



The Effect of Kelakai Vegetable Consumption on Hemoglobin Level Improvement among Pregnant Women at Bentot Community Health Center

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Abstract. Background : Anemia during pregnancy remains a significant public health concern because it increases the risk of maternal and fetal complications. In addition to iron supplementation, the utilization of iron-rich local food sources, such as kelakai (*Stenochlaena palustris*), may help improve hemoglobin levels. This study aimed to determine the effect of kelakai vegetable consumption on hemoglobin levels among pregnant women at Bentot Public Health Center. Methods : A quantitative study with a pre-experimental One Group Pretest–Posttest Design was conducted involving 60 pregnant women selected through purposive sampling based on predetermined inclusion criteria. Hemoglobin levels were measured before and after a 14-day intervention using a digital hemoglobin analyzer. Data were analyzed descriptively and inferentially using the Paired Sample t-test with a significance level of 95%. Results : The mean hemoglobin level increased from 10.12 ± 0.63 g/dL before the intervention to 11.28 ± 0.71 g/dL after consuming kelakai vegetables. Statistical analysis demonstrated a significant improvement in hemoglobin levels following the intervention ($p < 0.001$). These findings indicate that regular consumption of kelakai vegetables contributes positively to increasing hemoglobin levels among pregnant women. Conclusion : Consumption of kelakai vegetables has a significant effect on improving hemoglobin levels in pregnant women at Bentot Public Health Center. As an iron-rich indigenous vegetable, kelakai has the potential to serve as a complementary nutritional intervention for preventing maternal anemia. Future studies employing randomized controlled trials with larger sample sizes are recommended to strengthen the evidence regarding the effectiveness of this intervention.

Keywords : Anemia; Hemoglobin; Kelakai; Local Food; Pregnant Women.

1. Introduction

Anemia during pregnancy remains a major public health concern with substantial consequences for both maternal and fetal health. It is defined as a hemoglobin (Hb) concentration below 11 g/dL in pregnant women and is primarily associated with the increased physiological demand for iron that accompanies pregnancy when nutritional intake is insufficient to meet these requirements. Maternal anemia has been linked to a higher risk of preterm birth, low birth weight, postpartum hemorrhage, and increased maternal and neonatal morbidity and mortality. Although iron and folic acid supplementation programs have been widely implemented in Indonesia, the prevalence of anemia among pregnant women remains high. Consequently, complementary nutritional strategies utilizing locally available, iron-rich food sources have gained increasing attention as sustainable approaches to anemia prevention and management (World Health Organization [WHO], 2024; Ministry of Health of the Republic of Indonesia, 2023). Pregnancy induces several physiological adaptations, including a greater expansion of plasma volume relative to red blood cell mass, resulting in physiological hemodilution. As a consequence, hemoglobin concentrations naturally decline, particularly during the second and third trimesters. When the increased demands for iron, folate, vitamin B12, and vitamin C are not adequately met, this physiological reduction may progress to pathological anemia. In addition to these physiological changes, hemoglobin status is influenced by multiple factors, including adherence to iron supplementation, dietary habits, nutritional status, infectious diseases, and socioeconomic conditions. Therefore, comprehensive nutritional interventions that combine routine supplementation with the utilization of nutrient-rich local foods are increasingly recognized as effective strategies for improving maternal nutritional status during pregnancy (WHO, 2024; Ministry of Health of the Republic of

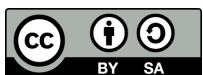
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Indonesia, 2023). National health reports continue to identify maternal anemia as a significant challenge to improving maternal health outcomes in Indonesia. The burden of anemia remains particularly high in regions where access to nutritious foods is limited. Beyond its adverse effects on maternal well-being, anemia compromises fetal growth and development by reducing the delivery of oxygen and essential nutrients to the fetus. Although integrated antenatal care services have incorporated promotive, preventive, and curative interventions to address this issue, their effectiveness remains constrained by poor adherence to iron supplementation and limited dietary diversity, particularly regarding the consumption of iron-rich foods (Ministry of Health of the Republic of Indonesia, 2023; WHO, 2024).

In response to these challenges, increasing attention has been directed toward the use of indigenous food resources as complementary nutritional interventions for improving hemoglobin status. Traditional leafy vegetables represent valuable sources of non-heme iron, vitamins, minerals, and antioxidant compounds that support erythropoiesis when consumed regularly. The promotion of locally available foods also aligns with Indonesia's national food diversification initiatives because these resources are affordable, accessible, culturally acceptable, and readily incorporated into local dietary practices. Consequently, investigating the nutritional benefits of local food resources has become increasingly relevant for strengthening maternal nutrition programs and reducing the prevalence of anemia among pregnant women (Food and Agriculture Organization [FAO], 2022; Ministry of Health of the Republic of Indonesia, 2023).

