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Use of moringa oleifera for anemia in pregnant women at wini

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ABSTRACT

Untreated anemia in pregnant women can have an impact on fetal development and even death in the mother. North Central Timor Regency, is very rich in Moringa (Moringaoleifera) plants which are well known for their benefits and are very easy to obtain. This study aims to determine the effect of using Moringa leaves on the treatment of anemia in pregnant women at the Wini Health Center. Design of this reseach Analytical observational study with cross sectional approach. By purposive sampling technique obtained a sample of 31 respondents, independent variables eating habits and consumption of tea and the dependent variable anemia. This research is an experimental research (pre-experiment) with a one group pre-post test design. This study only used one group of subjects, measurements were taken before and after treatment. The paired T-Test statistical test was used to determine the relationship between the two variables. The research results showed that after treatment, almost all pregnant women had hemoglobin levels in the normal range (> 11.5 g/dl; 67, 8%) and mild anemia as many as 10 respondents (<11.5g/dl; 32.2%). Analysis using the paired T-Test statistical test resulted in p = 0.000 < 0.05, which means there is an influence of the use of Moringa leaves on the treatment of anemia in pregnant women. Giving Moringa leaves as a preparation or vegetable helps to increase hemoglobin, therefore it is recommended to educate the public about consuming Moringa leaves, especially for pregnant women as an additional supplement besides Fe tablets.

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1. Introduction

Anemia is still a problem that is often found in pregnant women. Anemia that is not treated properly will have a negative impact on the fetus, because hemoglobin is related to the transport of oxygen throughout the mother's body tissues and of course the baby she is carrying. Among ordinary people, anemia is often known as anemia. Anemia is a condition when the level of hemoglobin which is responsible for carrying oxygen in the blood is lower than the normal value, and the pregnancy period is a time when the blood volume increases (hydremia or hemodolution), but as the blood cells increase, less than the increase in plasma results in dilution. Blood (hemphilia) and usually they don't pay much attention to this problem because it is not considered an emergency, because many people don't know in detail about anemia and its dangers to health if it is not treated properly. The Indonesian Ministry of

Health (2019) emphasized that at least half of pregnant women experience anemia caused by a lack of iron intake.

Maternal Mortality Rate (MMR) is an indicator of the success of health services in a country. Maternal death can occur due to several reasons, including anemia. The results of the study showed that the maternal mortality rate was 70% for mothers who were anemic and 19.7% for those who were non-anemic. 15-20% of maternal deaths are directly or indirectly related to anemia where hemoglobin levels fall below normal (Maharani & Sutrisno, 2023; Manik *et al*., 2021; Prautami, 2019).

The World Health Organization (WHO) reports that the prevalence of pregnant women experiencing iron deficiency anemia is around 35-75%, increasing with increasing gestational age and it is estimated that 30-40% of the causes of anemia are due to iron deficiency and (WHO) estimates that 800 women die every day due to this. complications of pregnancy and birth. According to the WHO report in 2019, the maternal mortality rate (MMR) in the world was 89,000. In Asia, the prevalence of anemia in pregnant women is around 48.2% (2005) (McLean *et al*., 2009).

In 2010 it was around 48% and in 2016 it was around 48.1% (WHO, 2021). Meanwhile in Indonesia, the incidence of anemia or lack of blood in pregnant women is still relatively high, in 2016 it was around 42% (WHO, 2021) and in 2018 it was around 48.9% (according to the Indonesian Ministry of Health in 2019). This condition shows that anemia is quite high in Indonesia and shows a figure approaching a serious public health problem with an anemia prevalence limit of more than 40% (Ministry of Health of the Republic of Indonesia, 2021).

Based on the East Nusa Tenggara Province Health Service Profile, 46.2% of pregnant women experience anemia (NTT Provincial Health Office Data Unicef, 2015). In 2018, the achievement of pregnant women receiving Fe 90 tablets in the province was 94.1% (NTT Provincial Health Office, 2024). In 2020, the prevalence of anemia in pregnant women in the city of Kupang was 1,943 cases (46%) (NTT Provincial Health Office, 2024). In North Insana sub-district, anemia cases are relatively high, namely 33 anemic pregnant women out of a total of 75 pregnant women or 44% in 2023 (NTT Provincial Health Office, 2024). If not handled properly, anemia in pregnant women can cause various problems in pregnancy.

