



## **Haemoglobin Levels and Mid-Upper Arm Circumference in Pregnant Women Through The Giving of Moringa Biscuits**

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### **Kata Kunci**

Biskuit Kelor;  
Haemoglobin;  
Lingkar lengan  
Atas;  
Hamil

### **Abstrak**

Mengonsumsi biskuit kelor merupakan salah satu alternatif untuk mengatasi gizi buruk di Indonesia. Hasil penelitian ilmiah modern menunjukkan bahwa daun kelor dapat menjadi sumber nutrisi bagi semua kelompok umur. Penelitian ini bertujuan untuk mengetahui perbedaan kadar haemoglobin dan lingkar lengan atas pada ibu hamil melalui pemberian biskuit daun kelor. Jenis penelitian ini merupakan penelitian analitik dengan desain RCT Populasi penelitian 70 ibu hamil yang dibagi dalam dua kelompok 35 responden pada kelompok kontrol 35 responden pada kelompok intervensi. Teknik pengambilan sampel menggunakan proporsive sampling. Variabel bebas adalah Pemberian Biskuit Kelor, variabel terikatnya Kadar Haemoglobin dan ukuran LILA. Hasil penelitian ditemukan rerata peningkatan kadar Hb kelompok perlakuan sebesar 0,74 gr% dengan nilai p-value<0,05. Rerata peningkatan ukuran LILA kelompok perlakuan 2,25 cm dengan nilai p-value kurang dari  $\alpha = 0,05$ . Peningkatan rerata asupan energi tertinggi ditemukan pada kelompok intervensi dengan rerata peningkatan 174,51 kkal. Persoalan status gizi pada ibu hamil seperti anemia relatif sering terjadi saat kehamilan dikarenakan ibu hamil mengalami hemodelusi (pengenceran) dengan peningkatan volume 30% sampai 40% yang puncaknya pada kehamilan 32 sampai 34 minggu. Pemberian cemilan berupa biskuit kelor menjadi alternatif mengatasi persoalan gizi pada ibu hamil sangat disarankan.

### **Keywords**

Moringa biscuit;  
Haemoglobin  
levels;  
Mid - Upper Arm  
Circumference;  
Pregnant

### **Abstract**

Consuming moringa biscuits is one of the alternatives to overcome malnutrition in Indonesia. The results of modern scientific research show that moringa leaves can be a source of nutrition for all age groups. This study aims to find out the difference in haemoglobin levels and mid-upper arm circumference in pregnant women by giving moringa leaf biscuits. This type of study is an analytic study with RCT design. The study population of 70 pregnant women was divided into two groups of 35 respondents in a control group of 35 respondents in the intervention group. Sampling techniques use proportions of sampling. The Independent variables are the moringa biscuit giving, dependent variables haemoglobin levels and the size of mid-upper arm circumference (MUAC). Study results found an average increase in hb levels of the treatment group by 0.74 gr% with a p-value<0.05. The average increase in the MUAC size of the treatment group is 2.25 cm with a p-value of less than  $\alpha = 0.05$ . The highest average increase in energy intake was found in the intervention group with an average increase of 174.51 kkal. Nutritional status in pregnant women such as anemia is relatively common during pregnancy because pregnant women experience hemodelusi (dilution) with a 30% to 40% increase in volume which peaks at 32 to 34 weeks of pregnancy. The provision of snacks in the form of moringa biscuits becomes an alternative to overcome nutritional problems in pregnant women is highly recommended

## Introduction

The issue of nutrition in pregnant women is of concern to the international community as formulated in one of the goals of the Sustainable Development Goals (SDGs) is to end hunger, achieve better food security and nutrition, and support sustainable agriculture, precisely in the formulation of the second target, stop all forms of malnutrition in 2030, in addition to achieving internationally agreed goals on sustainable agriculture. Malnutrition and neglect in children under five, also address the nutritional needs of adolescent girls, pregnant women & breastfeeding, and the elderly(1).

Everyday, out of 830 mothers die from pregnancy-related diseases/complications related to pregnancy and childbirth(2). Maternal mortality rates are one of the markers for the success of health services in a country. Maternal Mortality Rate (MMR) in Indonesia in 2013 amounted to 359/100.000, decreased in 2018 by 305/100.000, this figure is still above the target of MGD"s which is 102/100.000 Live birth (3).