Kelakai (*Stenochlaena palustris*), an indigenous edible fern widely distributed across Kalimantan, has traditionally been consumed as a vegetable by local communities. Phytochemical and nutritional studies have demonstrated that kelakai contains iron, vitamin C, protein, flavonoids, polyphenols, and various antioxidant compounds that may contribute to red blood cell formation and hemoglobin synthesis. Furthermore, its vitamin C content enhances the intestinal absorption of non-heme iron, thereby potentially improving hemoglobin concentrations more effectively when consumed consistently. Owing to these nutritional characteristics, kelakai has emerged as a promising functional food that may serve as a complementary dietary intervention alongside conventional iron supplementation during pregnancy (Andarwulan et al., 2021; Nurhayati et al., 2022).

Previous studies have explored the effects of kelakai consumption on hemoglobin status among several population groups, including adolescent girls, women of reproductive age, and postpartum mothers. Most of these investigations reported significant improvements in hemoglobin levels following the consumption of kelakai in various forms, including cooked vegetables, capsules, and plant extracts. Nevertheless, the magnitude of these benefits has varied considerably across studies due to differences in preparation methods, dosage, intervention duration, participant characteristics, and compliance with the intervention. Moreover, many previous studies were conducted with relatively small sample sizes, limiting the generalizability of their findings. Therefore, further research employing more rigorous study designs and involving pregnant women is needed to generate stronger evidence regarding the effectiveness of kelakai as a nutritional intervention for improving hemoglobin levels during pregnancy (Sari et al., 2021; Rahmawati et al., 2023).

A review of the existing literature reveals a significant research gap regarding the use of kelakai (*Stenochlaena palustris*) as a local food-based nutritional intervention for pregnant women, particularly within primary healthcare settings. Studies specifically examining the effect of kelakai vegetable consumption on hemoglobin improvement among pregnant women attending community health centers remain limited. Most previous investigations have focused primarily on the nutritional composition of kelakai or evaluated the efficacy of its extracts in populations other than pregnant women. Furthermore, only a few studies have assessed kelakai in its traditional vegetable form, which reflects the customary dietary practices of local communities and therefore offers greater potential for practical implementation in routine healthcare services. These limitations highlight the need for more applied research capable of generating evidence that is directly relevant to maternal nutrition programs and primary healthcare practice (Nurhayati et al., 2022; Rahmawati et al., 2023).

The Bentot Community Health Center (UPTD Puskesmas Bentot) is a primary healthcare facility that routinely provides antenatal care services, including regular monitoring of hemoglobin levels among pregnant women. Although iron supplementation has been incorporated into standard antenatal care, cases of low hemoglobin levels continue to be identified, placing pregnant women at increased risk of pregnancy-related complications if left untreated. The widespread availability and traditional use of local food resources within the surrounding community present an opportunity to introduce kelakai vegetables as a complementary nutritional intervention for improving maternal hemoglobin levels. Therefore, conducting this study in the Bentot Community Health Center is of considerable practical importance, as its findings may support the development of evidence-

based nutrition education programs that promote the utilization of locally available food resources. The novelty of this study lies in its evaluation of kelakai (*Stenochlaena palustris*) consumed as a natural vegetable, rather than as an extract or dietary supplement, for improving hemoglobin levels among pregnant women receiving antenatal care at the Bentot Community Health Center. Unlike many previous studies that investigated processed kelakai products or involved non-pregnant populations, this research assesses the effectiveness of kelakai in the form most commonly prepared and consumed in everyday meals. By focusing on a practical and culturally acceptable dietary intervention, this study is expected to generate findings that are readily applicable in primary healthcare settings and contribute to the development of community-based nutrition interventions that complement existing iron supplementation programs while promoting the use of indigenous food resources.

Based on these considerations, investigating the effect of kelakai vegetable consumption on hemoglobin levels among pregnant women at the Bentot Community Health Center is both timely and necessary. This study aims to analyze whether regular consumption of kelakai vegetables contributes to improvements in maternal hemoglobin levels, thereby providing scientific evidence regarding the effectiveness of locally available food resources as supportive nutritional interventions for the prevention and management of anemia during pregnancy. The findings are expected to assist healthcare professionals in developing nutrition education strategies based on indigenous food resources and to provide evidence for policymakers in designing promotive and preventive maternal health programs aimed at improving the health outcomes of both mothers and their infants (WHO, 2024; Ministry of Health of the Republic of Indonesia, 2023).

