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The Association Between Prenatal Care (PNC) Coverage and Distribution of Iron Supplements with Cases of Non-infectious Disease in Pregnant Mothers in Narmada Public Health Center (PHC), West Lombok in 2020

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ABSTRACT

Disturbances at an early stage, provide immediate intervention and prevent death. During PNC visits, mothers will also receive supplements such as folic acid and iron that help in preserving their healthy condition. This study aims to identify the association between PNC coverage and distribution of iron supplements with cases of non-infectious disease in pregnant mothers in Narmada PHC and identify factors associated with PNC coverage and distribution of iron supplements. A mixed of quantitative and qualitative data analysis were used in this study. Data of K1, K4, Fe1, Fe3, anemia, chronic energy deficiency (CED), and pregnancy hypertension were collected from 2020 PWS-KIA data from all eleven villages in Narmada District. We also conducted interviews with key informants such as midwives and nurses actively involved in the PHC's mother and child program. The findings show that the lowest coverage of K1 and K4 was in Tanak Beak village, Dasan Tereng had the lowest Fe1 coverage, and Gerimax Indah had the least Fe3 coverage. On the other hand, Batu Kuta had the highest K1 coverage while Mekar sari had the highest coverage of K4, Fe1 and Fe3. The village with the highest prevalence of anemia was Gerimax Indah, Mekarsari had the highest number of mothers with CED, and Nyurlembang had the highest prevalence of pregnancy hypertension. Analysis with Spearman's correlation showed a negative correlation between coverage of PNC and iron distribution with anemia in pregnancy. Study findings also inferred a negative correlation between coverage of PNC and pregnancy hypertension. Meanwhile, a positive correlation existed between PNC coverage and iron distribution with CED and between iron distribution with pregnancy hypertension. We found significant association between K1 to K4, Fe1 to Fe3, PNC coverage with total cases and between Fe3 coverage with CED. From qualitative analysis we found factors contributing to the low coverage of PNC and distribution of iron supplements are lack of compliance from mothers, under-reporting (e.g. still births, pregnancies), local belief system (myths), and general misconceptions due to low education. Our study suggested that PNC and iron supplements help in improving mothers' health during pregnancy. It is also suggested that a boost in understanding from mothers and the local community is needed to keep the mothers comply with healthy behaviors such as regularly attend recommended PNC sessions and diligently take iron supplements.

Keywords: *Prenatal Care, Iron Supplements, Non-Infectious, Pregnancy.*

1. INTRODUCTION

Oral iron supplementation is generally recommended during pregnancy to prevent iron deficiency due to the increased physiological needs of the mother and fetus [1]. The World Health Organization (WHO) recommends iron supplementation of 30-60 mg/day to avoid iron deficiency during pregnancy, starting as early as possible in pregnancy. and given throughout pregnancy [2]. Supplementation iron during pregnancy will improve maternal iron status which includes hemoglobin, serum iron, MCV, transferrin saturation, and serum ferritin [3].

The mothers' compliance to attend recommended Prenatal Care (PNC) sessions throughout their pregnancy is essential to identify any disturbances at an early stage, provide immediate intervention and prevent death. During PNC visits, mothers will also receive supplements such as folic acid and iron that help in preserving their healthy condition.

In an effort to increase the distribution coverage of iron tablets, it is necessary to take promotive actions to the community [1]. The promotive actions can be carried out through PNC services, increased partnerships, and cooperation with other sectors. In addition, it is also necessary to mobilize the community in creating an environment that supports these programs related to conducting KIE (Education Information Communication) and KIP-K (Inter Personal Counseling Communication) [4].

This study aims to identify the association between PNC coverage and distribution of iron tablets with cases of non-infectious disease in pregnant mothers in Narmada PHC and identify factors associated with PNC coverage and distribution of iron tablets.

2. METHOD

This study was performed in a single center. A mixed of quantitative and qualitative data analysis were used in this study. Data of K1, K4, Fe1, Fe3, anemia, chronic energy deficiency (CED), and pregnancy hypertension were collected from 2020 Narmada PHC's PWS-KIA data from all eleven villages in Narmada District. We also conducted interviews with key informants such as midwives and nurses actively involved in the PHC's mother and child program.

Inclusion criteria were as follows: K1 and K4 reported from 1st of January to 31st of December 2020, Fe tablets distribution data from 1st of January to 31st of December 2020, cases of pregnant mothers diagnosed with either anemia OR CED OR pregnancy hypertension recorded from 1st of January to 31st of December 2020. Key informants that we interviewed were those involved in PNC and iron tablets distribution program. Pregnant mothers with more than one health issues were excluded from this study. Key informants that were unreachable, unwilling to participate, or no longer staffs at Narmada PHC were also not included in this study. Ethical clearance for conducting this study was obtained from UNRAM's Faculty of Medicine review board. We received signed informed consent from participants prior to conducting the interview.

