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Comparison of Hb Levels Given Iron Supplements with and Without Vitamin B12 to Anemia Female Industrial Workers in Surakarta Residency Area

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ABSTRACT

Objective: The research objective was to analyze the comparison of Hb levels given iron supplements with and without vitamin B12 in female industrial workers who experience anemia. **Method:** The study used an experiment with a pretest-posttest control group design. The research respondents were female industrial workers who experienced anemia in the Surakarta Residency Area. The sampling method was carried out by purposive sampling. The number of samples was 33 respondents divided into a treatment group of 17 respondents and a treatment group of 16 respondents. **Results:** There was no significant difference in hemoglobin levels in the control group and the treatment group as indicated by a p>0.05. The results of the paired t-test statistic showed that there was a significant change in hemoglobin levels in the treatment group (0,96 ± 0,40) p 0,000 (p<0,05). **Conclusion:** Giving iron supplementation to anemic women workers can increase hemoglobin levels. Handling of anemia in female workers can be done by making iron supplementation programs and policies in all companies that employ female workers.
Key words: Anemia, Iron Deficiency, Iron Supplements, Vitamin B12, Women Industrial Workers.

INTRODUCTION

Indonesia has various industries and businesses where the majority of workers are women, work productivity in women is affected by anemia status, which is the availability of nutrients in the body, especially if workers have iron deficiency anemia.[1,2] Anemia in women is common, especially industrial working women. Women's work productivity is affected by anemia status, especially the availability of nutrients in the body, especially if workers experience iron deficiency anemia.[3]

Anemia is a condition in which the number of red blood cells or hemoglobin concentration is lower than normal.[4] Hemoglobin is needed to transport oxygen, if there is a shortage of red blood cells, the body's ability to carry oxygen to the tissues will decrease so that it is not sufficient to meet the body's physiological needs.[4,5] Several factors are associated with the incidence of anemia, namely energy intake, protein intake, iron intake, vitamin C, the habit of drinking tea or coffee.[6] Deficiency of iron, nutrition (folic acid, riboflavin, vitamin A, zinc, and vitamin B12), infections, chronic diseases, red blood cell disorders affect the occurrence of anemia.[7] Signs of anemia that often occur are skin that looks pale, has mood swings, looks very tired, has a headache, has a faster heart rate than usual, has jaundice (skin and eyes turn yellow). Anemia can be treated with drugs or iron supplements.[8] Based on research[1] it was found that 50 female workers who had their Hb levels checked showed that most of the female workers had anemia as many as 32 people (64%).

Iron is a micro mineral that is abundant in human and animal bodies, which is 3-5 grams in the adult human body. There are 2 forms of iron that come from food, namely heme (eg meat, fish, chicken, shrimp, squid) and non-heme (eg vegetables, fruit, nuts, rice, pasta).[9] Occurrence Iron deficiency is considered the most common cause of anemia, although deficiencies of folic acid, vitamin B12 and vitamin A, and inherited disorders can all cause anemia.[10,11] Iron in the form of food carries out iron metabolism by means of the process of destroying erythrocytes (recycled) in the endothelial reticulo by macrophages, from food in the form of ferric ions which must be reduced first to form ferrous ions before being absorbed in an acidic environment such as the presence of hydrochloric acid produced by parietal cells stomach, vitamin C, some substances such as fructose and amino acids facilitate the absorption process, if the iron reserves in the body are reduced or the need for iron increases, then iron absorption will increase, conversely if iron reserves increase then absorption will decrease.[9,12]

Vitamin B12 plays a role in the metabolism of folic acid which is an important component in the formation of hemoglobin in addition to iron. The main forms of vitamin B12 in food are 5-deoxyadenosylcobalamin, methylcobalamin, and hydroxocobalamin.[13] In the body, vitamin B12 is a coenzyme for two biochemical reactions in the body, the first as methyl B12, a cofactor for methionine synthase, the enzyme responsible for methylating homocysteine into methionine using Methyl Tetrahydrofolate (THF) as a methyl donor. The second is deoxy adenosyl B12 (ado B12) which helps convert methyl malonyl coenzyme (CoA) to succinyl CoA. Besides that, folic acid along with vitamin B12 and vitamin B6, plays an important role in the metabolism of methionine

