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Changes in Hemoglobin Levels Following Corn and Date Pudding Supplementation Among Anemic Pregnant Women: A Quasi-Experimental Study

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ABSTRACT

Introduction *Anemia commonly affects pregnant women and continues to pose a nutritional challenge, particularly because low hemoglobin levels can compromise maternal health and pregnancy outcomes. Improving dietary intake through supplementary foods prepared from locally available ingredients may help meet the increased nutritional needs of pregnant woman and support the management of anemia during pregnancy. This study was conducted to determine the change in hemoglobin levels among pregnant women after consuming corn and date pudding in the working area of Ngumpakdalem Community Health Center, Bojonegoro Regency.*

Methods *A quasi-experimental study with a one-group pretest-posttest design was carried out involving 30 pregnant women who were selected through total sampling. The participants received corn and date pudding for seven days. Hemoglobin levels were assessed before the intervention and again after the intervention. We analyzed the data using the Wilcoxon signed-rank test.*

Results *found a significant increase in hemoglobin levels following the intervention. The median hemoglobin level increased from 9.30 g/dL before the intervention to 11.10 g/dL afterward (p,0.001).*

Conclusion *these findings suggestthat corn and date pudding could serve as a supplementary food option pregnant womenwith anemia. Incorporating locally available ingredients, such as corn and dates. may providean accessible nutritional alternative to support effort to improve hemoglobin levels and reduce the risk of anemia during pregnancy*

Keywords : *anemia in pregnancy, hemoglobin, corn, dates, supplementary food.*

INTRODUCTION

Anemia remains a significant maternal health concern, particularly among pregnant women in Indonesia. in Indonesia. Low hemoglobin levels during pregnancy can compromise maternal well-being and potentially affect fetal health. Previous evidence has associated maternal anemia with a range of maternal and neonatal complications, highlighting the need to address anemia as art of routine antenatal care. The World Health Organization (WHO) continues to recognize anemia as a major public health issue among woman, with a substantial burden reported in low-and middle-income countries [1]. In Indonesia, anemia in pregnancy continues to require attention within maternal health services [2], [3]. This situation indicates that anemia needs to be prevented. One way to prevent anemia is by taking advantage of the potential of local foods [4].

Hemoglobin carries oxygen throughout the body, and anemia occurs when hemoglobin levels fall below the normal range [5]. Physiological and psychological changes occur during pregnancy. Physiological changes in pregnant women affect hemoglobin concentration. As pregnancy progresses, blood plasma volume increases more rapidly than red blood cell mass, leading to physiological hemodilution and a decrease in hemoglobin concentration [1], [6]. In addition to the physiological changes that cause anemia in pregnant women, insufficient iron intake is also a cause of anemia in pregnant women [7].

Iron and folic acid tablets are interventions used to prevent and treat anemia during pregnancy. The administration of iron tablets is an important part of antenatal care because it helps increase iron levels in pregnant women [3]. However, if a pregnant woman does not take iron supplements regularly, this can increase her risk of developing anemia during pregnancy [8]. In addition to iron supplements, pregnant women should eat foods rich in iron to reduce the risk of anemia and support their own health and the growth of the fetus [9].

The health of the mother and fetus will continue to deteriorate if anemia is not properly managed during pregnancy. Anemia during pregnancy can increase the risk of pregnancy complications, including postpartum hemorrhage [10]. Anemia can increase risks for pregnant women and worsen fetal conditions, such as preterm birth, low birth weight, and impaired fetal growth and development [11] [12]. Complications from anemia require immediate treatment through the provision of nutrients and supplementary foods for pregnant women, such as corn and dates [4][13][14].

Corn (*Zea mays L.*), for example, is commonly available and consumed in many communities. It provides carbohydrates as well as protein, minerals, folate, and B-group

vitamins [15][16]. Incorporating corn into a processed food product may therefore provide nutritional benefits while also creating a practical way to utilize a familiar local commodity. The development of food products based on locally available ingredients can additionally increase the potential value and utilization of these resources within the community [4] [17].