3. RESULT AND DISCUSSION

3.1 Result

Our findings showed that the lowest coverage of K1 and K4 was in Tanak Beak village, Dasan Tereng had the lowest F1 coverage, and Gerimax Indah had the least Fe3 coverage. On the other hand, Batu Kuta had the highest K1 coverage while Mekar sari had the highest coverage of K4, Fe1 and Fe3 (Table 1).

Gerimax Indah had the highest prevalence of mothers with anemia, Mekar Sari had the highest prevalence of mothers with CED, and Nyurlembang had the most PH prevalence. However, Batu Kuta was the village with the highest prevalence of total pregnancy-related non-infectious cases (Table 2).

The prevalence of anemia in pregnancy as published by National Bureau of Statistic in 2018 was 48.9% [5]. We found the prevalence of anemia in pregnancy the working area of Narmada PHC was 4.99% (Table 2).

The prevalence of CED in pregnant mothers in the working area of Narmada PHC was 11.3% (Table 2). This was considerably low compared to 18.2% of the national target of CED in 2019 [6].

Table 1. Coverage of PNC and Iron Tablets Distribution

Villages	PNC Coverage (%)		Iron Tablet Distribution (%)	
	K1	K4	F1	F3
Dasan Tereng	100	94	90,9	85,5
Mekar Sari	186	175	167,7	158,1
Sembung	96	86	109,9	98,8
Gerimax Indah	138	115	100	83,3
Badrain	114	106	102,9	96,1
Krama Jaya	128	113	101,6	89,7
Tanak Beak	60	60	100	100
Batu Kuta	189	163	105,4	91
Lembuak	110	108	101	99
Nyurlembang	137	133	124,1	120,4
Narmada	115	113	105,1	102,5
Total	116	107	105	96,8

Table 2. Prevalence of Non-infectious Diseases

Villages	Prevalence (%)			
	Anemia	CED	Pregnancy Hypertension	Total
Lasan Tereng	0,9	7,3	0	8,18
Mekar Sari	0	29	0	29,03
Sembung	4,9	3,7	4,9	10,78
Gerimax Indah	16,7	7,8	0	30,86
Badrain	0	8,7	4,9	9,71
Krama Jaya	4,8	9,5	0	16,22
Tanak Beak	7,4	17,6	4,4	15,87
Batu Kuta	7,2	12,6	0	32,35
Lembuak	4,1	13,4	2,1	19,59
Nyurlembang	1,9	16,7	5,6	24,07
Narmada	2,5	15,2	2,5	20,25
Total	5	11,3	1,6	17,88

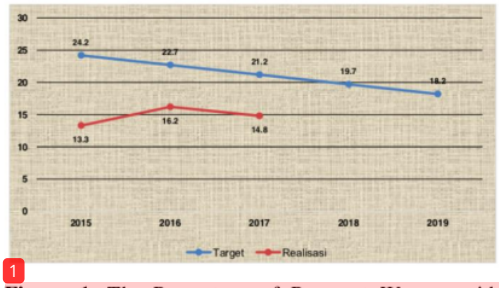

Figure 1. The Percentage of Pregnant Women with Chronic Energy Deficiency (CED) Compared to Medium-Term Targets [6]

From qualitative analysis we found factors contributing to the low coverage of PNC and distribution of iron supplements were:

3.1.1 Lack of compliance from mothers.

"The obstacle we usually find is that pregnant women do not comply with taking iron tablets due to the bad taste and pregnant women, who are mostly farm laborers, sometimes forget to take blood-added tablets"

"The obstacles found were that pregnant women did not come on time, pregnant women were not in the village, for example, they were at their parents-in-law's house so they did not come to the posyandu to do PNC and there were some pregnant women who were lazy to come to the posyandu to do PNC"

3.1.2 Under-reporting (e.g. still births, pregnancies)

fulfilled at the PHC is because of the high number of unreported pregnancy cases due to abortions, the finding of pregnant women more than 12 weeks that could be due to failed family planning or MBA (married

3.1.3 Local belief system such as still believe in myths

believe in myths related to dietary restrictions in pregnant women so that the nutrition obtained by

3.1.4 General misconceptions due to low education.

happening because of the behavioral factors of patients who are still not obedient in taking iron tablets because

