Jurnal Jamu Kusuma
Vol. 6, No 1, June-July 2026, pp 47-52
ISSN: 2798-0332 (print)
ISSN: 2798-558 (online)

THE EFFECT OF BLACK SESAME SEEDS (*Sesamum indicum*) ON INCREASING SERUM FERRITIN LEVELS FOR ANEMIA PREVENTION IN PREGNANT WOMEN

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ABSTRACT

Iron deficiency is the root cause of most cases of anemia. Iron is needed to address all physiological changes that occur during pregnancy, including fetal growth and development and the prevention of complications. Sesame seeds provide an additional source of iron. The prevalence of iron deficiency anemia in Indonesia among pregnant women, according to the 2021 Household Health Survey, was 24.5%. The prevalence in East Java Province in 2021 was 25.3%, while in Mojokerto Regency in 2021 it was 29.26%. The aim was to test the effect of administering black sesame seed capsules (*Sesamum indicum*) on increasing serum ferritin levels in pregnant women. This study used a quasi-experimental method with a one-group pretest-posttest design. The sample consisted of 28 pregnant women in their second trimester, 12-24 weeks of gestation, at the Bangsal Community Health Center in Mojokerto Regency. The treatment consisted of iron supplementation tablets (60 mg of elemental iron and 0.4 mg of folic acid) supplemented with black sesame seeds for 14 days, at a dose of 200 mg, taken once daily in the evening after meals. Serum ferritin examination using the ELFA (*enzyme-linked fluorescent immunoassay*) method. The study was conducted in September-October 2024. The results of the study obtained serum ferritin levels of pregnant women for Mean before intervention 42.57 µg / mL and Mean after intervention 44.93 µg / mL and a Delta difference (Δ) of 2.36 µg / mL. The results of the Wilcoxon test obtained a Significance value (Sig) of 0.001 <α 0.05 there is an effect of administering black sesame seed capsules (*Sesamum indicum*) on increasing serum ferritin levels in pregnant women. Black sesame seeds can be used as an alternative non-pharmacological treatment to increase hemoglobin levels in pregnant women if consumed regularly as an effort to prevent anemia by utilizing local plants as functional foods that are around us.

Keywords: anemia in pregnancy; black sesame; serum ferritin

INTRODUCTION

Iron deficiency can result in suboptimal brain development, the fetus's most important organ, which can have both short-term and long-term consequences, including impaired cognitive, motor, and social-emotional development. The inability to reduce the incidence of anemia can lead many women to experience adverse health effects, reduced activity, and stunted child growth and development (Wibowo, 2021).

Between 2000 and 2019, the prevalence of anemia in women of childbearing age between the ages of 15 and 49 decreased slightly, from 31% to 30%, while the prevalence of anemia in pregnant women between the ages of 15 and 49 also decreased, from 41% to 36%. According to the Sustainable Development Goals (SDGs), one of the United Nations (UN) goals is to reduce the prevalence of anemia in pregnant women and women of childbearing age by half by 2030. This is an extension of the *World Health Assembly* (WHA) goal to improve nutritional status globally by 2025 (Stevens, 2022).

The 2018 Basic Health Research (Riskesdas) reported that the prevalence of anemia in pregnant women in Indonesia was 37.1%. According to the Household Health Survey (SKRT),

ISSN: 2798-0332 (print)
ISSN: 2798-558 (online)

the prevalence of iron deficiency anemia in pregnant women in Indonesia was 63.5% in 1995, dropping to 40.1% in 2019 and 24.5% in 2021 (Widiastini et al., 2023). The number of pregnant women with anemia in East Java Province remains high. In 2021, 25.3% of pregnant women experienced anemia (Istiqumilaily et al., 2023).

Iron deficiency can result in suboptimal brain development, the fetus's most important organ, which will have both short-term and long-term consequences, including impaired cognitive, motor, and social-emotional development. The inability to reduce the incidence of anemia can lead many women to experience the adverse effects of several health problems and reduced activity, as well as hindering the child's growth and development (Almaidah, 2022).

The number of pregnant women with anemia in East Java Province remains high. In 2021, 25.3% of pregnant women experienced anemia. Meanwhile, in 2021, 29.26% of pregnant women in Mojokerto experienced anemia (Mojokerto Regency Health Office, 2021).

Most heme iron comes from animal products. Animal food sources are generally quite expensive, so local heme iron intake is very limited. Mashed cereals, green vegetables, fruits, and nuts are non-animal food sources with relatively high iron content that are less expensive than animal sources. Diversifying one's diet so that the body gets the nutrients it needs from a variety of foods will help prevent iron deficiency anemia (Kartiningsih dkk, 2023).

