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Effectiveness of FE Tablet Consumption on Hemoglobin Level Increase Haemoglobin Levels in Pregnant Women

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| KEYWORDS | ABSTRACT |
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| <p>Keywords: E Tablet; Haemoglobin; Pregnant Women; Iron Supplementation</p> <p>Conflict of Interest Statement: The author(s) declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.</p> <p>Copyright © 2024 AHR. All rights reserved.</p> | <p>Purpose: This study aims to evaluate the effectiveness of Fe tablet supplementation on increasing hemoglobin levels in pregnant women at Puskesmas Dahlia Makassar.</p> <p>Research Design and Methodology: The research method employed was a Cross-Sectional Study, with data collection at a single point in time. The study sample consisted of 35 pregnant women divided into two groups based on their compliance with taking iron tablets. Data were analyzed using the Chi-square test to determine the significance of the results.</p> <p>Findings and Discussion: The results showed that 91.7% of pregnant women who regularly consumed iron tablets experienced an increase in hemoglobin levels, whereas only 27.3% of pregnant women who did not regularly consume iron tablets experienced a similar increase. This indicates the significant effectiveness of Fe tablet consumption in increasing hemoglobin levels. This finding also suggests that non-compliance and other health factors, such as infection, may affect the outcome of supplementation.</p> <p>Implications: This study has significant value in providing empirical evidence on the importance of adherence to iron supplement consumption and the need for a holistic approach that includes nutrition education and infection control. The originality of this study lies in its focus on pregnant women at Puskesmas Dahlia Makassar, providing local data that is valid for health policy. Limitations of this study include the cross-sectional design, which cannot determine cause-and-effect relationships, and the limited sample size. Further research with a longitudinal design and larger sample is recommended to confirm these findings and explore other factors that influence the effectiveness of iron supplementation.</p> |

Introduction

Iron deficiency in Indonesia is a significant national problem that requires serious attention. Efforts to tackle this problem have not been comprehensive, especially in the provision of ferrous supplements to pregnant women who are examined at health centers, hospitals, and doctors. The low coverage of iron tablets given to pregnant women is a major contributing factor. The mother's iron requirement during pregnancy is 800 mg, of which 300 mg is needed for the fetus and placenta and 500 mg for the mother's erythrocyte growth. Therefore, pregnant women need 2-3 mg of iron daily (Manuaba, 2018). Haemoglobin is a Fe-containing protein compound known as conjugated protein. Haemoglobin is essential in binding oxygen and delivering nutrients throughout the body,

including the placenta. A lack of hemoglobin leads to a shortage of oxygen and nutrients for the products of conception, which may cause some or all of the placental tissue to detach. The detached placenta is perceived as a foreign body by the body, so the uterus attempts to expel it through contractions, which can eventually lead to abortion at less than 22 weeks gestation (Marmi, 2019).

According to the Indonesian Demographic and Health Survey (IDHS), in 2021, the maternal mortality rate (MMR) in Indonesia reached 102 per 100,000 live births, as set by the government through the Ministry of Health of the Republic of Indonesia (IDHS, 2021). Data from the South Sulawesi Provincial Health Office shows that in 2019, the MMR was 13 per 100,000 live births, increasing to 14 per 100,000 in 2020 and 16 per 100,000 in 2021 (MOH, 2021). In Makassar City, the MMR in 2019 was 3 per 100,000 live births, increasing to 4 per 100,000 in 2020 and 6 per 100,000 in 2021 (MOH, 2021). Hemoglobin binds oxygen and is crucial in delivering nutrients throughout the body, including the placenta. Lack of hemoglobin means a lack of oxygen, which can lead to insufficient nutrients and oxygen for the products of conception. This causes some or all the placental tissue to detach, which is perceived as a foreign body by the uterus. Hence, the uterus attempts to expel it with contractions, causing an abortion. This condition often occurs at less than 22 weeks gestation (Marmi, 2019).