3.2 Discussion

According to the Indonesian Ministry of Health, PNC examinations are carried out by professional health workers such as obstetricians, general practitioners, midwives and nurses in health services. Prenatal care services can be obtained at the time of Posyandu by the midwife, at the doctor's or midwife's private practice, at the maternity home and at the hospital's mother and child health (MCH) polyclinic [9]. Prenatal care services enable early diagnosis of pregnancy related disease and complications. It also ensures access of services such as health education, vaccines, diagnostic tests, and treatments including folic acid and iron supplements [10]. Fitrayeni's 2015 study found that midwives have an influence on PNC coverage and completeness of PNC visits [11]. Agustini's 2013 research explains that PNC coverage is influenced by the level of family knowledge and support [12]. Ritonga's 2012 research also mentions factors that

influence prenatal care, including knowledge, education, access to affordability and family support [13].

Analysis with Spearman's correlation showed a negative correlation between coverage of PNC and iron distribution with anemia in pregnancy. Study findings also inferred a negative correlation between coverage of PNC and pregnancy hypertension. Meanwhile, a significant positive correlation existed between PNC coverage and total case of pregnancy-related non-infectious diseases and iron distribution (Fe3) with CED (Table 3).

Table 3. Spearman's correlation values

Correlation	r	p-value
K1 to Anemia	-0,05	0,884
K1 to CED	0,255	0,45
K1 to Pregnancy Hypertension	-0,454	0,161
K4 to Anemia	-0,151	0,658
K4 to CED	0,396	0,228
K4 to Pregnancy Hypertension	-0,393	0,232
FE1 to Anemia	-0,338	0,309
FE1 to CED	0,36	0,277
FE1 to Pregnancy Hypertension	0,307	0,359
FE3 to Anemia	-0,392	0,233
FE3 to CED	0,8*	0,003
FE3 to Pregnancy Hypertension	0,483	0,133
K1 to Total Disease	0,845*	0,001
K4 to Total Disease	0,856*	0,001
FE1 to Total Disease	0,401	0,222
FE3 to Total Disease	0,173	0,612
K1 to K4	0,97*	0,00001
F1 to Fe3	0,651*	0,03

Based on the findings, there is a significant positive correlation between K1 and K4. Thus, effort in increasing the coverage of PNC services should be done since early stage of pregnancy by taking promotive actions to increase K1 coverage.

The 2020 data from West Nusa Tenggara Health Office showed that the total coverage of K1 in the working area of Narmada PHC has reached the target of 100% for K1 coverage and 98% for K4 coverage. This showed that the access of health workers (midwives) to pregnant women in 2020 was generally good, but for villages that have not yet reached the target, access to health workers still needs to be improved. This data correlates with our findings of PNC coverage in both K1 and K4 in the working area of Narmada PHC showing PNC Coverage of 116% and 107% respectively (Table 3).

The pregnancy hypertension in the working area of Narmada PHC in 2020 was 1.6%. (Table 3) This is significantly lower compared to 6.18% nation-wide and 10.4% in West Nusa Tenggara based on 2016 study conducted by Sari et al [7].

3.2.1 Anemia in Pregnancy

Anemia is a common problem in obstetric and perinatal care. A hemoglobin level below 10.5 g/dL can be considered anemia regardless of gestational age. The causes of anemia in pregnancy are mainly nutritional deficiencies, parasitic and bacterial diseases, and congenital erythrocyte disorders such as thalassemia. The main cause of anemia in pregnancy is iron deficiency, which has an estimated worldwide prevalence of between 20%-80% and comprises the female population.[10] Hemoglobin is composed of four globin chains, each containing a hemoglobin molecule that binds oxygen reversibly. Haem synthesis occurs both in the cytosol and in the mitochondria of erythrocytes. Protoporphyrin binds to Fe2+ (ferrous) ions to form haem [14].

Iron is an essential element involved in various physiological functions and cellular activities. Iron represents a cofactor for many enzymes and is involved in the transport of oxygen by hemoglobin (Hb) in erythrocytes as well as in various cellular processes, including DNA synthesis and oxidation-reduction reactions. low with consequent reduction in oxygen supply to tissues. Because of these effects, iron deficiency and iron deficiency anemia (IDA) can cause a variety of physical and cognitive effects [8]. Clinical manifestations of iron deficiency or IDA are often characterized by a variety of symptoms including fatigue, irritability, weakness, hair loss, and concentration and work performance. which is bad according to the severity of the condition [15].