Dates (*Phoenix dactylifera L.*) are another food ingredient with nutritional components that may be relevant to maternal dietary needs. Dates contain minerals, vitamins, dietary fiber, and several bioactive compounds [6], [18]. Dates contain several nutrient, including iron, that may support their use in food based approaches to maintaining hemoglobin status. [19], [20][21]. Combining dates with corn may further improve the nutritional profile of the resulting food product. This combination also allows the incorporation of two local or readily available food ingredients into a single supplementary food for pregnant woman [18][21][6][22][23].

Food products developed from locally available ingredients may also offer practical advantages when they are prepared in forms that are familiar and easy to consume. One such form is pudding, which provides a soft texture and can accommodate different food ingredients [24]. Corn and dates can therefore be combined into a pudding formulation that offers a different way of delivering these food sources as a supplementary food [4], [17]

Previous research has shown that hemoglobin levels in pregnant women increase after consuming foods containing iron and other nutrients that play a role in the process of hematopoiesis [4]. This is supported by other research indicating that dates have a significant effect on increasing hemoglobin levels [6][21]. A combination of corn and dates in the form of pudding can increase hemoglobin levels in pregnant women and is rich in nutrients that are beneficial for both the mother and the fetus.

The novelty of this study lies in the development of corn and date pudding as a dietary supplement made from local food ingredients, as well as the assessment of the effect of the combination of corn and dates on hemoglobin levels in pregnant women. This study aims to determine the effect of corn and date pudding supplementation on hemoglobin levels in pregnant women in the service area of the Ngumpakdalem Community Health Center, Bojonegoro Regency. The findings of this study are expected to contribute to and bring innovation in efforts to prevent and manage anemia during pregnancy.

METHODS

This study employed a quantitative approach with a quasi-experimental, one-group

pretest-posttest design. This design was used to determine changes in hemoglobin levels in pregnant women before and after they were given corn pudding and dates. The study was conducted in the working area of Ngumpakdalem Community Health Center, Bojonegoro Regency, in 2026.

The research activities were organized into three phases: baseline assessment, intervention, and final assessment. Hemoglobin concentration was determined at baseline before the intervention was given. The participants then consumed corn and date pudding once a day for seven consecutive days. At the end of the seven-day period, hemoglobin concentration was assessed again using the same measurement procedure.

The study including pregnant woman residing in the service area of Ngumpakdalem community health center, Bojonegoro Regency. We recruited 30 pregnant woman who met the eligibility criteria, resulting in a total sample of 30 participants. Participants were eligible if they were pregnant women in the second or third trimester, agreed to participate by providing written informed consent, underwent hemoglobin measurements before and after the intervention, and completed the prescribed corn and date pudding intervention. Woman were excluded from the study if they had pregnancy related complications, comorbidities that could affect hemoglobin levels, received other interventions to increase hemoglobin concentration, or failed to complete the intervention.

This study classified the severity of anemia into three categories mild, moderate, and severe based on the respondents' hemoglobin levels. The researchers determined the anemia category by comparing the hemoglobin test results with predetermined reference values. Hemoglobin levels in the range of 10.0–10.9 g/dL indicate mild anemia; levels in the range of 7.0–9.9 g/dL indicate moderate anemia; and levels below that threshold or less than 7 g/dL indicate severe anemia. This classification system was used to determine the severity of anemia and to facilitate the analysis of the respondents' conditions in the study.

Hemoglobin levels were measured twice for each participant, before the intervention a seven daysconsecutive period during which participants consumed corn and date pudding and after the intervention. Hemoglobin testing for pregnant women was conducted in accordance with standard operating procedures, starting with cleaning the respondent's fingertip with an alcohol swab until a hemoglobin measurement was obtained from the HB Meter after a drop of the respondent's blood was applied, after which the hemoglobin test results were recorded on the observation sheet. Hemoglobin testing was performed using a Nesco Multicheck 2 NW-01 Hemoglobin Kit. The researcher recorded the hemoglobin results

on the observation sheet.

