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The Effect Of Tomato Combination By Sweet Orange On Chemogrobin And Ferritin Levels Changes

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Women's participation in economic activities is not new. Besides playing a role as a housewife, women also play a role in labor.1 There are still many health problems due to the work of one of the nutritional problems, namely nutritional anemia. Women who experience anemia will experience symptoms with body complaints quickly tired, weak, tired, lethargic, sometimes the head feels dizzy, looks pale and less excited so that it can reduce work capacity and work productivity.5 Fe tablets can increase hemoglobin levels in the blood but Fe tablets are difficult to be absorbed by the body.15 So food is needed additional products such as tomatoes and oranges that contain vitamin C to speed up the process of iron absorption.16 This type of research is a quantitative study with the method used is a quasi-experimental research design. Population in this study were all female workers who were anemic in the Baso Kataji Company. The sample was 40 people divided menj There are 4 groups, 10 treatment groups 1 (tomatoes), 10 treatment groups 2 (oranges), 10 treatment groups 3 (tomato and citrus combination) and 10 control groups. The treatment was given for 14 days in each group with a 250 gr tomato dose, 200 gr grapefruit, 125 gr tomato combination with 100 gr grapefruit at lunchtime and the hemoglobin and ferritin levels were examined the first day and post test on day 15. Data analysis used Paired T-test to see the values before and after treatment in each group and one way ANOVA analysis to see the differences in the effects of the four groups. The results showed in the treatment group 1 increased 1.92 gr / dl for hemoglobin and 37.20 µg / dl for ferritin, treatment group 2 increased 2.70 gr / dl for hemoglobin and 21.40 µg / dl for ferritin, treatment group 3 increased 1.38 gr / dl for hemoglobin and 59.50 µg / dl for ferritin, the control group experienced an increase of 0.83 gr / dl for hemoglobin and 4.60 µg / dl for ferritin. Citrus fruit is more influential for raising hemoglobin and the combination of tomatoes and oranges is more influential for raising ferritin levels in female workers in the Kataji baso company.

Keywords: Tomato, Sweet Orange, Fe Tablets, Anemia of Female Workers, Hemoglobin Levels, Ferritin Levels

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INTRODUCTION

The number of female workers in Indonesia is increasing every year. BPS Statistics Indonesia (Central Statistics Agency) February 2016 TPAK (Labor Force Participation Rate) of female workers by 52.71% increased 2.33% to 55.04% in February 2017. (ILO, 2017) From 2007 Riskesdas observations the prevalence of anemia 19.7% increased to 23.9% in 2013.6 The number of cases of occupational diseases that can reduce work productivity, one of which is nutritional anemia among female workers. Iron deficiency anemia begins with depletion of iron stores (ferritin) and increased absorption of iron which is symbolized by increasing iron binding capacity. At a later stage in the form of depletion of iron stores, reduced saturation of transferrin, reduced amount of protoporpirin that is converted into heme, and will be followed by a decrease in serum ferritin levels <12 μg / ml. Serum ferritin levels can describe the state of iron stores in tissue. (Bakta, 2006) Thus, low serum ferritin levels will indicate that the person is in a state of iron deficiency anemia. (Yuniarti, 2017) Anemia affects the health and performance of female workers such as the body quickly tired, weak body and decreased work capacity. The main source of iron that is easily absorbed by the body is from animal foods which are relatively expensive so that not all women with anemia can consume continuously. Another alternative to help the process of absorption of iron is to consume fruit that is contain vitamin C such as sweet oranges and tomatoes which are affordable and easy to find in all regions of Indonesia. (Almatsier, 2010)

The women workers in this meatball factory are all placed in the packing area with a sitting position not using a chair. Based on an initial survey conducted by researchers obtained information from 50 female workers complaining of body fatigue, weakness, fatigue, lethargy, sometimes they get dizzy when they wanted to stand up after they worked and 40 female workers showed hemoglobin levels <12 gr / dl. For example when packaging, women workers are less energetic and enthusiastic, so packaging takes a long time.

