

# **The Effect of The Mixed Juice of Carrot and Guava with Iron Supplement for Adolescent with Anemia**

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**Abstract—** Anemia is a condition in which the value of Hemoglobin (Hb) in blood is lower than normal. Anemia for adolescents is when hemoglobin levels are less than 12 g/ dl. This research was experimental research. The sample in this research were female students who suffered from anemia from 2 junior high schools in South Jakarta. The intervention group was given mixed juice of carrot and guava juice with iron supplement while the control group was only given iron supplement. There were 20 respondents in the intervention group and 20 respondents in the control group. The intervention was given 2 times for 4 weeks. Before being given to respondents, the mixed juice was tested at the Pharmacy laboratory of University of Indonesia. The results showed that the Sig. (p-value) of 0.036 <0.05, meaning that there was a statistically significant difference between the increase of Hb levels resulted from the administration of iron tablets and the mixed fruit juice compared to the administration of iron supplement only. Iron supplement is to overcome iron deficiency and it can reduce the prevalence of anemia. The mixed juice of carrot and guava is the most effective supplement to increase hemoglobin levels compared to iron supplement only.

**Keyword: anemia, adolescent, iron supplement, mixed juice of carrot and guava**

## **1. INTRODUCTION**

Anemia is a health problem that is mostly occurred in developing countries. Although the main cause is iron deficiency, anemia is also a problem of micronutrient malnutrition that is quite large in the world with a prevalence of 40%. Anemia generally occurs in developing countries and in low socio-economic groups. <sup>1</sup>

Adolescence is a period of transition from childhood to adulthood. It is characterized by rapid physical, biological, and hormonal changes resulting in psycho-social, behavioral, and sexual maturity in an individual. It is the second growth spurt of life, and both boys and girls undergo different experiences in this phase. <sup>2</sup>

Anemia in adolescents is a condition in which the Hb value in the blood is lower than normal. The limitation of anemia for adolescents is if hemoglobin levels are less than 12 gr / dl. <sup>3-</sup> Anemia is a condition in which the number and size of red blood cells, or hemoglobin concentration, fall below the set limit value, damaging the blood capacity to carry oxygen around the body. <sup>4</sup>

Data in Indonesia showed 3.5 million children in Indonesia suffered from anemia. Based on the Survey Kesehatan Rumah Tangga (SKRT) in 2005 the prevalence of anemia in school children reached 26.5%.<sup>5</sup> Anemia prevalence is estimated at 9 percent in developed countries, while in developing countries the prevalence is 43 percent. Children and women of childbearing age (WUS) are the most at risk groups, with estimation of the prevalence of anemia in children under five by 47 percent, in pregnant women by 42 percent, and in non-pregnant women aged 15-49 years by 30 percent. <sup>6</sup> .

Anemia is one of the public health problems in Indonesia that can be experienced by all age groups ranging from toddlers to old age. Riskesdas 2013 showed that the prevalence of anemia in women aged ≥15 years was 22.7%, and the prevalence of anemia in pregnant women was 37.1%.<sup>6</sup> The World Health Organization (WHO) aims to reduce the prevalence of anemia in WUS by 50 percent by 2025.<sup>3</sup>

Anemia results in poor cognitive and motor development in children. It can cause fatigue and low productivity. In pregnancy case, it can cause low birth weight of the babies, prematurity, maternal and

perinatal death. In 2010, anemia is thought to cause more than 68 million years of life with disability, more than the case of major depression and respiratory disease.<sup>7</sup>

Nutritional requirements for young women are determined by loss of basal iron inside and outside the body, loss during menstruation and for growth. Most teenagers who have low iron nutritional status are caused by low quality of food and consumption habits. Teenage women often suffer from anemia due to consuming less foods with animal protein, doing diet because they want to slim down their body and experiencing menstruation every month. In addition, the group that loss and iron was quite high. Some causes are menstruation in long period, frequent blood donations, and very intensive exercise.<sup>8</sup>