The impacts for mothers who experience anemia during pregnancy include abortion, premature birth, easy infection, antepartum hemorrhage, premature rupture of membranes (KPD), during labor it can result in vaginal disorders, the first stage can last a long time, and abandoned labor occurs, and During the puerperium, subinvolution of the uterus occurs, causing post-partum bleeding and puerperium infection (Abu-Ouf & Jan, 2015; Goretik *et al*., 2021). The results of research conducted by Iqbal & Ekmekcioglu (2019) and Kassebaum *et al* (2014) explained that the negative effects caused by anemia during pregnancy are premature birth, low birth weight (LBW), neonatal and fetal death and maternal death. Apart from the direct consequences of iron deficiency in pregnant women, this is associated with brain development and function in childhood and continues into adulthood (Berglund *et al*., 2017; Radlowski & Johnson, 2013). Therefore, anemia in pregnancy requires special attention from the government regarding this problem.

The provincial government of East Nusa Tenggara in its program requires the heads of district governments to appeal to all communities to plant Moringa oleifera leaves and cultivate them. Head of the NTT Province PKK Mobilization Team, Julie Sutrisno Laiskodat, told RRI that NTT's moringa plants are in second place in the world after Spain. This shows that the quality of Moringa in NTT is very beneficial for public health, one of which is helping reduce anemia or anemia in pregnant women.

Moringa leaves (Moringa oleifera) are one of the green vegetables that can increase blood hemoglobin levels. Research on the nutritional content of Moringa leaves revealed that Moringa leaves contain 4 times more beta-carotene than carrots, 17 times more calcium than milk and 25 times more iron than spinach. Moringa leaves have more antioxidants than other green leaves (Gopalakrishnan *et al*., 2016). Local resource-based interventions such as the use of moringa leaves (Moringa oleifera) as an alternative or complementary treatment for anemia in pregnant women are gaining more attention in the context of regions with limited access like East Nusa Tenggara (NTT). Moringa leaves are a local plant rich in iron, vitamin A, vitamin C, and protein, which synergistically can help increase hemoglobin

levels. Compared to pharmaceutical iron supplementation, moringa-based interventions have advantages in terms of cultural acceptance, local availability, and sustainable potential.

Clinically, several studies have shown that regular consumption of moringa leaves has comparable effectiveness in increasing hemoglobin levels in pregnant women and women of childbearing age. For example, research by Kurniasih and Rahayu (2021) showed that the consumption of moringa leaf powder 2 times a day for 2 weeks can significantly increase Hb levels in pregnant women. These results are in line with the research of Daba et al. (2020) which stated that moringa leaf extract was able to significantly increase Hb levels and even had a lower potential for side effects compared to the consumption of Fe tablets.

Although pharmaceutical iron tablets have high and more measurable iron levels, the level of adherence to consumption is often a major obstacle, especially due to side effects such as nausea, constipation, and a metallic taste in the mouth. In the context of regions such as NTT, with geographical and socio-economic challenges, the moringa-based approach has become more relevant because this plant grows well in dry climates and minimal land, and is already known by the local community. Additionally, moringa can be processed into vegetables, tea, or powder, which makes it more flexible in serving.

From a sustainability perspective, the moringa-based approach is more empowering for local communities and supporting family food security. Integrative programs like this are also in line with promotive and preventive approaches in the primary health service system, such as in health centers, and open up opportunities to be implemented as part of national nutrition policies. Thus, although pharmaceutical iron supplementation remains important especially in cases of severe anemia, the integration of moringa-based interventions as a preventive and supportive measure provides a more contextual, sustainable, and friendly alternative to local socio-economic conditions.

Moringa leaves (Moringa oleifera) are a source of protein, vitamin A and vitamin C as well as minerals (iron and calcium, also a source of vitamin B. It has a low fat content. Vitamin A is higher than carrots, calcium content is higher than milk, iron is higher compared to spinach, vitamin C is higher than oranges and more potassium than bananas (Sri Winarti, 2012). This phenomenon shows that Fe tablet supplementation efforts that have been carried out massively have not fully succeeded in reducing the incidence of anemia. This can be caused by various factors, one of which is local socio-economic factors that have a major influence on the effectiveness of health interventions, including the use of local foods such as moringa leaves as an alternative to preventing anemia.

