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The Important Role of Iron, Protein and Vitamin C With the Incident of Anemia

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ABSTRACT**:** *Anemia is a condition where there is a lack of healthy red blood cells. Anemia can be caused by various factors, including deficiencies of iron and vitamin C. The aim of this research is to explore the important role of iron and vitamin C in preventing and treating anemia. This research adopts a qualitative approach in its research methodology. The data collection technique used is literature study. After the data is collected, analysis is carried out in three stages, namely data reduction to identify important information, data presentation to organize relevant information, and conclusion drawing to summarize the findings and their implications. The results showed that iron, protein and vitamin C have important roles in the prevention and treatment of anemia. There is a close relationship between these three components in preventing and treating anemia. Iron deficiency is the root cause of anemia, while vitamin C and protein play a role in increasing iron absorption, thus playing an important role in preventing or treating anemia. Iron is an indispensable mineral for the body to form hemoglobin and myoglobin, which are major components in the transport of oxygen and carbon dioxide. Vitamin C as an antioxidan has a positive effect on immune function and also helps the body absorb iron more easily. So to reduce the risk of anemia, by fulfilling daily protein and then eating foods rich in vitamin C and combining them with iron sources.*

Keywords- *Iron, Protein, Vitamin C, Prevention, Anemia*

INTRODUCTION

Anemia is a condition in which the number of red blood cells decreases, resulting in their inability to deliver sufficient oxygen to the body's tissues. Anemia is divided into two main types, namely nutrition-related anemia and non-nutrition anemia. Nutrition-related anemia occurs when nutrient intake is insufficient to meet the body's need to produce hemoglobin and erythrocytes (Sunardi et al., 2021). Clinically, anemia is often identified through measurements of decreased hemoglobin, hematocrit, or red blood cell count. Among the three, hemoglobin measurement is often

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used as the main indicator to diagnose anemia (Zaenab, 2020). Based on data from WHO, the prevalence of anemia in women in Indonesia reached 23.9%. The prevalence of anemia consists of 26.4% in women aged 5-14 years and 18.4% in women aged 15-25 years. Adolescent girls have a ten times higher risk of suffering from anemia compared to adolescent boys (Akib & Sumarni, 2017).

Anemia can be caused by various factors including iron deficiency, protein deficiency, and vitamin C deficiency. Iron deficiency can interfere with the production of hemoglobin, which is the main component of red blood cells that carry oxygen throughout the body. Meanwhile, protein in the human body acts as a shaper of blood grains (hemopoiesis), namely the formation of erytrocytes with hemoglobin in them. Based on the results of research (Yuliati & Pertiwi, 2015), showed a significant correlation between total protein consumption and animal protein to hemoglobin levels. This shows the important role of protein in the formation of hemoglobin which is the main cause of anemia.

Meanwhile, vitamin C plays an important role in iron absorption. Vitamin C, also known as ascorbic acid, is a water-soluble vitamin that has various important functions in the body. One of the main roles of vitamin C is as a coenzyme or cofactor in various biochemical reactions. In addition, vitamin C also acts as a powerful antioxidant, helping to fight free radicals in the body and protect cells from oxidative damage (Avida, 2016). Vitamin C is also involved in the formation of collagen, an important protein that supports the structure and strength of connective tissues, including cartilage, bones, teeth, skin, and tendons. Because of its role in collagen formation, vitamin C has an important role in healing wounds, bone fractures, and preventing and reducing bleeding under the skin and gums. In addition, vitamin C has also been shown to help lower blood pressure, cholesterol levels, and the risk of heart attack (Leo & Daulany, 2022).

Vitamin C deficiency can inhibit the absorption of iron in the body, so even though iron intake is sufficient, if it is not accompanied by adequate vitamin C intake, iron absorption is not optimal. This condition can cause anemia or worsen existing anemia conditions. Therefore, it is important to ensure adequate intake of both iron and vitamin C in the daily diet to prevent or treat anemia (Tania, 2018).

Previous research by (Krisnanda, 2020) showed that vitamin C given with iron will have an impact in the form of increased iron absorption. In conclusion, vitamin C helps iron absorption by converting iron from iron to iron so that it is more easily absorbed by the body. Another study by (Nisa et al., 2020) found that there was an increase in adolescent knowledge about anemia, the number of adolescent girls who experienced anemia was 35% of the total respondents. Iron is the main nutrient that plays an important role in hemoglobin synthesis so that the lack of iron intake obtained from food causes hemoglobin levels to decrease.