METHOD

This study used a quasi-experimental research design (Quasy Experiment Design) with pre-test and post-test with control group design. The target population taken in this study were all female workers who were anemic in the Baso Kataji Company. A total of 40 people were divided into 4 groups: 10 people in treatment group 1 (tomatoes and Fe tablets), 10 people in treatment group 2 (oranges and Fe tablets), 10 people in treatment group 3 (combination of tomatoes with oranges and Fe tablets) and 10 people in the control group (Fe tablets). each group was given treatment for 14 days. Before being given treatment, respondents were examined for hemoglobin and ferritin levels and hemoblobin and ferritin levels were examined again on day 15. Inclusion criteria included anemic female workers with Hb levels <12 gr / dl, female workers who were willing and signed an informed concent, no having nausea and vomiting, not pregnant, not having tumors and infections. Exclusion criteria included taking vitamin C drugs, when they entered the inclusion criteria then did not continue the research process.

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Data collection is carried out by means of observation; Interview; examination of hemoglobin levels using the Hemoglobin Testing System Quick-Check; examination of ferritin levels using the ELISA (Enzyme Linked Immunosorbent Assay) method; administration of Fe, tomato, and orange tablets, combination of tomatoes and oranges is given without processing. Hemoglobin measurements and blood sampling are performed by health analysts. Ferritin levels were measured at the Semarang GAKY Laboratory. Data analysis was performed using univariate analysis to determine the characteristics of respondents and bivariate analysis to determine differences in hemoglobin and ferritin levels assessed by paired t-test and Wilcoxon.

RESULTS

1. Univariate Analysis

Table 1 Characteristics of Respondents by Age, Education Level, Parity, Nutrition Status in the Treatment Group and Control Group in the Baso Kataji Company in Majalengka Regency in 2019

Variable	Group				*p value*
	Treatment 1	Treatment 2	Treatment 3	Control	
Age					0,062
Mean ± SD	26,40 ± 11,52	40,40 ± 10,98	37,50 ± 13,01	37,90 ± 11,27	
Median	21	40	36	39,5	
Min ± Max	16 ± 50	17 ± 53	17 ± 53	16 ± 54	
Education					0,06
Basic	20,00%	70,00%	50,00%	10,00%	
Intermediate	80,00%	30,00%	50,00%	90,00%	
High	0,00%	0,00%	0,00%	0,00%	
Paritas					0,336
Nulipara	40,00%	20,00%	30,00%	20,00%	
Primipara	40,00%	20,00%	20,00%	20,00%	
Multipara	20,00%	50,00%	30,00%	50,00%	
Grandemultipara	0,00%	10,00%	20,00%	10,00%	
Nutritional status					0,082
Less	10,00%	0,00%	20,00%	10,00%	
Normal	80,00%	50,00%	40,00%	90,00%	
More	10,00%	50,00%	40,00%	0,00%	

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Based on table 1 shows that the average age of respondents is 40 years with a value of p = 0.062 (> 0.05). Characteristics of respondents based on education are known to the average respondents having secondary education with a value of p = 0.060 (> 0.05). Characteristics of respondents based on parity were known to multipara respondents with an average value of p = 0.336 (> 0.05). Characteristics of respondents based on nutritional status is known that the average respondent has normal nutritional status with a value of p = 0.082 (> 0.05).

2. Bivariate Analysis

a. Hemoglobin

Table 2 Changes in Hemoglobin Levels Before and After Treatment in the Treatment and Control Groups

Group	Hemoglobin		*p value*	Difference
	Pre	Post		
Tomato	10,52 ± 0,89	12,44 ± 1,02	<0,001¶*	1,92 ± 0,58
Orange	10,75 ± 0,96	13,45 ± 1,03	<0,001¶*	2,70 ± 0,82
Tomatoes and oranges	11,10 ± 0,31	12,78 ± 0,30	<0,001¶*	1,38 ± 0,42
Control	10,26 ± 1,44	11,09 ± 1,34	0,005‡*	0,83 ± 0,41

Table 2 shows the levels of hemoglobin in treatment group 1 (tomatoes) before being given an average treatment of 10.52 g / dL while after treatment increased to 12.44 g / dL and the difference of 1.92 g / dL with p value 0.001 <α (0.005) which means that there are significant differences before and after treatment in the tomato treatment group. In treatment group 2 (oranges) before treatment an average of 10.75 gr / dL while after treatment 13.45 gr / dL and a difference of 2.70 g / dL with a p value of 0.001 <α (0.005) which means there are significant differences before and after treatment in the orange treatment group. In the treatment group 3 (tomatoes with oranges) before the average treatment of 11.10 gr / dL while after the treatment 12.78 gr / dL and a difference of 1.38 g / dL with a p value of 0.001 <α (0.005) which means that there are differences significantly before and after treatment in treatment group 3 (tomatoes with oranges). In the control group before treatment an average of 10.26 gr / dL while after treatment 11.09 gr / dL and a difference of 0.83 g / dL with a p value of 0.005 which means that there are significant differences before and after treatment in the control group. So it was concluded an increase in hemoglobin levels was higher in the treatment group compared with the control group, namely in the orange treatment group.