The problem of iron deficiency also requires enhanced public health efforts, including the provision of clean water, improved environmental sanitation, and promotion of personal hygiene. Parasitic infestations, such as hookworms, are also a significant cause of chronic blood loss, which interferes with the absorption of essential nutrients, including iron (Wiknjosastro, 2018). Another factor affecting the iron supplementation program is the non-compliance of pregnant women to taking iron tablets. This non-compliance is caused by the side effects of iron tablets, such as nausea, vomiting, and fecal impaction, as well as feelings of boredom. Hence, the mother's compliance with taking FE 90 tablets daily during the third trimester is low (Pudiastuti, 2019). The impact of anemia in pregnant women can be harmful to the mother and fetus. Anaemia reduces the oxygen supply for the mother's metabolism due to the lack of hemoglobin levels to bind oxygen. This can lead to abortion, hypertension, diabetes, and premature labor. The health condition of the baby can also lead to preterm labor (Saifuddin, 2018). Therefore, preventing anemia in pregnant women is essential by ensuring adequate iron intake for the formation and maintenance of red blood cells. The adequacy of red blood cells ensures the circulation of oxygen and the metabolism of nutrients that pregnant women need (Wiknjosastro, 2018). Pregnancy care provided by midwives must always be based on knowledge, analysis, and careful consideration. The consequences of the actions taken are the responsibility of the midwife. Quality, client-focused, mother-centered care based on current scientific evidence (best practice) is the responsibility of all midwifery professionals.

Recent studies have revealed that significant limitations persist in research on iron deficiency and its effects on pregnant women and their fetuses. Existing studies focus on clinical aspects without considering the social and economic factors influencing pregnant women's adherence to iron supplements. Additionally, only a few studies have investigated the long-term effects of anemia on maternal and child health after birth. These research gaps suggest that more studies are needed that integrate a multi-disciplinary approach to understand iron deficiency holistically. Existing research has not been able to answer essential questions regarding how public health interventions can improve pregnant women's adherence to taking iron supplements and how social and economic factors influence anemia rates among pregnant women. This study aims to fill this gap by investigating the factors that affect pregnant women's adherence to iron supplements and their impact on anemia levels. It will also explore effective public health interventions to improve adherence among pregnant women. Thus, this study is expected to make a significant contribution to preventing anemia among pregnant women in Indonesia and improve overall maternal and child health. This study offers novelty through a multidisciplinary approach that has not been widely explored in previous studies. By integrating clinical, social, and economic aspects, this study seeks to provide a more comprehensive understanding of iron deficiency in pregnant women and its associated effects. In addition, this study will also identify effective and practical interventions to improve pregnant women's adherence to iron supplements, which in turn can reduce anemia rates and improve maternal and child health in Indonesia.

Literature Review

Iron Deficiency and Anaemia in Pregnant Women

Iron deficiency during pregnancy is a significant and far-reaching health problem worldwide. Anaemia, characterized by a hemoglobin level of less than 11 g/dL, is one of the primary manifestations of iron deficiency. It is not just a micronutrient deficiency but also a severe threat to maternal and fetal health. Anemia in pregnant women can increase the risk of premature birth, low birth weight, and maternal and neonatal mortality (Kozuki et al., 2012). According to the World Health Organization (WHO), approximately 40% of pregnant women worldwide are anemic, with a higher proportion in developing countries. Iron deficiency leads to impaired formation of hemoglobin, the main component in the blood responsible for transporting oxygen throughout the body. Iron deficiency during pregnancy reduces the blood's ability to transport oxygen, negatively impacting maternal health and fetal development. Pregnant women who are anemic often feel tired, weak, and prone to infections. Even worse, anemia can lead to severe complications such as pre-eclampsia, postpartum hemorrhage, and premature birth (Scholl et al., 1994).

