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Original Research

Si Embul: Assesment In Baby And Children To Increasing Haemoglobin Level In 6-24 Months Children

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ABSTRACT

Background: *Iron deficiency anemia is one of the health problems in Indonesian children that need special attention because it has an impact not only for now but also on the upcoming time. The si Embul innovation program is a comprehensive activity that includes growth and development checks, evaluation of exclusive breastfeeding, identification of anemia by checking the baby's hemoglobin, and consultations with nutritionists and doctors.*

Methods: *This research used descriptive correlational with a cross-sectional research design. The sample was all children aged 6-24 months who are included in the Si Embul Program at the Tegalrejo Health Center in 2017-2019 as much as 149 children. The univariate analysis describes the characteristics of the research subjects. Relationship between the Si Embul Program and anemia status analyze using bivariate analysis, carried out with chi-square at a significant level of 5%. The research was carried out using secondary data in patient medical record and register books and taken from both books.*

Results: *The incidence of anemia was more common in female respondents as many as 31 people (20.81%). Based on the baby's birth weight, the incidence of anemia was more common in BBLN (normal birth weight) as many as 50 people (33.55%). The Si Embul program was associated with anemia status in children aged 6-24 months with a p-value of 0.004 (p<0.05).*

Conclusion: *The si Embul program was associated with anemia status in children aged 6-24 months with a p-value of 0.004. This shows that the excistence of Si embul program can reduce the incidence of anemia in children aged 6-24 months.*

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INTRODUCTION

One of the serious global public health problem is anemia, affecting most of the pregnant women and young children. The World Health Organization (WHO) estimates

that 42% of children under 5 years worldwide suffering from anemia (WHO, 2016). Anemia is a condition in which the concentration of hemoglobin in them is lower than normal. Hemoglobin is needed to carry oxygen and if the child has too few or abnormal red blood cells, or not enough hemoglobin, it will have an impact on performance and cognitive growth (WHO, 2016).

Iron Deficiency Anemia (IDA) is anemia caused by a lack of iron which is needed for the synthesis of hemoglobin. This type of anemia is the most common anemia (Amalia & Tjiptaningrum, 2016). The age group with the highest incidence of IDA is children under five years. Many studies reveal the fact that IDA has occurred in infants aged 0-6 months, especially at the age of 6-12 months. The older the baby, the greater risk of suffering from IDA (Ringoringo, 2016).

The incident of IDA is higher in infant, especially in premature infants (25-85%) and infants who consume exclusively breast milk without supplementation. Normal hemoglobin levels are generally different in the elderly and children, in children is 11 grams. Anemia occurs in 80% of children aged 6-23 months (Prieto-Patron et al., 2020). Anemia is dominant in male infants, while iron deficiency peaks at the age of 9-12 months. If anemia occurs in adults, it will be easy to detect, but if anemia occurs in infants or toddlers, it is not detected quickly, because infants/toddlers cannot reveal if they have signs of anemia.

Inadequate food intake, especially iron, will affect the nutritional status of children under five years and iron deficiency can occur, resulting in decreased blood hemoglobin (Hb) levels and causing iron deficiency anemia (Faiqah et al., 2018). Children more often eat foods with high carbohydrates than animal side dishes. Insufficient food intake causes them to lack micronutrients such as iron.

In research conducted by (Flora et al., 2022), iron deficiency in Tuah Negeri District is strongly related to stunting in elementary school children. However, in a study conducted by Bahagia Febriani et al., 2020 stated that low birth weight and low zinc level are the risk factors that cause stunting, while calcium, ferritin, albumin and vitamin D, were not associated.

The risk of stunting toodlers experiencing anemia is 2.3 times compared of normal toddlers. Then, toodlers who are overweight (z score > 2) tend to have anemia. Other causes of nutritional anemia are consumption, insufficient iron and inadequate absorption of iron, increased needs due to phsycal growth, and blood loss due to chronic bleeding, parasitic and infectious disease.

