ANEMIA DAN ANEMIA GIZI BESI PADA KEHAMILAN: HUBUNGANNYA DENGAN ASUPAN PROTEIN DAN ZAT GIZI MIKRO

Anaemia and Iron Deficiency Anaemia in Pregnancy: Association With Protein and Micronutrient Intake

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ABSTRAK

Anemia masih menjadi permasalahan kesehatan pada wanita hamil. Zat besi dianggap sebagai salah satu zat gizi mikro yang berperan terhadap terjadinya anemia. Kekurangan gizi besi dalam tingkat lanjut dapat menyebabkan anemia, yang disebut sebagai anemia gizi besi. Tujuan studi ini adalah untuk menganalisis perbedaan antara asupan protein dan gizi mikro serta menghitung odd ratio (OR) kejadian anemia dan anemia gizi besi akibat asupan protein dan gizi mikro pada wanita hamil di lokasi studi. Analisis ini merupakan analisa dari data studi kohor Tumbuh Kembang anak pada tahun pertama, yang dilaksanakan di Kelurahan Kebon Kalapa dan Ciwaringin, Kota Bogor yang dianalisa menggunakan disainkasus kontrol. Sebanyak 47 ibu hamil menjadi sampel dalam analisa ini. Kategori untuk anemia yaitu apabila kadar hemoglobin (Hb) ibu hamil ≤11 g/dL. Kekurangan gizi besi dikategorikan apabila kadar serum transferrin reseptor (sTfR) diatas 4.4 mg/L. Sedangkan Anemia Gizi Besi dikategorikan apabila memiliki kadar Hb < 11 g/dL dan sTfr > 4.4 mg/L. Tes *one way anova* digunakan untuk menganalisa adanya perbedaan asupan energi, protein dan zat gizi mikro antara ibu hamil yang mengalami anemia, anemia gizi besi maupun yang normal. Odd ratio dianalisa dengan menggunakan uji chi square. Nilai signifikan ditentukan apabila nilai p value < 0.05 dan perhitungan OR> 1. 27.7% dari ibu hamil di lokasi studi mengalami anemia, 14.9% tergolong dalam anemia ringan, 10.6% anemia sedang dan 2.1% anemia berat. Anemia gizi besi dialami oleh 17% dari wanita hamil. Terdapat hubungan yang signifikan antara keparahan anemia dan terjadinya anemia gizi besi. Tidak ditemukan perbedaan antara asupan protein, besi, folate dan zink pada wanita yang mengalami anemia, anemia gizi besi maupun yang normal. Akan tetapi terdapat kecenderungan bahwa asupan zat besi dan seng pada ibu yang anemia dan anemia gizi besi lebih rendah daripada ibu yang normal. Anemia masih menjadi permasalahan kesehatan pada ibu hamil, diantaranya merupakan anemia karena kekurangan zat besi. Semakin parah anemia maka akan semakin besar kemungkinan terjadinya anemia disebabkan oleh gizi besi. Ada kecenderungan kekurangan asupan besi dan seng pada ibu hamil akan berakibat pada anemia dan AGB, akan tetapi dalam analisis ini tidak ditemukan adanya hubungan yang signifikan.

