**The Relationship Between the Level of Knowledge, Attitude, and Behavior of Pregnant Women on Compliance with Iron Tablet (Ferrous Sulfate) Consumption and the Incidence of Anemia During Pregnancy**

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**Abstract**

Anemia is a direct or indirect cause of maternal mortality. Anemia is associated with maternal morbidity rates. The government’s effort to address anemia is to provide iron supplements (Ferrous Sulfate). The success of iron supplement administration depends on whether or not pregnant women take iron tablets. This study aims to determine the relationship between the level of knowledge, attitude, and behavior of pregnant women on compliance with iron tablet (Ferrous Sulfate) consumption and the incidence of anemia during pregnancy. This observational analytic study used a cross-sectional design with primary data from pregnant women at Puskesmas Pembina Palembang. 100 samples that met the inclusion and exclusion criteria were selected through consecutive sampling techniques. Statistical analysis results showed that 80% of respondents were not anemic while 20% were anemic. The respondents with a high level of knowledge mostly had positive attitudes (81%), positive behavior (94%), and compliance with iron tablet consumption during pregnancy (83%). The Chi-Square test and Fisher's Exact test showed a significant relationship between knowledge level (p-value = 0.000, OR = 11.746), attitude (p-value = 0.000, OR = 34.167), behavior (p-value = 0.001, OR = 7.309), and compliance with iron tablet consumption (p-value = 0.040, OR = 3.769) and the incidence of anemia during pregnancy. This study concludes that there is a relationship between the level of knowledge, attitude, and behavior of pregnant women on compliance with iron tablet (Ferrous Sulfate) consumption and the incidence of anemia during pregnancy.

**Keyword**s: Anemia, Ferrous Sulfate, Pregnant

1. **Introduction**

According to the World Health Organization WHO 2019, the global Maternal Mortality Rate (MMR) is estimated at 303,000 lives. The Maternal Mortality Rate (MMR) in ASEAN stands at 235 per 100,000 live births.1 Based on WHO data, 15-20% of maternal deaths, directly or indirectly, are caused by anemia, which is also associated with maternal morbidity. According to WHO, the incidence of pregnancy anemia ranges between 20% and 89%, with a threshold set at hemoglobin (Hb) <11 g/dL. The anemia rate during pregnancy is 3.8% in the first trimester, 13.6% in the second trimester, and 24.8% in the third trimester. WHO states that the percentage of pregnant women with iron deficiency is around 35-37% and increases as pregnancy progresses, with estimates of 30-40% anemia due to iron deficiency.2 Cases of iron deficiency anemia in developing countries are 51% more frequently found in Africa and Southeast Asia, including Indonesia.3 According to the Palembang City Health Office 2021, the number of maternal deaths in 2020 was 128, up from 105 in 2019. Palembang City ranks second with the highest maternal mortality rate at 14 deaths. According to the Palembang City Health Office in 2014, 963 pregnant women suffered from anemia.4 Government efforts to combat anemia include providing iron supplement tablets (Ferrous Sulfate). The percentage of pregnant women who received at least 90 iron supplement tablets in South Sumatra in 2020 was 89.4%, a 5% decrease compared to 2019.4 According to the Central Statistics Agency of South Sumatra Province 2021, the number of pregnant women reached 171.905, with 153.002 receiving iron (Fe) tablets. This indicates that the distribution of ferrous sulfate tablets to pregnant women was suboptimal due to compliance factors.4 Factors influencing compliance include the knowledge and attitudes of pregnant women. Good knowledge can lead to positive attitudes about the importance of taking iron tablets, which in turn encourages good behavior.5