During pregnancy, physiological iron requirements increase significantly, especially during the 2nd and 3rd trimesters [15], to support fetoplacental development and maternal adaptation to pregnancy [16]. Maternal iron loss over 9 months is estimated to be 200-250 mg. The developing placenta requires 90-100 mg, and the fetus requires 250-300 mg Fe. An additional 450 mg of Fe is required to increase maternal erythrocyte mass during pregnancy. Thus, 1200 mg of iron must be obtained during pregnancy to maintain maternal iron balance and support fetal development (estimated maternal weight 55 kg) [17]. Some of this iron is recycled after pregnancy when the erythrocyte mass contracts to pre-pregnancy concentrations with the exception of iron. lost through bleeding during delivery (~150 mg Fe for a blood loss of 300-500 mL) [17,18]. Therefore, the average maternal iron loss is estimated to be 740 mg. However, iron requirements are not uniform throughout the 3 trimesters of pregnancy. In the first trimester, the requirement (estimated at 0.8 mg/day) is lower than before pregnancy because menstruation has stopped. With advancing gestational age, maternal erythrocyte mass increases and placental and fetal growth increases, resulting in an increase in

physiological iron requirements to 3.0-7.5 mg/day in the third trimester [19].

To meet the accelerated physiological iron requirement, both the absorption of iron from food and the mobilization of iron stores need to be increased. Many women enter pregnancy with insufficient iron stores to meet the needs of pregnancy [16]. WHO promotes daily iron supplementation during pregnancy for women living in areas with a high prevalence of iron deficiency due to prophylactic iron administration in women with iron stores. a low one indicates a significant benefit. The exact dose for prophylactic iron supplementation is unclear, current guidelines suggest 60-120 mg iron/day. Lower doses show no effect. On the other hand, doses of 120 mg/day may increase unwanted side effects and consequently lead to poor adherence [8].

In Litasari's 2014 study, 85.7% of pregnant women took 90 tablets of iron tablets with an increase in Hb levels of 11gr/dL [20]. In Fanny's 2012 study, 93.3% of pregnant women took 90 tablets of iron followed by an increase in Hb levels as well [21].

3.2.2 Pregnancy Hypertension

Hypertension in pregnancy is the second highest cause of maternal death after bleeding. Hypertension in pregnancy especially preeclampsia can also have an impact in the form of miscarriage, kidney failure, pulmonary edema, brain hemorrhage, and intravascular blood clots. Preeclampsia is influenced by several factors such as primigravida, maternal age, medical illnesses that accompany pregnancy, blood pressure, and ANC examination [22]. The results of this study showed the prevalence of hypertension in pregnancy in the working area of Narmada PHC was 1.6%. Based on the 2018 Basic Health Research (RISKESDAS) report, hypertension in pregnancy was 3.3%, thus, the prevalence of hypertension in pregnancy in Narmada PHC was low. This is in line with the coverage of PNC service in Narmada PHC that has exceeded the target.

There is concern when non-anemic women take large doses of iron supplementation during pregnancy. This pattern of consumption can increase maternal iron stores and increase blood viscosity so that utero-placental blood flow is disrupted [3]. In addition, excessive iron can cause other toxin reactions and increase oxidative stress, and may be related to the mechanism of preeclampsia (PE) [1]. Pregnant women with high hemoglobin levels (Hb> 13 g/dL) have a significant increase in the risk of PE and diabetes mellitus. gestational. Poor pregnancy outcomes such as low birth weight, fetal growth restriction, and PE may be a consequence of increased blood viscosity and hemoconcentration.

Several studies have been published regarding the correlation between serum iron level in pregnancy and gestational hypertension with conflicting results. Five studies [23-26] reported a higher level of serum iron in patients with pre-eclampsia, relative to healthy pregnant women, while three studies [27-30] showed the lack of significant associations, and two studies [28,29] suggested that the serum iron levels are lower in patients with pre-eclampsia in comparison to healthy pregnant women. However, most of aforementioned studies are a retrospective studies regarding women who already developed the condition. Hence, the iron concentration in those studies may be a result of existing disorders. Therefore, a prospective study regarding the correlation between serum iron and pregnancy-induced hypertension was conducted in 2015-2019. This study, which involved a large number of pregnancy-induced hypertension, found that women with lower serum iron level (≤801.20 µg/L) had a 2.19-fold increase in pregnancy-induced hypertension risk in comparison to women with higher level of serum iron [31].