Kata kunci: Anemia; Anemia Gizi Besi; Kehamilan; Protein; Gizi Mikro

ABSTRACT

Anaemia is still a serious health problem among pregnant women. Iron is regarded as one of the micronutrients contributed to the occurrence of anaemia. Deficiency of iron in advanced stage can cause anaemia, called iron deficiency anaemia. This study aims to analyze the difference between protein and micronutrient intake and calculate the odd ratio (OR) of anaemia and iron deficiency anaemia due to protein and micronutrient intake among pregnant women in the study area. This was an analysis of the first year data of Child Growth and Development cohort studies conducted in Kebon Kalapa and Ciwaringin Villages, Bogor District that analysed with case control design. There are 47 pregnant mothers as the sample. Anaemia was categorized as the hemoglobin (Hb) level ≤ 11 g / dL. Iron deficiency categorized when serum transferrin receptor (sTfR) above 4.4 mg / L. Iron deficiency anemia categorized if they had hemoglobin levels <11 g / dL and sTfr> 4.4 mg / L. One way anova was used to analyze the differences in the intake of energy, protein and micronutrients among pregnant mothers who are anaemic, iron anaemic and normal. Odd ratio was done using chi square test. Significance was determined if the p value less than 0.05 and the calculation of odds ratios (OR> 1). There is 27.7% of pregnant women in the study area were anaemic, 14.9% categorized as mild anemic, moderate anaemic was 10.6% and 2.1% were severe anemic. Iron deficiency anaemia affects 17% of pregnant women. There was a significant relationship between

severity of anemia and iron deficiency anaemia. No difference was found between the intake of protein, iron, folate and zinc in women who are anemic, iron anemic and normal. However there was tendency that anaemic and iron anaemic mothers had lower intake of iron and zinc. Anaemia is still become a health problem during pregnancy, including iron deficiency anemia. The more severe anemia, the greater the likelihood of anemia caused by iron deficiency. There was a tendency that inadequacy of iron and zinc intake tends to result on the anaemia and IDA status althoughthere is no significant association.

Keywords: Anaemia; Iron deficiency anaemia; Pregnancy; Protein; Micronutrients

Background

Anaemia still become one of the important public health problem among pregnant mothers. Although estimates of the prevalence of anaemia may vary widely and accurate data are often lacking, it can be assumed that in resource-poor areas significant proportions of young children and women of childbearing age are anaemic[1]. World Health Organization and Food and Agriculture Organization of the United Nations stated that in developing countries the prevalence of anaemia among pregnant mothers was 50%[2]. In Indonesia, according to National Basic Health Research[3], the prevalence of anaemia among pregnant mothers was 24.5%. However, there was a disparity between provinces.[3]

Pregnancy is a period of drastic physiological change which places extreme stress on various systems of the body[4]. Anaemia often occurs because of the deficiency of the iron, that usually happen in pregnant mothers as there is an increase of iron requirement caused by the increment of blood volume to fullfil the mother's and fetus's need. However, it was estimated that almost 50% of the mother does not have enough iron stores in their pregnancy period, thus the risk of become iron deficient or anaemic will increase in pregnancies.

Anaemia can cause several health effects. Among pregnant women, anaemia can cause abortion, stillborn, low birth weight baby, bleeding before or on the delivery[5]. The most dramatic health effects of anaemia are include the increased risk of maternal and child mortality due to severe anaemia. In addition, the negative consequences of iron deficiency anaemia (IDA) on cognitive and physical development of children, and work productivity of adults are of major concern[6].

Anemia in pregnancy is multifactorial in etiology. Iron- and folate-deficiency anemias are common. The former are related to nutritional deficiency and intestinal helminthic infections and the latter to poor intake and chronic hemolytic states[7]. Report by USAID's, A2Z, Micronutrient and Child Blindness Project, ACCESS Program, and Food and Nutrition Technical Assistance (2006) showed that micronutrient deficiency (vitamin A, B6, B12, riboflavin and folic acid) is one of the contributing factors of the anaemia among pregnant mothers[8].

Therefore, This analysis was performed to analyze the difference between protein and micronutrient intake and calculate the odd ratio (OR) of anaemia and iron deficiency anaemia due to protein and micronutrient intake among pregnant women in the study area.

METHOD

Study Design

This was the data of prospective cohort study on child growth and development done in the first year (in 2012), that analyzed using case control design.

Study Population and Sample Size

The study conducted in Kebon Kalapa and Ciwaringin Villages, Bogor District. The entire population from the villages was become the study subjects. In 2012 there was 96 pregnant mothers. However, this analysis only includes the mothers that still in their pregnancy state in the day of blood sample examination. Thus, 47 pregnant mothers were included in this data analysis.

