoglobin* method, which was carried out in an integrated laboratory. First, prepare vacutainer EDTA solution has been added, then the cubital fossa baby was cleaned with alcohol 70% cotton, wait until dry. Two ml of blood was taken from the brachial vein. Blood that has been obtained was then collected and put in a coolbox and transported to the laboratory within about 25 km (49 minutes) from the point of sampling. In the laboratory, examination of blood samples of hemoglobin was done by Drabkin solution and read with *spetrofotometer* with a wavelength of 540 nm. Serum ferritin inspection procedures were performed

using *MiniVidas- Biomerieux's*. Limitation of anemia if Hb<11 g /dl, while iron deficiencyanemiaifHb<11 g /dL and serum ferritin levels <12 ug / L.

The bivariate analysis was conducted to determine the effect of each independent variable on the dependent variable (the status of IDA). The independent variables with p value <0.25 in the bivariate analysis would be processed into a multivariate analysis to determine the level of risk that previously known to be associated with the independent and the dependent variables. Logistic regression analysis with *backward* method. Prevalence Ratio with 95% significance level used to estimate the strength of the relationship between independent and dependent variables. In multivariate analysis, independent variables with *p value*<0.05 was a significant variable in the incidence of IDA.

Ethical feasibility to conduct the research was obtained from the Health Research Ethics Committee Universitas 'Aisyiyah Yogyakarta. Each of the respondents involved in this study must sign an informed consent form and given an explanation to the intentions and objectives of the research and its impact during the research process taken.

RESULTS

The research showed that the prevalence of anemic iron deficiency was 18.4% to the age <24 months consisted of 44 infants (28.9%), and meanwhile, 24 to 36 months were 108 (71.1%). Status of malnutrition was found in 30 infants (19.7%) and 122 infants (80.3%) with good nutritional status. Thirty mothers of infants (19.7%) had low levels of education and 46.1% had low income. Twenty-eight infants (18.4%) suffered from IDA (Table 1).

In this study, a group of children aged <24 months with malnutrition status had a significant association with IDA in children aged 12 to 36 months. Similarly, the low maternal educational level (SD- SMP) and low family income (<Rp 1,100,000) (Table 2).

Multivariate analysis revealed that the nutritional status variable, maternal education and family income were risk factors of anemic iron deficiency. The level of education was the most dominant risk factor associated with the incidence of IDA (OR : 12.1). Overall factors; nutritional status, education and family income affected 67.7% incidence of IDA in children aged 12 to 36 months in Puskesmas Jatilawang Banyumas (Table 3).

Table 1. Respondent characteristics

Characteristic	N	%
Age		
<24 month	44	28,9
24- 36 month	108	71,1
Nutritional Status		
Malnutrition	30	19,7
Adequate nutrition	122	80,3
Education background		
Primary school- Junior High School	30	19,7
Senior High School- University	122	80,3
Family Income		
≤ 1.100.000	70	46,1
> 1.100.000	82	53,9
Anemic iron deficiency to baby		

Positive IDA	28	18,4
Negative IDA	124	81,6

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Table 2.The correlation of risk factors to anemic iron deficiency to children

Variable	Anemic iron deficiency				Total	P value	PR	CI 95%
	Anemic iron deficiency		Negative Anemic iron deficiency					
	N	%	n	%				
Nutritional Status								
Malnutrition	16	53,3	14	46,7	30	0,00	10,47	4,123-26,618
Adequate nutrition	12	9,8	110	90,2	122			
Mother education background								
Primary School-Junior High	22	78,6	8	26,7	30	0,00	53,167	16,793-168,32
Senior High-University	6	21,4	116	95,1	122			
Income								
Rp< 1.100.000	22	78,6	48	68,6	70	0,00	5,806	2,196-15.350
Rp ≥ 1.100.000	6	21,4	76	92,7	82			
Age								
<24 Month	6	13,6	38	86,4	108	0,331	0,617	0,232- 1,645
>24 Month	22	20,4	86	79,6	44			