Infants who were not exclusively breastfed for 4-6 months had an 18.4 times higher risk of developing iron deficiency anemia than infants who were exclusively breastfed. Exclusive breastfeeding is recommended to be given to babies up to the age of 6 months and by providing complementary foods at the beginning of the age of 6 months, after that it is continued by continuing to give breast milk until the age of 2 years (Faiqah et al., 2018).

The use of iron supplements in infants aged 0-12 months provides benefits, namely preventing and treating iron-deficiency anemia in infants with a dose recommended by the Indonesian Pediatrician Association (2011), which is 2-3 mg/kgBW/day and the duration of iron supplements using from the 2016 WHO guidelines on the use of iron supplements should be used for 3 consecutive months to prevent anemia or deficiency. Infants who are exclusively breastfed for 6 months and then do not receive adequate iron from food are recommended to give iron supplements

of 1 mg/kg/day. Infants who are breastfed need to be given iron supplements from 4 or 6 months to prevent iron deficiency in the first year of life.

WHO states that iron supplementation can be given in bulk, starting at the age of 2-23 months with a single dose of 2 mg/kgBW/day. 1,5 infants with low birth weight have a 10-fold higher risk of iron deficiency. When there is a growth spurt, the need for iron will increase in the first two years of life. In term infants and children under 2 years, supplementation is given from the age of 6-23 months with 2 mg/kg/day.

According to WHO, breastfeeding greatly contributes to the health and nutritional status of infants. Breast milk contains all the nutrients that babies need. In addition to anemia, exclusive breastfeeding and incomplete or suboptimal intake can increase the risk of stunting. Stunting can affect the growth and development and future of children and has a negative impact, especially for children aged two years because it can interfere with their development (Purnamaningrum et al., 2022).

Children who suffer from stunting up to the age of 5 years can continue into adulthood and reduce the risk of offspring with low baby weight (Purnamaningrum et al., 2019). Children with low energy intake are six times more possibly to experience stunting than children with adequate energy intake and children with low protein intake are 3.22 times more likely to experience stunting than children with adequate protein intake (Hendraswari et al., 2021).

Tegalrejo Health Center is one of the public health centers in Yogyakarta City which has the Si Embul innovation program or Pemeriksaan Bayi Usia Enam Bulan (Six Months Baby Examination). The program which has just been implemented by the only health center of 18 health centers in the city of Yogyakarta has the aim of preventing anemia in infants, preventing impaired growth and development of infants and preventing malnutrition in infants.

The Si Embul innovation program is a comprehensive activity that includes growth and development checks, evaluation of exclusive breastfeeding, identification of anemia with infant hemoglobin examination, consultation on Infant and Child Feeding with nutritionists and doctor consultations regarding infant anemia.

Data on baby visits with hemoglobin checks at the Tegalrejo Health Center in 2019 were 231 babies. A total of 100 infants had a hemoglobin level of less than 11grdL. The percentage of anemic infants from the results of the examination was 43.29%. Research conducted by Supriyati in 2018 at the Tegalrejo Health Center in Yogyakarta City concluded that exclusive breastfeeding was statistically related to the anemia incidence in infants aged 6 months (Supriyati et al., 2018).

Based on the information that has been collected, no research examines the effectiveness of the Si Embul program at the Tegalrejo Health Center, Yogyakarta City. So it is still necessary to study the increase of the hemoglobin levels in children. Researchers determined the effectiveness and increase in hemoglobin levels as research variables. On this basis, the researcher will conduct a study entitled the relationship between the Si Embul program and the hemoglobin levels of children aged 6-24 months at the Tegalrejo Health Center, Yogyakarta City.

MATERIALS AND METHOD

This study used descriptive correlational with a cross-sectional research design. Correlational descriptive research is a research design used to explain the relationship, estimate and test a theory that exists between two variables. The population was children aged 6-24 months in the working area of the Tegalrejo Health Center.

The sample in this study was all children aged 6-24 months who are included in the Si Embul Program at the Tegalrejo Health Center in 2017-2019 as much as 149 children. The research was carried out using secondary data in patient medical records and register books and taken from both books. The Si Embul Program is complete if they meets ≥ 2 times and incomplete if they meet ≤ 1times.