Variables

The variables recorded and analyzed were Hb and soluble transferrin receptor

(sTfR) levels, age, sosioeconomic status (education level, occupation, grade of food expenditure and number of family member), gravidity, abortion, smoking habits, alcohol consumption, having supplementation in Posyandu and consumption of energy, macro (protein) and micro nutrient (Fe, Folate, Zn and Vitamin A).

Data Collection

Data collection was performed by trained enumerator using pre tested questionaires. Haemoglobin level of pregnant mothers was assesed one time using otomatic haemoglobin test, performed by Prodia laboratory test. The nutrient intake of the pregnant mothers was assesed using single 24hr recall every month (multiple 24hr recall).

Data Analysis

Anaemia among pregnant mothers define as the level of HB smaller than 11 g/dL. In order to assess the degree of anaemia among anaemic persons for the variables investigated, grades of anaemia were statistically classified as: Mild: 10.0–10.9 g/dL; Moderate: 7.0–9.9 g/dL; Severe: <7.0 g/dL[9]. Iron deficient categorized if sTfR level was above 4.4 mg/L. While Iron Deficiency Anaemia (IDA) categorized with the combination of Hb < 11 g/dL and sTfr > 4.4 mg/L.

Adequacy of energy and protein categorized by comparing the energy intake from single 24hr recall with Recommended Nutrient Intake (RNI)[10] and multiply with 100%. Adequacy of energy defined when the percentage was greater and equal to 70%, while for protein was greater and equal to 80%[11]. Adequacy of micro nutrients (Fe, Folate and Zn) categorized by comparing the intake from single 24hr recall with the Estimated Average Requirement (EAR)[12]. EAR was calculated from the Indonesia RNI divided by the conversion factors[13]. Table 1 presented the EAR of related nutrients for pregnant women between 13-49 years old.

Table 1. Estimated Averaged Requirement (EAR) of related nutrients for pregnant mothers

Nutrients	RNI (AKG 2004)	Conversion factor	EAR
Iron (Fe)	26 mg	1.6	16.25 mg
Zinc			
13-15 years	17.1 µgram	1.2	14.25 µgram
16-18 years	15.7 µgram	1.2	13.1 µgram
19-29 years	11 µgram	1.2	9.2 µgram
30-49 years	11.5 µgram	1.2	9.6 µgram
Folic acid	600 µgram	1.25	480 µgram
Vitamin A			
13-18 years	900 RE	1.4	642.86 RE
19-49 years	800 RE	1.4	571.43 RE

Adequacy of micronutrient defined when the intake was greater and equal to the EAR.

Food intake data was analysed using Nutrisoft software, while the other variables was analysed using SPSS. Characteristics of the subjects and the prevalence of anaemia and IDA was presented descriptively. The nutrient intake was describe using means and standard deviations. *One way anova* performed to analyse the differences of nutrient intake between anaemia with normal and Iron anaemic with not iron anaemic pregnant mothers[14]. Odd ratio significance was determined if the p value less than 0.05 and the calculation of odds ratios (OR> 1).

Ethical consideration

Informed concent was gathered before the subjects participated in this study. The ethical clearance of the study was approved by the Ethical commitee of the National Institute of Health Research and Development.

RESULTS

Characteristic of study subjects

Based on Table 1, many of the mothers who were anaemic and iron anaemic have younger and older age (<20 or ≥ 35 years). According to gestational age, anaemia tend to occur in the 1st trimester, while iron anaemic tend to occur in the 2nd and 3rd trimester. High proportion of anaemic and iron anaemic mothers were primary school graduated. Mothers occupation and knowledge of nutrition and health were not really different between anaemic, iron anaemic and normal mothers. Smoking and alcohol experience were happen mostly among anaemic and iron anaemic mothers rather than normal mothers. Mothers with primigravidity and have large family tend to be anaemic and iron anaemic than multigravidity.