The novelty of this study is the object of research, namely the important role of iron and vitamin C in the prevention and treatment of anemia, which has never been studied before simultaneously. This study contributes to the understanding of the importance of a balanced diet and

adequate nutrition in maintaining overall body health. The purpose of this study is to explore the important role of iron and vitamin C in the prevention and treatment of anemia.

RESEARCH METHODS

This research adopts a qualitative approach in its research methodology. Qualitative research method is a research approach used to understand phenomena or events in their natural context, emphasizing in-depth and interpretative understanding of the meaning given by participants or research subjects (Salim, 2019). The data collection technique used is a literature study. Data were collected through analyzing various literature sources related to the research topic. These literature sources are books, scientific journals, articles, research reports, and other documentation relevant to the research problem. After the data was collected, the analysis was carried out in three stages, namely data reduction to identify important information, data presentation to organize relevant information, and conclusion drawing to conclude the findings and their implications.

RESULTS AND DISCUSSION

Anemia remains a persistent public health challenge that requires special attention, especially in Indonesia. The high number of anemia cases in the country shows that this nutritional problem affects millions of people in developing countries and remains a major issue in human health. The prevalence of anemia is estimated at 9% in developed countries, while in developing countries the figure is as high as 43%. The most vulnerable groups are children and women of childbearing age, with an estimated prevalence of anemia in children under five reaching 47%, in pregnant women 42%, and in non-pregnant women aged 15-49 years reaching 30%. The World Health Organization (WHO) set a target of reducing the prevalence of anemia in women of childbearing age by 50% by 2025 (Anggreiniboti, 2022).

Anemia is defined as a condition in which the number of red blood cells or hemoglobin concentration in the blood is insufficient to meet the physiological needs of the body. Factors that can lead to anemia include parental education level, knowledge about anemia, economic conditions, iron intake, vitamin C intake, and the length of the menstrual cycle (Krisnanda, 2020). Lack of the main component of blood, haemoglobin, results in reduced oxygen availability in the body. This means that anemia occurs when the body lacks enough red blood cells or hemoglobin to transport oxygen

throughout the body. The main symptoms of anemia often include shortness of breath, dizziness, headache, chest pain, pale skin, and increased heart rate (Bhadra & Deb, 2020).

Anemia can affect anyone, including children and adolescents. Anemia in adolescents, especially in adolescent girls, is a very vulnerable age group because they tend to experience iron loss of 1.3 mg/day during menstruation, and the risk of anemia increases if the iron intake consumed is insufficient (Nurrahman et al., 2020). In addition, adolescent girls who experience anemia have a higher risk of developing the same condition as adults. Then when they reach adulthood and experience pregnancy, this risk of anemia can also remain high (Sungkar et al., 2022). Anemia in pregnant women can be a dangerous condition, both for the health of the mother and the baby she is carrying, and can even cause death.

Pregnant women who suffer from anemia are at risk of decreased immune function, increased risk of infection, and reduced quality of life, which in turn can result in miscarriage, life-threatening bleeding, premature birth (less than 9 months), low birth weight (less than 2500 grams) and shortness (less than 48 cm), and can cause death in the baby at birth. If the mother has severe anemia, the baby is also at risk of stillbirth. In cases of moderate and severe anemia, the risk of severe bleeding increases, which can lead to the death of both mother and baby. The impact on children born to anemic mothers can cause babies to be born with significant iron deficiency, increase the risk of developing anemia at an early age, and can hinder the growth and development of children (Carolin & Novelia, 2023).

Due to the high risk of anemia, effective prevention and treatment efforts are needed. Prevention is the measures taken before the occurrence of a condition or disease, while treatment is the measures taken after the condition has occurred. A combination of prevention and proper treatment is essential to prevent further complications of anemia and to reduce the risk of it occurring Anemia is a serious condition that, if not taken seriously, can lead to a person's death (Kaur, 2014). Therefore, it is important to prioritize anemia prevention and treatment measures to avoid more severe impacts, including the risk of death.

