**The analysis of chronic energy malnutrition and iron intake with anemia in preconception women of childbearing age in Terbanggi Besar Subdistrict, District of Central Lampung.**

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The prevalence of anemia among women of childbearing age (WCA) in Lampung Province in 2011 was 25,9%. Anemia in WCA usually continues until the pregnancy that may increase the risk of complications in pregnancy and childbirth. The purpose of this study is to determine the relationship of chronic energy malnutrition and iron intake with anemia in preconception women of childbearing age. This was an observational analytic study using cross sectional design. The study was conducted in Terbanggi Besar subdistrict, district of Central Lampung from August to November 2016. Samples were 183 preconception women of childbearingaged 20- to 40-years-old, taken with sampling cluster techniques. Chronic energy malnutrition data were assessed by measurement of mid-arm circumference, iron intake was obtained through 2x24h food recall, and anemia by measuring haemoglobin levels through blood tests. Data were analyzed using chi square test and fisher exact test. The results showed that26.8% of respondents suffered from anemia, 44,3% chronic energy malnutrition, and 95,7% less iron. The results showed that chronic energy malnutritionhas significant correlation (p = 0.02) with anemia, and iron intake have no correlation (p = 0.53) with anemia. Respondents with chronic energy malnutrition were 2.3 times more likely to have anemia than those without chronic energy malnutrition. Conclusions: There was a significant relationship between chronic energy malnutritionwith anemia in preconception women of childbearing agein Terbanggi Besar subdistrictdistrict of Central Lampung.

**Keywords : Anemia, chronic energy malnutrition, iron intake, women of childbearing age preconceptions**

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**1. Introduction**

World Health Organization (WHO) defines anemia as a condition where an individual suffers a decrease of haemoglobin (Hb) and haematocrit (Ht) concentration as well as the number of red blood cells to below the normal level of the cut-off point by age and gender [1]. Anemia is a symptom caused either by blood loss, the decreased production of erythrocytes, the increased destruction of erythrocytes or the combination of all three mechanisms [2].

Anemia is more prevalent in women than men as it is reported that Women of Childbearing Age (WCA) suffering from anemia reaches 45.7% in Southeast Asia. In Indonesia, the WCA affected by anemia reached 33.1% on 1993-2005 [1]. In addition, Indonesia’s Health Profile reported that the prevalence in WCA in Lampung province reached 25.9% [3].

Women of Childbearing Age are the most susceptible to iron-deficiency anemia, an anemia caused by the blood loss during menstruation. The anemic condition of the WCA often continues when they are pregnant that can increase the risks of complication on pregnancy and birth delivery such as maternal mortality, preterm delivery, low birth weight, prenatal mortality, as well as the increased risk of antepartum and postpartum bleeding [4].

Women of Childbearing age often suffer from a chronic energy deficiency and anemia. Anemia is defined as a condition in which the haemoglobin concentration is below 11gr/ml. Its primary cause on women are usually due to the insufficient iron intake. Iron needs increase during pregnancy and breastfeeding (physiological changes), and the blood loss. The possibility of anemia developed from these three factors can climb dramatically when the reserved of iron cannot accommodate the increase of iron needs. Women of Childbearing Age are the most susceptible from anemia because they do not have sufficient iron intake and reserve for the needs increase and the loss of it [5]. According to Mahirawati study, iron-deficiency anemia is caused by the imbalance in the needs of body for growth and the loss of blood, as well as the insufficiency of iron from diet. Besides iron, the nutrient needed to develop haemoglobin synthesis is folic acid [6].

Other causes of anemia in Women of Childbearing Age are blood loss, inadequate iron intake, the increase of body’s physiologic needs, malabsorption, insufficient iron reserve, inadequate nutrient intake, haemoglobinopathy, medicine, and other factors such as life style and health behavior. Individual’s eating behavior, for example, is one of health behavior that affects individual’s health status [5,7]. A study conducted by Gutmaningsih shown that there was a signifficant correlation between health status and anemia prevalence [8].

In Central Lampung regency, anemia is one of the most common health problems along with Vitamin A deficiency, chronic energy deficiency, and health problems caused by iodine deficiency [9].