Table 1. Characteristics of the mother

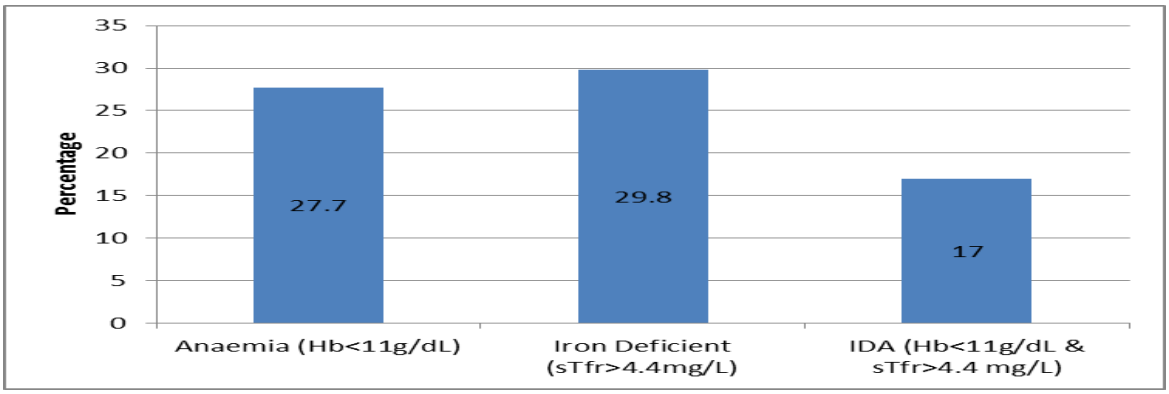
Characteristics of the mother	Anaemia status		IDA status	
	Normal	Anaemic	Normal	IDA
	n (%)	n (%)	n (%)	n (%)
Age				
< 20 years	2 (5.9)	3 (23.1)	2 (5.1)	3 (37.5)
20-34 years	29 (85.3)	5 (38.5)	31 (79.5)	3 (37.5)
≥ 35 years	3 (8.8)	5 (38.5)	6 (15.4)	2 (25)
Gestational age				
1st trimester	5 (14.7)	3 (23.1)	8 (20.5)	0 (0)
2nd trimester	17 (50)	6 (46.2)	19 (48.7)	4 (50)
3rd trimester	12 (35.3)	4 (30.8)	12 (30.8)	4 (50)
Mother's education level				
Primary school graduated	3 (8.8)	3 (23.1)	3 (7.7)	3 (37.5)
Junior high school graduated	14 (41.2)	2 (15.4)	16 (41.0)	0 (0)
≥ High school graduated	17 (50)	8 (61.5)	20 (51.3)	5 (62.5)
Mother's occupation				
Working	12 (35.3)	5 (38.5)	15 (38.5)	2 (25)
Not working	22 (64.7)	8 (61.5)	24 (61.5)	6 (75)
Knowledge on nutrition & health				
Good	1 (2.9)	0 (0)	1 (2.6)	0 (0)
Moderate	2 (61.8)	8 (61.5)	23 (59)	6 (75.0)
Low	12 (35.3)	5 (38.5)	15 (38.5)	2 (25)
Smoking experience				
Yes	3 (3.8)	2 (15.4)	4 (10.3)	1 (12.5)
Alcohol consumption experience				
Yes	0 (0)	2 (15.4)	1 (2.6)	1 (12.5)
Gravidity				
Primigravidity	7 (20.6)	5 (38.5)	8 (20.5)	4 (50)
Multigravidity	27 (74.9)	8 (61.5)	31 (79.5)	4 (50)
Abortion				
Yes	5 (14.7)	0 (0)	5 (12.8)	0 (0)

Next Table 1. Characteristics of the mother

Characteristics of the mother	Anaemia status		IDA status	
	Normal	Anaemic	Normal	IDA
	n (%)	n (%)	n (%)	n (%)
Number of household member				
≤ 4 (small family)	27 (79.4)	8 (61.5)	31 (79.5)	4 (50)
> 4 (large family)	7 (20.6)	5 (38.5)	8 (20.5)	4 (50)
Category of food expenditure				
Low (≤60% total expenditure)	25 (73.5)	9 (81.8)	11 (28.9)	0 (0)
High (>60% total expenditure)	9 (26.5)	2 (18.2)	27 (71.1)	7 (100)

Anemia status of the mother

Based on Picture 1, 27.7% of the mothers were anaemic. The pregnant mothers who are iron deficient were higher (29.8%). Among anaemic mothers, there were 17% of the mother were Iron Anaemic (anaemia and iron deficient in the same time).