Pathophysiology of anemia during pregnancy occurs due to hematological changes related to pregnancy, which involve circulatory changes that increasingly affect the placenta and breast growth. Plasma volume increases by 45-65%, starting from the second trimester of pregnancy and reaching its peak in the ninth month, increasing by around 1000 ml, slightly decreasing approaching term, and returning to normal three months postpartum.6 During pregnancy, anemia relatively occurs because pregnant women experience hemodilution (dilution) with an increase in volume of 30% to 40%, peaking at 32 to 34 weeks of pregnancy. The increase in blood cells is around 18% to 30% and hemoglobin is approximately 19%. Anemia in pregnant women is often found in the first and third trimesters, with the highest incidence in the third trimester. In the first trimester, pregnant women experience nausea and vomiting, which can reduce the availability of iron. In the third trimester, iron is needed by the fetus for growth and development. Therefore, the fetus absorbs iron from the mother, causing an increase in the mother's iron requirements.7 The diagnosis of anemia during pregnancy can be established through anamnesis. In the anamnesis, complaints such as fatigue, weakness, lethargy, shortness of breath, drowsiness, dizziness, headaches, blurred vision, nausea and vomiting, and pale lips and tongue can be found. The history of food intake during pregnancy (lack of vegetable and animal protein consumption), as well as any bleeding during pregnancy, can be examined. In addition, hemoglobin checks and monitoring can be carried out.8

Centers for Disease Control (CDC) defines anemia as a decrease in hemoglobin levels as follows: First trimester: Hb < 11 g/dl, Ht < 33%, second trimester: Hb 10.5 g/dl, Ht < 32%, third trimester: Hb < 11 g/dl, Ht < 33%. Meanwhile, according to the WHO, anemia during pregnancy is defined as hemoglobin levels below <11 g/dl. Research conducted stated that the digital strip tool Easy Touch GCHb can be used for blood hemoglobin examinations, as the results obtained show no significant differences when compared to hemoglobin levels measured using the Cyanmethemoglobin method recommended by WHO.9

Anemia during pregnancy can have a negative impact, especially during pregnancy, childbirth, and the postpartum period. The high prevalence of anemia leads to adverse effects such as growth disorders and delays in the development of body and brain cells. A deficiency of hemoglobin (Hb) in the blood results in reduced oxygen carried and transferred to the body cells or the brain. Pregnant women suffering from anemia have a higher likelihood of experiencing postpartum hemorrhage. The dangers of anemia during pregnancy are categorized into two: risks to the pregnancy and risks to the fetus. These include threats such as the mother experiencing miscarriage, premature delivery, impaired fetal growth in the womb, susceptibility to infections, risk of cardiac decompensation when Hb levels are below 6 g%, hydatidiform mole occurrence, hyperemesis gravidarum, and intrauterine growth restriction.10

1. **Methods**

The type of research in analytical observational with cross-sectional design. The study was conducted at Puskesmas Pembina Palembang from November to December 2022. The population of this study using consecutive sampling, involving women in the first, second, and third trimesters, about 92 samplings, who met the inclusion criteria

1. **Results**

The research conducted on 100 pregnant respondents at the Pembina Palembang Health Center revealed the characteristics of respondents based on age, education level, occupation, pregnancy age, and ANC (Antenatal care).

**Table 1. General characteristics of Respondent**

|  |  |  |
| --- | --- | --- |
| Variable | Frequency | Percentage (%) |
| Age17-25 | 27 | 27 |
| 26-35 | 61 | 61 |
| 36-45 | 12 | 14 |
| * Education level
 |  |  |
| Elementary school  | 16 | 16 |
| Junior high school  | 33 | 33 |
| Senior high school | 35 | 35 |
| Bachelor degree  | 16 | 16 |
| * Occupation
 |  |  |
| Housewife | 88 | 88 |
| Private employee | **7** | **7** |
| Teacher | 1 | 1 |
| Civil servant | 4 | 4 |
| * Pregnancy Trimester
 |  |  |
| First trimester | 9 | 9 |
| Second trimester | 46 | 46 |
| Third trimester | 45 | 45 |
| * Antenatal care visits (ANC)
 |  |  |
| 1-3 times | 59 | 59 |
| 4-6 times | 36 | 36 |
| 7-10 times | 5 | 5 |

Based on Table 1, the highest frequency is found in the age of 25-35 years old, with a senior high school education level. Most respondents are housewives, with the majority in their second trimester of pregnancy and having attended ANC (antenatal care) 1-3 times.

