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SEAWEEDS DODOL IS EFFECTIVE IN INCREASING HEMOGLOBIN LEVELS IN PREGNANT WOMEN WITH ANEMIA

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Abstract

Background: Anemia in pregnant women must be watched out for because it can cause pregnancy complications. The prevalence of pregnant women worldwide who experience anemia is 41.8% and in Indonesia in 2018 it reached 48.9%. The main cause of anemia is iron deficiency. Iron can be obtained from local food ingredients, one of which is seaweed. This study aims to analyze the effectiveness of seaweed dodol consumption on hemoglobin levels of pregnant women in the second trimester with anemia. **Method:** This study was a pre-experimental design with a pre-test post-test with control group design. The population was all pregnant women in the second trimester in the Bululawang Health Center work area, Malang Indonesia. The sampling technique used a purposive sampling technique. The sample size was 30 people, divided into 15 people in the control group (Fe tablets) and 15 people in the treatment group (Fe tablets and seaweed dodol). Data analysis used the Independent Sample T Test. **Result:** The results of the Independent Sample T Test in the treatment group with the control group obtained a p value = 0.040 <0.05, meaning that there was a difference in hemoglobin levels after the intervention between the control group and the treatment group, with the average hemoglobin of the treatment group (11.36 gr / dl) greater than the average control group (11.01 gr / dl). **Conclusion:** Seaweed dodol can be used as an effective non-pharmacological therapy to accompany Fe tablets to increase hemoglobin levels in pregnant women with anemia.

keyword : Seaweed Dodol, Fe tablets, Hemoglobin, Pregnant women

INTRODUCTION

Anemia in pregnant women is one of the risks that must be watched out for because it can affect the health of the mother and fetus. Anemia in pregnant women that is not treated properly can increase the risk of dangerous complications, even increase the risk of maternal death (Dai, 2021). Anemia in pregnant women correlates with adverse perinatal outcomes, including intrauterine growth retardation, premature labor, low birth weight, or neonatal

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anemia, and is responsible for maternal consequences too, including the increased risk of pre-eclampsia and postpartum depression. Taking these serious health consequences into account, the WHO has indicated that among the Global Nutrition Targets which should be achieved by 2025, is a 50% reduction in anemia frequency in women of reproductive age (Skolmowska, et al, 2022).

Anemia that occurs in pregnancy is a condition of pregnant women with hemoglobin levels of less than 11gr/dl in the first and third trimesters and less than 10.5gr/dl in the second trimester. WHO reports that the prevalence of pregnant women worldwide who experience anemia is 41.8%. In Indonesia, the rate of anemia in pregnant women is still quite high. Based on the results of the 2018 Riskesdas data, the percentage of anemia in pregnant women has increased by 11.8% over the past 5 years, from 2013 by 37.15% while in 2018 it reached 48.9% (Gusriani, 2024; Kemenkes RI, 2018).

The causes of anemia include iron deficiency caused by a lack of consumption of food sources containing iron, sufficient food but low iron bioavailability so that the amount of iron absorbed is lacking, and food eaten contains substances that inhibit iron absorption (Rahmi, 2018). Prevention or treatment of anemia in pregnant women can be done pharmacologically or non-pharmacologically, one of which is consuming foods rich in iron. Seaweed (Eucheuma Cottonii) is one of the foods that contains several intermediate compounds needed in hemoglobin synthesis such as iron, protein and vitamin B complex. How to get seaweed is not difficult, it is widely sold in traditional markets and modern markets and the seaweed needed by pregnant women every day is 200 grams. Seaweed is also easy to process into various foods that are more varied than other foods that contain Fe such as spinach, kale or other green vegetables. Seaweed can be processed into jelly, fresh drinks, ice cream, cakes, and meatballs (Mutiara, et al, 2021).

Seaweed contains approximately 2-10% more nutrients than vegetables, due to its phytic acid content, which can stabilize the number of red blood cells, white blood cells, and hemoglobin. Furthermore, seaweed also functions to reduce the side effect of inhibiting the production of red blood cell-producing cells (Anggeni et al, 2021). Research in the Naras Health Center work area of Pariaman City

revealed that consuming seaweed (eucheuma spinosum) is effective in increasing hemoglobin levels in pregnant women (Mutiara, et al, 2021). Research by Salma et al. (2021) showed that administration of two red seaweed biscuits (40 mg) and 60 mg iron tablets per day resulted in the highest increase in Hb levels compared to the control group. From the description above, researchers conducted a study to analyze the effectiveness of seaweed dodol on hemoglobin levels of pregnant women in the second trimester with anemia at the Bululawang Health Center, Malang Indonesia.

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METHOD

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This study is a pre-experiment with a pre-test post-test control group design. The research location was at the Bululawang Health Center in January-August 2023. The population was all pregnant women in the second trimester with anemia in the Bululawang Health Center, Malang Indonesia. The sampling technique used purposive sampling so that a sample of 30 people was obtained, divided into two groups, 15 people in the control group with the provision of Fe tablets only and 15 people in the treatment group who were given an intervention in the form of a combination of Fe tablets and seaweed dodol. The inclusion criteria for this study were pregnant women in their second trimester with anemia at the Bululawang Community Health Center who were willing to participate. The exclusion criteria were women with a history of seaweed allergy and pregnant women with complications or comorbidities such as diabetes, hypertension, and others.