Data analysis was carried out quantitatively. The univariate analysis describes the initial hemoglobin level given by the Si Embul program, the second and third visit hemoglobin levels. The relationship between the Si Embul program and hemoglobin levels analyze using the bivariate analysis, carried out with chi-square at a significant level of 5% (p=0.05).

This research was carried out after obtaining approval from the Poltekkes Kemenkes Yogyakarta by obtaining a research ethics letter from the Research Ethics Committee Poltekkes Kemenkes Yogyakarta Number: e-KEPK/POLKESYO/0593/IX/2020 dated 22 September 2020.

RESULTS

The following are the results of Frequency Distribution Based on Characteristics of Research Subjects.

Table 1. Frequency Distribution Based on Characteristics of Research Subjects

Variable	Frequency (N)	%
Gender		
Man	81	54.4
Woman	68	45.6
Baby Birth Weight		
Low Birth Weight	12	8.1
Normal Birth Weight	135	90.6
More Birth Weight	2	1.3
Breastfeeding		
Exclusive	135	90.6
Not Exclusive	14	9.4
Mother's Job		
Work	37	24.8
Does not work	112	75.2
Mother's Education		
Elementary school	3	2
Junior high school	19	12.8
Senior high school	87	58.4
College	40	26.8
Mother's Age		
< 20 Years	2	1.3
20-35 Years	133	89.3
> 35 Years	14	9.4

The characteristics of the respondents are mostly male as many as 81 people (54.5%). In terms of baby birth weight, most of the Normal Birth Weight was 135 people (90.6%). Viewed from the aspect of breastfeeding, most of them were given exclusively to 135 people (90.6%). The data above shows that most of the mothers do

not work as many as 112 people (75.2%). In terms of mothers' education, most of them are in senior high school education as many as 87 people (58.4%). Most of the mothers aged between 20-35 years were 133 people (89.3%).

Table 2. Characteristic Comparability

Variable	Anemia Status				P-Value	OR	95% CI	
	Anemia		No Anemia				Lower	Upper
	N	%	N	%				
Gender					0,126	0,597	0,307	1,159
Male	27	18.12	54	36.24				
Female	31	20.81	37	24.83				
Baby Birth Weight					0,069			
Low Birth Weight	8	5.36	4	2.68				
Normal Birth-Weight	50	33.55	85	57.04				
More Birth Weight	0	0	2	1.34				
Breastfeeding					0,404	1,667	0,497	5,587
Exclusive	54	36.24	81	54.36				
Not Exclusive	4	2.68	10	6.71				
Mother's Job					0,816	1,094	0,512	2,337
Work	15	10.06	22	14.76				
Does not work	43	28.85	69	46.30				
Mother's Education					0,068			
Elementary School	3	2.01	0	0				
Junior High School	7	4.69	12	8.05				
Senior High School	29	19.46	58	38.92				
College	19	12.75	21	14.09				
Mother's Age					0,921			
< 20 Years	1	0.67	1	0.67				
20-35 Years	52	34.89	81	54.36				
> 35 Years	5	3.35	9	6.04				

The incidence of anemia was more common in female respondents as many as 31 people (20.81%). Based on the baby's birth weight, the incidence of anemia was more common in normal birth weight as many as 50 people (33.55%). Based on the history of breastfeeding, the incidence of anemia was more common in mothers who gave exclusive breastfeeding as many as 54 people (36.24%).

Based on the work status of the mother, most cases of anemia occurred in mothers who did not work as many as 43 people (28.85%). Based on the level of education, most cases of anemia occurred in mothers who had a high school education level of 29 people (19.46%). Based on maternal age, cases of anemia occurred in mothers aged 20-35 years as many as 52 people (34.89%).

From the significance value, there are no characteristics associated with anemia in infants aged 6-24 months (p-value > 0,05). According to result by gender, girls are 0.59 times more likely to be anemic than boys. In exclusive breastfeeding, children who are not exclusive breastfed were 1.66 times more likely to suffer from anemia, and children from working mothers are 1,09 times more possibly to be anemic.