**2. Methods**

This study was observational research with cross sectional design study approach. It was conducted in Terbanggi Besar district of Central Lampung regency from August to November 2016. The population of this study was all women who were categorized as the Women of Childbearing Age in Central Lampung. Based on the calculation of sample size formula, we got 183 as the minimum number of sample in this study. We use the independence analytic categorical variabel type of sample size with reliability score 95% and power of the test 80%, and using cluster sampling as the sampling method. The samples were taken from 8 sub districts in Terbanggi Besar, Central Lampung. The inclusion criteria for the sample were: Women of Childbearing Age between the age of 20 and 40, administered as resident in the studied area and agreed to participate in the research. On the other hand, the exclusion criteria were: patient of chronic infectious diseases, women on a diet or weight loss program, women in pregnancy, and women in menopause. The independent variable in this study were chronic energy malnutrition (CEM) and iron intake while the dependent variable was anemia prevalence.

The chronic energy malnutrition (CEM) data were obtained by conducting anthropometric test; that was the arm circumference measurement by using tape measure. Those were the arm circumference <24.9 cm were categorized as suffering from CEM, while those >24,9 cm were categorized as in a healthy condition.

The iron intake was measured by using 2x24h food recall during weekdays and weekend. The estimated food intake was than compared to the average score of Recommended Dietary Allowance (RDA)-equivalent with Nutrient Adequacy Ratio (NRA)-of Indonesian people that was classified according to their age. Those who scored <80% of AKG were considered inadequate intake, 80-110% AKG were considered adequate intake, and >110% AKG were considered exceessive intake. During the data collection for iron intake, the subjects were required to remember and list all foods and beverages they consumed within 24 hours. The measurement of subjects’ food intake was conducted by measuring iron content in foods and beverages in the last 24 hours. After that, the average score of two-day iron intake was taken. We used food modelmethods to collect food intake data.

The anemia prevalence was diagnosed by measuring haemoglobin concentration using hemoglobin photometer test strip. It was defined as anemia if blood haemoglobin level < 12 gr%, and not as anemia if blood haemoglobin level ≥ 12 gr%.

In collecting the data, we assisted by 4 enumerators who had been previously briefed and trained. Then, the data were statistically analyzed by using chi square and fisher’s exact test with reliability 95% (p<0.05). This study was conducted after the letter of research ethical clearance from the Ethic Committee of Medical Faculty of Lampung University with number 1913/UN26/8/DL/2016 was issued.

**3. Result**

**Table 1. The association of chronic energy malnutrition and iron intake with anemia in women of childbearing age**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Anemia | | | | Total | | X2 | OR | *p value* |  |
| Yes | | No | | 95% CI |
| n | % | n | % | n | % |  |  |  |  |
| Chronic Energy Malnutrition |  |  |  |  |  |  |  |  |  |  |
| 1. Yes | 29 | 15,8 | 52 | 28,4 | 81 | 44,3 | 5,24a | 2,3 | 0,02\* | 1,17-4,45 |
| 1. No | 20 | 10,9 | 82 | 44,8 | 102 | 55,7 |  |  |  |  |
| Iron Intake |  |  |  |  |  |  |  |  |  |  |
| 1. Less Intake | 48 | 26,2 | 127 | 69,4 | 175 | 95,6 | ,870b | 2,6 | 0,64 | 0,31-22,07 |
| 1. Sufficient | 1 | 0,5 | 7 | 3,8 | 8 | 4,4 |  |  |  |  |

a=chi square analysis

b=fisher exact test analysis

\*=significant (p<0,05)

The result revealed that there were 49 people (26.8%) suffered from anemia while the rest 134 people did not. In addition, there were 81 people (44.3%) in a chronic energy malnutrition, while the rests had good nutritional status or in other words, not suffering from chronic energy deficiency. Most of the subjects had low iron intake, reaching 175 people (95.6%) while 8 people had it sufficient.

The anemia prevalence in preconception WCA in this study reached 26,8% (49 people). This prevalence was relatively higher from the report of Indonesia’s Health Profile where anemia prevalence in WCA in Lampung Province reached 25,90% [2]. From this result, it was clear that 26.8% preconception WCA in Terbanggi Besar district tended to have low immunity and productivity level. In addition, anemia prevalence in WCA tended to continue to pregnancy period that increased the risk of complication on pregnancy and birth delivery. This condition increased the possibility of maternal mortality as well as preterm delivery, low birth weight, and prenatal mortality [4].