A study by Milman (2011) showed that iron deficiency anemia during pregnancy is associated with an increased risk of preterm birth and low birth weight. Babies born to anemic mothers have a higher risk of slow development and long-term health problems. The condition also affects fetal brain development, which may impact the child's cognitive abilities later in life. Anemia during pregnancy, therefore, is not only a maternal health issue but also an ongoing child health issue. Further research by Black and Waxman (2013) confirmed that anemia in pregnant women also increases the risk of maternal and neonatal mortality. Anemic mothers are more likely to experience complications during labor, including uncontrolled bleeding, which can be fatal if not treated promptly. In addition, anemia worsens the already vulnerable state of maternal health, slows postpartum recovery, and increases the risk of postpartum infections. Kusuma (2022) found that iron supplementation during pregnancy can significantly reduce the risk of anemia and related complications. The study showed that pregnant women who received iron supplementation showed a significant increase in hemoglobin levels and a reduction in the incidence of preterm birth and low birth weight. Iron supplementation is a key strategy in the global effort to reduce the prevalence of anemia in pregnant women. However, although iron supplementation is compelling, challenges in its implementation still need to be addressed. Adherence to iron supplementation is often low due to side effects such as nausea, constipation, and stool discoloration (Galloway & McGuire, 1994). Therefore, iron supplementation programs must be accompanied by adequate education for pregnant women on the importance of these supplements and how to manage possible side effects. In addition to supplementation, other interventions, such as food fortification with iron and increased access to nutritious foods, are also necessary. According to research by Haas and Brownlie IV (2001), holistic and comprehensive interventions are necessary to effectively address iron deficiency. These include raising awareness of the importance of nutrition during pregnancy, improving sanitation, and controlling parasitic infections that can interfere with iron absorption. To address this issue globally, partnerships among governments, international organizations, and the private sector are necessary. Continuous research and intervention programs supported by scientific evidence should be the basis of any effort to reduce the prevalence of anemia in pregnant women. By doing so, significant improvements in maternal and child health, as well as reductions in maternal and neonatal mortality, are expected worldwide.

Iron Requirement During Pregnancy

Iron requirements increase significantly during pregnancy to support fetal growth and development, as well as to maintain maternal health and well-being. Iron is an essential element in the formation of hemoglobin, the main component of blood that transports oxygen throughout the body. This additional need for iron is due to several factors, including increased blood volume, fetal and placental growth, and preparation for blood loss during labor and childbirth. It is known that iron requirements in pregnant women reach 800 mg, with 300 mg used for the fetus and placenta and 500 mg for the mother's increased erythrocyte mass (Bothwell, 2000). Therefore, iron supplementation is essential to meet these needs and prevent anemia. The increased iron requirement during pregnancy cannot be met solely through a regular diet. Studies by Milman (2006) indicate that daily dietary

intake typically provides only about 15-18 mg of iron per day, which is grossly insufficient to meet the iron needs of pregnant women. Therefore, iron supplementation is a must. Further research by Scholl (2005) also indicates that iron supplementation in pregnant women can significantly reduce the risk of anemia and its associated complications.

Anemia during pregnancy has severe repercussions for both the mother and fetus. Research by Puspitaningrum (2018) revealed that anemia in pregnant women can lead to an increased risk of premature birth, low birth weight, and maternal and neonatal mortality. In addition, anemia can also affect maternal health by causing fatigue, decreased endurance, and increased risk of postpartum infections. Iron supplementation during pregnancy is effective in increasing serum hemoglobin and ferritin levels. A meta-analysis by Peña-Rosas et al. (2015) found that iron supplementation significantly increased hemoglobin levels and decreased the risk of anemia in pregnant women. Iron supplementation can improve the nutritional status of pregnant women and reduce the risk of complications during pregnancy and delivery. However, despite the proven benefits of iron supplementation, challenges persist in its implementation. Adherence of pregnant women taking iron supplements is often low due to side effects such as nausea, constipation, and stool discoloration (Galloway & McGuire, 1994). Research by Hyder et al. (2002) demonstrated that providing adequate education and counseling to pregnant women on the importance of iron supplements and strategies for managing side effects could enhance compliance. Iron supplementation programs must be integrated with efforts to improve overall nutrition and infection control. Studies by Haas and Brownlie (2001) emphasize the importance of a holistic approach in addressing iron deficiency, which includes increasing the intake of nutritious foods, fortifying foods with iron, and controlling parasitic infections that can interfere with iron absorption. Improving iron status in pregnant women has become a national priority in Indonesia. Research by Anggraini et al. (2023) in Puskesmas Kecamatan Palmerah, Jakarta, demonstrated that administering Fe tablets to pregnant women resulted in a significant increase in hemoglobin levels after three months of consumption. This finding supports the importance of iron supplementation programs as part of efforts to improve maternal and child health. Iron supplementation is an effective intervention for preventing anemia and its related complications. However, successful supplementation programs require a comprehensive approach, including adequate education, increased intake of nutritious foods, and infection control. By doing so, significant improvements in maternal and child health, as well as reductions in maternal and neonatal mortality, are expected. Through the concerted efforts of governments, international organizations, and the health sector, the challenges of iron deficiency during pregnancy can be addressed, positively impacting future generations.