The impact of anemia on young women is that during the period of growth they are easily infected by disease, body fitness is reduced, the spirit of learning and achievement is decreased. It put them to be in risk when they decide to be mother. Adolescent girls also get many other effects including: decreasing the ability and concentration of learning, interfering with the growth so that the height does not reach optimal, decreases the physical ability of do some sports and resulting in pale faces.<sup>1</sup>

Hemoglobin concentration cannot be used to diagnose iron deficiency. However, hemoglobin concentration must be measured, although not all anemia is caused by iron deficiency. Hemoglobin concentration can provide information about the severity of iron deficiency.<sup>7</sup>

Iron supplement is one way to overcome iron deficiency and reduce the prevalence of anemia. The provision of iron and vitamin C supplement in anemic children will result in an increase in hemoglobin levels which is most effective compared to nutritional education or supplement. Vitamin A can help for the growth and development of tissue in the body. It also can increase the number of red blood cells, and help iron into hemoglobin to carry oxygen.<sup>6</sup>

Adolescents are at high risk of iron deficiency and anemia. This is due to rapid pubertal growth with sharp increase in lean body mass, blood volume, and red cell mass, which increases iron requirements for myoglobin in muscles and Hb in the blood. Iron requirement increases two- to three folds from a preadolescent level of ~0.7–0.9 mg iron/day to as 1.40–3.27 mg iron/day in adolescent girls.<sup>9</sup> Every increase in blood for fertile women and pregnant women contains at least 60 mg of elemental iron in ferro fumarat or ferro gluconate dosage forms and folic acid.<sup>10</sup>

## 2. MATERIALS AND METHOD

This was experimental study. The research was conducted in 2 junior high schools in the South Jakarta : Dharma Putra Nusantara (DPN) 86 and Madrasah Tsanawiyah (MTS) Nurul Huda. Respondents were female students who had Hb less than 12 mg / dl who were examined for hemoglobin levels first. Sample respondents were randomly selected. The intervention in both intervention groups was twice a week for 4 weeks.

The exclusion criteria in this study were: respondents did not suffer from health-threatening diseases such as tuberculosis, cancer and autoimmune diseases. Respondents are not in therapy such as chemotherapy and auto immune therapy. And inspection is done by medical personnel first.

The sample in this study was 40 people , 20 respondents in the treatment group and 20 respondents in the control group. In the treatment group, a mixed of fruit juices and iron supplement were given. The control group was only given the iron supplement. Iron used contains ferrous Fumarat 180 mg (equivalent to elemental iron 60 mg of elemental iron and 400 mg of folic acid. The control and intervention groups must take and consume the supplements in front of the researchers.

The juice given to the control group was fruit juice which consisted of 100 grams of guava, 100 grams of carrot and 100 CC of boiled water. The filtered juice without added sugar was then given to the respondent. The fruit juice before being given to the respondent had been tested in the laboratory at the Pharmacy Laboratory of the University of Indonesia with the results of vitamin C levels 1.33 mg /g and vitamin A 17.18 mg / g. This research has been approved by Jakarta Ministry of Health's polytechnic ethics committee and there was no conflict of interest in this research.

### 3. RESULTS AND DISCUSSION

Table 1. Univariate Analysis of Respondent Distribution

Variable	Total	Percentage
Group Treatment		
Iron Supplement	20	50.0%
Iron Supplement and mixed juice	20	50.0%
Knowledge		
Good	21	52.5%
Poor	19	47.5%
Nutritional Status		
Normal	34	85.0%
Obesity	6	15.0%
Consumption		
Yes	21	52.5%
No	19	47.5%

From the table, it can be seen that there are 20 respondents given only iron tablets (50%), while 20 people receive iron supplement and fruit Juice (50%). There are 21 respondents who have good knowledge (52.5%), while 19 people have poor knowledge (47.5%). The number of respondents with nutritional status in the normal category is 34 people (85%), there are 6 categories of obesity (15%). There were 21 respondents who consumed animal protein (52.5%), while 19 people do not consume animal protein (47.5%).