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homocysteine.[14] A deficiency of vitamin B12 results in the bone marrow not being able to produce erythrocytes normally, this condition results in very limited hemoglobin carrying capacity. The symptoms that arise from this vitamin B12 deficiency disorder are paleness, and decreased body weight.[15]

Supplementation of iron tablets is one way to reduce the incidence of anemia. Supplementation of iron tablets with the right dosage is effective for increasing iron reserves if consumed regularly.[16] Supplementation of iron tablets is one way to reduce the incidence of anemia. Supplementation of iron tablets with the right dosage is effective for increasing iron reserves if consumed regularly.[17] Therefore, it is necessary to investigate whether there are differences in hemoglobin levels in working women with anemia with or without iron and vitamin B12 supplementation.

METHODS

This research is an experimental research with pretest-posttest control group design. The treatment group was given iron supplementation and a combination of iron and vitamin B12. The research was conducted at PT X Surakarta, Central Java. This is because 90% of the workforce at the PT are women and have complaints of dizziness and have never been examined. The population in this study were female workers at PT X as many as 1700 female workers. The total population that met the inclusion criteria was 54 participants. The number of samples in this study were 16 with the addition of 20% lost to follow-up, namely 3 samples so that a minimum sample size of 19 was obtained. Sample calculation is done by using the level of significance95% or $\alpha = 0.05$ ($Z\alpha = 1.96$), with the test strength level 80% or $\beta = 0.842$, s = 0.78 where is the estimated difference = 0.81 (Suwarni, 2012). So, obtained for the entire sample in the control group and the treatment group as many as 40 samples. Samples were taken by simple random sampling method.

During the study, it was found that 7 subjects had dropped out at the end of the study. A total of 4 subjects in the control group experienced a drop out, namely 2 subjects on leave so they could not take part in laboratory examinations at the end of the study and 2 subjects stopped working, as many as 3 subjects in the treatment group dropped out due to leaving so they could not take part in laboratory examinations at the end of the study. Thus, the number of subjects became 33 women of childbearing age consisting of 16 control groups and 17 treatment groups.

The inclusion criteria for the study sample were women who worked at PT X with hemoglobin levels of 8-10 gr/dl, not breastfeeding, not pregnant, age > 18 years, still menstruating, not suffering from chronic diseases (malaria, tuberculosis), or on long-term treatment. long term, not currently taking iron supplementation within 3 months. The exclusion criteria for the study sample were difficulties in taking oral medication and not coming to work at the time of initial data collection.

Data collection instruments consisting of respondent identity, 24-hour food recall list for nutritional consumption data, measurement of hemoglobin levels using the cyanmethemoglobin method and erythrocyte index using a semi-automatic hematology analyzer tool. Pirantel Pamoat 500 mg (Generic) before supplementation, Providing iron supplementation 60 mg (produced by Kimia Farma) elemental iron, Providing supplementation with a combination of 60 mg iron and 2.4 µg vitamin B12 (produced by Kimia Farma), 5 cc syringe/needle that has been given the name and number for taking the patient's blood sample, for hemoglobin examination provided from the Prodia Surakarta laboratory, 3 cc of venous blood samples for examination of hemoglobin levels were carried out by officers from the Prodia Surakarta laboratory.

Data collection was assisted by enumerators who had previously been trained and technically explained in conducting a 24-hour recall. Retrieval of 24-hour food recall data was carried out using interview techniques and recording food intake in the 24-hour food recall list with sizes adjusted to household measuring instruments. Samples that met the criteria of 40 subjects were divided into two groups, namely the treatment group and the control group. The pharmacist for the study had been prepared by the pharmacist Kimia Farma by giving the name of the research subject and a code that only the pharmacist knew during the study.