Picture 1. Percentage of anaemia and IDA among pregnant mothers

Beside that, this study also found that from all of the anaemic mothers, 14.9% was categorized as mild anaemic (Hb 10-10.9 g/dL), moderate anaemic (Hb 7.0-9.9 g/dL) (10.6%) and severe anaemic (Hb <7 g/dL) (2.1%).

Table 2 shows the relation between anaemic status (based on Hb level) and Iron deficient status (based on sTfr). It shows that 61.5% of anaemic mothers were also iron deficient, while 17.6% of non anaemic mothers were iron deficient. 82.4% of non iron deficient mothers were non anaemic. There was significant association between anaemia status and iron deficiency status (p=0.003).

Table 2. Proportion of Anaemic status of mothers based on iron deficiency

Category of iron deficiency	Anaemia status		p value
	Non anaemic	Anaemic	
Iron deficient	6 (17.6)	8 (61.5)	0.003
Non iron deficient	28 (82.4)	5 (38.5)	

Significant (p<0.05)

The severity of anaemia also significantly associate with the iron deficient status (p=0.001). Table 3 showed that there was a tendency that the iron deficient mothers tend to have lower Hb level; all of the moderate and severe anaemic mothers were iron deficient.

Table 3. Percentage of Iron Deficient Anaemic mothers with the severity of anaemia

Category of iron deficiency	Severity of anaemia				p value
	Normal	Mild anaemia	Moderate anaemia	Severe anaemia	
Iron deficient	17.6	28.6	100	100	0.001
Non iron deficient	82.4	71.4	0	0	

Significant, p<0.01

Macro and Micro nutrient Consumption

Table 4 shows the mean (SD) of macro and micro nutrient consumption of the mothers. There was no significantly difference between the mean of macro and micronutrient consumption and anaemia status or IDA status. Anaemic mothers had lower consumption on energy, protein, iron and zinc compare to normal mothers. While iron anaemic mothers only had lower consumption on iron compare to non iron anaemic mothers.

Table 4. Mean (SD) consumption of E, Protein and micronutrient intake

Energy & Nutrient intake	Anaemia status		p value	IDA status		p value
	Normal	Anaemic		not Iron anaemic	Iron anaemic	
Energy (Cal)	1469.5 (563.3)	1411.9 (539.2)	0.753	1415.3 (552.4)	1640.3 (524.8)	0.298
Protein (g)	53.6 (22.5)	48.7 (15.6)	0.475	51.4 (22.1)	56.2 (13.4)	0.557
Iron (mg)	11.6 (10.9)	8.4 (7.4)	0.328	11.34 (10.95)	7.7 (1.94)	0.357
Folic acid (µg)	139.9 (80.1)	152.3 (96.7)	0.656	137.5 (80.25)	171.9 (101.8)	0.556
Zinc (µg)	6.1 (2.6)	5.5 (1.8)	0.462	5.8 (2.5)	6.4 (1.7)	0.296
Vitamin A (RE)	1117 (660.2)	1137.7 (1479.3)	0.947	1063 (646.9)	1413.8 (1848.9)	0.342

Association between Anaemia, Iron deficiency anaemia and Macro and Micronutrient adequacy

Table 5 analyse the OR of anaemia and IDA based on energy, protein and micronutrient intake (iron and zinc). Based on the table there was a tendency that inadequacy of iron and zinc tend to result on the anaemia and IDA status. However, based on the statistical test (chi square), there was no significant association between iron and zinc with the anaemia and IDA status (p>0.05). Folate was not include in the analysis because none of the mothers have adequate intake of folate.