Table 2. Levels of HB Before and After in the Intervention Group

Respondents	Hb Before	Hb After	Hb Increase
1	10.1	12.2	2.1
2	11.6	13.5	1.9
3	11.4	12.0	0.6
4	10.1	11.8	1.7
5	9.6	14.1	4.5
6	11.6	12.1	0.5
7	11.7	13.2	1.5
8	11.3	12.0	0.7
9	11.1	12.5	1.4
10	11.6	14.0	2.4
11	11.4	13.7	2.3
12	8.9	12.1	3.2
13	11.7	12.7	1.0
14	10.4	12.4	2.0
15	11.7	12.2	0.5
16	9.8	12.0	2.2
17	10.8	12.4	1.6
18	11.2	13.2	2.0
19	11.2	12.8	1.6
20	11.0	13.4	2.4
<b>Mean</b>	<b>10.9</b>	<b>12.7</b>	<b>1.8</b>

**Table 3. Levels of HB Before and After in the Control Group**

<b>Respondent</b>	<b>Before</b>	<b>After</b>	<b>Increase</b>
1	11.2	12.2	1.0
2	11.6	13.5	1.9
3	7.1	10.0	2.9
4	9.8	11.8	2.0
5	11.7	12.3	0.6
6	10.9	12.1	1.2
7	9.7	12.3	2.6
8	10.6	12.0	1.4
9	10.6	12.5	1.9
10	10.0	12.2	2.2
11	11.3	11.7	0.4
12	10.7	12.1	1.4
13	11.2	11.7	0.5
14	11.5	11.7	0.2
15	11.2	12.2	1.0
16	10.0	10.6	0.6
17	9.2	10.2	1.0
18	11.0	11.2	0.2
19	10.0	10.2	0.2
20	10.4	11.4	0.6
<b>Mean</b>	<b>10.5</b>	<b>11.7</b>	<b>1.2</b>

**Table 4. HB Levels Before and After in the Control Group**

<b>Respondents</b>	<b>Before</b>	<b>After</b>	<b>Increase</b>
1	11.2	12.2	1.0
2	11.6	13.5	1.9
3	7.1	10.0	2.9
4	9.8	11.8	2.0
5	11.7	12.3	0.6
6	10.9	12.1	1.2
7	9.7	12.3	2.6
8	10.6	12.0	1.4
9	10.6	12.5	1.9
10	10.0	12.2	2.2
11	11.3	11.7	0.4
12	10.7	12.1	1.4
13	11.2	11.7	0.5
14	11.5	11.7	0.2
15	11.2	12.2	1.0
16	10.0	10.6	0.6
17	9.2	10.2	1.0
18	11.0	11.2	0.2
19	10.0	10.2	0.2
20	10.4	11.4	0.6
<b>Mean</b>	<b>10.5</b>	<b>11.7</b>	<b>1.2</b>

Table 5 Differences in Average Hb Before and After the intervention group.

Hemoglobin Value	Mean	Standard Deviation	P Value
Before giving iron +Juice	10.910	0.8181	0.000
After giving iron + Juice	12.715	0.7257	

From the table above, it shows that in the treatment group (intervention), the average value of Hb before the juice and the iron were given is 10.9, while the Hb value after is 12.7. It is seen that the value of Sig. (p-value) of 0.000 < 0.05. This means that statistically there is a significant difference between Hb levels before and after the intervention, resulting from the administration of iron supplement and mixed juice. Iron supplement and mixed of carrot and guava juice can significantly increase the average Hb level by 1.8.

Table 6 Differences in Average Hb Before and After Iron Supplement Tablets Were Given in the Control Group

Hemoglobin Value	Mean	Standard Deviation (SD)	P Value
Before tablet fe	10.910	0.8181	0.000
After tablet fe	12.715	0.7257	

It is seen that the value of Sig. (p-value) of 0.000 < 0.05. This means that statistically there is a significant difference between Hb levels before and after the intervention, resulting from the administration of Fe tablets. So, giving Fe tablets can significantly increase the average Hb level by 1.2. The increase in Hb levels occurred in 2 observation groups, both those given Fe + Tablets and Fruit Mixed, only those given Fe tablets.