2. Literature Review

Anemia in Pregnancy

Anemia is a hematological condition characterized by a hemoglobin (Hb) concentration below the normal reference range, resulting in a reduced capacity of the blood to transport oxygen to body tissues. During pregnancy, anemia is defined as a hemoglobin level of less than 11 g/dL and is predominantly caused by iron deficiency due to the increased physiological demands of gestation. However, other contributing factors include deficiencies of folate and vitamin B12, infectious diseases, chronic illnesses, and inadequate dietary intake. Maternal anemia is associated with numerous adverse pregnancy outcomes, including fatigue, impaired immune function, preterm delivery, low birth weight, and increased risks of maternal and neonatal morbidity and mortality. Consequently, anemia prevention requires not only routine iron supplementation but also adequate consumption of nutrient-rich foods that provide iron and other essential micronutrients involved in erythropoiesis (World Health Organization [WHO], 2024; Ministry of Health of the Republic of Indonesia, 2023).

Hemoglobin and Factors Affecting Its Concentration

Hemoglobin is an iron-containing protein located within erythrocytes that plays a vital role in transporting oxygen from the lungs to peripheral tissues while facilitating the return transport of carbon dioxide. Adequate hemoglobin synthesis depends on sufficient availability of iron, protein, folate, vitamin B12, vitamin B6, and vitamin C, the latter of which enhances the intestinal absorption of non-heme iron. During pregnancy, physiological plasma volume expansion exceeds the increase in red blood cell mass, producing hemodilution and a natural decline in hemoglobin concentration, particularly during the second and third trimesters. When maternal nutritional requirements are not adequately fulfilled, hemoglobin synthesis becomes impaired, increasing the likelihood of developing anemia. Therefore, maintaining optimal maternal nutrition throughout pregnancy is fundamental to preserving normal hemoglobin levels and supporting healthy maternal and fetal outcomes (Cunningham et al., 2022; WHO, 2024).

Potential of Kelakai (*Stenochlaena palustris*) as a Local Food Resource

Kelakai (*Stenochlaena palustris*) is an indigenous edible fern widely distributed throughout Kalimantan and has long been consumed as a traditional leafy vegetable by local communities. Nutritional analyses have demonstrated that kelakai is a valuable source of iron, vitamin C, protein, calcium, flavonoids, and antioxidant compounds that may contribute to erythropoiesis and hemoglobin synthesis. Its vitamin C content further enhances the bioavailability of non-heme iron by promoting intestinal absorption, thereby potentially improving hemoglobin levels when consumed regularly. In addition to its nutritional value, kelakai is inexpensive, readily available, and culturally accepted as part of the local diet. These characteristics make it a promising food-based intervention for supporting maternal nutrition and complementing existing strategies for preventing anemia during pregnancy through the utilization of indigenous food resources (Andarwulan et al., 2021; Nurhayati et al., 2022).

Previous Studies

A growing body of evidence has demonstrated the potential benefits of kelakai consumption for improving hemoglobin status. A study conducted by Sari et al. (2021) reported significant increases in hemoglobin levels among women of reproductive age following the consumption of kelakai-based food products. Similarly, Nurhayati et al. (2022) concluded that the iron and antioxidant content of kelakai may enhance erythropoiesis and contribute to improved hemoglobin concentrations. Furthermore, Rahmawati et al. (2023) observed a greater improvement in hemoglobin levels among participants who received kelakai compared with those in the control group. Despite these encouraging findings, most previous studies have focused on non-pregnant populations or have investigated kelakai in the form of extracts or dietary supplements rather than as a commonly consumed vegetable. Consequently, evidence regarding the effectiveness of consuming fresh or cooked kelakai vegetables among pregnant women in primary healthcare settings remains limited. This gap in the literature provides a strong rationale for conducting the present study.

Conceptual Framework

This study is based on the conceptual assumption that regular consumption of kelakai (*Stenochlaena palustris*) as a locally available vegetable rich in iron, vitamin C, and other bioactive compounds may enhance iron availability for hemoglobin synthesis. Iron serves as a fundamental component in erythropoiesis, while vitamin C facilitates the intestinal absorption of non-heme iron, thereby improving its bioavailability. The combined nutritional properties of kelakai are therefore expected to support red blood cell production and contribute to increased hemoglobin concentrations among pregnant women.