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Table 3. The result of logistic regression analysis to risk factors related to anemic iron deficiency

Variable	**P value**	**PR**	**CI 95%**
Nutritional status	0,002	10,5	2,39- 46,0
Mother education background	0,000	12,1	12,16- 202,5
Income	0,007	7,08	1,70- 29,3
R^2			0,677

Multivariate analysis revealed that the nutritional status variable, maternal education and family income were risk factors of anemic iron deficiency. The level of education was the most dominant risk factor associated with the incidence of IDA (OR : 12.1). Overall factors; nutritional status, education and family income affected 67.7% incidence of IDA in children aged 12 to 36 months in Puskesmas Jatilawang Banyumas

DISCUSSION

The research was a analytic study conducted to determine the prevalence of IDA in children aged 12 to 36 months done for the first time in Puskesmas Jatilawang Banyumas. The results of this study revealed that the prevalence of IDA in children aged 12 to 36 months was 18.4%. The data was reported by 32% and it was lower than the national incidence rate compared to the prevalence of IDA in Indonesia in 2011. However, these results could not be compared with the incidence in the other regions in Indonesia since the prevalence of anemic iron deficiency in children aged 12 to 36 months were not yet available nationally. This was caused by the government that still focused on the handling and prevention of IDA, whereas WHO stated that children aged 6- 59 months was one of the groups with a high risk of IDA out of adolescents, pregnant and lactating mothers groups [8].

The research showed that children aged <24 months who were IDAwas13.6%, however, statistically it showed no significant correlation between age children with IDA (*p value* = 0.331). This finding fitted to the results of research conducted by Sekartini, *et.al.* (2005) indicated that infants aged 4- 12 months there had no significant relationship between IDA in infants with the age factor (*p value* = >0.05) [9]. The results of this study was different from the results of research conducted by Gebreegziabiher *et. al.* (2014) who argued that children aged 6- 23 months was the age group at most risk almost 3 times were anemic compared to 48- 59 months age group (40.7%) [13]. The prevalence of IDA was decreased according to the age, this decrease occurred dramatically in children aged > 23 months. It was due to lower iron requirements per kg body weight associated with a reduction in the rate of growth and a shift in dietary patterns of meal replacement supplements into the adult food.

The explanation that could be described on different research findings was the short of age range.Therefore, it affected the results of statistical analysis. Whereas, other studies revealed that the greater age range, the better and meaningful result obtained.In addition, this study did not assess of the child's diet to support the analysis of the incidence of IDA in that age range.

Children aged 12 to 36 months with malnutrition status and suffered anemic iron deficiency was 53.3% and there was a significant relationship with the incidence of anemic iron deficiency (*p value* = 0.00). The study showed that children with malnutrition status were at risk for IDA 10.5 times higher compared to children who had good nutritional status (CI: 2,39- 46.0). Leite, et. al. (2013) supported the result that he suggested that nutritional status was positively associated with the incidence of IDA after controlling other variables (PR: 1.31, 95% CI: 1,21- 1,41). Anemia and malnutrition often occurred together, the problems of shortage of certain nutrients would occur simultaneously on individual. The relationship between the measurement of nutritional status and anemia was affected by some common causes such as socioeconomic status, sanitation, infectious and parasitic diseases as well as diet food (10).

Based Banyumas Health Profile 2015, Puskesmas Jatilawang region was an area that has a number of infants with the highest malnutrition status throughout Banyumas Regency [11]. Various attempts have been made to address the issue of malnutrition in the region such as support exclusive breastfeeding, provision of food supplementation *(Taburia)* to the baby through a group of neighborhood health center, health service in children under five (weighing infants routinely in Posyandu), as well as provide treatment in cases of malnutrition in Puskesmas Jatilawang. However,

the handling for underweight infants were limited until now by providing food supplements and not followed by screening or screening of the long-term risks such as IDA screening. It happened because the investigation of the condition of IDA in infants and young children have not been implemented as a program of health care of infants and toddlers in the Puskesmas level. The government was only implementing screening programs and prevention of anemia in pregnant women.