The result also showed that chronic energy malnutrition (CEM) prevalence reached 44.3% (81 people). The CEM prevalence in women between the ages of 18-19 was relatively high and surpassed the number of CEM in non-pregnant WCA nationally because according to Basic Health Research (RISKESDAS) in 2013, CEM prevalence in pregnant women between the ages of 15-49 in Indonesia reached 24.2% while in non-pregnant women of the same ages reached 20.8%. In total, CEM prevalence in all age levels and pregnancy condition (pregnant and non-pregnant) from 2007-2013 increased. CEM prevalence in pregnant women and WCA between the age of 15-49 in Lampung province reached 21,3% dan 17,6 % respectively, where the highest prevalence was in Central Lampung that reached 52,6% [10].

*Chi square* test revealed that chronic energy deficiency prevalence had significant correlation with anemia prevalence in pre-conception Woman of Childbearing Age (*p* value < 0,05, 95% Confidence Interval : 1,17-4,45). The analyses also revealed that the odds ratio was 2.3; meaning that the subject who suffered from chronic energy deficiency were 2.3 times more susceptible to anemia compared to those who did not suffer from the chronic energy malnutrition. In addition, *fisher’s exact* test showed that iron intake was not significantly correlated with anemia prevalence in preconception Women of Childbearing Age (p value > 0,05; Confidence Interval : 0,31-22,07).

The study conducted by Gutmaningsih and Thompson mentioned that Body Mass Index (BMI) was positively correlated with haemoglobin concentration [8,11]. Nutritional status was obtained from the balance of measurement between nutritional intake and nutritional needs. There were three types of nutritional deficiency: qualitative deficiency, quantitative deficiency, and the combination of both deficiencies.

The lower the nutritional status of individuals is, the higher their risk to suffer from anemia. If the foods consumed by individuals have good nutrition, they will definitely have good nutritional status. On the other hand, if the foods they consumed have low nutrition, they will probably have nutritional deficiency that can lead to anemia, because anemia prevalence was directly affected by individuals’ daily eating behavior of low iron foods besides the existence of infectious trigger factor [12].

We assumed that preconception WCA who became respondents in this research had met the standard of quantitative nutrient intake. From the interview on types of intake, most of the respondent had sufficient and even higher energy intake or macronutrient. The foods consumed mostly contained high carbohydrate and fat.

The studies conducted by Anari et al. in Iran and by employing 316 adult women between the age of 18-65 as respondents showed that there was no significant correlation between BMI and Hb concentration (*p*=0,580) that was also similar with the research conducted by Mendonca et al.with *p*=0,82 [13, 14]

The research showed that 95.6% of the subjects (175 people) had low iron intake. It inferred that almost all respondents had a risk of anemia, especially iron-deficiency anemia. Iron is needed to produce haemoglobin, protein in the red blood cells carrying oxygen throughout the body. Some of the heamoglobin increases are obtained from reserved iron and absorbed iron [14].

There are two kinds of iron in the foods, the first is heme iron and the last is non-heme iron. Heme iron can be found in animal protein from our diet, while non-heme iron can be found in plant-based foods (beans, fruits, vegetables, grains, and tofu) and dairy products (milk, cheese, and eggs). However, dairy products contain very low iron [13].

The main causes of anemia in women are the insufficient iron food intake, iron needs increase during pregnancy and breastfeeding (physiology changes), and blood loss. The possibility of anemia developed from these three factors can climb dramatically when the reserved iron cannot fullfill the increase of iron needs. Women of Childbearing Age are the most susceptible from anemia because they do not have sufficient iron intake and reserve for the needs increase and the loss of it [5]. According to Mahirawati, iron-deficiency anemia is caused by the imbalance in the needs of body for growth and the loss of blood, as well as the insufficiency of iron from diet. Besides iron, the nutrient needed to develop haemoglobin synthesis is folic acid [6].

Women of Childbearing Age are susceptible to anemia because within this period, there is needs increase of iron developed from growth, menstruation, diet, and eating behavior that is inappropriate to the rules of nutrition science. In pregnant women, the impact of anemia can be observed from the high rates of maternal morbidity and mortality, fetal morbidity and mortality, and low birth weight. The main cause of maternal mortality is postpartum and placenta previa that are developed from iron-deficiency anemia [15].