As discussed above, lower iron concentration correlates to higher risk of pregnancy-induced hypertension. Therefore, an iron supplementation regiment in order to maintain or increase the level of serum iron should lower the risk of pregnancy-induced hypertension which leads to several studies conducted in past several years. Interestingly, several randomised controlled studies (RCT) regarding the effect of iron supplementation on pregnancy-induced hypertension showed a conflicting result. One RCT published in 2018 reported that iron-containing multiple micronutrient supplementation was associated with a reduced risk of pregnancy-induced hypertension compared to folic acid supplementation only [32]. In contrast, two RCTs showed an increased risk of developing pregnancty-induced hypertension [1,33]. The included participants of all three of the aforementioned studies were not anaemic when enrolled to the study. Yet, haemoglobin level criteria were slightly different. The study which showed a reduced risk of developing pregnancy-induced hypertension used a lower cut-off level of haemoglobin when excluding the participants (<10g/dL) while studies which showed an increased risk sets it higher (<13,2g/dL and <11g/dL).

However, low iron tablets distribution is not a sole cause of anemia in pregnancy. Other micronutrient deficiencies that may lead to anemia in pregnancy are B-12 and Folic Acid deficiency. Moreover, iron tablets distribution also cannot reflect the mothers' compliance to regularly take iron tablets as recommended.

3.2.3 Chronic Energy Deficiency in Pregnancy

The anabolic and catabolic processes during pregnancy lead to increased maternal nutritional requirements to ensure optimal fetal growth. Inadequate

nutritional intake during pregnancy increases the risk for both mother and child from a poor outcome. Chronic energy deficiency (CED) is a common nutritional problem among pregnant women in developing countries. In Indonesia, women with an middle upper arm circumference (MUAC) below 23.5 cm are classified as having CED [34]. MUAC measurement is the standard for detecting CED. Maternal with MUAC <23.5 cm should be a concern because this condition can be a symptom of a mother giving birth to a low birth weight (LBW) baby [35]. In a study in Ethiopia, there was a positive correlation between CED and serum ferritin levels [36]. showed that pregnant women with MUAC <23 cm had a higher prevalence of anemia [37]. Iron tablet supplementation as a form of anemia prevention indirectly affects the incidence of CED in pregnant women.

In an observational study conducted at Narmada PHC, the incidence of CED in pregnant women in 2020 showed an average prevalence of 12.9%, where this figure was already below the national target of 16% [38]. The incidence of CED in pregnant women is generally caused by low intake of substances. maternal nutrition during pregnancy, one of which is iron. The increased need during pregnancy, low intake of animal protein, vitamin C deficiency and increased consumption of tea and coffee and caffeinated drinks are among factors causing low absorption of iron in the body even though pregnant women consume adequate amounts of Fe. According to research by Mardatun in 2015, which found a significant relationship between the level of iron intake and the incidence of CED, suggested that the incidence of CED in pregnant women is not only influenced by the level of iron consumption but also the history of nutritional status before pregnancy, history of chronic diseases and others [39].

In addition to being associated with nutritional status, the incidence of CED is also associated with a history of PNC. At every PNC visit, the officer collects data and analyzes the mother's condition through a physical examination to get a pregnancy diagnosis and whether there are problems or pregnancy complications [39]. This is in line with the results of research conducted by Lubis in Langsa in 2015 which showed a significant relationship between PNC history and the incidence of CED in pregnant women and is supported by the results of the 2015 Mardatun study, which also found a significant relationship between PNC and the incidence of CED [39,40].

From the interviews we found the factors that cause non-infectious health problems in pregnant women was the behavior of pregnant women who are still lack of compliance for instance in consuming iron tablets. This is in line with the results of research conducted at Pringsewu PHC in Lampung. The study found that the proportion of pregnant women who did not comply with taking iron tablets and experienced anemia was 81.9% [41]. Among things that cause the lack of compliance from mothers are the unpleasant taste of iron tablets, the side effects, and the mother's busy activities so that she forgot to take the iron tablets. Another factor that plays a role is cultural factors. Local people still believe in myths related to dietary restrictions in pregnant women so that the nutrients obtained by pregnant women are still lacking. This is in accordance with research conducted at the Kutalimbaru PHC in Deli Serdang in 2018 which stated that pregnant women who had poor nutrition increased the risk of experiencing anemia [42]. Moreover, a study conducted at the Rekas PHC in 2017 suggested that the husband's knowledge and support also play a role in non-infectious health disorders of pregnant women [43].

Our study found that K1 coverage will contribute to the coverage of K4. Thus, effort in increasing the coverage of PNC services should be done since early stage of pregnancy by taking promotive actions to increase K1 coverage. We also found significant positive correlations between K1 to K4, Fe1 to Fe3, Fe3 to CED, K1 to Total Case, and K4 to Total Case of non-infectious disease in pregnancy. However, we found no significant association between coverage of PNC and iron tablets distribution with cases of non-infectious disease in the working area of Narmada PHC. However, as those findings also cannot justify a significant statistical association between the variables, thus, further study should be done. Moreover, iron deficiency is not a sole cause of anemia in pregnant mothers. Other causes include folate-deficiency and vitamin B12 deficiency.