Accordingly, this study proposes that consistent consumption of kelakai vegetables has the potential to produce a positive effect on maternal hemoglobin levels during pregnancy. This theoretical assumption forms the basis of the study's conceptual framework, in which kelakai vegetable consumption is treated as the independent variable, while hemoglobin concentration in pregnant women serves as the dependent variable. The framework is intended to examine whether regular dietary intake of kelakai is associated with improvements in maternal hemoglobin status and may therefore represent a practical, food-based strategy for supporting anemia prevention during pregnancy.

3. Research Methods

This study employed a quantitative approach using a pre-experimental One-Group Pretest–Posttest Design to evaluate changes in hemoglobin (Hb) levels among pregnant women following an intervention involving the consumption of kelakai (*Stenochlaena palustris*) vegetables. This design was selected to assess the effectiveness of the intervention by comparing hemoglobin concentrations measured before the intervention (pretest) and after participants had completed the intervention period (posttest). The pretest–posttest comparison enabled direct evaluation of changes in maternal hemoglobin levels attributable to the intervention.

The study was conducted at the Bentot Community Health Center (UPTD Puskesmas Bentot). The study population consisted of all pregnant women attending antenatal care services within the health center's catchment area during the study period. Participants were

recruited using purposive sampling based on predetermined inclusion and exclusion criteria. Eligible participants were pregnant women who voluntarily agreed to participate, had hemoglobin levels below or close to the normal threshold according to the study criteria, and completed the entire intervention protocol. Pregnant women diagnosed with pregnancy-related complications, hematological disorders, or those who did not complete the intervention were excluded from the study.

The independent variable was the consumption of kelakai vegetables, whereas the dependent variable was maternal hemoglobin concentration. Participants received standardized portions of kelakai vegetables at predetermined frequencies throughout the intervention period. Hemoglobin levels were measured using a calibrated digital hemoglobin analyzer that met routine healthcare service standards. In addition, demographic and obstetric characteristics—including maternal age, gestational age, parity, educational level, and occupation—were collected using a structured participant information form to support descriptive analysis.

Data were collected through direct observation and documentation of hemoglobin measurements obtained before and after the intervention. The research instruments consisted of an observation checklist, a participant characteristics questionnaire, and a digital hemoglobin measurement device routinely used in clinical practice. Prior to data collection, all research instruments underwent content validity assessment by subject-matter experts and were considered appropriate for use. Instrument testing demonstrated satisfactory validity, while reliability analysis yielded coefficients that met acceptable standards, indicating that the instruments provided consistent and dependable measurements throughout the study.

Data analysis was performed using both descriptive (univariate) and inferential (bivariate) statistical methods. Univariate analysis was used to summarize participants' demographic characteristics and describe hemoglobin levels before and after the intervention using means, standard deviations, frequencies, and percentages. Prior to inferential analysis, the normality of the data distribution was evaluated using the Shapiro–Wilk test. If the data were normally distributed, differences in hemoglobin levels before and after the intervention were analyzed using the paired-samples t-test. Alternatively, when the normality assumption was not satisfied, the Wilcoxon signed-rank test was employed as the non-parametric alternative. All statistical analyses were conducted using a 95% confidence level, with statistical significance established at $p < 0.05$ (Dahlan, 2020).

The conceptual model of this study illustrates the relationship between kelakai vegetable consumption as the independent variable (X) and changes in maternal hemoglobin concentration as the dependent variable (Y). The intervention variable (X) consisted of regular consumption of kelakai vegetables throughout the intervention period, whereas the outcome variable (Y) was represented by hemoglobin levels measured before and after the intervention. The effectiveness of the intervention was determined by comparing the mean hemoglobin concentrations obtained during the pretest and posttest assessments using appropriate statistical analyses. The findings of this study are expected to provide empirical evidence regarding the effectiveness of kelakai vegetables as a locally available, food-based nutritional intervention for improving hemoglobin levels among pregnant women and supporting anemia prevention during pregnancy.

4. Results and Discussion

This study was conducted at the Bentot Community Health Center (UPTD Puskesmas Bentot) between February and April 2026. The research process began with administrative coordination and collaboration with the health center, followed by participant recruitment based on the predefined inclusion and exclusion criteria. A total of 60 pregnant women met the eligibility requirements, provided informed consent, and successfully completed all stages of the study.

At baseline, participants underwent pre-intervention (pretest) assessment of hemoglobin (Hb) concentration using a calibrated digital hemoglobin analyzer. Following the initial assessment, each participant received the study intervention consisting of standardized portions of kelakai (*Stenochlaena palustris*) vegetables consumed over a 14-day period in conjunction with routine antenatal care services. Upon completion of the intervention, hemoglobin levels were measured again during the post-intervention (posttest) assessment to determine changes in maternal hemoglobin concentration.