Based on the research conducted on 100 respondents, the results of the univariate analysis were obtained, including the distribution based on knowledge level, attitude, behavior, adherence to consuming Fe tablets during pregnancy, and hemoglobin levels. The category of maternal knowledge was identified through questionnaires distributed to the respondents, where the knowledge level was classified as either good or poor. Maternal knowledge level in this study showed that the majority, 81% of the respondents had good knowledge, while 19% had poor knowledge. The attitudes were classified as positive and negative, positive attitude category with 94% of respondents, while the negative attitude category included 6% of respondents. The highest frequency distribution in the behavior category is positive, with 83% of respondents, while 17% of respondents displayed negative behavior. The frequency distribution for adherence to consuming Fe tablets during pregnancy falls in the adherent category with 83% of respondents, while 17% of respondents were in the non-adherent category. The frequency distribution of anemia during pregnancy shows that the majority fall into the non-anemic category, with 80% of respondents, while 20% of respondents were categorized as anemic.

The bivariate analysis aimed to find the relationship between maternal knowledge level, attitude, and behavior with adherence to consuming Fe tablets during pregnancy and adherence to Fe tablet consumption related to the occurrence of anemia during pregnancy. The analysis of the relationship between maternal knowledge level and adherence to consuming Fe tablets was conducted using the Chi-square test with a significance level of 95% (α = 0.05), as this study is a comparative test between two groups and is unpaired. In the analysis results of the relationship between attitude and behavior with adherence to Fe tablet consumption and adherence to Fe tablet consumption with anemia occurrence during pregnancy, there were cells with expected counts of less than 5, which did not meet the Chi-square test requirements. Therefore, the alternative Fisher’s exact test was conducted.

**Table 2. Relationship Between Knowledge Level and Adherence to Fe Tablet Consumption**

|  |  |
| --- | --- |
| Knowledge | Compliance |
| **Compliance (%)** | **Non-Compliance (%)** | **Total** |
| Good | 74 (91.4%) | 7 (8.6%) | 81(100%) |
| Poor | 9 (47.4%) | 10 (52.6%) | 19(100%) |
| Total | 83 (83%) | 17 (17%) | 100(100%) |

**p 0.00; OR (95% CI) 11.746**

Based on Table 2, it can be seen that out of 81 respondents with a good knowledge level, 74 (91.4%) adhered to consuming Fe tablets, while 7 (8.6%) did not adhere. Meanwhile, out of 19 respondents with a poor knowledge level, 9 (47.4%) adhered, and 10 (52.6%) did not adhere. There is a significant relationship between knowledge level and adherence to Fe tablet consumption, as indicated by a p-value of 0.000 (p < 0.05). The analysis results showed an Odds Ratio (95% CI) of 1.746, meaning that mothers with a good knowledge level have a 1.746 times higher likelihood of adhering to Fe tablet consumption during pregnancy.

Based on Table 3, from a total of 94 respondents who had a positive attitude, 82 (87.2%) adhered to consuming Fe tablets, while 12 (12.8%) did not adhere. A total of 6 respondents had a negative attitude, 1 (16.7%) adhered, while 5 (83.3%) did not adhere. There is a significant relationship between attitude and adherence to Fe tablet consumption, as indicated by a p-value of 0.000 (p < 0.05). The analysis results showed an Odds Ratio (95% CI) of 34.167, meaning that mothers with a positive attitude have a 34.167 times higher likelihood of adhering to Fe tablet consumption during pregnancy.

**Table 3 Relationship Between Attitude and Adherence to Fe Tablet Consumption**

|  |  |  |
| --- | --- | --- |
| **Attitude** | **Compliance**  | **Total** |
| **Compliance (%)** | **Non-compliance (%)** |
| Positive | 82 (87.2) | 12 (12.8) | 94 |
| Negative | 1 (16.7) | 5 (83.3) | 6 |
| Total | 83 | 17 | 100 |

**p-value 0.000; OR (95% CI) 34.167**

**Table 4. Relationship Between Behavior and Adherence to Fe Tablet Consumption**

|  |  |  |
| --- | --- | --- |
| **Behavior** | **Compliance** | **Total** |
| **Compliance (%)** | **Non-compliance (%)** |
| Positive | 74 (89.2) | 9 (10.8) | 83 |
| Negative | 9 (52.9) | 8 (47.1) | 17 |
| Total | 83 | 17 | 100 |

P-value 0.001; OR (95% CI) 7.309

Based on Table 4, from a total of 83 respondents who exhibited positive behavior, 74 (89.2%) adhered to consuming Fe tablets, while 9 (10.8%) did not adhere. Of the 17 respondents with negative behavior, 9 (52.9%) adhered, and 8 (47.1%) did not adhere. There is a significant relationship between behavior and adherence to Fe tablet consumption, as indicated by a p-value of 0.001 (p < 0.05). The analysis results showed an Odds Ratio (95% CI) of 7.309, meaning that mothers with positive behavior have a 7.309 times higher likelihood of adhering to Fe tablet consumption during pregnancy.