4. CONCLUSION

Prenatal care visits with a predetermined time are aimed at providing protection to pregnant women and or their fetuses in the form of early detection of risk factors, prevention and early treatment of pregnancy complications. Prenatal care services enable early diagnosis of pregnancy related disease and complications. It also ensures access of services such as health education, vaccines, diagnostic tests, and treatments including folic acid and iron supplements.

We found significant association between PNC coverage with total cases and between Fe3 coverage with CED. From qualitative analysis we found factors contributing to the low coverage of PNC and distribution of iron tablets are lack of compliance from mothers, under-reporting (e.g. still births, pregnancies), local belief system (myths), and general misconceptions due to low education. Our study suggested that PNC and iron supplements help in improving mothers' health during pregnancy. It is also suggested that a boost in understanding from mothers and the local community is needed to keep the mothers comply with healthy

behaviors such as regularly attend recommended PNC sessions and diligently take iron supplements. Further study should be done in order for a better justification of significant association between PNC coverage and iron intake with cases of non-infectious disease in pregnancy.

AUTHORS' CONTRIBUTIONS

CW and PD conceptualized the idea. CW and IWID conducted the literature review. CW, LN, IDGNA, IWID, BMNS, NAP, and SFM were each responsible for the conception and design of the descriptive and qualitative study. CW was responsible for the conception and design of the analytical study. CW, LN, IDGNA had full access to all of the data in the study. IWID, BMNS, NAP, and SFM collected the data. CW, IWID, BMNS, NAP, and SFM analysed and interpreted the data. CW drafted and revised the manuscript. All authors read and approved the final version of the manuscript.

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The authors declare that there is no conflict of interest.

REFERENCES

[1] Jirakittidul P, Sirichotiyakul S, Ruengorn C, Techatraisak K, Wiriyasirivaj B. Effect of iron supplementation during early pregnancy on the development of gestational hypertension and pre-eclampsia. *Arch Gynecol Obstet* 2018;298:545–50. https://doi.org/10.1007/s00404-018-4821-6.

[2] WHO. WHO Recommendations on Antenatal Care for a Positive Pregnancy. *World Heal Organ* 2018;10:1–10. https://doi.org/10.1186/1742-4755-10-19.5.

[3] Scholl TO. Iron status during pregnancy: Setting the stage for mother and infant. *Am J Clin Nutr* 2005;81:1218–22. https://doi.org/10.1093/ajcn/81.5.1218.

[4] Tumaji. Pemberian Tablet Zat Besi oleh Tenaga Kesehatan dan Kepatuhan Ibu Hamil Mengonsumsi Tablet Besi Lebih dari 90 Tablet yang Diperoleh dari Tenaga Kesehatan di Daerah Kumuh Perkotaan di Propinsi Jawa Barat dan Yogyakarta. *Bul Penelit Sist Kesehat* 2014;17:241–8.

[5] Statistik BP. *Prevalensi Anemia pada Ibu Hamil. Tujuan Pembang Berkelanjutan* 2018. https://www.bps.go.id/indikator/indikator/view_data/0000/data/1333/sdgs_2/1 (accessed April 22, 2021).

[6] Kementerian Kesehatan RI. *Laporan Kinerja Ditjen Kesehatan Masyarakat Tahun 2017*. Jakarta: Kementerian Kesehatan RI; 2018.

[7] Astriana W. Kejadian Anemia pada Ibu Hamil Ditinjau dari Paritas dan Usia. *J Aisyah J Ilmu Kesehat* 2017;2:123–30. https://doi.org/10.30604/jika.v2i2.57.

[8] Garzon S, Cacciato PM, Certelli C, Salvaggio C, Magliarditi M, Rizzo G. Iron deficiency anemia in pregnancy: Novel approaches for an old problem. *Oman Med J* 2020;35:1–9. https://doi.org/10.5001/omj.2020.108.

[9] Kementerian Kesehatan Republik Indonesia. *Laporan Nasional Riset Kesehatan Dasar*. Kementeri Kesehat RI 2018:1–582.

[10] K. G, J.A. S, F. K, C. P, B. O. Antenatal care in practice: An exploratory study in antenatal care clinics in the Kilombero Valley, south-eastern Tanzania. *BMC Pregnancy Childbirth* 2011;11:1–11. https://doi.org/10.1186/1471-2393-11-36.