The American Academy of Pediatrics (AAP) recommended doing hemoglobin (Hb) and hematocrit (Ht) tests at least once at the age of 9-12 months and repeated six months later at the age of 15-18 months or additional checkuponce every 1 year at age 2 -5 years. The examination was conducted on a high-risk population, such as premature infants, low birth weight, history of getting prolonged care unit neonatology, and children with a history of bleeding, chronic infection, ethnic group with high prevalence of anemia, exclusive breastfeeding without supplementation, fresh cow's milk at an early age, and other social risk factors [12].

The study showed that the mothers with SD- SMP education backgrounds and having children with IDA was 22 (78.6%). Statistical analysis showed a significant relationship between maternal education SD-SMP with IDA (*p value* = 0.00) and at risk of IDA 12 times higher (95% CI: 202.5- 12,16) compared to children who had mothers with higher school education (SMA-PT) after being controlled by the nutritional status and family income variables. This study findings were supported by Woldie *et. al*. (2008), which revealed that children of unschooled mothers was more experienced to suffer from anemia than children of secondary education and higher education mothers (AOR = 2.6; 95% CI: 1,26- 5.27) [4].

According Woldie, *et. al*. (2015), the level of education of parents positively influenced the practices associated with health care and feeding practices in children [4]. Mothers with a good education were more aware of the health of their children and their scientifically proven practice of feeding their children and prove the health status of their children. Mother's educationwas also associated with knowledge about nutrition. In general, the higher a person's education, the better the level of knowledge. Mothers with relatively high education tended to have the ability to use resources better family than mothers with low education. The higher the mother's education, the higher knowledge about the variety of food. Variety of foods was used to meet the nutritional needs in infants [4].

The study obtained that the *odds ratio* of the variable of maternal education on the incidence of IDA (OR: 12.1, CI: 12,16- 202.5). It occured because the distribution of the data obtained relating to maternal education level was uneven so it obtained unclear description of the actual maternal education.

Parents who have an income < Rp 1,100,000 with the child suffered from IDA was22 (78.6%). Statistical test explained a significant relationship between family income and the incidence of IDA in children aged 12 to 36 months (*p value* = 0.00). Bivariate and multivariate analysis showed a significant relationship between income and IDA in children aged 12 to 36 months. Children who came from families with incomes < Rp 1.100.000,-obtained a risk of IDA by 7.08 times higher (95% CI: 1,70- 29.3) than children who come from families with incomes > Rp1,100,000,- after it was controlled by the nutritional status and maternal education variables.

The findings were consistent with the results of research conducted by Gebreegziabiher, *et. al.* (2014) which stated that the anemia incidence experienced by children was related to low family income. The children who came from low-income families were at risk 4.8 times higher and likely to develop anemia than children from families with higher incomes (95% CI: 3,2- 7,3) [14]. According Woldie, *et. al.* (2015), in some research findings showed low family income related to food security in

the household [4]. The low economic status would cause the loss of the ability to provide a variety of foods and rich in nutrients and ensure food security. Finally, food security in the family was a determinant factor in the status of malnutrition (undernutrition) including anemic iron deficiency [13].

The research strength was the first research done relating to IDA in Puskesmas Jatilawang, so it might give a description of early IDAin children aged 12 to 36 months in this region. In addition, laboratory tests were conducted to determine hemoglobin level and serum ferritin whether it met the standard set by WHO through *cyanmethemoglobin* and *enzyme linked immunosorbentassay* (ELISA) methods. The research also showed a disadvantage that the number of samples in this study was insufficient to affect the results of statistical calculations and variations in the value of each independent variable.

CONCLUSION

Nutritional status, maternal education and family income were risk factors of anemic iron deficiency. Overall factors; nutritional status, education and family income affected 67.7% incidence of IDA in children aged 12 to 36 months in Puskesmas Jatilawang Banyumas. The government should collaborate with Puskesmas to create a program of IDAdetection in infants as one of protection of anemic in early age.

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