Table 5. Odd ratio (OR) analysis of Anaemia and IDA based on energy, protein and micronutrient intake

Nutrient intake	Anaemia status		p value	OR (95%CI)	IDA status		p value	OR (95%CI)
	Normal	Anaemic			Not Iron anaemic	Iron anaemic		
Energy								
Adequate	22 (64.7)	7 (53.8)	0.493	1.57 (0.43-5.75)	23 (59)	6 (75)	0.396	0.479(0.086-2.683)
Not adequate	12 (35.3)	6 (46.2)			16 (41)	2 (25)		
Protein								
Adequate	16 (47.1)	5 (38.5)	0.596	1.422 (0.386-5.243)	16 (41)	5 (62.5)	0.266	0.417(0.087-2.00)
Not adequate	18 (52.9)	8 (61.5)			23 (59)	3 (37.5)		
Iron								
Adequate	5 (14.7)	1 (7.7)	0.519	2.1 (0.218-19.629)	6 (15.4)	0 (0)	0.235	1.242(1.069-1.445)
Not adequate	29 (85.3)	12 (92.3)			33 (84.6)	8 (100)		
Zinc								
Adequate	3 (8.8)	0 (0)	0.268	1.419 (1.172-1.719)	3 (7.7)	0 (0)	0.417	1.222(1.063-1.405)
Not adequate	31 (91.2)	13 (100)			36 (92.3)	8 (100)		
Vitamin A								
Adequate	25 (73.5)	8 (61.5)	0.421	1.736 (0.449-6.713)	27 (69.2)	6 (75)	0.745	0.75(0.132-4.268)
Not adequate	9 (26.5)	5 (38.5)			12 (30.8)	2 (25)		

Adequacy : E ≥ 70%AKG, P ≥ 80%AKG, Micronutrients ≥ EAR

DISCUSSION

Micronutrient malnutrition is widespread in all regions of the world, in the industrialized nations, but even more so in the developing regions. Of the micronutrient malnutrition, iron deficiency is the most prevalent. Iron deficiency is the result of a long-term negative iron balance; in its more severe stages, iron deficiency can lead to anaemia[2].

Anaemia is defined as a low blood haemoglobin concentration. It can affect all age groups, but young children and women of reproductive age are the most groups at risk of developing anaemia. Women due to their reproductive stage (pregnancy and lactating) needs more iron, however they usually have low nutrient intake that can increase their risk of having anaemia. Globally, in developing countries the prevalence of anaemic among pregnant mothers estimated to be about 50%[2].

Based on this study, as many of 27.7% pregnant mothers was anaemic. The recent data of anaemia among pregnant mothers in Bogor Tengah subdistrict and specifically Kebon Kalapa village can not be found until the time of writing this article. The most recent data could be found was the result of mapping survey of Chronic Energy Deficiency (CEC) and anaemia among pregnant mothers conducted by Bogor District Health Office in 2002, that found the anaemia prevalence among pregnant mothers was 40.4%[15]. The National figure, as the result of Riskesdas 2007 found the prevalence of anaemia among pregnant mothers was 24.5%. Based on this, it still considered as public health problem, as the prevalence was exceed from 5% of total population[9].

Micronutrient malnutrition has many adverse effects on human health. Even in moderate levels of deficiency (which can be detected by biochemical or clinical

measurements) can have serious detrimental effects on human function[2]. It means that the more severe the anaemia the worst will be the effect for both mothers and the fetus. This analysis found that among anaemic mothers there was 2.1% of pregnant mothers categorized as severe anaemic. This result shoud get attention because comparing with another study done in South Sulawesi, that from 41% anaemic pregnant mothers, there were no severe anaemic pregnant mothers. They were all categorized as mild and moderate anaemic[16]. The severe anaemia in pregnancy should get serious attention since it was associated with an increased risk of both maternal and child mortality in the perinatal period[1,2].