The control group was given 100 mg of iron tablets per day for 14 days. The treatment group was given 100 mg of iron tablets per day and 40 mg of seaweed dodol per day for 14 days (Salma et al, 2021). Monitoring compliance with iron tablet and seaweed dodol consumption using a compliance control sheet that must be filled in every time the sample consumes iron tablets and seaweed dodol and photo/video documentation when consuming iron tablets and seaweed dodol via WhatsApp. Hemoglobin examination was carried out before and after treatment through the Bululawang Health Center laboratory. Data collection using observation sheets related to the provision of interventions and the results of Hb

measurements/examinations before and after treatment (intervention). Data analysis using Paired sample t-test.

RESULT AND DISCUSSION

1. Respondent Characteristics Data

Respondent characteristic data are as follows:

Table 1.1 Distribution of Respondent Characteristics

DESCRIPTION	TREATMENT GROUP		CONTROL GROUP		TOTAL	
	F	%	F	%	F	%
Age						
a. <20 years	3	20,0	4	26,7	7	23,3
b. 20-35 years	11	73,3	10	66,7	21	70
c. >35 years	1	6,7	1	6,7	2	6,7
Total	15	100	15	100	30	100
Education						
a. Primary education	9	60	7	46,7	16	53,3
b. Secondary education	5	33,3	6	40	11	36,7
c. Higher education	1	6,7	2	13,3	3	10
Total	15	100	15	100	30	
Job						
a. Not working	11	73,3	11	73,3	22	73,3
b. Working	4	26,7	4	26,7	8	26,7
Total	15	100	15	100	30	100
Gravida						
a. Primigravida	7	46,7	5	33,3	12	40
b. Multigravida	8	53,3	10	66,7	18	60
Total	15	100	15	100	30	100

2. Analysis of differences in hemoglobin levels before and after intervention in the control group..

Table 1.2 Paired T Test in the Control Group

	Mean (standard deviation)	Difference (standard deviation)	IK 95%	*p value*
Pre test	10,17 (0,317)	0,84 (0,318)	1,01612 - 0,66388	0,000
Post test	11,01 (0,375)			

Table 1.2 explains the hypothesis is accepted, there is a significant difference in hemoglobin levels before and after giving Fe tablets.

3. Analysis of differences in hemoglobin levels before and after intervention in the treatment group

Table 1.3 Paired T Test on Treatment Group

	Mean (standard deviation)	Difference (standard deviation)	IK 95%	*p value*
Pre test	10,50 (0,449)	0,86 (0,372)	1,05934 - 0,6473	0,000
Post test	11,36 (0,495)			

Table 1.3 explains the hypothesis is accepted, there is a significant difference in hemoglobin levels before and after being given a combination of seaweed dodol and Fe tablets.

4. Analysis of differences in hemoglobin levels in the treatment group and the control group.

Table 1.4 Independent Sample T Test on Treatment Group with Control Group

Kadar hemoglobin	Mean (SD)	*p value*
Hemoglobin level score of treatment group (n=15)	11,36 (0,495)	0,040
Hemoglobin level score of control group (n=15)	11,01 (0,375)	

Table 1.4 explains the hypothesis is accepted, there is a significant difference in hemoglobin levels after the intervention between the treatment group and the control group, where the average Hb level in the treatment group (11.36 gr/dl) is higher than the average Hb level in the control group (11.01 gr/dl). In other words, the combination intervention of giving seaweed dodol and Fe tablets is more effective in increasing Hb levels in pregnant women compared to giving Fe tablets alone.

This study is in line with previous studies that seaweed is very effective in increasing Hb levels in pregnant women with anemia. The results showed a p value <0.0001 (p <0.05) with a mean change before the intervention of 8.94 gr/dl to 10.72 gr/dl after the intervention (Rahmi, 2018). Other studies also showed a difference in the average value of Hb levels before seaweed intervention of 9.4 gr/dl and after seaweed intervention of 11.4 gr/dl. Based on the results of the bivariate test, the p value was 0.001 (Carolin et al., 2023).

Pregnancy is a period that greatly determines the quality of future human resources, because the growth and development of children is largely determined by their condition during pregnancy. Pregnant women require higher nutrition compared to non-pregnant women because malnutrition during pregnancy can cause nutritional anemia, low birth weight babies and babies born with defects,

during pregnancy the body needs more iron than when not pregnant. Iron (Fe) for pregnant women is needed for the formation of red blood cells which are increasingly needed by the fetus and placenta, as the gestational age increases, the iron needed also increases (Ernawati, 2017).