Table 3 Differences in Mean Hemoglobin Levels Before and After Treatment in the Treatment and Control Groups

Hemoglobin	Grou[	Mean ± SD	P
Pre	Tomato (P1)	10,52 ± 0,89	0,022£*
	Orange (P2)	10,75 ± 0,96	
	Tomatoes and Oranges (P3)	11,10 ± 0,31	
	Control	10,26 ± 1,44	

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Post	Tomato (P1)	12,44 ± 1,02	<0,001£*
	Orange (P2)	13,45 ± 1,03	
	Tomatoes and Oranges (P3)	12,78 ± 0,30	
	Control	11,09 ± 1,34	
Difference	Tomato (P1)	1,92 ± 0,58	<0,001§*
	Orange (P2)	2,70 ± 0,82	
	Tomatoes and Oranges (P3)	1,38 ± 0,42	
	Control	0,83 ± 0,41	

Based on table 3, the results of the study showed differences in hemoglobin levels before treatment 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges) and control with p values 0.022 <α (0.005), which means that there were significant differences. After treatment between treatment 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges) and control with p value 0.001 <α (0.005), which means that there are significant differences. While the difference in hemoglobin levels between treatment groups 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges), and controls with a p value of 0.001 <α (0.005) which means that there is a significant difference in the difference in the increase in hemoglobin levels between groups treatment and control groups.

b. Ferritin

Table 4 Table of Changes in Ferritin Levels Before and After Treatment in the Treatment and Control Groups

Group	Ferritin		*p value*	Difference
	Pre	Post		
Tomato (P1)	44,40 ± 44,84	81,60 ± 47,32	0,005‡*	37,20 ± 10,43
Orange (P2)	39,50 ± 35,72	60,90 ± 34,32	0,005‡*	21,40 ± 8,70
Tomatoes and Oranges (P3)	43,00 ± 31,23	102,50 ± 39,84	0,000¶*	59,50 ± 30,50
Control	49,10 ± 51,44	53,70 ± 50,67	0,005‡*	4,60 ± 3,13

Based on table 4 ferritin levels in the tomato treatment group before being given an average treatment of 44.40 μg / dl while after treatment increased to 81.60 μg / dl and a difference of 37.20 μg / dl with a p value of 0.005 which means that there are significant differences before and after treatment in treatment group 1 (tomatoes). In the treatment group 2 (oranges) before treatment an average of 39.50 μg / dl while after treatment 60.90 μg / dl and a difference of 21.40 μg / dl with a p value of 0.005 which means there are significant differences before and after treatment at treatment group 2 (orange). In treatment group 3 (tomatoes with oranges) before treatment on average 43.00 μg / dl while after treatment 102.50 μg / dl and a difference of 59.50 μg / dl with p value 0.000 <α (0.005) which means there are differences

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significantly before and after treatment in treatment group 3 (tomatoes with oranges). In the control group before treatment an average of 49.10 μg / dl while after treatment 53.70 μg / dl and a difference of 4.60 μg / dl with a p value of 0.005 which means there are significant differences before and after treatment in the control group. So it was concluded an increase in ferritin levels was higher in the treatment group compared to the control group, namely in the treatment group 3 (tomatoes with oranges).

Table 5 Differences in Mean Ferritin Levels Before and After Treatment in the Treatment and Control Groups

Ferritin	Group	Mean ± SD	P
Pre	Tomato (P1)	44,40 ± 44,84	0,932£
	Orange (P2)	39,50 ± 35,72	
	Tomatoes and Oranges (P3)	43,00 ± 31,23	
	Control	49,10 ± 51,44	
Post	Tomato (P1)	81,60 ± 47,32	0,033£*
	Orange (P2)	60,90 ± 34,32	
	Tomatoes and Oranges (P3)	102,50 ± 39,84	
	Control	53,70 ± 50,67	
Difference	Tomato (P1)	37,20 ± 10,43	<0,001£*
	Orange (P2)	21,40 ± 8,70	
	Tomatoes and Oranges (P3)	59,50 ± 30,50	
	Control	4,60 ± 3,13	