In areas like Wini, the socio-economic conditions of the community also affect how health interventions are received and implemented. Most pregnant women come from families with low levels of education. This low level of education has a direct impact on the mother's understanding of the importance of balanced nutritional intake during pregnancy and on knowledge about the benefits of local foods such as moringa leaves. In addition, limited family incomes often limit the economy's ability to meet nutritional needs as a whole.

In fact, moringa is a plant that is easy to grow in the surrounding environment and is very rich in iron, vitamin A, vitamin C, and protein which are very beneficial for pregnant women (Mahmudiono et al., 2020). However, although moringa is available naturally, not all people make optimal use of it. This is due to eating habits and cultures that are not used to consuming moringa, especially in processed forms that suit the needs of pregnant women.

Limited access to information and lack of nutrition counseling activities are also obstacles. Many pregnant women in this area do not get adequate information about the proper way to process moringa leaves so that their nutritional content is maintained and easy to consume in a culturally accepted form. In addition, the limited number of health workers and health care facilities in remote areas such as Wini also affected the success of the intervention. Monitoring and assistance for pregnant women with anemia cannot be carried out intensively, so alternative interventions, such as the administration of moringa leaf extract, require a more contextual and sustainable approach.

Support from the health center or health cadre is very important to ensure that pregnant women not only get food such as moringa, but also understand the benefits and are willing to consume

it regularly. Taking into account all these factors, interventions based on the use of moringa leaves have great potential to become an alternative solution that is cheap, easily accessible, and highly nutritious for pregnant women in the Wini area. However, its success is largely determined by an approach that pays attention to socio-economic, cultural, and educational aspects of the community. Targeted education, strengthening the role of health workers, and innovation in processing moringa into a more easily consumed form will greatly determine the effectiveness of this intervention in reducing the incidence of anemia among pregnant women.

Based on the background description above, researchers want to research: "Utilization of Moringa leaves in the treatment of anemia in pregnant women at the Wini Community Health Center, Insana District North Central Timor Regency" Research purposes Knowing the effect of Moringa leaves on the treatment of anemia in pregnant women at the Wini Health Center, North Central Timor Regency.

2. Methods

This research design uses a one group pre and posttest design, which only uses one group of subjects, measurements are taken before and after treatment. The population in the study were all anemic pregnant women at the Wini Community Health Center, North Insana District, North Central Timor Regency who met the inclusion and exclusion criteria, totaling 31 respondents. The sampling technique in this research is purposive sampling. The research location used was the Wini Community Health Center, North Insana sub-district, North Central East Regency. Data collection time was carried out from 17 November 2024 to 30 November 2024. This research used questionnaires and observation instruments. Bivariate data analysis was carried out using the paired T test.

In the implementation of this study, the researcher systematically developed standard operating procedures (SOPs) for intervention to ensure consistency and accuracy of implementation. The first step is to provide clear and complete information to all respondents about the intervention to be carried out. The researcher explained that respondents would receive an intervention in the form of consumption of moringa leaf vegetables as much as 30 grams per day, consumed once a day for 14 consecutive days. Respondents were given the flexibility to choose the time of consumption—morning, afternoon, or evening—according to their habits and comfort. This information was delivered in easy-to-understand language, with a persuasive and educational approach, so that respondents felt comfortable and willing to participate actively during the intervention period.

Before the intervention began, the researcher examined hemoglobin (Hb) levels as preliminary data using peripheral blood (capillaries). This examination is carried out with the Nesco Hemoglobin tool, which is practical and efficient for use in the field. The Hb examination was then carried out again after 14 days of the intervention ended (posttest), to evaluate the extent of the influence of moringa leaf consumption on hemoglobin levels in pregnant women who were study respondents. The examination procedure is carried out by competent health workers, in accordance with ethical standards and the principles of safety and comfort for respondents. To ensure that respondents actually consumed 30 grams of moringa leaves every day according to a predetermined schedule, the researcher applied several monitoring strategies.