The urgency of prevention and treatment of anemia highlights the important role of iron, protein and vitamin C because iron deficiency is the leading cause of anemia worldwide, and vitamin C is a food constituent other than animal tissue that has been shown to increase iron absorption (Li et al., 2020). Then protein also has an important role in the absorption of iron in the body. Lack of protein intake can interfere with the process and inhibit iron absorption, which in turn can cause iron deficiency (Marfuah & Kusudaryati, 2021). So, based on this, it is concluded that there is a close relationship between these three components in preventing and treating anemia. Iron deficiency is the

root of the problem, while vitamin C and protein play a role in increasing iron absorption, thus playing an important role in preventing or overcoming anemia.

Iron is an essential element for almost all living organisms as it plays a role in various metabolic processes, including oxygen transport, deoxyribonucleic acid (DNA) synthesis, and electron transport (Abbaspour et al., 2014). There are two forms of iron in food: heme and nonheme. Iron found in animal meat such as beef, chicken and fish is the main source of heme iron, while nonheme iron can be found in cereals, nuts, fruits and vegetables (Basrowi & Dilantika, 2021).

Iron deficiency can cause anemia, as iron is required to form red blood cells, particularly hemoglobin. Hemoglobin contains iron as one of the important heme components. In the body, iron absorption occurs in the upper part of the small intestine (duodenum), with the help of the protein transferrin. Blood transferrin carries most of the iron to the bone marrow, where it is used to make hemoglobin, which is an important part of red blood cells. When iron deficiency occurs, iron stores in the body will be used to meet the need. However, if iron stores are depleted, the body will experience a shortage of red blood cells and the amount of hemoglobin will decrease, causing anemia (Lewa, 2016).

Furthermore, besides iron, another important element for the human body is protein, which is one of the macronutrient groups and plays a significant role in the formation of biomolecules. Protein is a very important food substance for the body because it functions as a building and regulating substance. According to the Nutritional Adequacy Rate (AKG), adequate protein intake is around 65 grams per day, according to the body's needs (Permatasari & Soviana, 2022). Protein has a strong relationship with hemoglobin levels, especially in foods of animal origin that contain a lot of iron. Transferrin is a type of glycoprotein produced in the liver. The main role of protein in the body's iron metabolism lies with transferrin, which is responsible for transporting iron in circulation to places where it is needed, for example from the intestine to the bone marrow to form new hemoglobin. Besides transferrin, ferritin is also an important protein in iron metabolism. Under normal conditions, ferritin is responsible for storing iron that can be recovered to be used as needed by the body (Elba et al., 2021).

Lack of protein intake can interfere with iron transport necessary for the formation of hemoglobin and red blood cells. This can lead to iron deficiency which can eventually result in anemia. Therefore, based on previous research by (Rusman, 2018), it is recommended to change the diet to be better and more regular by increasing the consumption of foods that contain protein, both from vegetable and animal sources. In addition, it is also recommended to reduce the consumption of fast food and snacks (junk food) and reduce the consumption of packaged tea which can inhibit iron absorption.

Recommendations in meeting the daily protein needs required by the body, it is advisable to consume both plant and animal protein. Plant-based protein can be obtained from various food sources such as cereals, tubers, nuts, seeds, vegetables, and fruits. Examples of plant-based protein

sources include soybeans, peanuts, mung beans, koro beans, as well as various other types of grains. Meanwhile, animal protein can be obtained from food sources such as meat, chicken, fish, processed meat products, and milk and its processed products (Ernawati et al., 2016). Thus, increasing protein from both plant and animal sources can help ensure that iron intake is sufficient for the body and prevent anemia.

In contrast to Vitamin C, a vitamin recognized as an essential component for human health, it was first identified in fruits such as oranges, vegetables, and the adrenal glands as hexuronic acid in the 1920s by Albert Szent-Györgyi, a Hungarian biochemist. This vitamin is water-soluble, which means the human body cannot store it and will eliminate it quickly. In addition, vitamin C cannot be synthesized by the human body itself, so it is important to include this vitamin in our diet (Pacier & Martirosyan, 2015).