Throughout the study, all respondents continued to take iron (Fe) supplements in accordance with government recommendations outlined in the Ministry of Health's guidelines on the administration of iron supplements to pregnant women as part of efforts to prevent and manage anemia in this population. In addition to the regular consumption of iron supplements, the researchers intended to provide supplementary food to pregnant women in accordance with the study's original objectives. The provision of supplementary food to pregnant women aimed to support the respondents' nutritional needs and optimize the intake of nutrients related to anemia. Therefore, in this study, the researchers continued to provide iron supplements as the standard intervention, while supplementary food was provided as outlined in the study design.

The intervention provided corn and date pudding as a locally sourced supplementary food. Each participant consumed a 100-g serving of pudding daily for seven consecutive days. Each serving consisted of 50g of sweet corn kernels and 25 g of pitted dates, while remaining ingredients were added to achieve a final weight of 100g. the researchers used the same recipe. Composition, and serving size throughout the intervention to ensure consistency. We monitored participant adherence daily using a monitoring sheet that recorded both pudding distribution and consumption during the seven days intervention.

Data processing and statistical analysis were conducted using the *Statistical Package for the Social Sciences* (SPSS). Participant characteristics and hemoglobin measurements obtained at baseline and after the intervention were summarized using univariate analysis. The *Shapiro Wilk test* assessed the normaly of the data. Because the data were not normally distributed, we used the *Wilcoxon signed rank test* to compare hemoglobin levels before and after the intervention. We considered *p-values* <0.05 statistically significant.

The health Research Ethics Committee of STIKES Rajekwesi Bojonegoro granted ethical approval for this study (Approval number: 033/KEPK/LPPM.STIKes.R/VII/2026). Before participating, each regnant woman received a clear explanation of the study's purpose, procedures, potential benefits, and possible risk. Written informed consent was obtained from all participants before data collection began. Participant identities and research data were kept confidential throughout the stages of data collection, processing, analysis, and publication.

RISULT / CLINICAL OUTCOME

Table 1. Characteristics of Pregnant Women with Anemia

Characteristics	Total	
	Frequency (f)	%
Gestational Age		
Second trimester	12	40
Third trimester	18	60
Maternal Age		
<20 years	1	3,3
20-35 years	25	83,4
>35 years	4	13,3
Educational Level		
Elementary school	2	6,7
Junior high school	6	20
Senior high school	15	50
Higher education	7	23,3
Occupation		
Employed	11	36,7
Unemployed	19	63,3
Pregnnacy History		
Primigravida	13	43,3
Multigravida	15	50
Grand Multigravida	2	6,7
History of Anemia in Previous Pregnancy		
History of anemia	8	26,7
No history of anemia	22	73,3
Total	**30**	**100**

Source primary data from Juli 2026

Table 1 describes the characteristics of the 30 pregnant women included in the study. Most participants were in the third trimester, with 18 women (60.0%), while the remaining 12 women (40.0%) were in the second trimester. The largest proportion of participants was within the 20–35-year age group, consisting of 25 women (83.4%). With regard to education, senior high school was the most frequently reported level, representing 15 participants (50.0%). Most participants were not employed, accounting for 19 women (63.3%).