Most women suffer from anemia during pregnancy, both developed and developing countries(4). Who estimates that 35-75% of pregnant women in developing countries and 18% of pregnant women in developed countries have anemia (5). However, many of them have experienced anemia at conception, with an estimated prevalence of 43% in women who are not pregnant in developing countries and 12% in developed countries(6).

Increased need for iron (Fe) during pregnancy is said to meet the needs of fetal growth and development (growth that requires a lot of iron), placental growth, and an increase in the mother's blood volume(7). Iron needs in the first trimester are relatively small at 0.8 mg a day, increasing dramatically during the second and third trimesters to 6.3 mg a day (8).

Anemia in pregnant women is a global health problem because it affects half of all pregnant women worldwide(9). It is estimated that 41.8% of pregnant women worldwide have anemia and most of it is caused by iron with Hb levels less than 11mg / L. The impact of anemia on pregnant women is (1) inhibited growth of body and brain cells, (2) the transfer of oxygen to body cells and the brain. Anemia that occurs can experience postpartum bleeding due to uterine atonia (10).

Nearly half or 48.9% of pregnant women in Indonesia have anemia or blood deficiency, according to The Basic Health Research (Riskesdas) in 2018. The percentage of pregnant women who experience anemia increased from 2013 by 37.1%(10). Data in 2018, the number of pregnant women who experience the most anemia at the age of 15-24 years is 84.6%, the age of 25-34 years is 33.7%, the age of 35-44 years is % 33.6%, and the age of 45-54 years is 24%. Meanwhile, data on women of childbearing age suffering from chronic energy shortages showed a positive trend compared to previous years.

The incidence of anemia and chronic energy deficiency (CED) in pregnant women in the Sinorang Health Center area in the last 3, 2018 reported 1 case of death of pregnant women with a diagnosis of metabolic disorders. This fact proves that the incidence of CED and anemia is still relatively high and can even be life-threatening. In line with the seriousness of the government in dealing with nutritional problems in pregnant women is shown in the program of the First Thousand Days of Life (1000 HPK) by providing additional nutrition (PMT), milk and Fe pills to prevent anemia and continue to provide counseling to pregnant women, and equip families and communities to maintain good nutrition intake, maintain a healthy lifestyle and improve public health services. So with this the researchers chose the place of this research in the working area of the Sinorang Health Center.

Consuming moringa leaves (Moringa Biscuits) is one of the alternatives to overcome malnutrition in Indonesia. The results of modern scientific research show that moringa leaves can be a source of nutrition for all age groups (11), thenutritional element contained in moringa leaves is 7 times vitamin C in citrus fruits, 4 times vitamin A in carrots, 4 times calcium in milk, 3 times potassium in bananas, 3 times iron in spinach and 2 times the protein found in yogurt or protein in an egg (12).

Moringa leaves have a great ability to meet the nutritional content for the body, increase energy and stamina and overcome mineral deficiencies such as iron deficiency that causes (13). Giving moringa leaf biscuits to pregnant women during pregnancy can be an alternative to overcome nutritional problems, especially the problem of anemia (14), increasing the size of Mid – Upper Arm circumference (MUAC) pregnant women (15). Dried moringa leaves are rich in protein, iron, vitamin A and vitamin C, making them very effective in treating iron deficiency anemia(16). In addition, in moringa leaves do not contain harmful substances so it has no side effects. So far there have been no cases or poisonings from eating moringa. Given the potential of moringa leaves has not been maximized with high nutritional value in moringa leaves, the author is interested in lifting the title of the study "The effect of giving Moringa Leaf Biscuits on the increase in Haemoglobin (Hb) and Mid–Upper Arm Circumference (MUAC) levels of pregnant women".

## Methods

The method used in this study is an experiment or experimental research with a Single-Blind randomized controlled trial (RCT) design approach. That is to take variable measurements to respondents before intervening (pretest), then given moringa biscuit intervention as much as 5 pieces (60 gr) per day, for 3 consecutive weeks then re-measured against the previously measured variables (post test), in the control group was not given moringa biscuit intervention but still consumed vitamin Multi Mictonutrien (MMN). or vitamin engel with a daily dose of 1 capusl from public health center. Sample size in this study was 35 pregnant women treatment group and 35 pregnant women in the control group. The sampling technique in this study is Proporsive Sampling.