Herbal ingredients such as sesame seeds provide an additional source of iron. Sesame seeds partially influence hemoglobin (Hb) formation. Furthermore, sesame seeds are a rich source of minerals. 100 grams of sesame seeds contain 629 mg of phosphorus and 14.55 mg of iron. Approximately 1-2 mg of iron is consumed by the duodenum from dietary sources, and it can also be lost through sweat, skin desquamation, and feces (Amin, 2021).

One of the natural fortifiers that is rich in iron content is sesame seeds. According to the USDA (United States Department of Agriculture) in 2019, sesame seeds contain 14.55 mg/100 grams of iron, which is higher than red meat, oysters, liver, spinach, and potatoes and has been used as a fortifier in tofu cakes. Sesame flour has also been used as a fortifier to increase the mineral content of biscuits and bread. Therefore, sesame seeds have great potential as a natural fortifier. Sesame seeds were chosen as a food additive because when roasted they produce fragrant and delicious oil and are a type of grain that has not been widely processed into food additives (O'Toole, 2024).

Early detection of iron deficiency without anemia is crucial because it can lead to permanent neurocognitive developmental impairment. This is particularly evident in high-risk populations, including young children and pregnant women. Serum ferritin levels are essential for early detection of iron deficiency because hemoglobin testing is not sensitive for anemia. Serum ferritin levels can be affected by illness and irritation. Various medical facilities worldwide use ferritin as a marker of iron deficiency. Serum ferritin indicates the level of iron stores in the human body (Candra, 2021).

METHOD

The research is *quasi-experimental* with *a one-group pretest-posttest design*. The treatment group was given iron supplements (elemental iron 60 mg and folic acid 0.4 mg) with the addition of black sesame seeds for 14 consecutive days, a dose of 200 mg once daily, taken at night after meals. Black sesame seed capsules are made by roasting the seeds, grinding them into a dry powder, and then inserting them into empty capsule shells. The sample was pregnant women in the second trimester at the Bangsal Public Health Center, Mojokerto who met the criteria. The sample size was 25 respondents plus 10% to anticipate *lost to follow-up* (*dropout*) to 28 respondents with Simple Random Sampling. Inclusion criteria included willingness to be research respondents by signing *informed consent,* undergoing antenatal care, second trimester gestational age 12-24 weeks, while exclusion criteria included severe anemia with hemoglobin levels <7g/dL, malnutrition with an upper arm circumference <23.5 cm, chronic infectious

ISSN: 2798-0332 (print)
ISSN: 2798-558 (online)

diseases such as Hepatitis, HIV, Syphilis, TB, and food taboos or following a certain diet. The study period was September-October 2024. The instrument used an observation sheet. Serum ferritin levels were examined using the ELFA method (enzyme-linked fluorescent immunoassay). Laboratory examinations were performed twice before and after the intervention. Analysis was performed using Wilcoxon test. Ethical clearance was conducted by the Health Research Ethics Commission of the Semarang Ministry of Health Polytechnic, marked by the obtaining of an Ethical Approval Certificate No. 1142/EA/F.XXIII.38/2024E.

Figure 1. Black sesame (*Sesamum indicum*)
(Source; https://www.google.com/search**)**

RESULTS AND DISCUSSION

The characteristics of the research respondents are as follows:

Table 1. Frequency Distribution of Respondent Characteristics at Bangsal Mojokerto Public Health Center (n=28)

Respondent Characteristics		Amount	
		f	%
Age	20-35 years	20	71.4
	<20 and >35	8	28.6
	Total	28	100
Education	High School-High School	20	71.4
	Elementary-Middle School	8	28.6
	Total	28	100
Work	Work	16	57.1
	housewife	12	42.9
	Total	28	100
Income	≥UMR	14	50.0
	<UMR	14	50.0
	Total	28	100

Based on Table 1, frequency distribution data based on age was obtained, with the majority of respondents aged 20-35 years, namely 20 mothers (71.4%). Frequency distribution based on education, the majority of respondents had a high school-college education, namely 20 mothers (71.4%). Frequency distribution based on occupation: more than half of the respondents worked, namely 16 mothers (57.1%). Frequency distribution based on income half of the respondents have income above the regional minimum wage of Mojokerto Regency in 2024 of Rp.2,832,710, amounting to 14 mothers (50.0%).

ISSN: 2798-0332 (print)
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Table 2. Analysis of Serum Ferritin Levels Before and After Intervention in the Treatment Group Black Sesame Seed Capsules at Bangsal Mojokerto Public Health Center (n=28)

Variables	Group Black Sesame Seed Capsules
Serum Ferritin Level Before (µg/mL)	
Mean	42.57
Min	9.20
Max	109.50
SD	30.07
Serum Ferritin Level After (µg/mL)	
Mean	44.93
Min	12.93
Max	110.15
SD	29.73
Serum Ferritin Level Difference (µg/mL)	2.36
Serum Ferritin Levels Before – After	
ρ value	0.001

Based on Table 2. shows that before the intervention the average serum ferritin levels of pregnant women in the group given capsules with the addition of black sesame seeds were 42.57µg/mL After the intervention the average serum ferritin levels of pregnant women were 44.93µg/mL The difference in the average increase in serum ferritin levels of pregnant women was 2.36µg/mL The results of *the Wilcoxon* test showed that the Significance (Sig) value in the group given herbal capsules with the addition of black sesame seeds obtained a ρ value of 0.001 smaller than 0.05.