Participant demographic and obstetric characteristics, together with all hemoglobin measurement results, were systematically recorded using structured observation forms. The collected data subsequently underwent data management procedures, including editing, coding, data entry, data cleaning, and statistical analysis, using appropriate statistical software to ensure the accuracy, consistency, and reliability of the research findings.

Karakteristik Responden**Table 1.** Karakteristik Responden (n = 60).

Characteristics	Frequency (n)	Percentage (%)
Age(years)		
<20 tahun	6	10,0
20–35 tahun	46	76,7
>35 tahun	8	13,3
Gestational Age		
Second Trimester	25	41,7
Third Trimester	35	58,3
Educational Level		
Primary Education	18	30,0
Secondary Education	31	51,7
Higher Education	11	18,3
Occupation		
Homemaker	42	70,0
Employed	18	30,0

Source: Primary Data, 2026

Based on Table 1, the majority of participants were 20–35 years of age (76.7%), 58.3% were in the third trimester of pregnancy, 51.7% had completed senior high school education, and 70.0% were housewives. These demographic characteristics indicate that most respondents belonged to the optimal reproductive age group, which is generally considered the safest period for pregnancy and is associated with a lower risk of maternal and obstetric complications.

Overview of Hemoglobin Levels Before and After the Intervention**Table 2.** Mean Hemoglobin Levels Before and After Kelakai (*Stenochlaena palustris*) Vegetable Consumption.

Variable	Mean $\pm$ SD	Minimum	Maximum
Before the Intervention	10.12 $\pm$ 0.63	8.80	10.90
After the Intervention	11.28 $\pm$ 0.71	9.90	12.80

Source: Primary Data (Processed), 2026.

Based on Table 2, the mean hemoglobin concentration prior to the intervention was 10.12 $\pm$ 0.63 g/dL, with values ranging from 8.80 to 10.90 g/dL. Following the 14-day intervention involving kelakai (*Stenochlaena palustris*) vegetable consumption, the mean hemoglobin level increased to 11.28 $\pm$ 0.71 g/dL, with measurements ranging from 9.90 to 12.80 g/dL. Descriptive analysis indicates an average increase of 1.16 g/dL in hemoglobin concentration after the intervention, suggesting that regular consumption of kelakai vegetables was associated with an improvement in maternal hemoglobin levels during the study period.

Analysis of the Effect of Kelakai (*Stenochlaena palustris*) Vegetable Consumption on Hemoglobin Levels

Before conducting the bivariate analysis, the data were tested for normality using the Shapiro–Wilk test. The results indicated that hemoglobin levels measured both before and after the intervention were normally distributed ($p > 0.05$). Therefore, the assumption of normality was satisfied, and subsequent analysis was performed using the paired-samples t-test.

Table 3. Results of the Paired-Samples *t*-Test.

Variable	Mean Difference	<i>t</i> -value	<i>p</i> -value
Pretest–Posttest	1.16	12.74	< 0.001

Source: Primary Data (Processed), 2026.

As presented in Table 3, the paired-samples *t*-test demonstrated a mean difference of 1.16 g/dL between pre-intervention and post-intervention hemoglobin levels, with a *t*-value of 12.74 and a highly significant *p*-value (< 0.001). These findings indicate a statistically significant increase in hemoglobin concentration following the consumption of kelakai (*Stenochlaena palustris*) vegetables. Accordingly, the study demonstrates that kelakai vegetable consumption had a significant positive effect on improving hemoglobin levels among pregnant women attending the Bentot Community Health Center (UPTD Puskesmas Bentot).

The findings of this study demonstrate that the consumption of kelakai (*Stenochlaena palustris*) vegetables significantly increased hemoglobin levels among pregnant women. The mean hemoglobin concentration rose from 10.12 g/dL before the intervention to 11.28 g/dL after two weeks of regular kelakai consumption. This improvement suggests that kelakai, as an indigenous nutrient-rich vegetable, has considerable potential to support hemoglobin synthesis in pregnant women with mild anemia or hemoglobin levels approaching the normal range.

