Original Research Article

Analysis of Iron (Fe) Content in Breast Milk of BreastfeedingMothers

ABSTRACT

Aims: The study aimed to determine the level of iron (Fe) in breast milk samples from breastfeeding mothers who were not anemic (normal), had mild anemia, and had moderate anemia.

Methodology: This research is descriptive in nature with a cross-sectional research design. The research subjects were 30 breast milk samples from breastfeeding mothers who had babies aged 0-6 months in TTU Regency, East Nusa Tenggara. 10 samples each in the categories of no anemia (normal), mild anemia, and moderate anemia. Analysis of Fe levels in breast milk samples using Atomic Absorption Spectroscopy (SSA) at the Testing, Calibration, and Certification Services Laboratory Unit, Bogor Agricultural Institute.

Results: The results of the analysis showed that the average Fe content in breast milk samples from breastfeeding mothers (normal category) was 4.17 mg/Kg; Fe levels in breast milk samples from breastfeeding mothers (mild anemia category) were 2.01 mg/Kg; while the Fe level in breast milk samples from breastfeeding mothers (moderate anemia category) was 1.05 mg/Kg. From the average figures, it can be seen that there is no significant difference in Fe levels between the three breast milk samples, which is confirmed by the distribution of Fe levels for the 30 samples which is not much different, even from the minimum number of Fe levels in breast milk samples from breastfeeding mothers (normal). still found at 1.03 mg/Kg (almost the same as the minimum Fe level for breast milk samples from breastfeeding mothers (mild anemia), namely 0.70 mg/Kg.

Conclusion:there were no significant differences in Fe levels in breast milk samples from breastfeeding mothers in the categories of no anemia (normal), mild anemia, and moderate anemia. However, it is still recommended that it is very important to ensure sufficient iron in breast milk to help the baby's growth and development.

Keywords: Iron, Anemia, Breast Milk, Fe Levels, Breastfeeding Mothers

1. INTRODUCTION

The stunting rate in Indonesia tends to decrease from year to year, the prevalence in 2013 was 37.2%, in 2018 it was 30.8%, and in 2021 based on data from the Indonesian Nutrition Status Study it was 24.4%, but in accordance with the 2020 RPJMN- 2024, the 2025 target for stunting prevalence is 19% [1], so currently efforts are still needed to achieve this. Factors that can influence the incidence of stunting include ineffective nutrition for newborns up to 2 years of age, poor parenting practices, lack of access to nutritious food, provision of clean water and sanitation, and limited access to integrated health services for mothers. pregnant. Stunting not only causes disruption to children's physical growth, but also brain growth, thereby affecting the ability to achieve, productivity and creativity in children of

productive age [2; 3]. Fulfillment of infant nutrition is influenced by several factors, including the baby's weight, the baby's growth rate, the baby's sleep cycle and physical activity, temperature and climate, metabolic response, and health status during the recovery period of the sick baby [4; 5; 6].

Several micronutrients play a role in growth failure. Micronutrients are essential for physical growth, sexual maturity, brain development and the integrity of immune system function [7]. Deficient intake of calcium and vitamin D during the growth period can cause rickets in children [8]. Intake of vitamin A and zinc indirectly affects the immune system and infections in stunted children). Lack of consumption of macronutrients such as energy, protein and micronutrients such as zinc and iron, especially during the growth period, will disrupt a child's growth process which has an impact on stunting [9], so that many factors cause stunting, such as insufficient nutritional intake over a period of time. long-term results in growth disorders. Good nutritional status occurs when the body obtains enough nutrients, both macronutrients (macronutrients) and (micronutrients) which will be used efficiently to help in the physical growth and brain development of children. Fulfilling nutritional needs, especially optimal micronutrients (micronutrients) in children, can help in the growth and development of the child's brain [10]. One of the micronutrients (micronutrients) that plays a role in brain development and thus helps in improving children's learning achievements includes namely iron (Fe) [11].