[11] Fitrayeni F, Suryati S, Faranti RM. Penyebab Rendahnya Kelengkapan Kunjungan Antenatal Care Ibu Hamil Di Wilayah Kerja Puskesmas Pegambiran. *J Kesehat Masy Andalas* 2016;10:101–7. https://doi.org/10.24893/jkma.v10i1.170.

[12] Suryani NNMAN, Murdani P. Hubungan Antara Tingkat Pengetahuan Ibu dan Dukungan Keluarga dengan Cakupan Pelayanan Antenatal di Wilayah Kerja Puskesmas Buleleng I. *J Magister Kedokt Kel* 2013;1:67–9.

[13] Ritonga FJ, Sitohang NA. Faktor-Faktor Yang Mempengaruhi Ibu Hamil Dalam Melakukan Pemeriksaan Antenatal Care. *J Keperawatan Klin* 2012;4.

[14] Thomas C, Lumb AB. Physiology of haemoglobin. Contin Educ Anaesthesia, *Crit Care Pain* 2012;12:251–6. https://doi.org/10.1093/bjaceaccp/mks025.

[15] Camashella C. Iron-deficiency anemia. N Engl *J Med* 2015;372:1832–43. https://doi.org/10.1056/NEJMra1401038.

[16] Moegni EM, Ocviyanti D. *Buku Saku Pelayanan Kesehatan Ibu di Fasilitas Kesehatan Dasar dan Rujukan*. *1st ed*. Jakarta: Kementerian Kesehatan Republik Indonesia; 2013.

[17] Breymann C. Iron Deficiency Anemia in Pregnancy. *Semin Hematol* 2015;52:339–47. https://doi.org/10.1053/j.seminhematol.2015.07.003.

[18] Fisher AL, Nemeth E. Iron homeostasis during pregnancy. *Am J Clin Nutr* 2017;106:1567S-1574S. https://doi.org/10.3945/ajcn.117.155812.

[19] Bothwell TH. Iron requirements in pregnancy and strategies to meet them. Am *J Clin Nutr* 2000;72. https://doi.org/10.1093/ajcn/72.1.257s.

[20] Litasari D, Sartono A, Mufnaetty. Kepatuhan Minum Tablet Zat Besi Dengan Peningkatan Kadar Hb Ibu Hamil di Puskesmas Purwoyoso Semarang. *J Gizi Univ Muhammadiyah Semarang* 2014;3:25–33.

[21] Fanny L, Mustamin H, Dewi T, Kartini S. Pengaruh Pemberian Tablet Fe Terhadap Kadar Hemoglobin Ibu Hamil di Puskesmas Tamamaung Tahun 2011. *Media Gizi Pangan* 2012;8:7–11.

[22] Isnanda EP, Noor MS, Musafaah. Hubungan Pelayanan Antenatal Care (ANC) dengan Kejadian Preeklampsia Ibu Hamil di RSUD Ulin Banjarmasin. *J Univ Lambung Mangkurat* 2012;004:46–50.

[23] Gupta S, Nanda S, Singh U, Bansal S, Lal H. Evaluation of the changes in serum iron levels in pre-eclampsia. *Indian J Clin Biochem* 1997;12:91–4. https://doi.org/10.1007/BF02867964.

[24] Rayman MP, Barlis J, Evans RW, Redman CWG, King LJ. Abnormal iron parameters in the pregnancy syndrome preeclampsia. *Am J Obstet Gynecol* 2002;187:412–8. https://doi.org/10.1067/mob.2002.123895.

[25] Serdar Z, Gür E, Develioğlu O. Serum iron and copper status and oxidative stress in severe and mild preeclampsia. *Cell Biochem Funct* 2006;24:209–15. https://doi.org/10.1002/cbf.1235.

[26] Fenzl V, Flegar-Meštrić Z, Perkov S, Andrišić L, Tatzber F, Žarković N, et al. Trace elements and oxidative stress in hypertensive disorders of pregnancy. *Arch Gynecol Obstet* 2013;287:19–24. https://doi.org/10.1007/s00404-012-2502-4.

[27] Duvan CI, Simavli S, Keskin EA, Onaran Y, Turhan NO, Koca C. Is the level of maternal serum prohepcidin associated with preeclampsia? *Hypertens Pregnancy* 2015;34:145–52. https://doi.org/10.3109/10641955.2014.988350.

[28] Adam B, Malatyalioglu E, Alvur M, Talu C. Magnesium, zinc and iron levels in pre-eclampsia. *J Matern Fetal Med* 2001;10:246–50. https://doi.org/10.1080/jmf.10.4.246.250-14.

[29] Sarwar MS, Ahmed S, Ullah MS, Kabir H, Rahman GKMM, Hasnat A, et al. Comparative study of serum zinc, copper, manganese, and iron in preeclamptic pregnant women. *Biol Trace Elem Res* 2013;154:14–20. https://doi.org/10.1007/s12011-013-9721-9.