Clinically, a delta difference in serum ferritin increase of 2.36 ng/mL indicates a small or minimal increase in iron stores. This figure is considered clinically or biologically insignificant unless supported by strong statistical significance in a large sample size.

In line with research results, the more sesame seed flour used, the higher the resulting iron content, ranging from 5.75 to 9.12 mg/100 grams. Sesame seed flour significantly influences the amount of iron in food. One package contains 471.2 kilocalories of energy, 11.52 grams of protein, 19.20 grams of fat, 63.08 grams of carbohydrates, 1.71 grams of ash, and 4.41 grams of water. The recommended serving size is 45 grams per meal. The iron content obtained per serving is 2.6 mg (Karani & Oktafa, 2021).

Anemia can occur during pregnancy due to a 30-40% increase in blood plasma volume, which inhibits the number of red blood cells, resulting in thinner blood, which leads to decreased hemoglobin. This blood thinning has the benefit of reducing the heart's workload in pumping blood and preventing excessive iron loss during labor. This decrease in red blood cells must be accompanied by adequate nutrition, particularly iron. This prevents further anemia, which can lead to decreased hemoglobin levels (Tombokan, 2021).

One example of a food containing iron that is both affordable and readily available is sesame seeds. Sesame seeds, as a high-iron food, can help increase iron levels. The addition of sesame seed powder capsules is expected to be well-tolerated by sufferers and help prevent iron deficiency anemia (Oktafa & Suharsono, 2019).

Sesame seeds contain high levels of ferrous, folic acid, and vitamin B12. Iron tablets, along with other micronutrients, are recommended because they are more easily absorbed and can last longer in the body, making them more effective in increasing the absorption of non-heme iron. Furthermore, sesame seeds are easily found and inexpensive, making them accessible to everyone. Capsules containing herbal powder are particularly helpful in the absorption process because they are more readily absorbed, rapidly absorbed by the digestive

ISSN: 2798-0332 (print)
ISSN: 2798-558 (online)

system within 20 minutes, while those in seed form take longer, around 18 hours. The efficacy of sesame seeds in increasing serum ferritin levels is also linked to their content, which contains compounds that can increase serum ferritin levels in the blood, including iron, copper, and manganese, which are essential for regulating metabolism, cell function, the immune system, and oxygen circulation throughout the body (Ekawati, 2024).

Other research indicates that iron is a micronutrient that functions as a means of transporting oxygen from the lungs to all body tissues and aids in the formation and maturation of red blood cells. Iron in food comes in the form of heme iron and non-heme iron. Heme iron is found in animal foods, and non-heme iron is found in plant foods (Anggraeni, 2016).

The main weaknesses of true experimental research include unnatural artificial environments, high costs and time, and ethical limitations. The duration of the intervention was limited to two weeks, resulting in less than optimal improvement in laboratory results and daily food consumption that is not the same for each respondent can bias the results of the repeat examination.

It is hoped that the results of this study can be developed as an alternative and complementary management besides pharmacological drugs in complementary midwifery care as one of the efforts in the prevention program and reducing the prevalence of anemia in pregnancy.

CONCLUSION

Based on the results of the Wilcoxon test, the ρ value obtained was 0.001 (<α 0.05), the conclusion of the study was that there was an effect of administering black sesame seed herbal capsules (*Sesamum indicum*) in increasing serum ferritin levels for anemia prevention in pregnant women. Daily consumption of black sesame seeds is very effective in helping prevent iron deficiency anemia. Black sesame seeds are high in iron, a key component in the formation of hemoglobin, which binds oxygen in the blood.The limitations of the research encountered include the fact that the arrangement and observation of the control and treatment groups required considerable effort and time.

ACKNOWLEDGMENTS

The author would like to express sincere gratitude to the Director of the Health Polytechnic of the Ministry of Health Semarang, the Head of the Postgraduate Program, the Head of the Applied Masters Midwifery Study Program, and the Head of the Majapahit College of Health Sciences Mojokerto for their invaluable support and facilities provided the research process. Deep appreciation is also extended to the Head of the Public Health Center Bangsal Mojokerto and the Head of the Regional Health Laboratory Mojokerto for their cooperation and assistance during the data collection and laboratory examinations. Furthermore, the authors are grateful to all enumerators who have contributed their time and effort, and to all research respondents who willingly participated in this study. This research would not have been possible without the dedication and support of all parties involved.

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