The observed increase in hemoglobin concentration can be explained by the physiological mechanisms underlying erythropoiesis. Hemoglobin synthesis requires an adequate supply of iron, protein, folate, vitamin C, and other essential micronutrients. Kelakai (*Stenochlaena palustris*) is recognized as a rich source of iron, vitamin C, protein, flavonoids, and antioxidant compounds, all of which contribute to red blood cell formation. In particular, vitamin C enhances the absorption of non-heme iron by reducing ferric iron (Fe³⁺) to the more readily absorbable ferrous form (Fe²⁺) within the gastrointestinal tract. Improved iron bioavailability facilitates more efficient hemoglobin synthesis and erythropoiesis in the bone marrow, thereby contributing to the significant increase in hemoglobin levels observed following the intervention.

The present findings are consistent with those reported by Sari et al. (2021), who demonstrated that kelakai-based food products significantly increased hemoglobin concentrations among women of reproductive age. Similarly, Nurhayati et al. (2022) concluded that the iron and antioxidant content of kelakai plays an important role in improving hemoglobin status by supporting erythropoiesis. In addition, Rahmawati et al. (2023) observed a positive trend in hemoglobin improvement following kelakai consumption, although the magnitude of the effect varied according to intervention duration, dosage, and participants' adherence to the dietary regimen.

Variations in outcomes across previous studies may be attributed to differences in participant characteristics, nutritional status, gestational age, methods of kelakai preparation, frequency of consumption, and compliance with iron supplementation. In the present study, all participants continued to receive routine antenatal care, including standard iron supplementation. Therefore, the improvement in hemoglobin levels is likely to reflect the synergistic effect of conventional iron supplementation combined with regular consumption of kelakai as a locally available source of iron and other essential micronutrients.

From a statistical perspective, the paired-samples *t*-test yielded a *p*-value of less than 0.001, indicating a highly significant difference between hemoglobin levels measured before and after the intervention. Consequently, the study hypothesis was accepted, confirming that kelakai vegetable consumption exerted a significant positive effect on hemoglobin concentrations among pregnant women. These findings further support the concept that food-based nutritional interventions utilizing indigenous food resources can serve as valuable complementary strategies for preventing and managing anemia during pregnancy.

From a theoretical standpoint, the results reinforce existing concepts in maternal nutrition, which emphasize that increasing dietary iron intake through natural food sources can enhance erythropoiesis and improve hemoglobin synthesis. Moreover, this study contributes additional evidence supporting kelakai as a functional indigenous food with substantial nutritional value. Beyond its high iron content, kelakai provides vitamin C and antioxidant compounds that facilitate iron metabolism and optimize the physiological processes involved in red blood cell production.

The practical implications of this study are noteworthy for maternal healthcare practice. Kelakai vegetables may be promoted as a complementary dietary option for pregnant women, particularly in regions where the plant is readily available. Nutrition education emphasizing the benefits of locally available nutrient-rich foods can be integrated into routine antenatal care and community-based anemia prevention programs at primary healthcare facilities. Such an approach offers a sustainable strategy that complements iron

supplementation by encouraging the consumption of affordable, culturally acceptable, and nutritionally valuable local foods, thereby supporting improvements in maternal hemoglobin status and overall pregnancy outcomes.

The findings of this study indicate that nearly half of the participants reported high levels of exposure to health-related information on social media. This suggests that social media has become one of the primary sources of information for pregnant women seeking knowledge about fetal development, childbirth preparation, maternal nutrition, and pregnancy-related complications. The widespread availability of smartphones enables pregnant women to access health information at any time; however, this convenience also increases the likelihood of encountering inaccurate, misleading, or scientifically unverified content.

Most participants were classified as experiencing moderate levels of anxiety. This finding reflects the considerable psychological and emotional adjustments required during pregnancy. In addition to physiological and hormonal changes, maternal anxiety may be influenced by uncertainty regarding labor and delivery, concerns about fetal health, previous pregnancy experiences, and information obtained from family members, peers, and particularly social media platforms.

Bivariate analysis demonstrated a statistically significant association between exposure to social media information and anxiety levels among pregnant women ($p = 0.001$). Participants with greater exposure to health-related content on social media tended to report higher levels of anxiety. These findings are consistent with the Health Belief Model, which proposes that individuals' perceptions of health threats are shaped by the information they receive. Exposure to content describing pregnancy complications, traumatic childbirth experiences, or unverified health claims may heighten perceived susceptibility and severity, thereby triggering emotional responses such as anxiety.

The findings are also consistent with previous studies. Boursier et al. (2020) reported that excessive exposure to online health information, commonly referred to as *information overload*, is associated with increased anxiety among digital media users. Likewise, Gao et al. (2020) found that frequent social media use is positively associated with psychological distress. Among pregnant women, Nanjundaswamy et al. (2023) concluded that while social media can improve maternal health knowledge, exposure to unverified or misleading information may generate unnecessary concern, particularly among first-time mothers who have limited pregnancy-related experience.