Based on Table 5, from a total of 83 respondents who adhered to Fe tablet consumption, 70 (84.3%) did not experience anemia during pregnancy, while 13 (15.7%) experienced anemia. Out of 17 respondents who did not adhere, 10 (58.8%) did not experience anemia, while 7 (41.2%) experienced anemia. There is a significant relationship between adherence to Fe tablet consumption and the occurrence of anemia during pregnancy, as indicated by a p-value of 0.040 (p < 0.05). The analysis results showed an Odds Ratio (95% CI) of 3.769, meaning that mothers who adhered to Fe tablet consumption had a 3.769 times higher likelihood of not experiencing anemia during pregnancy.

**Table 5 Relationship Between Adherence to Fe Tablet Consumption and Occurrence of Anemia During Pregnancy**

|  |  |  |
| --- | --- | --- |
| **Compliance** | **Incidence of anemia** | **Total** |
| **Non-Anemia (%)** | **Anemia (%)** |  |
| Compliance | 70 (84.3) | 13 (15.7) | 83 |
| Non-compliance | 10 (58.8) | 7 (41.2) | 17 |
| Total | 80 | 20 | 100 |

**P-value 0.040; OR (95% CI) 3.769**

**4. Discussion**

The research results showed that the maternal knowledge level was mostly in the good category, with 81 (81%). These results are consistent with the study reported by Wachdin FR on pregnant women in Madiun City, where out of a total of 45 respondents, 41 (91%) had a good knowledge level. 11 The research results showed that the majority of attitudes fell into the positive category, with 94 (94%). Attitude is a person's closed response to a particular stimulus or object, involving factors of opinion and emotion (such as happy-unhappy, agree-disagree, good-bad, like-dislike, etc. According to Budi et al, attitude is defined as awareness and the tendency to act as a closed response of an individual to a particular stimulus or object involving opinion and emotional factors, such as feeling happy or unhappy, agreeing or disagreeing, and considering something as good or bad. Attitude consists of three important interrelated components: the cognitive component (perceptual component) that includes beliefs, convictions, knowledge, and personal experiences, the affective component (emotional) related to one's ability to evaluate an object, and the conative component (behavioral component) related to the tendency to act.12 Attitude is a predisposition for the formation of an action. Pregnant women who have a positive attitude will likely act obediently in consuming Fe tablets, while pregnant women with a negative attitude tend to be non-compliant in consuming Fe tablets during pregnancy .13

The research results showed that the majority of behaviors fell into the positive category, with 83 (83%). Behavior is divided into two categories: covert behavior a hidden response to stimuli that is limited in form and overt behavior (an open response to stimuli in the form of observable actions. Human behavior is influenced by several factors that drive individuals to act: Genetic or endogenous factors are fundamental for behavioral development and originate within the individual, including race, and gender: Men are more likely to engage in rational considerations when Physical characteristics: differences in physical traits among individuals will lead to varied behaviors, Personality traits: A collection of personality traits formed by the combination of genetic and environmental factors, intelligence: The ability and maturity to think and act.14

External factors include environmental factors that serve as a platform for behavior, education, and knowledge to play roles in the development of individual or group behavior, religion, socioeconomic status, and culture, which derives from arts, customs, or civilization, influence the formation of individual behavior. Adherence to Fe Tablet Consumption During Pregnancy. The research found that adherence to Fe tablet consumption during pregnancy was mostly in the adherent category, with 83. Similar results were reported by Wachdin FR in a study of pregnant women in Madiun City, where out of 45 respondents, 22 (55%) were found to be in the adherent category.15