Table 2. Hemoglobin Levels of Pregnant Women Before and After the Intervention

Hemoglobin Level	Pre-test		Post-test	
	n	%	n	%
No anemia (Hb ≥ 11 g/dL)	0	0	10	33,3
Mild anemia (Hb 10,0-10,9 g/dL)	6	20	20	66,7
Moderate anemia (Hb 7,0-9,9 g/dL)	24	80	0	0
Severe anemia (Hb < 7 g/dL)	0	0	0	0
Total n (%)	**30**	**100**	**30**	**100**

Table 2 present the participants hemoglobin status at baseline and after the intervention. At baseline, all 30 participant had anemia, with moderate anemia being the most common category (24 participants, 80%). The remaining 6 participants (20.0%) had mild anemia. Following seven days of consuming corn and date pudding, the distribution of hemoglobin status shifted toward less severe categories. Mild anemia was observed in 20 participant (66,7%), while 10 participants (33.3%) achieved hemoglobin levels within the non anemic range. Notably, none of the participants remained in the moderate anemia category at the post-test assessment.

Table 3. Effect of Corn and Date Pudding on Hemoglobin Levels in Pregnant Women

Hemoglobin Level	n	Median	Min	Max	*p-value*
Pre-test	30	9,30	8,6	10,5	
Post-test	30	11,10	10,7	12,5	0,000

**Wilcoxon signed-rank test*

Table 3 shows the hemoglobin levels measured before after the intervention. At baseline, the participants had a median hemoglobin concentration f 9.30 g/dL, ranging froom 8.6 to 10.5 g/dL. Following seven days of corn and date pudding consumption, the median hemoglobin level increased to 11.10 g/dL, with values ranging from 10.7 to 12.5 g/dL. The *Wilcoxon signed rank test* confirmed a statistically significant difference between the pre-intervention and post-intervention hemoglobin levels ($p<0.001$).

DISCUSSION

Pregnant women who take iron supplements experience changes in their hemoglobin levels because the iron content in these supplements helps meet the iron requirements needed for hemoglobin production in red blood cells. Pregnant women should take iron supplements regularly as recommended to ensure their iron needs are met during pregnancy [1][25]. On the other hand, taking iron supplements can cause side effects such as nausea, vomiting, diarrhea, constipation, stomach pain, dizziness, and other digestive disorders, which can reduce a pregnant woman's comfort and adherence to taking the supplements [26]. Therefore, the provision of complementary foods in this study serves as one approach to help meet iron requirements and increase hemoglobin levels in pregnant women through dietary sources; thus, these complementary foods are not intended as a substitute for iron (Fe) supplements but rather as a supplement to meet the iron needs of pregnant women [4], [17].

Hemoglobin levels showed a noticeable change after the participants consumed a supplementary diet of corn pudding and dates for seven consecutive days. The median

hemoglobin level increased from 9.30 g/dL before the intervention to 11.10 g/dL after the intervention, representing a median increase of 1.80 g/dL. The *Wilcoxon signed-rank test* confirmed a statistically significant difference between pre- and post-intervention measurements ($p<0.001$). These results indicate that dietary supplements derived from local food sources, such as corn and dates, can serve as a complementary nutritional approach to increase hemoglobin levels in pregnant women.

The observed increase in hemoglobin levels may be related to the nutritional composition of the ingredients used to prepare the corn and date pudding. Corn (*Zea mays L.*) contains several nutrients that are involved in erythropoiesis, including iron, folate, B group vitamins, and protein [23][15]. Iron plays a central role in hemoglobin synthesis, whereas folate and B-group vitamins are involved in the formation and maturation of red blood cells [27] [12]. Dates (*Phoenix dactylifera L.*) also contain iron, minerals, and vitamins that are beneficial for meeting the nutritional needs of pregnant women [13], [28][6]. The combination of dates and corn in the form of a processed food namely, pudding serves as a practical source of other nutrients that support the physiological process of red blood cell production [6], [13], [23], [28], [29]

Corn and date pudding is rich in iron and vitamin C. Vitamin C can enhance the absorption of non-heme iron in the gastrointestinal tract by converting the iron into a form that is more easily absorbed by the body [12] [12][30]. This mechanism is particularly important during pregnancy, as the increase in the mother's blood volume, along with the growth and development of the fetus and placenta, increases the body's need for more iron [31]. The combination of iron intake with other supporting nutrients obtained from corn pudding and dates can help pregnant women meet their increased nutritional needs for hemoglobin synthesis [6], [13], [23], [28], [29].