Nevertheless, these findings should not be interpreted as evidence that social media is inherently harmful. When health information is obtained from qualified healthcare professionals, professional organizations, or official public health institutions, social media can serve as an effective tool for improving maternal health literacy and supporting informed decision-making. Therefore, the impact of social media depends not only on the frequency of its use but also on the quality, reliability, and credibility of the information accessed. From a theoretical perspective, this study reinforces the concept that the digital environment constitutes an important psychosocial determinant of maternal mental health. The observed relationship expands existing knowledge regarding the determinants of anxiety during pregnancy, which has traditionally focused on biological, obstetric, and socioeconomic factors, by highlighting the growing influence of digital information exposure on maternal psychological well-being.

From a practical standpoint, these findings provide valuable implications for midwives at PMB Neneng Mahfuzah in developing digital health literacy education as part of routine antenatal care services. Pregnant women should be equipped with the skills to critically evaluate online health information, distinguish credible sources from unreliable ones, and minimize exposure to content that may unnecessarily increase anxiety. Furthermore, the results may inform the development of evidence-based health promotion programs delivered through social media by healthcare facilities, ensuring that pregnant women receive accurate, accessible, and scientifically reliable information to support both maternal and fetal health.

The findings of this study demonstrate that the consumption of *kelakai* (*Stenochlaena palustris*) vegetables had a significant positive effect on hemoglobin levels among pregnant women attending the Bentot Community Health Center (UPTD Puskesmas Bentot). Mean hemoglobin concentrations increased following the intervention, indicating that *kelakai* has considerable potential as an indigenous food source capable of supporting maternal iron requirements during pregnancy. These findings further suggest that food-based nutritional interventions using locally available vegetables may serve as effective complementary strategies for anemia prevention alongside routine iron supplementation, which remains the cornerstone of antenatal care programs (World Health Organization [WHO], 2024; Ministry of Health of the Republic of Indonesia, 2023).

From a physiological perspective, hemoglobin synthesis depends on an adequate supply of iron, protein, folate, vitamin B12, and vitamin C, the latter of which enhances intestinal iron absorption. During pregnancy, maternal iron requirements increase substantially because of expanded blood volume and the nutritional demands of fetal and placental development. Failure to meet these increased requirements can impair erythropoiesis and reduce hemoglobin production, leading to anemia. Kelakai contains both iron and vitamin C, which together may improve iron bioavailability and facilitate more efficient hemoglobin synthesis. This biological mechanism provides a plausible explanation for the significant improvement in hemoglobin levels observed after the intervention (Cunningham et al., 2022; WHO, 2024).

In addition to its iron content, kelakai (*Stenochlaena palustris*) is rich in flavonoids, polyphenols, protein, and naturally occurring antioxidant compounds that contribute to cellular function and hematopoiesis. Antioxidants help reduce oxidative stress, which may otherwise interfere with red blood cell production, while dietary protein provides essential amino acids required for hemoglobin synthesis. Therefore, the beneficial effects of kelakai on hemoglobin status are likely attributable not only to its iron content but also to the synergistic interaction of multiple nutrients and bioactive compounds that collectively support erythropoietic processes (Andarwulan et al., 2021; Nurhayati et al., 2022).

The results of the present study are consistent with previous research demonstrating the positive effects of kelakai consumption on hemoglobin status across different population groups. Sari et al. (2021) reported significant increases in hemoglobin concentrations among women of reproductive age following regular consumption of kelakai-based foods. Likewise, Rahmawati et al. (2023) observed greater improvements in hemoglobin levels among participants receiving kelakai interventions compared with control groups. The consistency of these findings strengthens the growing body of evidence supporting kelakai as a functional indigenous food with potential applications in the prevention and management of anemia (Sari et al., 2021; Rahmawati et al., 2023).

Nevertheless, the observed improvement in hemoglobin levels cannot be attributed solely to kelakai consumption. Several additional factors, including adherence to iron supplementation, habitual dietary intake, gestational age, maternal nutritional status, and overall health conditions, may also influence hemoglobin concentrations during pregnancy. Throughout the study period, all participants continued to receive routine antenatal care, including standard iron supplementation. Consequently, the increase in hemoglobin levels likely reflects the combined effects of conventional supplementation and regular consumption of kelakai vegetables. Therefore, kelakai should be regarded as a complementary nutritional intervention rather than a replacement for established clinical recommendations in maternal healthcare (Ministry of Health of the Republic of Indonesia, 2023; WHO, 2024). From the perspective of public nutrition, promoting the use of locally available food resources offers several advantages. Indigenous foods are generally more affordable, readily accessible, and culturally acceptable within local communities, making them sustainable options for improving dietary quality. This approach is consistent with the principles of food diversification, which emphasize the utilization of local resources to enhance nutritional intake and strengthen food security. Accordingly, kelakai represents a practical and realistic dietary intervention, particularly in regions where the plant is naturally abundant. Beyond improving maternal nutritional status, encouraging its consumption may also support local food systems and reduce dependence on externally sourced food products (Food and Agriculture Organization [FAO], 2022; Ministry of Health of the Republic of Indonesia, 2023).