Table 3. Connection Si Embul Program with Hemoglobin levels for children aged 6-24 months

Variable	Anemia Status						p-value	OR	95% CI	
	Anemia		No Anemia		Amount				Low	Up
The Si Embul Program	N	%	N	%	N	%				
Complete	40	26.84	80	53.70	120	80.54	0.004	0.306	0.132	0.708
Incomplete	18	12.08	11	7.38	29	19.46				
Total	**58**	**38.92**	**91**	**61.08**	**149**	**100**				

Si Embul program was associated with hemoglobin levels in children aged 6-24 months with a p-value of 0.004 ($p<0.05$). This shows that the existence of a screening Si Embul program can reduce the incidence of anemia in children aged 6-24 months. Then, children with incomplete examination of the Si Embul program are 0,30 times more likely to suffer from anemia.

DISCUSSION

This study examines the relationship of Si Embul Program with hemoglobin levels for children aged 6-24 months at the Tegalrejo Health Center, Yogyakarta City. Iron deficiency in early life can lead to impaired brain development and other developmental effects. Iron is very important for brain development, anemia causes a lack of metabolic energy, meilin formation and memory function (Robert & Geer, 2018).

Results analysis showed that the incidence of anemia was more common in female children. The results of this study are in line with research by Faiqah (2018) which stated that anemia under five years was more common in women (Faiqah et al., 2018). The 2013 Basic Health Research (Riskesdas) showing that the proportion of anemia in women is higher than in men.

The result is not in line with the research by (Nazari, 2019), the prevalence of iron deficiency anemia was 18.2% (95% CI: 14.3-22) among the Iranian children under 6 years of age and according to the result by gender. The prevalence of iron deficiency anemia was higher in boys (17.7% with 95% CI: 5.9-29.5) than in girls (14.4% with 95% CI: 4.5-24.2). Based on WHO's report, the prevalence of iron deficiency among children aged 6-59 months is 62.3% in Africa, 22.3% in North America, and 53.8% in Southeast Asia (Nazari et al., 2019).

The results indicate that the incidence of anemia is more common in normal birth weight babies as many as 50 people (33.55%). This study is in line with the results of a study conducted by (Ramin Tabibi, 2013) which states that there is no statistically significant relationship between iron deficiency anemia and other anthropometric measurements, namely birth length, weight and current height. Research conducted by Faiqah stated that the incidence of anemia was more experienced by LBW infants (95.4%) compared to LBW (4.6%) (Faiqah et al., 2018).

However, research conducted by (Gebreweld A, 2019) stated that underweight children were 2.1 time (AOR=2.11; 95% CI: 1.23-10.18) more likely to be anemic than children with normal weight and children living in an urban area were 1.8 times (AOR=1.83; 95% CI: 1.05-3.18) more likely to be anemic than those living in a rural area. Based on Indonesian Doctor Association (IDI) recommendations in 2011 for term

infants and children under 2 years, iron supplementation is given if the prevalence of IDA is high (above 40%) or does not receive fortified food.

Research conducted at the Binjai City Health Center stated that infant birth weight was significantly associated with the incidence of anemia in infants aged 6-12 months with a p-value of 0.001 (Prihartini, 2021). Research conducted in South Wollo, Northeast Ethiopia among under-five children, stated that 112 (67.5%) had mild anemia, 52 (31.3%) had moderate anemia, and 2 (1.2%) had severe anemia. The highest prevalence was recorded in the age group of 6-11 months (57.0%) and it gradually decreases as the age of the children increased (Gebreweld A et al., 2019).

Another study conducted by (Prihartini, 2021) in Binjai Health Center regarding anemia in children under 6-12 months, reported that there was a significant relationship between baby birth weight and anemia in children age 6-12 months with p-value 0,001 (Prihartini, 2021). This study states that the incidence of anemia in children under five is more common in children with a history of exclusive breastfeeding. This is in line with research by (Prihatini, 2021) which states that the exclusively breastfeeding is associated with the incidence of anemia in infants 6-12 months with p-value 0,001.