First, regular assistance is provided by health cadres or field enumerators who have received special training. This cadre is tasked with reminding respondents, conducting home visits, and recording consumption compliance in a daily monitoring sheet. Second, respondents were given a consumption control card that they had to fill out every time they consumed moringa vegetables, as a form of self-reporting which was then collected and checked by researchers every three days. In addition, researchers also communicate directly or indirectly through text messages or phone calls, to provide motivation, monitor the obstacles faced, and answer questions that arise during the intervention period. The researcher also built a good and open relationship with the respondents, so that they felt valued and made an important contribution to improving their personal health and the surrounding community. With this approach, it is expected that the level of adherence to the intervention will remain high until the end of the study period, So that the data obtained can accurately reflect the effectiveness of the intervention and can be scientifically accounted for.

3. Results and Discussion

Below are described the results of research on the use of Moringa leaves for treating anemia in pregnant women at the Wini Community Health Center, North Insana District, North Central Timor Regency with a total of 31 respondents according to the sample criteria. Based on its geographical location, the Wini Health Center is located in the Humusu C sub-district, North Insana sub-district, Central Timor Regency with a population of 10,165 people, with details of 5167 men and 4998 women. Postal code: 85674, Telephone number: (0388) 31799, Community health center code: P5305041101, Type of health center: Inpatient, BPJS Health Call Center: 500400. The working area of the Wini Health Center is 5106 km with the following borders: (a) North: Oekusi District of East Leste State, (b) East: Insana Moenleu District, (c) South: Insana Fafinesu District, (d) West: Naibenu District. The responses of respondents by age group can be seen in the following table:

Table 1.
Distribution of Pregnant Women by Age Group at Wini Health Center, Insana Tengah District, North Central Timor Regency

Age group (years)	Frequency	Percentage (%)
< 20	1	3.2
20– 35	4	77.4
>35	6	19.4
Total	31	100,0

Source: Primary Data 2023

Table 1. shows that the most respondents were in the age group 20 - 35 years, namely 24 respondents (77.4%), aged > 35 years (19.4%) and the least age group was <20 years and namely 1 respondent (3.2%).

Table 2.
Distribution of Anemic Pregnant Women Based on Education at the Wini Community Health Center, North Insana District, North Central Timor Regency

Education	Frequency	Percentage (%)
Elementary School	12	38,7
Junior High School	10	32,3
High School	6	19,3
College	3	9,7
Total	31	100,0

Source: Primary Data 2023

Table 2. shows that the most respondents had elementary school education, 12 respondents (38.7%), 10 respondents (32.3%), 10 respondents (32.3%), 6 respondents (19.3%) and the least had PT education. 3 respondents (9.7%).

Table 3.
Distribution of anemic pregnant women based on parity at the Wini Health Center, North Insana District, Timor Regency Central North

Paritas	Frekuensi	Persentase (%)
1	8	25,81
2	8	25,81
3	6	19,35
>3	9	29,03
Total	31	100,0

Source: Primary Data 2023

Table 3. shows that respondents generally have a parity of more than three as many as 9 respondents (29.03%), respondents who have a parity of 1 and 2 are 8 respondents (25.81%), and respondents who have a parity of at least 3 are 6 respondents (19.35%).

Tabel 4.
Distribution of Anemic Pregnant Women Based on Hemoglobin Levels of Pregnant Women During Pre-Test and Post-Test

Hemoglobin Levels	Mean ±SD
Pre test	10.5548±0.27669
Post test	11.3613±0.37299

Source: Primary Data 2023

Table 4. shows that the Mean hemoglobin level of the respondents during the pre test was 10.5548 with a standard deviation of 0.27669 while during the post test the respondent's hemoglobin level was 11.32613 with a standard deviation of 0.37299.

Table 5.
Distribution of Pregnant Women with Anemia Based on Respondents' Hemoglobin Levels If Categorized as Anemia and Normal at the Wini Health Center, North Insana District, North Central Timor Regency

Anemia	Pre test		Post test	
	N	%	N	%
Yes	31	100	10	32
No	0	00,0	21	68
Total	31	100	31	100