Table 7 Differences in the Average Hb Before and After the Administration of Fruit Juice and Fe in the Intervention Group and Given Fe in the Control Group.

Value Hemoglobin	N	Mean	Standard Deviation (SD)	P Value
Iron Tablet + Juice	20	1.805	0.9616	0.036
Iron Tablet	20	1.190	0.8233	

The value of Sig. (p-value) of 0.036 < 0.05. This means that statistically there is a significant difference between the increases in Hb levels resulted from iron supplement and mixed juice compared to iron supplement only.

Table 8 Results of Bivariate Analysis of Dependent Variables with Independent Variables

Variable	N	Mean	Standard Deviation	P Value
<i>Knowledge</i>				
Poor	19	1.679	1.1356	0,262
Good	21	1.333	0.7010	
<i>Consumed</i>				
Bad	19	1.563	1.1922	0,688
Good	21	1.438	0.6515	
<i>Nurtrition Status</i>				
Obesity	6	2.050	0.3782	0,188
Normal	34	1.400	0.9748	

It can be seen that the mean value (average) of the increase in Hb levels in respondents who have poor knowledge is greater than the respondents with good knowledge (1.68 > 1.33). It is seen that the value of

Sig. (*p-value*) of  $0.262 > 0.05$ . This means that statistically there is no significant difference between the increases in Hb levels in the two knowledge groups.

The table above shows that the mean (average) increase of Hb levels in respondents who consume animal protein is smaller than those who do not consume ( $1.44 < 1.56$ ). It is seen that the value of Sig. (*p-value*) of  $0.688 > 0.05$ . This means that statistically there is no significant difference between the increases of Hb levels in the two diets.

It can be seen that the mean increase of Hb levels in respondents with normal nutritional status is smaller than those of obesity ( $1.40 < 2.05$ ). It is seen that the value of Sig. (*p-value*) of  $0.118 > 0.05$ . This means that statistically there is no significant difference between the increases of Hb levels in the two groups of nutrition status.

Table 9 Results of Bivariate Selection

Variable	Statistic	p-value	Selection
Juice / iron	Independent T-Test	0.036	Passed
Knowledge	Independent T-Test	0.262	No
Consumption	Independent T-Test	0.688	No
Nutritional status	Independent T-Test	0.118	Passed

From the results obtained two variables that passed the selection, namely the Observation and Nutrition Status Group.

Table 10 Preliminary Model of Multivariate Modeling

Variable	B	SE	beta	P Variabel
Treatment Group	0.615	2.77	0.332	0,032
Nutritional Status	0.153	0.856	0.251	0.102

From the table above, it shows that the model has a Sig. (*p-value*)  $< 0.05$ , which is 0.029. This means that simultaneously the two independent variables are strong enough to explain the dependent variable (Increase in Hb). It's just that in the table *coefficients* (per variable) there are variables that have a *p-value*  $> 0.05$ , namely nutritional status at 0.102

Table 11 Final Model of multivariate modeling

Variable	B	SE	Beta	P Value
Treatment Group	0.615	2.83	0.332	0,036

From the table above, it shows that the model has a Sig value. (*p-value*)  $< 0.05$ , which is 0.036. So is the Sig. (*p-value*) in the table coefficients (per variable). P values are  $< 0.05$ . This means that the treatment group variable has a strong relationship with the dependent variable (Increase in Hb).