The instruments / ingredients used are moringa biscuits with a composition containing nutritional value: moringa leaf flour as much as 5%, 480.44 kcal, protein 13.07 g, carbohydrates 58.67 g, vitamin C 3,535 mg, and iron 7.39 mg which will be given to respondents as much as 5 pieces (60 gr) per day, for 3 consecutive weeks.

The data collection method in this study was done by examining pregnant women directly to find out the Haemoglobin levels and MUAC measures of respondents before intervention (pretest) and after intervention (posttest). Moringa leaf biscuits were given weekly to respondents as many as 35 pieces for three weeks. After the intervention period is complete, the Hb and MUAC (posttest) levels are measured.

Bivariate analysis is used to determine the effect of moringa leaf biscuits on increased levels of Hb and MUAC. Previously, the normality test of Hb levels and MUAC measures using the Shapiro-Wilk normality test (<50 sample). To test the differences before and after the intervention using pair t-test and Wilcoxon test, to test the influence or difference between the two interventions using the independent t test and the Mann Whitney test, where the confidence level reached 95% with the conclusion that if the value  $p < 0.05$  then the research hypothesis is accepted (17). Ethical permission for this research with no. 0013/KEPK-PTKMKS/II/2021 issued by Health Research Ethics Committee Health Polytechnic Makassar.

## Results

### Distribution of respondents based on Hb Levels of pregnant women

The distribution of respondents based on the level of anemia in both control and treatment groups at the time of the pretest is as shown in the following table:

Table 1. Distribution of respondents based on the degree of anemia in pregnant women

Haemoglobin Levels	Pretest	Post Test
<b>Control</b>		
Severe anemia	2	
Mild anemia	32	8
Moderate anemia	1	2
Not anemia		25
<b>Treatment</b>		
Severe anemia	32	15
Moderate anemia	3	
Not anemia		20
<b>Grand Total</b>	<b>70</b>	<b>70</b>

Distribution of respondents based on anemia rates in both control groups and treatment at the time of pretest majority distributed at mild anemia levels with a range of Hb levels of 9.0 to 10.9 gr% each as many as 32 respondents, while at the time The majority of respondents in both groups were in the non-anemic category with 25 respondents in the control group, 20 respondents in the treatment group. In addition.

In addition, the results were strengthened by statistical tests carried out with results showing that there was a significant difference in Haemoglobin levels before and after the intervention in a group giving Moringa leaf biscuits ( $p=0.000$ ), control ( $p=0.000$ ).

### Distribution of respondents based on MUAC levels of pregnant women

The results of pretest data collection showed that the control and treatment groups had MUAC size in the CED category ( 23.5 cm), namely 35 respondents each. At the time of the post test, the two majority groups were in the normal MUAC size category, respectively, as shown in the table 2

Table 2. Distribution of Respondents by MUAC size category of pregnant women

MUAC category	Pretest	Post Test
<b>Control</b>		
chronic energy deficiency (CED)	35	10
Normal		25
<b>Treatment</b>		
chronic energy deficiency CED	35	9
Normal		26
<b>Grand Total</b>	<b>70</b>	<b>70</b>

The results of pretest data collection were obtained by the control group and the treatment had a MUAC size in the CED category ( $\leq 23.5$  cm) which is 35 respondents each. At the time of the post test the two majority groups were in the normal MUAC size category of 25 respondents each in the control group, 26 respondents in the treatment group.

In addition, the results were strengthened by statistical tests that had been carried out with results showing that there was a significant difference in the size of MUAC before and after the intervention in the group giving Moringa leaf biscuits ( $p=0.000$ ), control ( $p=0.000$ ). This shows that there are differences in the size of MUAC before and after the intervention or giving Moringa leaf biscuits for 90 days can increase the size of MUAC in pregnant women.