Source: Primary Data 2023

Discussion

a. Analysis of the incidence of anemia before administering Moringa leaves at the Wini Health Center. Based on table 5. it was found that before the action of giving Moringa leaf vegetables, of the total cases of anemia in the Wini health center, 31 respondents experienced mild anemia out of 75 pregnant women (44%) and after the intervention, anemia cases became 10 cases (13.3%) in the Wini health center area. Anemia in pregnancy is a condition of decreased blood hemoglobin levels due to iron deficiency with hemoglobin levels in the first trimester and third trimester <11 gr/dl and hemoglobin levels in the second trimester <10.5 gr/dl. This limit value and the difference with the condition of non-pregnant women is due to hemodilution, especially in pregnant women in the second trimester (Lauer *et al*., 2024; Means, 2020). Meanwhile, according to the American National Institute of Health (NIH) 2011, anemia occurs when the body does not have a sufficient number of red blood cells due to a lack of iron (Fikawati *et al*., 2017).

Based on research results, there are still many cases of anemia in pregnant women in the Wini Community Health Center area, which is caused by several factors, including: a) Age, table 1. shows that the majority of respondents were in the 20 – 35 year age group, 24 respondents (77.4%), while the risk group for experiencing anemia was (22.6%). This means that in the Wini Health Center area, ages that are not susceptible to anemia dominate the incidence of anemia, which is the cause of anemia in pregnant women. Pregnant women aged 20-35 years are biologically not in optimal mental condition. The emotions of pregnant women tend to be unstable. Pregnant women easily experience shocks due to their mental immaturity in facing the transition period of becoming a mother, which often results in a lack of attention to meeting nutritional needs. There are many various factors that influence each other and do not rule out the possibility of getting pregnant even at a mature age, namely aged 20-35 years, the incidence of anemia is much higher (Amini *et al*., 2018). b) Education, table 2. Shows that the most respondents had elementary education as many as 12 respondents (38.7%), and the least had tertiary education as many as 3 respondents (9.7%). Education has an influence on improving thinking abilities, someone who has a higher education will be able to make more reasonable decisions, and in general will

be more open to accepting changes and new things compared to those with a low education. The higher a person's level of education, the higher their ability to receive information. c) Parity, table 3. shows that respondents generally have a parity of more than three as many as 9 respondents (29.03%), respondents who have a parity of 1 and 2 are 8 respondents (25.81%), and respondents who have a parity of at least 3 are 6 respondents (19.35%).

Maternal parity is the number of births experienced by the mother, whether live births or not, but does not include abortions. Parity influences the incidence of anemia in pregnancy, the more often a woman is pregnant and gives birth, the greater the risk of experiencing anemia because pregnancy depletes iron reserves in the body (Syakira Husada, 2008).

b. Analysis of the incidence of anemia in pregnant women after giving Moringa leaves at the Wini Health Center. Based on table 5, it was found that after giving Moringa leaf vegetables, a total of 31 respondents were anemic, 21 respondents (67.7%) were in the normal category (>11.0g/dl) and 10 respondents (32.3%) were still in the mild anemia category (< 11.0g/dl).

Moringa (Moringa oleifera L.) is a small plant with a height of 7 – 12 m. Moringa is a plant with stems and is a type of woody plant so it is hard and strong, has a round shape, a rough surface and grows upwards. The leaves are green to brownish green. The leaves are egg-shaped, 1 – 3 cm long and 4 mm to 1 cm wide. The taproot is white and rounded like a radish. The flowers are yellowish white and have five petals surrounding five stamens. The seeds are round and brownish in color. The plant can grow in many semi-tropical and tropical countries, one of which is Indonesia, especially in the Timor plains. Moringa leaves grow abundantly and can thrive in the rainy and hot seasons and Moringa leaves are known by different names (Patil *et al*., 2022; Trigo *et al*., 2021).

Giving Moringa leaves to pregnant women with anemia is a complement to health (Ristica, 2019) because the content of Moringa leaves can increase hemoglobin levels due to the high iron content. The details of the content of fresh Moringa leaves are as follows: (a) Protein: 6.8 g, (b) Fat: 1.7 g, (c) Beta-carotene (Vitamin A): 6.78 mg, (d) Thiamin (Vitamin B1): 0.06 mg, (e) Riblofamin (Vitamin b2): 0.05 mg, (f) Vitamin C: 220 mg, (g) Calcium: 440 mg, (h) Calories: 92 cal, (i) Carbohydrates: 12.5 g, (j) Fiber: 0.9 g, (k) Ferum (iron): 0.85 mg, (l) Magnesium: 42 mg, (m) Phosphorus: 70 mg, (n) Potassium: 259 mg as well, (o) Zinc: 0.16 mg (Rahayu *et al*., 2024). Research on the nutritional content of Moringa leaves revealed that Moringa leaves contain 4 times more beta-carotene than carrots, 17 times more calcium than milk and 25 times more iron than spinach. Moringa leaves have more antioxidants than other green leaves(Gopalakrishnan *et al*., 2016).