## DISCUSSION

### Mixed Carrot and Guava Juice with Iron Supplements to Increase Hemoglobin Levels

In the treatment group the average Hb value before treatment was 10 mg/dl. While the Hb value after was 12.7. It is seen that the value of Sig. (*p-value*) of  $0.000 < 0.05$ . This means that statistically there was a significant difference between Hb levels before and after the intervention, resulted from the administration of iron supplements and mixed juice of guava and carrot. The combination of iron supplement and mixed of carrot and guava juice can significantly increase the average hemoglobin level. It is seen that the value of Sig. (*p-value*) of  $0.036 < 0.05$ . This means that statistically there was a significant difference between the

increase in Hb levels resulted from the administration of iron supplements and mixed of carrot and guava juice compared to iron supplements only.

To increase hemoglobin in the body, micro-nutrient intake can be provided by supplementing micro-nutrient care, namely iron. To overcome the low absorption, it is accompanied by consuming foods that contain vitamin C. Guava (*psidium Guava Linn*) contains vitamin C which is twice as high as vitamin C in citrus fruits. Vitamin C is known to help the increase of iron absorption by reducing iron from ferric to ferro in the intestine so that it becomes more easily absorbed. In addition vitamin C can also inhibit the formation of hemosiderin which is difficult to mobilize by iron. In addition, iron absorption in non-heme conditions can increase fourfold in the body.<sup>11</sup> Vitamin A works for the absorption of iron and or the use of iron reserves for the production of new heme. It shows that the effect of iron supplement on hemoglobin concentration can be increased by the addition of vitamin A.<sup>5</sup>

There was no significant difference in the average hemoglobin level between groups control and intervention groups. The differences and averages between the control and treatment groups occur tend to increase the average hemoglobin level. The intervention group in this study was given a tablet of blood and vitamin C tablets, and the control group was given iron supplements only.<sup>12</sup>

Research at the Maitreyawira Buddhist Training Center can conclude that significant iron intake and vitamin C intake affect the value of adolescent hemoglobin levels. This happens because iron is a major component that plays an important role in the formation of blood which is synthesizing Hb. Iron intake which is less than RDA will not directly affect Hb levels because the body still has iron reserves in the liver, accompanied by adequate intake of vitamin C it will help the absorption of iron more optimally. Decrease in Hb levels occurs after iron reserves are depleted, which begins with a decrease explained that vitamins play a role in mobilizing iron reserves in the body to be able to synthesize Hb. Poor vitamin A status is associated with changes in iron metabolism in cases of iron deficiency. Previous research that supports this theory concludes that with the treatment of vitamin A supplement will increase Hb levels, the possibility of a mechanism can reduce anemia because vitamin A plays a role in mobilizing iron reserves in the liver, increasing erythropoiesis, and reducing anemia accompanied by infection.<sup>13</sup>

### Knowledge

In this study statistically there was no significant difference between the increases in Hb levels in the two knowledge groups. In Health belief theory, the knowledge model is one of the factors that influence and trigger someone to handle or prevent a disease to be addressed.<sup>14</sup>

Knowledge is related to education. The higher the education of a person, the wider the knowledge. Education influences the learning process, the higher one's education will be the easier it is to receive information because it tends to get more information, both from other people and from the mass media. The more information entered, the more knowledge is gained.<sup>13</sup> In this study there is probably no relationship between knowledge because the education of respondents is still junior high school, so the exposure to information is still low.

A behavior or self-regulatory depends on belief. To change one's dietary behavior, it cannot be done simply by providing basic knowledge about nutrition, but also the need for motivation and a will from the individual which then guides a process of self-regulatory control. A person's ability to control someone in carrying out a particular action. Health promotion through education is an interactive process that encourages learning, and learning is a way to increase knowledge, attitudes, and skills through certain practices and experiences. Education on nutrition is the most commonly used method to promote eating behavior but the results are very lacking.<sup>15</sup>

Adolescent girls exhibited good knowledge toward anemia but they have not accessed to proper attitude and practice. However, adolescent girl's knowledge alone is not sufficient to impact practices and attitudes. Behavioral, physiological, and socioeconomic limitations must be addressed efficiently. Dissemination of comprehensive nutritional knowledge regarding diet and supplements should be made.<sup>16</sup>