Discussions about toddlers (children under two years) and toddlers (under five years) are often related to maternal issues, including in the health sector. This is not without reason, maternal health patterns and maternal parenting patterns are the basic foundation in reducing the threat of stunting. Providing breast milk (ASI) is one factor in fulfilling nutritional needs for toddlers, because breast milk contains a lot of hormones, nutrients, growth and immune factors, which are expected to reduce the prevalence of stunting. Breast milk (ASI) is the best food for babies. Breast milk consists of macronutrients and micronutrients. Macronutrients include carbohydrates, proteins and fats, while micronutrients include vitamins and minerals. Almost 90% of breast milk consists of water. The amount of breast milk produced by each mother and the nutritional content of breast milk vary depending on the baby's needs. The above differences in the amount and composition of breast milk are also visible during breastfeeding (colostrum, transitional breast milk, mature breast milk, and breast milk) They are also different. Colostrum is produced on days 1 to 5 of breastfeeding and is rich in nutrients, especially protein. There is a policy set by the government regarding the provision of breast milk supplements because several components in breast milk such as zinc and fatty acids have decreased. This is in accordance with the results of research conducted on the fatty acid content of breast milk (ASI) during long-term breastfeeding. Based on several studies, omega-3 levels in exclusive breastfeeding compared to omega-3 levels in long-term breastfeeding are 16.53%: 8.68%. Meanwhile, the Omega-9 content in exclusive breast milk and the Omega-9 content in long-term breast milk are 25.11%: 48.49%. This is in accordance with previous research which shows that fatty acid levels in breast milk aged under 6 months have the highest levels of omega-3 [12].

The nutritional content of breast milk provides bioactive components to babies during the first 4-6 months of life [13] and can protect babies from various diseases [14]. Breast milk contains macronutrients and micronutrients. The nutritional composition of breast milk produced varies from mother to mother and varies over several lactation periods [13]. Iron is an important component in breast milk for babies. The average iron content in breast milk is (0.27-0.90 mg/L) [15]. It is important to pay attention to adequate iron levels in the body. Iron (Fe) is a mineral that is very necessary, especially for babies [5]. Based on the description above, it is very necessary to know the description of the micronutrient content, one of which is iron (Fe) contained in the breast milk of breastfeeding mothers, so this research aims to determine the description of the levels of iron (Fe) in the breast milk of nursing mothers.

2. MATERIAL AND METHODS

This research is descriptive with a cross-sectional research design. This research aims to determine the description of the Fe content in breast milk. Descriptive research is a research method carried out to create a picture or describe a situation objectively.

Population and Sample

The population in this study were all breastfeeding mothers who had babies aged 0-6 months in North Central East Regency (TTU), East Nusa Tenggara (NTT). Sampling was carried out using a purposive sampling technique. The sample size obtained was 30 people.

Inclusion Criteria

Breastfeeding mothers with babies aged 0-6 months

Exclusion Criteria

Breastfeeding mothers with babies over 6 months old

Research variable

The research variable is the Fe content in breast milk

Research Location

The location for taking research samples was Kefamenanu, TTU Regency, NTT, and the location for Fe content analysis was carried out at the Testing, Calibration and Certification Services Laboratory Unit, Bogor Agricultural Institute

Tools and Materials

The tools used in this research were a volume pipette, glass beaker, Erlenmeyer, hot plate, funnel, filter paper, stirrer rod, pump pipette, analytical balance, and atomic absorption spectrophotometry (SSA).

Material

The materials used are breast milk (ASI), Aquadest, HNO3, and 1000 mg/LB iron (Fe) standard solution.

Research procedure

1. Preparation (destruction) of breast milk samples

Sample preparation begins with collecting breast milk samples from respondents. Prepare a 100 mL beaker glass, then add 20 grams of breast milk, add 30 mL of distilled water, and 10 mL of HNO3. Then heat until the volume becomes 20 mL and cool. Then filtered using Whatman No. 5 and filtrate, ready. Analyzed using SSA

2. Preparation of Fe Standard Solution: 1000 mg/L of the available Fe standard solution was taken, 5.0 mL then distilled water was added to make it 50.0 mL, and 100 mg/L of Fe metal standard solution was obtained. After that, the solution was pipetted to 0.5 mL, and 1 mL, respectively. 2 mL 4 mL and supplemented with HNO30.1 N to 100 mL Then it was measured using Atomic Absorption Spectrophotometry. Then a calibration curve is made

3. RESULTS AND DISCUSSION

Breast milk sampling from 30 breastfeeding mothers was categorized based on three groups of maternal status, namely breastfeeding mothers with normal status, mild anemia, and severe anemia. The division into status groups is based on the results of measuring hemoglobin levels. From the results of laboratory analysis of 30 breast milk samples, they are shown in Table 1 below.