In pregnant women, there is an increase in plasma volume in the blood by 30% to 40% so that blood thinning occurs (hemodilution) (Sitepu & Hutabarat, 2020). The blood volume in pregnant women increases by around 1500 ml consisting of 1000 ml of plasma and around 450 ml of Red Blood Cells (RBC). RBC production increases during pregnancy, the increase in RBC depends on the amount of iron available. Although RBC production increases, hemoglobin and hematocrit decrease, this is called physiological anemia. Pregnant women in the second trimester experience a rapid decrease in hemoglobin and hematocrit because during this period there is a rapid expansion of blood volume. The lowest decrease in Hb is at 20 weeks of pregnancy, then increases slightly until full-term pregnancy (Septiasari & Dian Mayasari, 2023). Hemoglobin is a protein in erythrocytes that functions as a carrier of oxygen from the lungs to the entire body. Hemoglobin also functions to transport carbon dioxide back to the lungs to be excreted from the body (Sitepu & Hutabarat, 2020).

Seaweed is a type of marine plant that is classified as macroalgae that lives attached to the bottom of the waters. Seaweed is rich in minerals, vitamins, proteins, carbohydrates with very little fat content. The main content of seaweed is agar-agar, alginic acid and carrageenan (Yulaikah, 2020). The iron content in dried seaweed is around 0.5-3.5 mg in 100 mg of seaweed. In addition, the bioavailability of substances contained in seaweed is around 2-10% higher compared to vegetables, because the phytic acid content in seaweed that can interfere with iron absorption is very small. Seaweed can stabilize the number of red blood cells, white blood cells, and hemoglobin. In addition, seaweed functions to reduce the side effects of inhibiting the production of blood cell-producing cells (Damayanti, et al., 2021; Anggeni, et al., 2024). The seaweed dodol used in this study is made from natural seaweed flour, is high in fiber, contains no harmful preservatives, and is low in sugar. When given in measured doses according to research (40 g/day), this seaweed dodol poses a relatively low risk to healthy

pregnant women because the sugar content is within safe limits (WHO: maximum 25 g of added sugar/day) (WHO, 2025).

The high nutritional content of seaweed makes seaweed the most important vegetable source. Leucine is an essential amino acid found in abundance in seaweed, while nonessential amino acids such as glutamic acid and iron are found in seaweed. The high nutritional content of amino acids and iron in seaweed makes seaweed have a promising therapeutic effect, besides being an ideal complementary food in overcoming iron deficiency in general (Wahyunita et al., 2023).

The iron contained in seaweed when combined with protein molecules in the body will form ferricin. After being absorbed in the small intestine, it will form transferrin which functions as a transporter that carries red blood cells and oxygen needed by pregnant women during pregnancy. This increase in hemoglobin is also supported by the consumption of daily foods that contain a lot of protein (Arianti, 2021)

In addition to being easy to obtain, seaweed is also easy to process into various foods that are more varied than other foods that contain Fe such as spinach, kale or other green vegetables. Seaweed can be processed into jelly, fresh drinks, ice cream, cakes, and meatballs (Mutiara, et al., 2021). This study used seaweed processing, dodol cake. Seaweed dodol can be used as an effective non-pharmacological therapy for pregnant women with mild anemia. In addition to being rich in iron, seaweed also contains a lot of vitamin C. Vitamin C can help increase the absorption of heme iron up to four times by converting ferric iron to ferrous. This process occurs in the small intestine to make it easier to absorb and vitamin C also forms an iron-ascorbate group that remains soluble at a higher pH in the duodenum (Krisnanda, 2020).

This was also proven in the study of Yulaikah, (2020) which used processed seaweed in the form of ice cream, the results of the study showed that there was an effect of consuming seaweed ice cream (Eucheuma cottonii) on hemoglobin levels in pregnant women in the second trimester who had anemia. In addition to pharmacological consumption in the form of Fe tablets, consumption of processed seaweed can be an additional nutrient to increase Hb levels in pregnant women

with anemia. Other studies have also shown that interventions of providing higher amounts of iron, providing higher amounts of multiple nutrients, or nutritional counseling, are effective in preventing or treating anemia in pregnant women (Skolmowska, et al., 2022).

CONCLUSION AND SUGGESTION

There is a difference in hemoglobin levels after giving a combination of seaweed dodol and Fe tablets with after giving Fe tablets to pregnant women in the second trimester. The average Hb level in pregnant women who were given seaweed dodol and Fe tablets (11.36 gr/dl) was higher than the average Hb level in pregnant women who were given Fe tablets alone (11.01 gr/dl). This phenomenon shows that giving seaweed dodol and Fe tablets is more effective in increasing hemoglobin levels compared to giving Fe tablets alone.

DECLARATION

Conflict of Interest

The Authors in this research have noaffiliations with or involvement in any organizationor entity with any financial interest or non financialinterest in the subject matter or materialsdiscussedin this manuscript.

Authors' Contribution

Author 1 is in charge of coordinating the course of research, participating inresearch, compiling research reports, and publishing journal articles. Authors 2, 3 and 4 participated in research, the preparation of research reports, and journal publications.

Ethical Approval

This research has received approval from the Wava Husada Hospital Health Research Ethics Committee with the number MMR/2022/11/2568.

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Data Availability

The data supporting the findings of this study are available upon reasonable request from the corresponding author, with restrictions due to participant confidentiality.

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