### MUAC nutritional intake for pregnant women

The results of pretest data collection obtained a comparison of the average intake of pregnant women before and after the intervention, respectively, as in the following table:

Table 3. Comparison of the average intake of pregnant women before and after intervention

Responden Group	Nutrition	Pretest	Posttest	P-value
<b>Control</b>	Energy (kkal)	1.544,90	1.656,63	0,049
	Protein (gr)	46,93	56,75	0,05
	Vitamin C (mg)	49,93	39	0,092
	Iron (mg)	5,88	8,25	0,04
<b>Intervensi</b>	Energy (kkal)	1.358,37	1.532,88	0,04
	Protein (gr)	56,07	58,81	0,074
	Vitamin C (mg)	37,71	62,65	0,034
	Iron (mg)	5,87	6,87	0,05

From tabel 3 of the comparison of respondents intake at the beginning and end of the study collected was found that the average increase in energy, protein, and iron intake in both groups with a p-value of  $< 0.05$ , vitamin C intake in the control group decreased intake with a p-value of  $> 0.05$ . The highest average increase in energy intake was found in the intervention group with an average increase of 174.51 kcal.

## Discussion

### Increased Size of MUAC Before and After Kelor Biscuits in Pregnant Women

Assessment of nutritional status can be done directly or indirectly, namely: First, assessment of nutritional status is indirectly done by anthropometry, physical examination such as clinical, biochemical, and biophysical symptoms. An anthropometric method is a method of assessing nutritional status that is commonly used given nutrition (18).

Direct assessment of nutritional status by monitoring weight gain during pregnancy and measuring MUAC to determine whether Someone suffers from CED. The effect of Moringa Biscuits on the increase in the size of MUAC can be seen in table 2 above, the results of pretest data collection obtained by the control group and treatment have a MUAC size in the CED category ( $\leq 23.5$  cm) which is 35 respondents each, At the time of post-test, both groups were partly in the normal MUAC size category of 25 respondents each in the control group, 26 respondents to the treatment group.

A follow-up statistical analysis of MUAC measures found an increase in MUAC size in both control and treatment groups, with an average increase in the MUAC size of the treatment group of 2.3cm, and 1.15 cm in the control group. The results of the Wilcoxon test analysis were found p-value 0.000 (Value  $p < 0.05$ ) so that based on the basis of decision making that the provision of moringa leaf biscuits can increase the size of MUAC in pregnant women.

Moringa leaf extract can make increase weight but not in the intake of pregnant women who work in the informal sector. The study found that the administration of moringa leaf extract was not associated with increased nutrient intake and was markedly associated with weight gain in pregnant women in the informal sector (19).

Conventional consumption of moringa leaves as a macro and micronutrient supplement is effective, although it is not suitable as a substitute for nutrient-rich supplements. However, it is sustainably and economically rich in nutrients as an option for people suffering from chronic or acute macro and micronutrient deficiencies. Moringa tree planting has low cost, rapid growth, high leaf yield, and high viability in the dry season. This suggests that moringa is a unique tropical plant with many benefits(15).

In addition to being high in iron, moringa biscuits also contain high amounts of protein. Protein is one of the nutrients that play a role in increasing iron availability (20). Moringa leaves have a high quality of protein and are easily digestible which is influenced by the quality of their amino acids. In addition, the content of vitamin C in moringa leaves is quite high and plays a role in increasing the bioavailability of iron. Vitamin C can act as an absorbent iron enhancer in non-heme sources, can increase the intake of non-heme iron up to fourfold(21). Vitamin C and iron will form an iron ascorbic complex that dissolves until easily absorbed, and vegetables and fruits will become fresh (22).

### **Increased Hb Levels Before and After Giving Moringa Biscuits to Pregnant Women.**

From the study result, the researchers found that the condition of pregnant women who experienced anemia when giving Moringa biscuits at the time of posttest (treatment) with moderate anemia category amounted to 15 respondents into the non-anemic category totaling 20 respondents. This is due to the routine giving of Moringa biscuits and the compliance of respondents to consume Moringa biscuits every day so that it can increase Hb levels in the blood. Moringa biscuits significantly increased hemoglobin concentration in anemic female patients (23). Moringa Biscuits may have a potential effect on women, including pregnant ones.