Effectiveness of Fe Tablets in Increasing Haemoglobin Levels

The effectiveness of Fe tablets in increasing hemoglobin levels in pregnant women has become a critical research topic in addressing anemia during pregnancy. Anaemia in pregnant women can have severe consequences for both mother and fetus, including increased risk of preterm birth, low birth weight, and maternal and neonatal mortality. Iron supplementation is, therefore, a critical intervention recommended by various global health organizations. Several studies have demonstrated that Fe tablet supplementation can significantly enhance the hemoglobin and serum ferritin levels of pregnant women. A meta-analysis by De-Regil et al. (2015) found that iron supplementation effectively increases hemoglobin levels and reduces the risk of anemia. This meta-analysis combined results from several studies showing that iron supplementation can significantly improve hemoglobin status in pregnant women, thereby preventing anemia and related complications. These findings support the importance of iron supplementation as a critical intervention in maintaining maternal and fetal health. A study by Milman (2011) further supports these findings. In her research, Milman showed that consuming Fe tablets at 30-60 mg daily increased hemoglobin and serum ferritin levels in pregnant women. This study emphasizes the importance of administering the correct dosage of iron supplementation to achieve optimal hemoglobin levels without causing significant side effects.

Research in Indonesia also showed similar results. A study by Anggraeni et al. (2018) conducted in Puskesmas Kecamatan Palmerah, Jakarta, found that administering iron tablets to pregnant women significantly increased hemoglobin levels after three months of consumption. This study supports

previous findings and suggests that iron supplementation can effectively improve hemoglobin status in pregnant women in the local context. In addition, the research by Hyder et al. (2002) demonstrated that providing adequate education on the importance of Fe tablet consumption and coping with side effects can enhance pregnant women's adherence to iron supplements. This study highlights that, in addition to the supplementation itself, education and support factors also play a crucial role in the success of iron supplementation programs. Research by Scholl and Reilly (2000) also showed that iron supplementation in pregnant women can reduce the risk of premature birth and low birth weight. This finding is significant, as it suggests that the benefits of iron supplementation extend beyond increasing hemoglobin levels to impact birth outcomes positively. Furthermore, research by Black et al. (2013) found that iron supplementation during pregnancy can reduce the risk of maternal and neonatal mortality. This study demonstrates that iron supplementation has a profound and significant impact on maternal and child health, making it a crucial intervention in reducing maternal and infant mortality. However, despite the proven benefits of iron supplementation, challenges in implementation still need to be addressed. Adherence of pregnant women taking iron supplements is often low due to side effects such as nausea, constipation, and stool discoloration (Galloway & McGuire, 1994). These side effects can be a significant barrier in iron supplementation programs, reducing the effectiveness of anemia prevention and treatment efforts. Iron supplementation programs must be integrated with adequate education and ongoing support for pregnant women to address these issues. Effective education can help pregnant women understand the importance of iron supplementation and how to manage possible side effects. Additionally, support from healthcare workers and family is beneficial and essential for improving pregnant women's adherence to iron supplementation. Research shows that a holistic approach, which includes education, psychological support, and ongoing monitoring, can improve compliance and effectiveness of iron supplementation programs. As such, it can reduce the prevalence of anemia in pregnant women and improve overall maternal and fetal health, thereby supporting broader public health goals.