Based on table 5 the results of the study showed differences in levels of ferritin before treatment 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges) and control with a p value of 0.932> α (0.005), which means there were no significant differences. After treatment between treatment 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges) and control with a p value of 0.033 which means that there are significant differences. While the difference in hemoglobin levels between treatment groups 1 (tomatoes), treatment 2 (oranges), treatment 3 (tomatoes with oranges), and control with a p value of 0.001 <α (0.005) which means that there is a significant difference in the difference in the increase in ferritin levels between the treatment group and the control group. The group with the highest increase in ferritin levels was treatment group 3 (tomatoes with oranges) by 59.50 μg / dl, then treatment group 1 (tomatoes) by 37.20 μg / dl, treatment group 2 (oranges) by 21.40 μg / dl, and the lowest increase is the control group of 4.60 μg / dl.

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DISCUSSION

1. Characteristics of Respondents

Characteristics of respondents based on age showed that the average respondent was included in the WUS category (women of childbearing age) namely women who were still in reproductive age between the ages of 15-49 years. Where WUS is prone to anemia because of menstrual cycles where women will lose blood during menstruation every month. Characteristics of respondents based on education indicate that most respondents fall into the category of secondary education (junior and senior high school). The results of data collection related to the education level of respondents in the treatment group and the control group showed a homogeneous data variant test or equality test equal to $p = 0.060 > \alpha\ (0.005)$. This indicates that the level of education does not affect the results of the study. The higher the level of one's education, the easier he receives information and finally the more knowledge they have. Conversely, if a person's education level is low, it will hinder the development of his behavior towards the reception of new information and knowledge. (Sarliana, 2018) Characteristics of respondents based on parity indicate that most respondents are included in the multipara category. Based on data related to parity in the treatment group and the control group showed homogeneous data variance test or equality test equal to $p = 0.336 > \alpha\ (0.005)$. This shows that parity does not affect the results of the study. The results of this study are in line with Suharni's research that more frequent pregnant and giving birth women then the risk of anemia is greater because pregnancy depletes iron reserves in the body. (Suwarni, 2013) Characteristics of respondents based on nutritional status illustrated through BMI (Body Mass Index) some of the respondents included in the category of normal nutritional status. Based on data related to nutritional status in the treatment group and the control group showed homogeneous data variance test or equality test equal to $p = 0.082 > \alpha\ (0.005)$. This indicates that the nutritional status does not affect the results of the study. Female workers with normal nutritional status will have better work capacity and endurance. Female workers with poor nutritional status even though the percentage is not large, but need attention. This is because inadequate energy consumption which causes the need for allergies to work will be taken from the energy reserves that are in the cell. If this happens it can result in female workers not being able to do their jobs properly and their work productivity will decline and even reach a low target. (Muhadjir, 1994) Conversely, female workers with more nutritional status then the person is less nimble and slow working. While those who have normal weight will be more agile in working women workers who are underweight will be less able to work hard. (Suma'mur, 2001)

2. The effect of giving a combination of tomatoes with oranges on changes in hemoglobin levels

Based on the results of statistical tests that have been done to see differences in hemoglobin levels in the four groups showed a significant change. In the treatment group hemoglobin levels increased higher than those in the control group. The highest increase

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occurred in treatment group 2 (oranges and Fe tablets), then in treatment group 1 (tomatoes and Fe tablets) and treatment group 3 (combination of tomatoes with oranges and Fe tablets).

The above results can be explained that giving tomatoes and oranges to anemic female workers can increase hemoglobin levels, this is because tomatoes and oranges contain iron and vitamin C which are high enough so that it can help the process of absorption of iron in the body. The role of vitamin C in the process of absorption of iron is by reducing ferric iron (Fe3 +) to Ferro (Fe2 +) in the intestine so that it is easily absorbed, the reduction process will be even greater if the pH in the stomach is more acidic. Vitamin C inhibits the formation of hemosiderin which is difficult to mobilize to free iron when needed. While the iron absorption inhibitors are materials containing polyphenol compounds such as tannin contained in tea that can reduce up to 80%. 16,81 The results of research conducted by S Mehnaz, et al with the title research Iron, Folate and Vitamin C Supplementation On The Prevalence Of Iron Deficiency Anemia In Non-Pregnant Famales Of Pero Urban Aries Of Algargh showed that non-pregnant women who experienced anemia when given vitamin C, folic acid and iron showed a very good increase in iron. (Mehnaz, 2006) Likewise with research conducted by Krisnapilai Madhavan Nair, Ginnela NV Brahmam with the result that the absorption of non-heme iron was significantly greater in the group consuming iron tablets coupled with consuming guava fruit, because vitamin C found in guava can help good absorption of iron. (Nair, 2013)