The imbalance in the number of erythrocytes and plasma reaches its peak in the second trimester because the increase in plasma volume stops towards the end of pregnancy, while red blood cell production continues to increase. Anemia is defined as a decrease in the number of red blood cells or a decrease in hemoglobin concentration in the blood circulation (24). Anemia is relatively common during pregnancy because pregnant women experience hemodelution (dilution) with an increase in volume of 30% to 40%, which peaks at 32 to 34 weeks of gestation.

This literature review will also reveal the potential effects of Moringa Biscuits as an alternative supplement for pregnant women. The development of functional food cannot be avoided. The most popular local plant with amazing health benefits is the Moringa Biscuits. In addition, Moringa leaves are rich in vitamin A, vitamin B, vitamin C, and calcium. Therefore, Moringa leaves are not only suitable for pregnant women but also all age groups(25).

Moringa biscuits have a lot of medicinal properties, therefore, this plant which is called the miracle tree or in Senegal is known as a plant that never dies. Moringa biscuits can be an effective anti-cancer agent and play an important role for their anti-diabetic properties. Moringa biscuits are also good and have anti-microbial agents that are high in antioxidant activity including vitamins and minerals. Moringa-based supplementation has several health benefits, especially for pregnant women (26).

### **Relationship of Moringa Biscuits to Increase Hb Levels and MUAC Size of Pregnant Women**

Statistical analysis of Hb levels and MUAC measures in both groups showed significant results with an average increase in the levels of the treatment group by 0.74 gr% with a p-value value of 0.000. The average increase in the highest MUAC size was in the treatment group, with an average increase of 2.25 cm and a p-value of 0.000 (p-value < 0.05)). So that it can be withdrawn to the Impulan there is a meaningful difference between the increase in the HB rate of MUAC size and the provision of moringa biscuits to pregnant women.

The results also revealed the fact that the increase in Hb levels and the highest size of MUAC in pregnant women was found in the second trimester, which was 24 respondents (24.29%) with an increase in Hb levels < 2 gr%, and 14 respondents (20%) with an increase in the size of MUAC < 2 cm.

In moringa leaves containing high iron (Fe), even iron levels in moringa leaves that have become flour are much higher, 28.2 mg / 100 grams of moringa leaf flour. If moringa leaves are dried (indoors) and mashed, the nutritional content can increase many times over, except for the content of vitamin C. the nutrient content in dried moringa leaves is due to the evaporation of water content in fresh moringa leaves, and the heat causes the content of moringa. Hidden nutrients break the bonds(18).

A food consumption survey is an indirect way to determine nutritional status by looking at the amount and type of nutrients consumed. From table 3 on the comparison of the average intake of pregnant women before and after the intervention, it was found an increase in the average intake of energy, protein and iron in both groups with p-value <0.05, vitamin C intake in the control group decreased intake with p-value values > 0.05.

The nutritional status of pregnant women is a physical condition resulting from the consumption, intake, and use of various types of macro and micronutrients. If the mother's nutritional status before and during pregnancy is normal, she will most likely give birth to a healthy baby with an average weight. In

other words, the quality of the baby born is very dependent on the nutritional status of the mother before and during pregnancy. Under normal circumstances, without any intervention, the mother's weight will increase if the mother consumes a variety of nutritional foods (27) .

The nutritional status of pregnant women is one of the indicators used to measure the nutritional status of the community. If the nutritional intake for pregnant women from food is not adjusted to the body's needs, then there is malnutrition. Malnutrition and poor health in pregnant women are still very vulnerable, aimed at mothers' high mortality rate due to bleeding due to nutritional anemia and CED during pregnancy(28).

## Conclusion

There is a significant difference between the provision of moringa biscuits with the increase in Hb levels and the size of MUAC in pregnant women. The study also concluded that Moringa Biscuits effectively correct hemoglobin levels in moderately anemic women. It should be considered and included in the daily diet as a health prevention and maintenance strategy. Furthermore for educational institutions, this research is expected to be developed again from science, especially science about the benefits of moringa leaves against increased Hb levels and increased MUAC in pregnant women and nursing mothers. For students who will research about Hb levels and MUAC Size Pregnant women can try to research food ingredients consumed in addition to moringa leaves that can add science for readers.

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