Insufficient iron intake in WCA were mostly because they consumed vegetables which had iron was difficult to be absorbed and white meat like fish and chicken instead of red meat that is iron-rich like beef and lamb. From the interview, we also obtained information that the WCA who became respondents often drank tea that actually could prevent iron absorption.

Iron needs have strong correlation with anemia prevalence because anemia is a form of adaptation from physiology changes during pregnancy that is developed from: iron needs increase for fetus growth, insufficient iron intake from the daily foods consumed, and low reserved iron tendency in women. Menstruation will also increase iron needs in the body. Iron deficiency can principally be overcome by changing eating behavior because basically anemia is caused by insufficient iron intake from foods and low bioavailability of iron consumed. Therefore, increasing food quality is one of the alternatives for a long-term plan [16].

**4. Conclusion**

Chronic energy malnutrition describes inadequate of nutritional status in individuals, and it is the higher their risk to suffer from anemia. Anemia was affected by individuals’ daily eating behavior of low iron foods besides the existence of infectious trigger factor. The anemic condition of the Women of Childbearing Age often continues when they are pregnant that can increase the risks of complication on pregnancy and birth delivery such as maternal mortality, preterm delivery, low birth weight, prenatal mortality, as well as the increased risk of antepartum and postpartum bleeding.

We believe that to increase the quality of life in women of childbearing age, in facts they become pregnant women, we must reduce the chronic energy malnutrition and anemia in the women.

**Acknowledgement**

This work was supported by an internal grant of Medical Faculty of Lampung University**.**

**Reference**

1. WHO. Worldwide Prevalence of Anemia. Geneva. Switzerland: World Health Organization. 2008.
2. Kiswari R. Hematologi dan Transfusi. Jakarta: Penerbit Erlangga. 2014.
3. Departemen Kesehatan Republik Indonesia (Depkes RI). Profil Kesehatan Indonesia. Jakarta: Kementrian Kesehatan Republik Indonesia. 2011.
4. Citrakesumasari. Anemia Gizi, Masalah dan Pencegahannya Cetakan I. Yogyakarta: Kaliaka. 2012.
5. Fatmah. Gizi dan Kesehatan Masyarakat. Jakarta: Rajagrafindo Persada. 2007.
6. Mahirawati, V.K. Faktor-faktor yang Berhubungan dengan Kekurangan Energi Kronis (KEK) pada Ibu Hamil di Kecamatan Kamoning dan Tambelangan, Kabupaten Sampang Jawa Timur. Buletin Penelitian Sistem Kesehatan 2014: Vol. 17 No. 2 April 2014: 193–202.
7. Gibney M. Gizi Kesehatan Masyarakat. Jakarta: Penerbit Buku Kedokteran EGC. 2009.
8. Gutmaningsih D. Faktor-faktor yang Berhubungan dengan Kejadian Anemia pada Remaja Putri di SMA Negeri 1 Kecamatan Jatibarang Kabupaten Brebes Tahun 2007 [Skripsi]. Semarang: Universitas Negeri Semarang. 2007.
9. Kementerian Kesehatan Republik Indonesia (Kemenkes RI). Profil Kesehatan Indonesia. Jakarta: Kementrian Kesehatan Republik Indonesia. 2011.
10. Kementrian Kesehatan Republik Indonesia (Kemenkes RI). Riset Kesehatan Dasar. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kementrian Kesehatan RI. 2013.
11. Thompson B. Food-Based Approaches for Combating Iron Deficiency. Food and Agriculture Organization (FAO). 2007;22.
12. Almatsier S. Prinsip Dasar Ilmu Gizi. Jakarta: Gramedia Pustaka Utama. 2009.
13. Anari AG, Nazemian N, Vahedian-Ardakani H-A. Association of Body Mass Index with Hemoglobin Concentration and Iron Parameters in Iranian Population. Hindawi Publishing Corporation. 2014;3.
14. Mendonca EBS, Muniz LF, Arruda IKGd, Diniz A. Hemoglobin Concentrations and Associated Factors in Adolescentes from Recife, Brazil. Nutrition Journal. 2014;27.
15. Arisman MB. Buku Ajar Ilmu Gizi dalam Daur Kehidupan Edisi 2. Jakarta: Penerbit Buku Kedokteran EGC. 2014.
16. Supariasa IDN, Bakri B, Fajar I. Penilaian Status Gizi. Jakarta: Penerbit Buku Kedokteran EGC. 2012.