In this study, there were 31 respondents who, before being given Moringa leaf vegetables, had cases of anemia in pregnant women in the mild anemia category. Meanwhile, 30 grams of Moringa leaves have been given for 14 days. The incidence of cases of anemia in pregnant women in the mild anemia category was 10 respondents and in normal pregnant women there were 21 respondents. There are still cases of anemia from 31 cases to 10 cases of anemia. Of the 10 cases of pregnant women with anemia, we monitored and analyzed that there was no increase in Hb after giving Moringa leaves. This is because pregnant women do not consume Moringa leaves regularly and do not comply with the SOP (processing of Moringa leaves. correct).

c. Analysis of the effect of using Moringa leaves on the treatment of anemia in pregnant women at the Wini Health Center. The research results in table 4.8 show that the benefits of Moringa leaves in treating anemia in pregnant women before and after the intervention. The results of quantitative data analysis using the Paired T-Sample Test with the help of the SPSS computer program obtained a mean of -.80645 while the standard deviation was .31931 and with a significance of 0. .01 produces a P value = 0.00 which is smaller than the value □ = 0.05 (0.00 < 0.05) so that H0 is rejected and H1 is accepted, which means there is an influence of the use of Moringa leaves on the treatment of anemia in pregnant women at the Community Health Center. Wini, North Insana sub-district, North Central Timor regency.

Anemia in pregnant women can increase the risk of various health problems for both the fetus and mother. The risks of health problems that can be experienced include low birth weight (LBW)

babies, babies experiencing congenital defects, mothers experiencing miscarriages, bleeding before and during delivery, and even the risk of death for the mother and baby (Stephen *et al*., 2018).

Basically, the need for iron during pregnancy will increase, especially in the final trimester of pregnancy. Based on the Ministry of Health's Nutritional Adequacy Rate (AKG) table 2019, pregnant women in the second and third trimesters need additional iron intake of 9 mg per day in addition to iron requirements based on their age. Considering the high amount of iron required, the risk of anemia in pregnant women is very high. Pregnant women's initial hemoglobin levels are determined by their consumption habits and nutritional status. All pregnant women have received iron tablets from local health services, but there are still pregnant women who are anemic. Pregnant women need to pay attention to iron intake in their daily consumption, need additional supplements such as Fe tablets and foods that are high in iron such as Moringa leaves (Lidia *et al*., 2020; Saputri *et al*., 2020).

In 100 mg of Moringa leaf soup contains 0.85 mg of iron, there is also 6.7 gm of protein, and 1.7 gm of fat, energy of 92 Kcal, 440 mg (Ca) calcium, 0.8 mg of Niacin or commonly known as B3, 0.05 mg Riboflavin or commonly known as Vitamin B2, 0.06 mg Thiamine or commonly known as B1 and finally 220 mg Vitamin C (Akande & Olorunsogo, 2019; Thenmozhi & Bhuvaneshwari, 2020). Moringa leaf vegetables can increase hemoglobin levels so that they can deal with the problem of anemia in pregnant women in the Wini Health Center working area. Apart from being economical, Moringa plants are very easy to obtain. This complementary therapy can support Fe tablets taken by pregnant women.

This research is relevant to Simangunsong *et al* research 2023 showing an increase in the average Hb of pregnant women (30 people) after being given Moringa leaf extract + honey from 10.17gr% to 11.1gr%. Moringa leaf extract is put into capsules (per capsule 500 mg), dose 2 x 2 a day for 15 days, given together with honey. Iriani's research (2023) states that giving Moringa leaves with extract or flour put into capsules still has useful properties for significantly increasing the hemoglobin levels of anemic pregnant women, as well as if Moringa leaves are consumed directly as a vegetable. This is because Moringa leaves contain high levels of iron and vitamin C.