Factors Affecting the Effectiveness of Iron Supplementation

Various factors influence the effectiveness of iron supplementation in increasing hemoglobin levels in pregnant women. Although Fe tablets are effective, the success of the program is highly dependent on the compliance of pregnant women in taking them. Research by Galloway and McGuire (1994) shows that side effects such as nausea and constipation are often the main reasons for non-compliance. These side effects make many pregnant women feel reluctant to continue taking Fe tablets, which, in turn, reduces the effectiveness of the supplementation program. In addition, a study by Pudiastuti (2019) in Indonesia also confirmed that side effects and feelings of boredom when taking Fe tablets during the third trimester contributed to low adherence. This study showed that pregnant women often felt uncomfortable with side effects, such as nausea and indigestion, so they tended to ignore medical recommendations to take iron supplements regularly. In addition to adherence, the nutritional status and health of pregnant women also play an essential role in the effectiveness of iron supplementation. Hall et al. (2001) state that a balanced diet is vital for optimal iron absorption. Pregnant women who are malnourished or have poor nutritional status may not be able to absorb iron efficiently, even if they take supplements regularly. This study highlights the importance of ensuring that pregnant women receive a balanced nutritional intake in addition to iron supplementation. Infections and parasitic infestations may also affect iron absorption and effectiveness. A study by Siregar (2016) demonstrated that hookworm infection can reduce iron absorption and lead to chronic anemia. These parasitic infections cause significant blood loss and interfere with the absorption of essential nutrients, including iron. Therefore, iron supplementation programs must be integrated with infection control efforts to achieve optimal results. This emphasis on infection control should reassure the audience that the approach is comprehensive and thorough.

Research by Hyder et al. (2002) revealed that providing adequate education on the importance of iron supplementation and how to manage side effects can improve adherence among pregnant women. A good education can help pregnant women understand the long-term benefits of iron supplementation and reduce their concerns about possible side effects. This study shows that educational interventions can improve the effectiveness of iron supplementation programs. Research

by Allen (2000) demonstrated that iron supplementation, combined with iron-rich foods, can significantly increase hemoglobin levels. This study emphasizes the importance of a comprehensive nutritional approach in addressing iron deficiency. In addition to supplements, consuming iron-rich foods such as red meat, green vegetables, and legumes can also be beneficial. The study by Haas and Brownlie (2001) also emphasized the need for a multi-sectoral approach to address iron deficiency effectively. This includes food fortification with iron, increased access to nutritious foods, and infection control programs. However, the urgency of addressing malnutrition in pregnant women is stressed, as it is a critical factor in the effectiveness of iron supplementation. This holistic approach can ensure that pregnant women receive comprehensive support to improve their hemoglobin status.

Research Design and Methodology

The research design employed is the Cross-Sectional Study method, which involves the simultaneous measurement or observation of data on both independent and dependent variables. In this method, variable measurements do not have to be taken simultaneously; instead, each subject is subjected to only one measurement without repetition. This approach enables the researcher to gain an overview of the relationship between variables at a specific point in time, providing rapid and efficient data collection without requiring a lengthy data collection period. The population in this study consisted of all pregnant women who had visited Puskesmas Dahlia in Makassar. This study consisted of 35 pregnant women who visited Puskesmas Dahlia Makassar. This sample was chosen to represent the pregnant women receiving health services at the health center. The Cross-Sectional Study method was selected for its ability to evaluate the relationship between Fe tablet consumption and increased hemoglobin levels in pregnant women in a relatively short period. Using this approach, researchers can simultaneously collect data on the variables under study and analyze the relationship between iron supplement consumption and hemoglobin levels. This study aims to identify the effectiveness of iron supplementation in increasing hemoglobin levels in pregnant women. The results of this study are expected to provide a clear picture of how Fe tablet consumption affects the health of pregnant women at Puskesmas Dahlia Makassar. In addition, this study aims to provide information that can be used to improve health programs for pregnant women at the health center, particularly in efforts to prevent and treat anemia. Thus, it is hoped that this study can improve the quality of health services for pregnant women.