Table 1. Results of analysis of Fe levels in Busui breast milk samples

No	Sample id	Group/Status	Fe Content in Breastmilk	Unit	Average of Fe Level
1	BN 3	Normal	2,61	mg/Kg	4,17 mg/Kg
2	BN 2		7,26	mg/Kg	
3	AM 2		4,63	mg/Kg	
4	AM 3		5,95	mg/Kg	

5	AK 2		3,60	mg/Kg	
6	KL 3		1,12	mg/Kg	
7	OE 2		9,58	mg/Kg	
8	KL 6		2,33	mg/Kg	
9	KL 1		1,03	mg/Kg	
10	SN 2		3,54	mg/Kg	
11	BN 1	Mild Anemia	6, 14	mg/Kg	2,01 mg/Kg
12	AK 1		3,42	mg/Kg	
13	MB 1		1,26	mg/Kg	
14	KB 1		0,82	mg/Kg	
15	KB 2		1,56	mg/Kg	
16	KL 2		0,99	mg/Kg	
17	OE 3		0.70	mg/Kg	
18	KB 4		1,37	mg/Kg	
19	KL 4		2,10	mg/Kg	
20	FC 5		1,78	mg/Kg	
21	FC 4	Moderate Anemia	1,01	mg/Kg	1,05 mg/Kg
22	MN 3		0,21	mg/Kg	
23	BT 4		0,10	mg/Kg	
24	KB 6		0,80	mg/Kg	
25	OE 1		0,69	mg/Kg	
26	KB 3		2,12	mg/Kg	
27	AM 1		1,44	mg/Kg	
28	MN 4		1,67	mg/Kg	
29	MB 2		2,15	mg/Kg	
30	MN 1		0,30	mg/Kg	

Descriptively, the results of the Fe content analysis above can be expressed as the data in Table 2 below:

Table 2. Description of Fe Content Analysis Results

No	Category Breastfeeding Mother	Maximum Fe Level (mg/Kg)	Minimum Fe Level (mg/Kg)	Average (mg/Kg)
1	Normal (No Anemia)	9.58	1,03	4,17
2	Mild Anemia	6,14	0,70	2,01
3	Moderate Anemia	2,15	0,10	1,05

To analyze the iron content in breast milk, the SSA wet digestion method was used with a wavelength of 248.33 mm [20]. Atomic absorption spectrophotometry has high sensitivity, selectivity, and precision [21]. The tested sample is reacted with a strong acid and a strong oxidizing acid while being heated. Analysis of Fe levels in 30 Busui breast milk samples. of which 10 samples were breastfeeding samples in the normal category (not anemic) which were known based on measurements of hemoglobin levels > 12 g/dL; Meanwhile, 10 samples of breast milk were in the mild anemia category with maternal hemoglobin levels of 10.9 g/dl to 10 g/dl; The next 10 breast milk samples were breast milk with moderate anemia category with maternal hemoglobin levels of 9.9g/dl to 7.0g/dl.
Based on analysis in the research laboratory using Atomic Absorption Spectroscopy (AAS), it can be seen that if we look at the average Fe levels in breast milk, breastfeeding mothers who are not anemic (normal) have an average Fe level (4.17 mg/Kg), the results This is higher than the average Fe level in breast milk of breastfeeding mothers in the mild category (2.01 mg/Kg) and the average Fe level in breast milk of breastfeeding mothers in the moderate anemia category of 1.05 mg/Kg. In graphical form, these results are depicted in Figure 1 below:

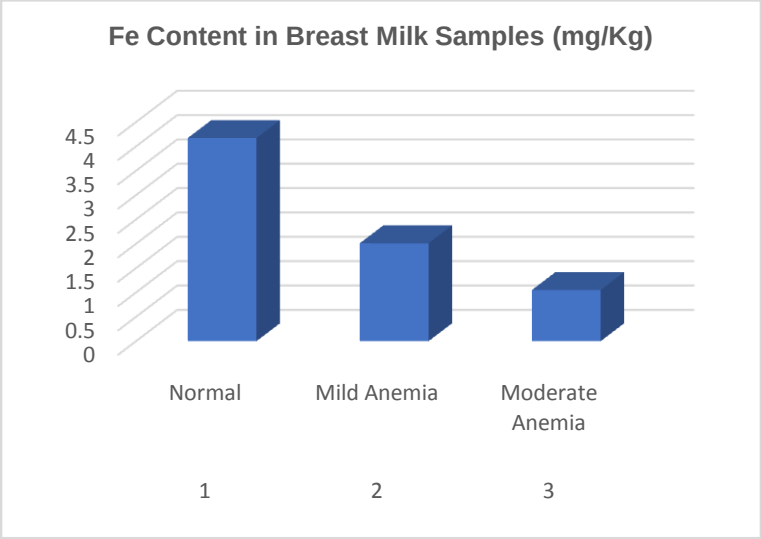

Figure 1. Data diagram of average Fe levels in breast milk samples

However, if we refer to the results of the overall analysis as in table 1, the Fe levels in the breast milk samples of breastfeeding mothers do not actually show a significant difference. This can be clearly seen that in the breast milk samples of breastfeeding mothers who are not anemic (normal) levels are still found. The minimum Fe was 1.03, almost the same as the minimum Fe level in breast milk samples from breastfeeding mothers with mild anemia. The difference in average figures is caused by the presence of two breast milk samples which have very high Fe levels in mothers who are not anemic (normal), namely: sample Id OE2 (Fe level 9.5 mg/Kg) and sample id BN2 (7.26 mg /Kg) in the normal category (not anemic). As a result of confirmation through interviews with the two breastfeeding mothers, information was obtained that the two mothers, from pregnancy to birth and breastfeeding, regularly consumed local wisdom plants from NTT, namely the Moringa plant. The Moringa plant is a plant that can generally be consumed by almost all parts of the plant starting from the leaves, roots, stems and flowers, which based on several research results has a very high mineral and nutrient content, including Fe content. The absence of significant differences in Fe levels in breast milk samples from breastfeeding mothers is in line with

research [22], suggesting that Fe in breast milk decreased progressively from day 1 to 14 weeks and at 6 months in both groups, but no significant differences were noted between mothers who did not anemia and anemia (P> 0.05). However, it is stated that the Fe content in breast milk is more easily absorbed during the baby's growth process compared to the Fe content in formula milk. Therefore, it is very important to pay attention to adequate Fe levels for breastfeeding mothers, as an effort to prevent anemia. Anemia itself is a condition where a mother experiences a lack of red blood cell, or in other words, anemia is a condition when the number of red blood cells or the concentration of oxygen transporter Hemoglobin (Hb) in the blood is insufficient for the body's physiological needs [21,26]. Iron deficiency anemia is anemia caused by a lack of iron, folic acid and vitamin B12 due to inadequate intake or low iron availability. Several factors that can cause pregnancy anemia include education level, economic status and compliance with the consumption of Fe tablets [22,25]. This means that the incidence of anemia in breastfeeding mothers is in line with the quality of Fe levels in breast milk, where the healthier the mother is, the better the quality of the breast milk produced.

The causes of anemia are iron deficiency due to insufficient iron intake, high iron absorption during pregnancy, and iron loss due to bleeding or infectious diseases. Apart from that, it can also be caused by knowledge, too young age, number of births, close pregnancy spacing, non-compliance in consuming Fe tablets, socio-economics, not consuming enough protein, vegetables and fruit, consuming excessive coffee and tea are predictor factors for the high prevalence of anemia. in pregnancy [29,30].Although several studies state that there is no significant relationship between the incidence of anemia in breastfeeding mothers and the nutritional status of babies [31], it is very important to note that adequate iron (Fe) intake for children aged 0-6 months is important. considering that the function of iron as one of the building blocks of hemoglobin (Hb) is very necessary in the child's growth and development process. Mothers who breastfeed babies 0-6 months old consume iron sources below the 2004 nutritional adequacy standard (AKG) with an average iron intake of 28.3 mg with a minimum intake of 11.55 mg and a maximum intake of 97.72 mg. Iron is the main component in blood formation, especially in the formation of hemoglobin molecules (hemopoiesis). The formation of red blood cells in the bone marrow will be fulfilled if there is no iron deficiency and the storage reserves are still sufficient. If there is a continuous iron deficiency, it will reduce or even deplete iron reserves which will later have an effect on the incidence of iron deficiency anemia. Sources of iron that have high bioavailability come from animal sources such as beef, chicken, eggs, liver organ meats and fish. Most breastfeeding mothers eat less food from animal sources, but consume more vegetable sources every day, such as tofu and tempeh. Vegetable sources have lower bioavailability than animal sources, so animal sources of iron are absorbed more quickly by the body.

4. CONCLUSION

From the results of the research, it was concluded that there was no significant difference between the Fe levels in breast milk samples from breastfeeding mothers who were not anemic (normal) and the Fe levels in breast milk samples from breastfeeding mothers who were anemic, which was indicated by the relatively similar figures obtained, especially for The minimum Fe level obtained in breast milk samples from breastfeeding mothers (normal category), namely 1.03 mg/Kg, is not much different from the minimum Fe levels in breast milk samples from breastfeeding mothers (mild anemia category), namely 0.70 mg/Kg.

CONSENT

Breastfeeding Mothers Who Have Expressed Their Consent By Filling In The Informed Consent

ETHICAL APPROVAL (WHEREEVER APPLICABLE)

The research protocol has been provided by the Research Ethics Commission, Indonesian Christian University with an ethical clearance letter number, namely No.012/Research Ethics/FK UKI/2023

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