Recent recommendations state that iron supplementation should be given from 4-8 weeks of age and continued until 12-15 months of age, with a single dose of 2-4 mg/kg/day regardless of gestational age and birth weight. Sri's research in 2019 stated that the complementary feeding (MP ASI) was not associated with the incidence of anemia. This study found that most of the 82 child (76.6%) received the complementary feeding at the age of fewer than 6 months.

But the clinical significance that the complementary feeding has an effect on anemia in infants is 1.57 times. This is a critical period for infants, because at the age of 6 months they get complementary foods which is a transition period from exclusive breastfeeding with additional food (Prieto-patron et al., 2017). Food components are a supporting factor in increasing hemoglobin levels in infants.

Children with early (<6 months) introduction of complementary foods was 3.5 times (AOR= 3.53; 95% Ci: 1.23-10.18) more likely to be anemic than children with timely (>6 months) initiation of complementary foods (Gebreweld A, 2019). Research conducted in Jatilawang Health Center, Banyumas Regency stated that children aged 12-36 months who did not receive exclusive breastfeeding was 61 times more likely to suffer from iron deficiency anemia compared to children who received exclusive breastfeeding with p-value 0.000. Exclusive breastfeeding is recommended to be given to infants up to 6 months old and by providing complementary foods at the beginning of the age of 6 months, and then continued by continuing to give breast milk until the age of 2 years (Dewi, 2018).

Children who are not exclusively breastfed are 11.33 times more likely to suffer from iron deficiency (Ahmad et al., 2018). Breastfeeding in infants can prevent anemia, iron absorption in infants from breast milk increases with the increasing age of the baby. Although the amount of iron in breast milk is low, the absorption is highest. As much as 49-50% of the iron in breast milk can be absorbed by the baby. While cow's milk can only be absorbed as much as 10-12% of iron.

The 2013 Basic Health Research (Riskesdas), the trend of breastfeeding in children 0–23 months increased by 34.5% in 2013, compared to 2010 which was 29.3% (Kemenkes RI, 2013). This study stated that the status of anemia in children was more common in mothers who did not work as much as 43 people (28.85%). Research in

Northeast Ethiopia found that income affected the incidence of anemia when compared to infants with higher incomes (Gebreweld A et al., 2019).

This is associated with the ability to buy so that there is no variety of food and insufficient intake including iron. Socio-economic conditions and low incomes allow them to get respiratory infections, diarrhea and cause nutritional deficiencies. Several studies have found that the incidence of anemia is higher in families with low incomes.

This is different with Ahmad research which states that children of working mothers are 8.29 times more possibly to suffer from iron deficiency (Ahmad et al., 2018). The workload can affect the mother's own nutrition and health, resulting in a decreased capacity to carry out other activities such as child-rearing. Then due to the limited time to work, their children's nutritional needs are not being observed.

In addition, there is a possibility for working mothers, their children will be cared for by other people who may not be good at raising children. The results of another study stated that income was not a factor in the incidence of anemia in infants, $p>0.05$ was obtained. In this study 89 mothers (83.2%) with high incomes, although mothers do not work, they get income from their husbands.

In this study, the most anemia status was found in mothers with high school education, as much as 29 people (19.46 %). The maternal education has no significant relationship with the incidence of anemia in infants aged 6 months with a p-value of 0.119 (Yulita, 2018). The results of this study are not consistent with a study in rural Malaysia which found that maternal education was significantly associated (p: 0.002) with anemia under five and increased risk by 2.52 times. However, from this study, it can be seen that mothers with basic education have a risk of 2,4 times more likely to have anemic babies than mothers with advanced education (OR 2.847 95% CI 0.728-11.139).

Anemia status is more common in mothers aged 20-35 years by 52 people (34.89%). That maternal age has no statistically significant relationship with the incidence of anemia in infants aged 6 months with a p-value of 0.659 but the age of the mother at-risk is 1.2 times more likely to have an anemic baby than the mother's age who were not at-risk (OR 1.216 95% CI 0.510-2.899) (Yulita, 2018). The results of this study are different from Leal's research (2011) which states that mothers of at-risk age have a significant relationship in both urban and rural areas with the incidence of anemia in children under five.