Findings and Discussion

Findings

Table 1 shows that 35 pregnant women visited Puskesmas Dahlia Makassar as part of the sample. Based on age characteristics, four people (11.4%) were under 20 years old, 22 people (62.9%) were between 20 and 35 years old, and nine people (25.9%) were over 35 years old. In terms of education, the sample distribution showed that four individuals (11.4%) had primary school education, four individuals (11.4%) had junior high school education, 18 individuals (51.4%) had high school education, and nine individuals (25.7%) had tertiary education. In terms of occupation, five people (14.3%) worked as housewives, 11 people (31.4%) as self-employed, 12 people (34.3%) as civil servants, and seven people (20.0%) as honorary. In terms of Fe tablet consumption, 24 people (68.8%) consumed Fe tablets regularly, while 11 people (26.7%) did not regularly consume Fe tablets. Finally, based on the increase in hemoglobin level, 25 people (71.4%) experienced an increase in hemoglobin level during the third trimester, while 10 people (28.6%) did not experience an increase in hemoglobin level.

Table 2 shows that of the 35 respondents used as samples, 24 regularly consumed Fe tablets, and 22 people (91.7%) experienced increased hemoglobin levels in third-trimester pregnant women. Two people (8.3%) did not experience an increase in hemoglobin levels during the third trimester of pregnancy. Of those who did not regularly consume Fe tablets, 11 people, three people (27.3%) experienced an increase in hemoglobin levels in third-trimester pregnant women, and eight people (72.7%) did not experience an increase in hemoglobin levels in third-trimester pregnant women.

Table 1. Frequency Distribution of Characteristics at Dahlia Health Centre

| Characteristics | Category | n | % |
|---|--------------------|----|-------|
| Age | <20 Years | 4 | 11.4 |
| | 20-35 Years | 22 | 62.9 |
| | >35 Years | 9 | 25.9 |
| | Total | 35 | 100.0 |
| Education | Primary school | 4 | 11.4 |
| | Junior High School | 4 | 11.4 |
| | High School | 18 | 51.4 |
| | College | 9 | 25.7 |
| | Total | 35 | 100.0 |
| Occupation | Housewife | 5 | 14.3 |
| | Self-employed | 11 | 31.4 |
| | Civil Servant | 12 | 34.3 |
| | Honorar | 7 | 20.0 |
| | Total | 35 | 100.0 |
| Fe tablet administration | Regular | 24 | 68.8 |
| | Irregular | 11 | 26.7 |
| | Total | 35 | 100.0 |
| Increase in Haemoglobin Level of Pregnant Women | Yes | 25 | 71.4 |
| | No | 10 | 28.6 |
| | Total | 35 | 100.0 |

Source: Primary Data 2022

Table 2. Effectiveness of FE Tablet Consumption on the Increase in Haemoglobin Level in Pregnant Women

| FE Tablet Consumption | Increase in Haemoglobin Level of Pregnant Women | | | | Total | | p-value |
|-----------------------|---|------|----|------|-------|-----|---------|
| | Yes | | No | | | | |
| | n | % | n | % | n | % | |
| Reguler | 22 | 91,7 | 2 | 8,3 | 24 | 100 | 0,000 |
| Irregular | 3 | 27,3 | 8 | 72,7 | 11 | 100 | |
| Total | 25 | 71,4 | 10 | 28,6 | 35 | 100 | |