The research results showed that the majority of cases of anemia during pregnancy fell into the non-anemic category, with 80 (80%) respondents. Similar results were reported by Rofiani Romi & Ratnawati in a study on pregnant women in Pekalongan Regency, where 35 (36.5%) out of 96 respondents did not experience anemia.21 The same findings were reported by Omasti NK, et al, at Kungkung Public Health Center, where 50 (50%) out of 52 respondents were not anemic. Anemia is a decrease in hemoglobin (Hb) concentration or hematocrit (HCT) or a reduction in RBC count.16 Anemia can be described as a decrease in the proportion of red blood cells in circulation or a condition where the number of red blood cells (with oxygen-carrying capacity) is insufficient to meet physiological needs. Although anemia is most commonly diagnosed by measuring low Hb concentration or low hematocrit, it can also be diagnosed by examining red blood cell count, average red blood cell volume, blood analysis, or Hb electrophoresis Anemia occurs due to an imbalance in erythropoiesis relative to production, which can be attributed to ineffective erythropoiesis, nutritional deficiency, blood loss, or genetic disorders, such as hemolysis and excessive erythrocyte destruction. Anemia is often classified based on the causative mechanism, such as IDA, hemolytic anemia, and anemia.17

The results of this study found a significant relationship between knowledge level and adherence to Fe tablet consumption, with a p-value of 0.000. This indicates that pregnant women with a good knowledge level are more likely to adhere to Fe tablet consumption compared to those with a lower knowledge level. Similar findings were reported by Wachdin FR in Madiun City, where it was concluded that there is a significant relationship between knowledge level and adherence to Fe tablet consumption.11

The results of this study found a significant relationship between attitude and adherence to Fe tablet consumption, with a p-value of 0.000. This indicates that pregnant women with a positive attitude are more likely to adhere to Fe tablet consumption compared to those with a negative attitude. Similar findings were reported by Erwin et al in a study on pregnant women in Padang City, which found a significant relationship between attitude and adherence to Fe tablet consumption.13 Another study conducted by Wahyuni S, et al on pregnant women in Banjar Regency also found a significant relationship between attitude and adherence to Fe tablet consumption.18

Based on the results of this study, pregnant women were categorized as having a positive attitude. According to the researcher's assumptions, this was because most of the respondents in this study had a good level of knowledge. This aligns with the theory by Verrayanti, which states that good knowledge will lead to a positive attitude, and conversely, mothers with a negative attitude tend to be non-compliant in regularly consuming Fe tablets according to the recommendations of health workers.19

The results of this study found a significant relationship between behavior and adherence to Fe tablet consumption, with a p-value of 0.001. This indicates that pregnant women with positive behavior are more likely to adhere to consuming Fe tablets compared to those with negative behavior. Similar results were reported by Rofiani & Ratnawati in a study on pregnant women in Pekalongan Regency, which also found a significant relationship between behavior and adherence to Fe tablet consumption.16

Consumption and the Occurrence of Anemia During Pregnancy. The results of this study found a significant relationship between adherence to Fe tablet consumption and the occurrence of anemia during pregnancy, with a p-value of 0.040. This indicates that pregnant women who adhere to consuming Fe tablets do not experience anemia during pregnancy. Similar findings were reported by Omasti, et al at Klungkung II Health Center, which showed a significant relationship between adherence to Fe tablet consumption and the occurrence of anemia during pregnancy.20 A study conducted by Yanti at Bernung Health Center in Pesawaran Regency also reported similar results, indicating a significant relationship between adherence to Fe tablet consumption and the occurrence of anemia during pregnancy.21

**5. Conclusions**

There is a significant relationship between knowledge level, attitude.and adherence to Fe tablet consumption. There is a significant relationship between adherence to Fe tablet consumption and the occurrence of anemia during pregnancy, with a p-value of 0.040. Prevention of anemia in pregnant women includes sufficient rest, consuming nutritious foods rich in iron, undergoing pregnancy checkups at least four times, and regularly consuming Fe tablets (1 tablet/day for 90 days). Iron supplements are crucial for pregnant women as their iron requirements double due to the increased blood volume without plasma expansion, to meet the needs of the mother (preventing blood loss during childbirth) and fetal growth.

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