The results of this study indicate that the Si Embul program is associated with hemoglobin levels in children aged 6-24 months with a p-value of 0.004 ($p<0.05$). This shows that the existence of Si Embul program can reduce the incidence of anemia in children aged 6-24 months. The Si Embul innovation program is a comprehensive activity that includes growth and development checks, evaluation of exclusive breastfeeding, anemia identification with an examination of the baby's haemoglobin, consultation on Infant and Child Feeding with nutritionists and doctor's consultation regarding infant anemia.

The general objective of this program is to determine haemoglobin levels in infants aged 6 months. The specific objectives of this program are knowing how to prevent anemia in infants, knowing how to prevent malnutrition in infants, and knowing how to prevent developmental disorders in infants. There was a significant relationship between protein intake (p:0,300), variation (p:0,000) and food frequency (p:0,035) on hemoglobin levels. In the formation of hemoglobin, protein has an important role. So to be able to increase hemoglobin levels in children, it is very necessary to increase protein

intake, regulate eating frequency and variety in food, not only from the amount of daily intake, iron and vitamin C intake alone (Rosalinna & Sugita, 2020).

At the age of one year, The American Academy of Pediatrics (AAP) and WHO recommends to screening for anemia (Wang et all., 2016). The American Academy of Pediatrics (AAP) and the CDC in America recommend checking hemoglobin and hematocrit (Ht) at least once at the age of 9-12 months and repeated 6 months later at the age of 15-18 months or additional examinations every 1 year. Once at the age of 2-5 years (Pusponegoro, 2012). The AAP recommends screening for anemia in infants with risk factors such as eating disorders, impaired growth and lack of iron intake. To prevent iron deficiency in the first year of life, infants who are breastfed need to be given iron supplementation from the age of 4 or 6 months (Pusponegoro, 2012).

To prevent anemia, WHO recommends giving iron tablets to children aged 6-23 months in areas with a high incidence of anemia (WHO, 2016). Babies before the age of 24 months are susceptible to iron deficiency, this is because iron stores during pregnancy are reduced and the diet contains less iron. Iron reserves in newborns will last until the age of 4-6 months and the incidence of anemia in children usually occurs from the age of 9 months. In contrast to premature babies, iron reserves can be used until the age of 3-4 years so that premature birth is a risk factor for anemia (Abdullah & Hospital, 2010).

Research conducted in India in 2021 on children aged 1-14 years suffering from iron deficiency anemia stated that there was a significant relationship between Ret-Hb and serum ferritin values after oral iron supplementation for 3 days (Behera et al., 2021). Malnutrition and obesity can affect iron status in children. Iron acts as a cofactor for tyrosine hydroxylation or a neurotransmitter synthesis enzyme.

The changes in dopamine levels in the substantia nigra and putamen can cause the lack of iron. Iron deficiency can also lead to ADHD (attention deficit hyperactivity disorder) in children. In a study conducted at Sanglah Hospital, it was stated that low ferritin levels (<45ng/mL) were found in 56% of the case group, namely children with ADHD and 16% of the control group. This means that ferritin levels has a significant relationship with the incidence of ADHD (Wirantari et al., 2020).

Iron deficiency can interfere with DNA synthesis, affect immunity, increase the risk of infection, and infant mortality (Anggraini et al., 2017). Some serious health problem cause by anemia such as decreased intelligence and motor and behavioral development in children (Faiqah et al., 2018). Anemia in toddlers can lead to stunted physical growth, impaired mental development, reduced intelligence, decreased work productivity, and impaired reproductive function in the future (Faiqah et al., 2018).

CONCLUSION

The incidence of anemia is more common in infants with normal birth weight, mothers who give exclusive breastfeeding, mothers who do not work, mothers with high school education levels and those aged 20-35 years. The Si Embul program was associated with anemia status in children aged 6-24 months with a p-value of 0.004 ($p<0.05$). This shows that the existence of Si Embul program can reduce the incidence of anemia in children aged 6-24 months.

It is hoped that the Si Embul program can be maintained and continue to be implemented at the Tegalrejo Health Center.

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