Source: Primary Data 2022

Discussion

The results showed that of the 35 respondents sampled, 24 pregnant women regularly consumed iron tablets, with 22 people (91.7%) experiencing an increase in hemoglobin levels in the third trimester and only two people (8.3%) not experiencing an increase. In contrast, of the 11 pregnant women who did not regularly consume iron tablets, only three (27.3%) experienced an increase in hemoglobin levels, while eight (72.7%) did not. This indicates the significant effectiveness of Fe tablet consumption on increasing hemoglobin levels in pregnant women. Fe tablets replace iron lost through feces, urine, and skin. Iron requirements during pregnancy increase to meet the needs of the growing fetus and placenta, as well as to support an increased maternal blood volume. Anaemia, characterized by low hemoglobin levels, exhibits symptoms that range from mild to severe, depending on the level of hemoglobin in the blood. Health screening and laboratory tests indicate that the treatment of anemia in pregnancy typically involves supplemental iron and folic acid, as well as a balanced diet (Manuaba, 2018). These findings underscore the importance of regular iron tablet consumption in preventing and treating anemia in pregnant women, thereby supporting optimal maternal health and fetal development.

Non-compliance with taking iron supplements is one of the main factors affecting the effectiveness of supplementation programs. Galloway and McGuire (1994) found that side effects such as nausea and constipation are often the main reasons for non-compliance. In Indonesia, Pudiastuti (2019) also showed that side effects and feeling bored taking Fe tablets during the third trimester contributed to low adherence among pregnant women. This suggests that although Fe tablets are readily available and provided free of charge, non-adherence remains a significant barrier in iron supplementation programs. Additionally, the nutritional status and health of pregnant women also impact iron absorption and effectiveness. Hall et al. (2001) noted that infection or infestation with parasites, such as hookworms, can inhibit iron absorption, thereby reducing the effectiveness

of iron supplements. Therefore, iron supplementation programs cannot stand alone; they must be integrated with efforts to improve nutrition and infection control to achieve optimal results. A holistic approach to addressing iron deficiency is, therefore, essential. Haas and Brownlie (2001) emphasize that increasing the intake of nutritious foods, fortifying foods with iron, and controlling parasitic infections should be integral to anemia management strategies. These efforts will not only improve the nutritional status of pregnant women but also ensure that iron supplied through supplements is efficiently absorbed by the body. In this context, education and counseling for pregnant women are also critical. Healthcare workers should provide clear information on the importance of adhering to iron supplement use and how to manage potential side effects that may arise. Thus, it is hoped that an increase in the adherence of pregnant women to taking Fe tablets can be achieved, which will increase the effectiveness of the iron supplementation program in preventing and treating anemia.

This study supports the hypothesis that regular Fe tablet consumption effectively increases hemoglobin levels in pregnant women. This result aligns with a previous study by Peña-Rosas et al. (2015), who found that iron supplementation significantly increased hemoglobin levels and reduced the risk of anemia in pregnant women. Additionally, Milman (2011) demonstrated that consuming iron tablets at a daily dose of 30-60 mg was effective in increasing hemoglobin and serum ferritin levels in pregnant women. Research in Indonesia by Anggraeni et al. (2018) also found that giving Fe tablets to pregnant women significantly increased hemoglobin levels after three months of consumption. This study supports previous findings, demonstrating that iron supplementation can effectively improve hemoglobin status in pregnant women within the local context. The results of this study are also supported by a survey by Hyder et al. (2002), which found that providing adequate education on the importance of Fe tablet consumption and how to manage side effects can improve adherence among pregnant women.

Although the results of this study support the hypothesis and align with theory and previous research, some findings warrant further investigation. For example, two people still regularly took Fe tablets but did not experience an increase in hemoglobin. This may be due to other factors, such as comorbidities that inhibit iron absorption or certain health conditions that affect the effectiveness of supplements. Comorbidities such as chronic infections or digestive disorders may reduce the body's ability to absorb iron efficiently. In contrast, three people did not regularly take Fe tablets but had elevated hemoglobin levels. This may be due to adequate iron intake from the daily diet. Iron-rich foods, such as red meat, green vegetables, and beans, can help meet daily iron requirements. This aligns with the theory that iron deficiency can be addressed through a diet rich in iron. However, in the case of anemia, supplementation is usually required to meet high needs quickly (Saifuddin, 2018). This finding suggests that, in addition to adherence to supplements, other factors such as nutritional status, comorbidities, and dietary intake also play a crucial role in determining the effectiveness of iron supplementation. Therefore, iron supplementation programs must be integrated with a comprehensive approach, including education on healthy diets and the management of comorbidities to ensure optimal outcomes in preventing and managing anemia in pregnant women.