4. Conclusion

The use of moringa leaves as a nutritional intervention in overcoming anemia in pregnant women has the potential for a significant long-term impact on improving maternal health status, as well as supporting the sustainability of maternal health programs in the work area of the Wini Health Center. Moringa leaves (Moringa oleifera) are known as local plants that are rich in essential nutrients, especially iron, vitamin A, vitamin C, and vegetable proteins that play an important role in the process of hemoglobin formation. Regular consumption of moringa leaves in the right amount has the potential to increase pregnant women's hemoglobin levels continuously, so that it can reduce the prevalence of anemia in the long term.

The positive impact of the use of moringa leaves is not only limited to improving individual health conditions, but also strengthening local food security and community empowerment. Since moringa plants are easy to cultivate and do not require special care, this strategy can be used as a community-based approach that is inexpensive and easy to implement. That way, this intervention can be integrated into sustainable maternal health programs, such as pregnant women's classes, posyandu, or supplementary feeding (PMT) programs at the Wini Health Center.

In the long term, consistent cultivation and utilization of moringa has the potential to reduce reliance on pharmaceutical iron supplements that are sometimes less effective due to compliance issues or side effects. Local food-based interventions such as moringa are also more easily accepted by the community because they are natural, affordable, and in accordance with the local cultural and socio-economic context. This will strengthen the promotive and preventive efforts of the Health Center in improving the nutrition of pregnant women, as well as being a long-term solution in reducing the incidence of anemia which is still quite high in the region.

More than that, moringa interventions can be used as part of sustainable nutrition education. For example, by integrating moringa processing in health cadre training, healthy cooking training, and housewife empowerment programs, the benefits will be felt across generations. With this approach, the Wini Health Center not only focuses on handling anemia as a disease, but also encourages changes in

behavior and consumption patterns that are healthier and more sustainable. Interventions based on the consumption of moringa leaves (Moringa oleifera) in the management of anemia in pregnant women show promising effectiveness and have the potential to be recommended more widely to other regions, despite having different geographical and socioeconomic characteristics. This is because the advantages of moringa leaves lie not only in their high nutritional content, but also in their flexibility of use and potential adaptation in various local contexts.

However, it should be noted that the effectiveness of this intervention is not solely determined by its nutritional content, but also by the level of public acceptance, availability of raw materials, eating culture, and the capacity of local health workers to educate and monitor consumption. In areas with climates and soils that allow the growth of moringa, this intervention can be applied immediately, either in the form of fresh consumption or processed such as powders or capsules. On the other hand, in areas that do not support moringa cultivation, this approach can still be applied through the distribution of processed materials or cooperation between regions that have a surplus of moringa production.

From a socio-economic perspective, the use of moringa leaves is very relevant in areas with limited access to pharmaceutical supplements or expensive health services. Low cost and ease of processing make moringa an efficient and sustainable intervention option. On the other hand, in areas with better economic conditions and adequate access to pharmaceuticals, moringa interventions can be recommended as a complement to national nutrition strategies, especially to encourage healthy consumption patterns based on natural ingredients.

It is also important to note that the success of the adoption of these interventions in various regions is greatly influenced by local policy support, the involvement of community health cadres or workers, and consistent education to pregnant women and families. Therefore, the effectiveness of this intervention will be more optimal if it is integrated into comprehensive maternal health programs, such as pregnant women's classes, posyandu, and healthy living community movements (Germas). Considering its flexibility, moringa leaf intervention is very feasible to be recommended as an alternative and complementary strategy in reducing the prevalence of anemia in pregnant women in various regions of Indonesia, as long as its application is adjusted to local conditions and supported by an adaptive and responsive health service system.

Based on the researcher's direct experience in this research process, there were several limitations experienced and there could be several factors that future researchers could pay more attention to in further perfecting their research because this research itself certainly has shortcomings and continues to need improvement. Some of these limitations include: (a) The research time was only 14 days so the research results were less than optimal because there were still several respondents who experienced anemia. (b) The research object was not given intervention homogeneously, thus affecting the research results. (c) There were still respondents who did not experience a significant increase in HB after being given the intervention, namely of the 31 respondents there were still 10 respondents who were still in the mild anemia category, possibly because the respondents did not comply with the SOP for giving Moringa leaves.

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