Both groups of study subjects were given deworming medication (Pirantel Pamoat 500 mg) with the aim of avoiding worm infection. research subjects were given supplementation by dividing group A and group B accompanied by the company's clinical nurses, researchers and staff who assisted the research. The implementation phase is the provision of the first supplementation according to a predetermined time and if the subject is absent or has a day off, it is given the following day. The checklist sheet for measuring adherence to consuming supplementation was filled out by the subject himself and asked and wrote down complaints about the effects of the supplementation given. The supplementation is handed over to the company's clinic nurse to be stored in a cool place to avoid damage from the supplement. If while taking the supplementation the subject experiences side effects such as nausea, vomiting, constipation or stomach pain, then the supplementation is stopped and the subject is declared to have dropped out of the study. If while taking the supplementation the subject does not experience side effects and feels that there are changes for the better, then the research subject will continue taking the supplement and follow the research to completion. If the subject does not take the supplement three times, the subject is declared to have dropped out of the study and if the subject who has dropped out is more than three times, additional subjects are added to meet the number of subjects required. If while taking the supplementation the subject does not experience side effects and feels that there are changes for the better, then the research subject will continue taking the supplement and follow the research to completion. If the subject does not take the supplement three times, the subject is declared to have dropped out of the study and if the subject who has dropped out is more than three times, additional subjects are added to meet the number of subjects required. If while taking the supplementation the subject does not experience side effects and feels that there are changes for the better, then the research subject will continue taking the supplement and follow the research to completion. If the subject does not take the supplement three times, the subject is declared to have dropped out of the study and if the subject who has dropped out is more than three times, additional subjects are added to meet the number of subjects required.

Data on nutritional intake is carried out by means of a 24-hour food recall by trained officers. The 24-hour food recall was carried out 4 times at the start of the study, and 3 times during the study by enumerators who had been included in the study. The results of the 24-hour food recall that have been obtained are converted into grams and processed using the nutrisurvey program to then analyze food intake during the study. Assess the level of consumption, needs, and nutritional intake compared to the nutritional adequacy rate (2013). In the final stage of the study, a second blood sample was taken after being given the supplementation treatment. Second blood draw by Prodia laboratory with examination of hemoglobin level and erythrocyte index.

Data analysis was carried out using SPSS 22. The data analyzed were hemoglobin level data, erythrocyte index before and after the supplementation intervention and 24-hour recall data that had been carried out during the study. Descriptive analysis was used to describe the characteristics of the respondents and present the results of the pre-test and post-test hemoglobin levels. Shapiro Wilk's analysis was used to test the normality of the data for each group, the results of which were normally distributed data. Paired t test (paired sample t test) to see the

effect of hemoglobin levels in each group on normally distributed data, data not normally distributed was carried out by the Wilcoxon sign test. Multivariate test to see differences in hemoglobin levels between treatment groups in normally distributed data. Nutritional intake data were analyzed using the 24-hour food recall method on weekdays and holidays and carried out using the nutrisurvey program.

This study followed the process of ethical review and ethical approval obtained from the Health Medicine Research Ethics Committee, Faculty of Medicine, State University of Sebelas Maret Surakarta (ethical approval number: 417/VI/HREC/2015 dated 25 June 2015). Data collection was carried out after the participants received information about research consent and signed the consent form after explanation. It was explained that participants were voluntary and they could choose not to complete the Research without any consequences. Furthermore, the participants were informed about the anonymity of the participants, that the data to be provided would be kept confidential. Confidentiality of the respondent's name is done by providing a code as a substitute for the respondent's name.

RESULTS

Participant characteristics

The number of research subjects was 33 women of childbearing age consisting of 16 control groups and 17 treatment groups. The full characteristics of the respondents are presented in Table 1 below.