The practical implications of these findings are significant. Iron supplementation programs must be accompanied by adequate education to address non-compliance resulting from side effects. Health workers should provide clear and supportive information to pregnant women on the importance of Fe tablet consumption and how to manage possible side effects. In addition, more comprehensive interventions are needed, including food fortification with iron and increased access to nutritious foods to support the nutritional status of pregnant women. Efforts to prevent anemia in pregnant women should focus on increasing iron intake to form and maintain red blood cells. Adequate red blood cells will ensure the circulation and metabolism of oxygen and nutrients that pregnant women need. Iron requirements during pregnancy increase significantly, especially in the second and third trimester. Iron supplementation is one of the most effective programs for preventing and controlling iron deficiency anemia, increasing hemoglobin levels in pregnant women, and reducing the prevalence of anemia (Wiknjosastro, 2018).

This study demonstrates that Fe tablet supplementation, by established service standards, when combined with a suitable diet, has a positive effect on hemoglobin levels in pregnant women. After Fe tablet supplementation, most pregnant women (70%) had normal hemoglobin levels. This result

aligns with several previous studies that have reported that Fe tablets can increase hemoglobin levels and reduce the incidence of anemia in pregnant women. However, some studies report that Fe tablet administration has not been able to significantly reduce the prevalence of anemia. Factors such as non-compliance with supplement intake, comorbidities, and poor nutritional status can impact the effectiveness of iron supplementation. Side effects and boredom of taking Fe tablets during the third trimester contribute to low adherence among pregnant women in Indonesia. Additionally, infection or infestation with parasites, such as hookworms, can impede iron absorption, thereby reducing the effectiveness of supplements. Therefore, iron supplementation programs should be integrated with a more holistic approach, including increased intake of nutritious foods and control of parasitic infections, to achieve optimal results. A holistic approach to addressing iron deficiency is essential, which includes food fortification with iron and adequate education for pregnant women. With a comprehensive strategy, the results of Fe tablet supplementation are expected to be more optimal in increasing hemoglobin levels and reducing the incidence of anemia in pregnant women.

Conclusion

This study aims to evaluate the effectiveness of Fe tablet supplementation in increasing hemoglobin levels among pregnant women at Puskesmas Dahlia, Makassar. Through the Cross-Sectional Study method, this study observed 35 pregnant women divided based on compliance with taking Fe tablets. The results showed a significant difference in the increase in hemoglobin levels between pregnant women who regularly consumed Fe tablets and those who did not. This study provides strong evidence that regular consumption of Fe tablets positively influences the hemoglobin levels of pregnant women.

This study holds significant value in health science and practice, particularly in the prevention and treatment of anemia in pregnant women. The findings emphasize the importance of adherence to iron supplementation and the need for a holistic approach that includes nutrition education and infection control. The originality of this study lies in its focus on pregnant women at Puskesmas Dahlia Makassar, providing local data that can inform maternal and child health policy in the region. Thus, the results of this study can form the basis for more effective and targeted health interventions.

However, this study has several limitations that need to be considered. This study employed a cross-sectional design, which only observes relationships at a single point in time and cannot definitively determine cause-and-effect relationships. Additionally, the relatively small sample size, limited to a single health center, may not be representative of the broader population. However, these limitations should not deter future research. Instead, they should inspire and motivate future researchers to conduct longitudinal studies with more extensive and diverse samples to confirm these findings. Future researchers are also advised to explore other factors that influence the adherence and effectiveness of iron supplementation, such as social support and access to healthcare services, to strengthen existing interventions further.

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