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Effectiveness of Adding Tomato Juice to Fe Tablet Supplementation on the Hemoglobin Levels of Anemic Adolescent Girls in Class XII at SMK Negeri 1 Sukanagara, Indonesia

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A B S T R A C T

Introduction: Iron deficiency anemia (IDA) in adolescent girls is a serious public health problem. Iron supplementation is one of the most effective efforts to control ADB. The addition of tomato juice to Fe tablet supplementation is expected to increase iron absorption and reduce side effects. This study aims to determine the effectiveness of adding tomato juice to Fe tablet supplementation on the hemoglobin levels of anemic teenage girls in class XII at SMK Negeri 1 Sukanagara, Indonesia. **Methods:** This research used a quasi-experimental design with a pretest-posttest with control group design. The research sample was 60 anemic teenage girls in class Fe tablet supplementation. The intervention was carried out for 4 weeks. Hemoglobin levels were measured before and after intervention. Data were analyzed using the t-test. **Results:** The results showed that there was a significant difference in hemoglobin levels between the intervention group and the control group after the intervention ($p<0.05$). Hemoglobin levels in the intervention group increased by an average of 1.2 g/dL, while in the control group, they only increased by an average of 0.5 g/dL. **Conclusion:** The addition of tomato juice to Fe tablet supplementation is effective in increasing hemoglobin levels in anemic adolescent girls.

1. Introduction

Iron deficiency anemia (IDA) is a prevalent public health problem in Indonesia, especially in adolescent girls. Data shows that the prevalence of ADB in adolescent girls in Indonesia reaches 27.2%, meaning that almost 1 in 4 adolescent girls in Indonesia suffer from iron deficiency. This condition is not without reason. Adolescent girls are a group that is vulnerable to experiencing ADB. Adolescent girls experience rapid physical growth and development, including menstruation, starting at puberty. This causes the need for iron to increase to support this process. Many young women do not eat foods rich in iron, such as red meat, liver, and green vegetables. Excessive menstruation can cause significant iron loss. Iron deficiency can cause fatigue and lack of energy so young women easily feel tired and lack enthusiasm for activities. Iron deficiency can disrupt brain and nerve function so teenage girls have difficulty concentrating and learning. Iron deficiency can weaken the immune system, making young women more susceptible to disease. In severe cases, ADB can hinder the growth and physical development of adolescent girls.[1-3]

Iron supplementation is one of the most effective efforts to control ADB. Fe tablets can help increase iron levels in the body and treat anemia. However, Fe

tablet supplementation can cause side effects such as constipation and nausea. This can make young women uncomfortable and reluctant to continue supplementation. The addition of tomato juice to Fe tablet supplementation is expected to increase iron absorption and reduce side effects. Tomato juice is rich in vitamin C, which can help absorb iron. Apart from that, tomato juice also contains antioxidants, which can help reduce the side effects of Fe tablet supplementation.[4,5] The research aims to determine the effectiveness of adding tomato juice to Fe tablet supplementation on hemoglobin levels in anemic adolescent girls.

2. Methods

This research used a quasi-experimental design with a pretest-posttest with a control group design. This design was chosen to determine the effectiveness of adding tomato juice to Fe tablet supplementation on hemoglobin levels in anemic adolescent girls. The research sample was 60 anemic teenage girls in class XII at SMK Negeri 1 Sukanagara, Indonesia. The sample was calculated using the Slovin formula with a confidence level of 95% and a margin of error of 5%. The sample was divided randomly into two groups, namely: Intervention group (n=30): Received Fe tablet supplementation and tomato juice for 4 weeks. The control group (n=30) only received Fe tablet supplementation for 4 weeks. The intervention was carried out for 4 weeks. The intervention group received supplementation with Fe tablets 1 tablet per day and tomato juice 200 ml per day. The control group only received Fe tablet supplementation, 1 tablet per day. Hemoglobin levels were measured before and after the intervention using a Hemoglobinometer. Data were analyzed using the t-test to determine differences in hemoglobin levels between the intervention group and the control group before and after the intervention.

3. Results and Discussion

The results showed that there was a significant difference in hemoglobin levels between the intervention group and the control group after the intervention ($p<0.05$). This shows that the addition of tomato juice to Fe tablet supplementation is effective in increasing hemoglobin levels in anemic adolescent girls. Intervention group: Hemoglobin levels before intervention: mean 11.5 g/dL; Hemoglobin levels after intervention: average 12.7 g/dL and Average increase: 1.2 g/dL. Control group: Hemoglobin levels before intervention: mean 11.6 g/dL; Hemoglobin levels after intervention: average 12.1 g/dL and average increase: 0.5 g/dL.

Table 1. Comparison of Hb levels before and after intervention.

Group	Hb level before intervention (g/dL) ± SD	Hb level after intervention (g/dL) ± SD	Mean increase (g/dL) ± SD
Intervention	11,5 ± 1,4	12,7 ± 1,5	1,2 ± 0,1
Control	11,6 ± 1,6	12,1 ± 1,4	0,5 ± 0,03

This study showed that the increase in hemoglobin levels in the intervention group, which received Fe tablet supplementation and tomato juice, was significantly higher compared to the control group, which only received Fe tablet supplementation. The addition of tomato juice to Fe tablet supplementation is effective in increasing iron absorption. The vitamin C in tomato juice helps convert non-heme iron (which is found in plant foods) into the heme form (which is more easily absorbed by the body). Tomato juice helps with anemia. The increase in hemoglobin levels in the intervention group shows that tomato juice helps the body produce more red blood cells.[6,7]

Vitamin C in tomato juice has an important role in increasing iron absorption. Iron occurs in two forms: Heme iron, which is found in red meat, poultry, and fish. This form is easily absorbed by the body as well as non-heme iron. It is found in plant foods such as green vegetables, legumes, and cereals. This form is more difficult for the body to absorb. Vitamin C

reduces non-heme iron (Fe^{3+}) into the heme form (Fe^{2+}), which is more easily absorbed by the body. Vitamin C increases the solubility of non-heme iron in water, making it more easily transported by the intestines into the bloodstream. Vitamin C can reduce the effects of phytates and tannins, which inhibit iron absorption. Tomato juice is a good source of vitamin C. One glass of tomato juice (240 ml) contains about 24 mg of vitamin C, which is equivalent to 40% of an adult's daily vitamin C requirement.[8-10]

Iron deficiency anemia (IDA) is a condition when the body lacks iron. ADB can cause fatigue, shortness of breath, and pallor. The vitamin C in tomato juice helps increase the absorption of iron from foods consumed together. Tomato juice also contains non-heme iron, although not as much as in red meat. The vitamin C in tomato juice may help reduce the side effects of iron supplementation, such as constipation and nausea.[11,12]

4. Conclusion

Based on the results of this study, it can be concluded that adding tomato juice to Fe tablet supplementation can be an effective strategy to increase iron absorption and help overcome anemia in adolescent girls.

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