The results of this study indicate a change in hemoglobin levels following the administration of a supplementary food consisting of corn pudding and dates to pregnant women. Before the intervention, 24 respondents (80.0%) were classified as having moderate anemia, whereas 6 respondents (20.0%) were categorized as having mild anemia. At the second assessment, none of the participants were classified as having moderate anemia. Instead, 20 participants (66.7%) were categorized as having mild anemia and 10 participants (33.3%) had hemoglobin concentrations of ≥11 g/dL. The movement of participants toward higher hemoglobin categories provides additional descriptive evidence of improvement after the seven days intervention. Nevertheless, these categorical changes should be considered in

the light of the study design, as factors beyond the intervention may have also contributed to changes in hemoglobin levels [8].

The results are broadly in line with previous research concerning food-based approaches for improving maternal hemoglobin status. According to previous research, foods containing iron, folate, vitamin C, and other nutrients play a role in hemoglobin production [12], [17], [30]. Research involving dates has similarly reported their potential contribution to improving hemoglobin levels, which may be related to their nutritional composition [6], [13], [18], [19], [21], [28]. The present findings add to this body of evidence by examining corn and dates in a combined food preparation rather than considering the ingredients separately. The use of locally available food ingredients in a prepared supplementary product may therefore represent one possible way of supporting maternal nutritional intake [4], [6], [17], [23], [28].

The form in which the ingredients were provided may also be relevant from a practical perspective. Rather than requiring participants to consume corn and dates separately, the two ingredients were incorporated into a single pudding product. Its soft texture and ready-to-consume form may make the product easier to incorporate into daily dietary intake. Developing food-based interventions in an acceptable and practical form can support dietary diversification during pregnancy and may facilitate the delivery of nutritional messages as part of antenatal care [4], [24].

The findings should not, however, be interpreted as evidence that corn and date pudding can replace established anemia treatment. Iron supplementation remains an essential component of anemia prevention and management during pregnancy and should be provided in accordance with established standards of maternal healthcare [4], [30]. Corn and date pudding serves as a complementary food to provide additional nutrition for pregnant women. The combination of iron and vitamin C found in corn and date-based foods, along with appropriate nutritional counseling and regular monitoring of hemoglobin levels, can provide a more comprehensive approach to managing anemia during pregnancy.

Bojonegoro Regency is known as one of the major corn-producing regions in East Java. One processed corn product is corn and date pudding. Corn and date pudding can be considered an alternative supplementary food to support efforts to prevent and manage anemia in pregnant women. Corn (*Zea mays L.*) contains various nutrients that play a role in the process of erythropoiesis, including iron, folate, B vitamins, and protein. Therefore, the availability of locally produced corn in Bojonegoro Regency offers an opportunity to utilize local food

commodities as part of maternal nutrition interventions to support adequate intake of iron-related nutrients during pregnancy and contribute to efforts to prevent and manage anemia.

CONCLUSIONS

The results of this study indicate an increase in hemoglobin levels among pregnant women with anemia following an intervention involving the consumption of corn pudding with dates. Statistical analysis using the *Wilcoxon signed-rank test* revealed a significant difference in hemoglobin levels before and after the administration of corn and date pudding, with the median hemoglobin level increasing from 9.30 g/dL to 11.10 g/dL ($p < 0.001$). This study demonstrates that a pudding made from corn and dates can be used as a dietary supplement to increase hemoglobin levels during pregnancy. In addition to its easy and simple preparation process and complex nutritional composition, this dietary supplement can also be integrated into community-based maternal health services.

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AUTHOR CONTRIBUTIONS

The first author is responsible for developing the research concept and design, collecting, processing, and analyzing data, and preparing the draft manuscript. The second author contributed by providing input on the conduct of the research, validating and interpreting the results, and editing and refining the manuscript.

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