In this study the IDA was assesed using serum transferin (sTfr). One of the advantage of using sTfr are the concentrations are not really affected by the infection of chronic disease[17]. WHO stated that the use of sTfr are know become more popular because it is sensitive to the inadequate delivery of iron to bone marrow and tissue[18]. Prevalence of IDA among pregnant mothers in this study were 18%. It means that the low level of Hb as the indicator of anaemia was not caused only by iron deficiency, but due to other causes of anaemia.

There is assumption that the only major factor contribute to anaemia is iron deficiency, however not all of anaemic people were iron deficient. Iron deficiency can exist in the absence of anaemia, if it was not severe enough to make the haemoglobin level falls below the thresold for the specific age and sex[2,9]. Thus, iron deficiency in an advanced phase will lead to anaemia, reduce the haemoglobin level, that called Iron Deficiency Anaemia (IDA). This analysis indicates the similar results.

Other factors related to anaemia are include[2,9] : a low intake of haem iron (which is present in meat, poultry and fish), an inadequate intake of micronutrient such as vitamin C (ascorbic acid), vitamins A and B12, folate and riboflavin, poor absorption of iron due to diets high in phytate (including legumes and cereals) also foods source of phenol (such as coffee and tea), periods of life when iron requirements are especially high (i.e. growth and pregnancy), parasite infections such as hookworm and heavy blood losses as a result of menstruation, chronic infections, including malaria, can also lower haemoglobin concentrations. However, the limitation of this analysis was that it not included the parasite infections such as hookworm and also chronic infections that could affect on the lower Hb level, thus cause anaemia.

This study found no differences between the protein and micro nutrient intake between anaemic with normal pregnant mothers, also iron anaemic with non iron anaemic pregnant mothers. This result was not in line with several publication that stated, the micronutrients consumption is the important thing for the pregnant mothers[1-9]. Some micronutrients are related with the occurence of anaemia, namely iron, vitamins A, B12, C, and folic acid. One study conducted in Sidoarjo District, investigated the association between animal protein and iron intake with haemoglobin level among underfive children found the significant association between protein consumption ($r = 0.579$), animal protein consumption ($r = 0.763$), total iron intake ($r = 0.554$), and vitamin C intake ($r = 0.273$). The correlation of animal protein consumption with hemoglobin concentration is stronger than other[19].

However, based on this study there is a tendency that anaemic and IDA mothers have lower iron and zinc intake than the normal pregnant mothers. The absence of the association probably due to the small sample size that did not allow many variations of the nutrient intake. Most of them have inadequate consumption of micronutrient. Another factors that related to none differences between the micronutrient intake of anaemia and IDA with normal or not IDA pregnant mothers was because type of the iron in foods. Whereas the heme iron were more easy to absorbs than non heme iron. While the type of the diets of Indonesian people, especially in the study area was included in the low or intermediate iron bioavailability[2], thus it means low consumption of heme iron and high consumption of non heme iron.

Among these micronutrients, iron known as the most nutrient lies behind the occurence of anaemia. Therefore, the provision of iron supplements to pregnant women is one of the most widely practiced public health measures[20]. Besides iron, folic acid also become one of the compulsory supplements for pregnant mothers. In Indonesia, the compulsory supplementation program for pregnant mothers was 90 tablets of iron and folic acid.

The limitation of this analysis was because this analysis did not include the consumption of inhibitor such as tanin, phytat, fiber, that could inhibits the iron absorption and also could become the confounder for this analysis. Another is that there was no differentiation between heme and non heme iron, while actually they have different mechanism of being absorbed and utilized by the human body.

CONCLUSION AND RECOMMENDATION

Conclusion

Anaemia still become one of the public health problem in the study area. Among the anaemic pregnant mothers there were mothers that suffer from iron deficiency anaemia. The more severe the anaemia, are more likely caused by iron defiency. There was a tendency that inadequacy of iron and zinc intake tend to result on the anaemia and IDA status, however there is no significant association.

Recommendation

Attention on the anaemia problem among pregnant mother should also focus on other aspects related to anaemia besides micronutrient intake, such as hookworm infestation, or other infection, thus the promotion of healthy living behaviour should be more encouraged.

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