This study also contributes to the existing body of knowledge in the fields of maternal nutrition and public health. Unlike many previous investigations that examined kelakai in the form of extracts or dietary supplements, the present study evaluated the effectiveness of kelakai consumed as a traditional vegetable prepared in the manner commonly practiced by local communities. This approach enhances the practical relevance of the findings by demonstrating an intervention that can be readily incorporated into routine dietary counseling and nutrition education within primary healthcare settings. Consequently, the study provides additional scientific evidence supporting the use of indigenous food resources as non-pharmacological interventions for preventing anemia during pregnancy (Nurhayati et al., 2022; Rahmawati et al., 2023).

Overall, the findings indicate that regular consumption of kelakai vegetables has the potential to improve hemoglobin levels among pregnant women and may therefore be considered a valuable complementary intervention within maternal anemia prevention programs implemented in primary healthcare facilities. However, several limitations should be acknowledged. The study did not control for all potential confounding variables that may influence hemoglobin concentrations, including daily dietary variation, adherence to iron supplementation, and the presence of underlying medical conditions. Future studies

employing randomized controlled experimental designs, larger sample sizes, longer intervention periods, and more comprehensive control of confounding factors are recommended to generate stronger evidence regarding the effectiveness of kelakai (*Stenochlaena palustris*) vegetable consumption for improving hemoglobin levels during pregnancy (Polit & Beck, 2021; WHO, 2024).

5. Conclusion And Recommendations

The findings of this study indicate that the consumption of kelakai (*Stenochlaena palustris*) vegetables had a positive effect on improving hemoglobin levels among pregnant women attending the Bentot Community Health Center (UPTD Puskesmas Bentot). Statistical analysis demonstrated a significant difference between hemoglobin concentrations measured before and after the intervention, indicating that the study objective—to evaluate the effect of kelakai vegetable consumption on maternal hemoglobin levels—was successfully achieved. These results suggest that kelakai, as a locally available and nutrient-rich food resource, has the potential to serve as a complementary nutritional intervention for the prevention and management of anemia during pregnancy. Nevertheless, the findings should be interpreted with caution because the study was conducted at a single healthcare facility with a specific study population. Therefore, broader generalization of the results requires confirmation through additional studies involving more diverse populations and research settings.

Based on these findings, healthcare professionals working in primary healthcare facilities may consider incorporating kelakai vegetables into nutrition education programs for pregnant women while continuing to emphasize adherence to routine iron supplementation and the importance of maintaining a balanced, nutrient-rich diet. Integrating locally available food resources into antenatal care programs may strengthen both promotive and preventive maternal health strategies, particularly in regions where kelakai is readily accessible and commonly consumed. Several limitations should be acknowledged. The study employed a pre-experimental design without a control group, included a relatively small sample size, and did not control for all potential confounding factors that could influence hemoglobin levels, including variations in daily dietary intake, adherence to iron supplementation, maternal nutritional status, and the presence of underlying medical conditions. Furthermore, the relatively short intervention period may not have been sufficient to evaluate the long-term effects of kelakai consumption on maternal hemoglobin status.

Future research should employ more rigorous study designs, such as **true** experimental studies or randomized controlled trials, incorporating appropriate control groups, larger sample sizes, broader geographic coverage, and longer intervention periods. In addition, subsequent studies should include complementary outcome measures, such as serum ferritin concentration, daily dietary iron intake, adherence to iron supplementation, and comprehensive assessments of maternal nutritional status. Such approaches would provide more robust scientific evidence regarding the effectiveness of kelakai (*Stenochlaena palustris*) as a locally available food-based intervention for improving hemoglobin levels and preventing anemia during pregnancy.

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in accordance with accepted scientific principles and established ethical standards for human subject research. The authors hope that the findings of this study will contribute to the advancement of knowledge in maternal health and nutrition and serve as a valuable reference for the development of evidence-based, local food interventions aimed at preventing anemia during pregnancy.

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