Vitamin C plays an important role in the prevention and treatment of anemia. As an antioxidant, vitamin C not only helps boost immune function, but also plays a role in promoting more efficient iron absorption. By increasing the absorption of iron from food, vitamin C facilitates the formation of hemoglobin in the blood (Chintiabadi et al., 2015). Iron itself is a very important mineral for the body as it plays a role in the formation of hemoglobin and myoglobin, the main components in the transportation of oxygen and carbon dioxide in the body (Oliveira et al., 2014). Increased iron intake from food will contribute to increased hemoglobin levels in the blood, with optimal hemoglobin levels the risk of anemia can be reduced (Sholicha & Muniroh, 2019).

Vitamin C also has an important role in converting ferric iron into a ferrous form that is more easily absorbed by the body. The iron absorption process mainly occurs in the upper part of the duodenum and jejunum, where iron is transported into the mucosal epithelial cells of the small intestine. When iron is consumed orally, it tends to be oxidized to Fe3+ from its original form. For efficient absorption, an acidic digestive environment is required. Vitamin C helps create a more acidic environment in the stomach and prevents the oxidation of ferric iron to ferrous, which is more easily absorbed by the body (Li et al., 2020). Iron in the ferrous form is more easily absorbed in the small intestine, so absorption increases up to four times. In addition, vitamin C also facilitates the transfer of iron from transferrin in the plasma to ferritin in the liver (Alamsyah & Andrias, 2016).

In addition, vitamin C also inhibits the formation of hemosiderin, which is a storage form of iron that is difficult to mobilize to free iron when needed (Prandanti & Wulandari, 2015). This suggests that vitamin C not only improves iron absorption, but also affects iron metabolism in the body in various ways, all of which contribute to its important role in the prevention and treatment of anemia. Various studies in Indonesia have shown that iron consumption accompanied by vitamin C is more effective in increasing hemoglobin levels. Taking vitamin C along with iron can increase iron absorption by up to 67%. By taking vitamin C together with iron tablets, iron absorption increases, so that hemoglobin levels in the blood also increase (Rieny et al., 2021).

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To reduce the risk of anemia, it is important to eat foods that contain iron and vitamin C. Products rich in vitamin C combined with iron sources have been shown to improve iron status in the body (Skolmowska & Glabska, 2022). Sources of vitamin C are commonly found in plant foods, such as vegetables and fruits, especially those with a sour taste, such as oranges, pineapple, rambutan, papaya, gandaria, and tomatoes. In addition, vitamin C is also widely found in leaf vegetables and some types of cabbage (Chintiabadi et al., 2015).

In addition to eating foods rich in iron and vitamin C, iron supplements can also be considered. Iron supplements are additional iron-containing minerals, often with vitamin C added. Previous studies have shown that iron supplementation combined with vitamin C is effective in increasing hemoglobin levels by 0.79 higher than iron supplementation without the addition of vitamin C (Aini & Safitri, 2021). This supplementation model can be a good alternative in implementing iron supplementation programs, because the addition of vitamin C can increase the effectiveness of iron absorption by the body.

Therefore, ensuring adequate daily protein intake for the body, then consuming foods rich in vitamin C and combining them with iron sources has been shown to improve iron status in the body. In addition to eating foods rich in iron and vitamin C, it is also worth considering taking iron supplements. Iron supplements are additional supplements that contain the mineral iron, and often vitamin C, to help meet the body's need for iron more effectively. Increased iron intake from food will contribute to increased hemoglobin levels in the blood, with optimal hemoglobin levels the risk of anemia is reduced.

CONCLUSION

Iron, protein and vitamin C play a crucial role in the prevention and treatment of anemia. Iron, as an essential mineral, plays a major role in the formation of hemoglobin and myoglobin, key components in the transportation of oxygen and carbon dioxide in the body. Meanwhile, protein plays an important role in the absorption of iron in the body. In addition, vitamin C, which functions as an antioxidant, not only increases endurance, but also facilitates more efficient iron absorption. Thus, there is a close relationship between these three components in preventing and treating anemia. Iron deficiency is the root of the problem, while vitamin C and protein play a role in enhancing iron absorption, thus playing an important role in preventing or treating anemia. Therefore, ensuring adequate daily protein intake for the body, then consuming foods rich in vitamin C and combining them with iron sources has been shown to improve iron status in the body. Increased iron intake from food will contribute to increased hemoglobin levels in the blood, with optimal hemoglobin levels the risk of anemia can be reduced.

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