Tomatoes used in this study were plum tomatoes, plum tomatoes are one of the fruits that contain vitamin C and other beneficial compounds in the formation of red blood cells such as vitamin E, folate, minerals (Fe and Cu). (Besuni, 2013) Every 100 gr consumed tomatoes contain vitamin C 40 mg. The content of vitamin C in plum tomatoes can help in the process of absorption of iron so that it can overcome the problem of anemia. (Merida, 2014) Provision of Fe tablets together with 250 gr tomatoes for 14 days on a regular basis turned out to have a significant effect on changes in hemoglobin levels.

Oranges used in this study are sweet oranges. The content of vitamin C in 100 gr oranges is 49 mg. Besides containing a lot of vitamin C, oranges also contain energy, protein, water, fat carbohydrates, calcium, iron, and vitamin B1 and vitamin A. vitamin C contained in oranges increases the absorption of iron by the body. (Nurasih, 2015) Provision of Fe tablets along with 200 gr oranges for 14 days on a regular basis it has a significant effect on changes in hemoglobin levels. The combination of 125 grams of tomatoes with 100 grams of oranges and Fe tablets for 14 days regularly turned out to have a significant effect on changes in hemoglobin levels.

3. The effect of giving a combination of tomatoes and oranges on changes in ferritin levels

From the results of statistical studies of ferritin levels showed that in the treatment and control groups an increase occurred. The average ferritin content in the control group consuming Fe tablets was lower than the average ferritin content in treatment group 1, treatment group 2, and treatment group 3.

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Serum or plasma ferritin concentrations can reflect the total iron stores in the body when there is no inflammation or infection. Increased serum ferritin levels in individuals can also be an indicator of inflammation. Normal categories of serum ferritin that exceed the maximum upper limit can indicate the presence of an iron overload condition. Conversely serum ferritin levels lower than 10 μg / ml may indicate a decrease in iron stores. (Lubis, 2019) Serum ferritin levels will be low in conditions of long bleeding, anemia, iron deficiency and poor nutritional status whereas inflammatory conditions will increase ferritin levels. Serum ferritin can be affected in a number of clinical settings such as acute liver disease, cirrhosis, horlgkin's disease, acute leukemia, chronic kidney failure infections, and solid tumors. These clinical conditions can affect fake serum ferritin levels or even in iron deficiency anemia sufferers who should have low serum ferritin levels, b due to the above conditions, serum ferritin levels may become normal or even increase.51 The role of vitamin C in the process of absorption of iron is helps reduce ferric iron (Fe3 +) to ferrous iron (Fe2 +) in the small intestine so that it is easily absorbed, the reduction process will be even greater if the pH in the stomach gets more acidic. Vitamin C can increase acidity so that it can increase iron absorption by up to 30%. Vitamin C inhibits the formation of hemosiderin which is difficult to mobilize to free iron when needed. Vitamin C plays a role in transferring iron from transferrin in plasma to liver ferritin. (Varney, 2008)

CONCLUSION

Based on the results of research on the provision of a combination of tomatoes with oranges on increasing levels of hemoglobin and ferritin levels in anemic female workers who consume Fe tablets that there is an influence of giving 250 grams of tomatoes and 60 mg Fe tablets, administration of 200 gr oranges and 60 mg Fe tablets, giving tomato combinations 125 gr with 100 gr grapefruit and Fe tablets for 14 days against increased levels of hemoglobin and ferritin levels in female workers at the Kataji baso factory.

SUGGESTION

For female workers to consume vitamin C in 250 gr tomatoes, 200 gr oranges or a combination of 125 gr tomatoes with 100 gr oranges before consuming Fe tablets so that Fe tablets consumed can be absorbed maximally by the body so that hemoglobin levels in anemic female workers can increase.

For companies to provide additional food in the form of tomatoes and oranges at every lunch hour.

This research is expected to be used as input and scientific reference, especially K3 Promotion.

For further researchers can do a screening of the history of diseases that can affect hemoglobin levels and ferritin levels by using laboratory results and continue research by making deeper observations about the factors that influence the occurrence of anemia including chronic diseases and infections, disorders of blood vessels or plasma and enlargement.

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