[30] Gutierrez-Aguirre CH, García-Lozano JA, Treviño-Montemayor OR, Iglesias-Benavides JL, Cantú-Rodríguez OG, González-Llano O, et al. Comparative analysis of iron status and other hematological parameters in preeclampsia *Hematology* 2017;22:36–40. https://doi.org/10.1080/10245332.2016.1220120.

[31] Lewandowska M, Sajdak S, Lubiński J. Can serum iron concentrations in early healthy pregnancy be risk marker of pregnancy-induced hypertension? *Nutrients* 2019;11. https://doi.org/10.3390/nu11051086.

[32] Chen S, Li N, Mei Z, Ye R, Li Z, Liu J, et al. Micronutrient supplementation during pregnancy and the risk of pregnancy-induced hypertension: A randomized clinical trial. *Clin Nutr* 2019;38:146–51. https://doi.org/10.1016/j.clnu.2018.01.029.

[33] Ziaei S, Norrozi M, Faghihzadeh S, Jafarbegloo E. A randomised placebo-controlled trial to determine the effect of iron supplementation on pregnancy outcome in pregnant women with haemoglobin ⩾ 13.2 g/dl. BJOG An Int J *Obstet Gynaecol* 2007;114:684 – 8. https://doi.org/10.1111/j.1471-0528.2007.01325.x.

[34] Prameswari FSP, Marliyati SA, Dewi MD. A Supplementary Protein Food for Pregnant Women with Chronic Energy Deficiency to Improve Fetal Growth. *J Gizi Dan Pangan* 2020;15:1–10. https://doi.org/10.25182/jgp.2020.15.1.1-10.

[35] Darmawati D, Tahlil T, Siregar TN, Kamil H, Fithria, Audina M. Antenatal Care and Iron Deficiency Anemia among Pregnant Women. *Proceeding AIC Heal Life Sci* 2018;8:13–24.

[36] Haidar J, Muroki NM, Omwega AM, Ayana G. Malnutrition and iron deficiency in lactating women in urban slum communities from Addis Ababa, *Ethiopia*. *East Efrican Med* J 2003;80:191–4.

[37] Okube OT, Mirie W, Odhiambo E, Sabina W, Habtu M. Prevalence and Factors Associated with Anaemia among Pregnant Women Attending Antenatal Clinic in the Second and Third Trimesters at Pumwani Maternity Hospital, Kenya. *Open J Obstet Gynecol* 2016;06:16–27. https://doi.org/10.4236/ojog.2016.61003.

[38] Kementerian Kesehatan RI. I*ndikator Program Kesehatan Masyarakat dalam RPJMN dan Rentra Kementerian Kesehatan 2020-2024*. Jakarta: Kementerian Kesehatan RI; 2020.

[39] Mardiatun, Yani LA, Purnamawati D, Zulkifli, Ristrini. Hubungan Riwayat Ante Natal Care (ANC) dan Tingkat Di Provinsi Nusa Tenggara Barat dan di Daerah Istimewa (Analisis Lanjut Data Riset Kesehatan Dasar 2013). *Bul Penelit Sist Kesehat* 2015;18:221–8.

[40] Lubis LA, Lubis Z, Aritonang E. Faktor-Faktor yang Berhubungan dengan Kejadian Kekurangan Energi Kronik (KEK) pada Ibu Hamil di Puskesmas Langsa Lama Kota Langsa Tahun 2015. *J Univ Sumatera Utara* 2015:3–10.

[41] Yanti DAM, Sulistianingsih A, Keisnawati. Faktor-Faktor Terjadinya Anemia pada Ibu Primigravida di Wilayah Kerja Puskesmas Pringsewu Lampung. *J Keperawatan* 2015;6:79–87. https://doi.org/https://doi.org/10.22219/jk.v6i2.2862.

[42] Damanik S. Faktor-Faktor yang Mempengaruhi Terjadinya Anemia pada Ibu Hamil Trimester II. *J Ilm Ilmu Kesehat Wawasan Kesehat* 2019;5:232–9. https://doi.org/10.33485/jiik-wk.v5i2.133.

[43] Pattipeilohy MY. *Faktor-Faktor yang Mempengaruhi Perilaku Ibu Terhadap Ketepatan Kunjungan Antenatal Care di Puskesmas Rekas Kabupaten Manggarai Barat Nusa Tenggara Timur Tahun 2017*. Yogyakarta: Politeknik Kesehatan Kementerian Kesehatan; 2018.

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