### Pattern of Consumption

The results of the study show that the value of Sig. (p-value) of 0.688 > 0.05. This means that statistically

there was no significant difference between the increases in Hb levels in the two diets. Food sources which are rich in iron and folic acid are generally found in animal proteins such as liver, fish and meat which most people in Indonesia are not able to afford. Giving blood tablets as one of the important efforts in preventing and controlling anemia is an effective way because it can prevent and overcome iron or folic acid deficiency.<sup>15</sup> Low iron intake often occurs in people who consume foods that are less diverse with a diet consisting of rice, nuts and a little meat, poultry, fish which is a source of iron. Other determinant factors are influenced by the level of energy consumption, iron and vitamin. Research in Makassar City, South Sulawesi, showed that there was no significant relationship between food intake and hemoglobin (Hb) levels in adolescent girls intake was strongly influenced by diet. Especially young women are very concerned with their diet to keep their body ideal, so that the possibility of malnutrition is higher to be occurred. The number of diet methods that are not in accordance with the principles of nutrition can cause problems of foods intake. Anemia can be caused by a lack of intake or consumption of nutrients. Several studies have shown that improper diet can cause low hemoglobin levels, including low iron intake and a vegetarian diet.<sup>17</sup> Among nutritional correlates, statistically significant association of anemia was found with vegetarian diet, worm infestation, and no history of iron supplement. Anemia was more commonly found in the girls who were vegetarian, who had positive history of worm infestation, and who had no iron supplement.<sup>18</sup> Nutritional Components are very important factor, especially with respect to iron deficiency. Dietary Iron is classified into two forms: heme irons and non-heme iron. Heme iron is found in meat and has high bioavailability. Whereas Non-heme iron is rich in plant and has lower bioavailability. The Bioavailability of non-heme iron depends on the other nutrients that act as enhancers or inhibitors.<sup>19</sup>

### **Nutritional Status**

The value of Sig. (p-value) of 0.118 > 0.05, this means statistically that there was no significant difference between the increase of Hb levels in the two groups of Nutrition Status. Teenagers who have less BMI or thin body have a risk of 1.5 times to suffer from anemia.<sup>5</sup> BMI has a positive correlation with hemoglobin concentration, meaning that someone who has less BMI will suffer from anemia. Allegedly changes in menstrual status, which is when some of the samples have not been menstruated will affect the correlation.<sup>8</sup> Foods originated from animals have more complete amino acids and quality of nutrients, namely protein, vitamins and minerals better. The content of these nutrients is more easily absorbed by the body. Fat from poultry meat contains more saturated fat.<sup>20</sup> Teenage growth period has something to do with nutritional needs that must be fulfilled. When nutritional needs can be met, the growth will be optimal. Lack of nutrient intake results in problems such as malnutrition and anemia.<sup>21</sup> Lower BMI are reported as the most important factors associated with anemia among adolescent girls. Nutritional deprivation has long been identified as one of the most important causes of anemia, particularly among adolescent girls from underdeveloped countries. Our study identified that malnutrition (BMI-for-age Z-score < -2SD) was a significant risk factor of anemia among adolescent girls. Studies conducted in similar setting also found that lower BMI is associated with higher rate of anemia among adolescent girls. However, contradictory to this, BMI had not significantly been.<sup>22</sup> Anemia in adolescent had an impact of significant lower weight and BMI than adolescent without anemia<sup>23</sup>

## **4. CONCLUSION**

The provision of iron supplement is one way to overcome iron deficiency and reduce the prevalence of anemia. Giving iron supplement and mixed of fruit juice to anemic adolescent will give the most effective increase in hemoglobin levels compared to supplement alone.

## **5. ACKNOWLEDGEMENT**

### **Primary Health Centre**

Primary Health Centre should conduct a socialization on the mixed of iron supplement and fruit juice to overcome anemia.

### **Parents**

Parents should increase their intake of vitamins A, C and tablets for their daughters, so that anemia can be overcome.

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