The results of the independent t-test stated that there was no significant difference between the mean age of the subjects of the two groups. The BMI data before and after showed that there was no significant difference between the mean of the control group and the treatment group. Likewise, the average nutrient intake based on food recall for the two control and treatment groups showed no significant difference in energy, vitamin C and iron intake, but there was a significant difference between the control and treatment groups in protein and carbohydrate intake. The average intake in the control group and the treatment group is still a deficit from the 2013 Nutritional Needs Figures (> 70%)

The age distribution of the control and treatment group subjects was mostly 19-29 years old. 12 (75%) subjects in the control group aged 19-29 years and 11 (65%) subjects in the treatment group. While subjects aged 30-49 years in the control group were 4 (25%) respondents and 6 (35%) respondents in the treatment group. While the distribution of BMI in the control group and the treatment group, most of the BMI was less than normal. In the control group with less BMI during the study, it increased from 9 to 10 respondents, while in the treatment group during the study, BMI did not change, with a distribution of BMI less than 10 respondents and normal BMI with 7 respondents.

Tabel 2 indicates that there was an increase in mean hemoglobin and average levels of MCV and MCH during the study in both the control group and the treatment group. However, there was no increase in the mean MCHC levels in both the control and treatment groups. The results of the paired t-test statistic showed that there was a significant change in hemoglobin levels in the treatment group (0.96 ± 0.40) p 0.000 (p <0.05). For more details can be seen in table 3.

Tabel 5 is the results of the multivariate statistical test. The results showed that there were no significant differences in the levels of hemoglobin, MCV, MCH and MCHC in the control group and the treatment group with a p>0.05. However, in laboratory tests there were changes in the results of hemoglobin, MCV, MCH and MCHC before and after treatment in both groups as can be seen in table 2.

DISCUSSION

The results showed that the anemia experienced by the research subjects was hypochromic microcytic anemia (iron deficiency anemia). Some of the results of previous studies found that anemia often occurs in industrial workers obtained from annual health checks, and is more common in female worker[4,19]. Research in Indonesia found that as many as 24.6% of female workers experienced higher anemia than male workers, namely as much as 7.6%.[20]

Intake of nutrients in all research subjects included in the category of deficit, so they experienced iron deficiency anemia (ADB). The results showed that the average energy intake compared to the 2013 Nutritional Needs (RDA) was a deficit of <70%, in the control group it was 45%

Table 1: Average distribution of BMI, food recall of research subjects.

Variable	Control (n=16)		Treatment (n=17)		p
	Mean ± SD		Mean ± SD		
Age (Years)	27.94 ± 4.34		28.24 ± 6.42		0.878
BMI before	17.63 ± 2.94		17.27 ± 2.79		0.720
BMI after	17.68 ± 3.14		17.30 ± 2.86		0.717
Food recalls					
Energy (Kcal)	1000.60 ± 154.08		1311.02 ± 1793.68		0.496
Carbs (g)	134.08 ± 27.33		115.72 ± 21.54		0.003
Proteins (g)	35.09 ± 6.85		30.01 ± 7.34		0.049
Vitamin C (mg)	10.49 ± 6.80		11.59 ± 11.29		0.740
Iron (mg)	4.93 ± 1.17		4.58 ± 1.14		0.395
Length of work (Year)	Frequency (n=16)	%	Frequency (n=17)	%	
1-1,9	4	25	6	35	
2-2,9	7	44	9	53	
3-3,9	5	31	2	12	
Residence	**Frequency (n=16)**	**%**	**Frequency (n=17)**	**%**	
Surakarta	5		9		
Karanganyar	7		5		
Sukoharjo	2		0		
Boyolali	1		2		
Klaten	0		1		
Sragen	1		0		

Table 2: Hemoglobin levels and erythrocyte index.

Information	Control			Treatment		
	Before	After	Change	Before	After	Change
Hemoglobin level (g/dl)						
Means	9.70	10.41	0.71	9,68	10.65	0.96
SD	0.37	0.37	0.36	0.20	0.41	0.44
Min	8,5	9.6	0.2	9.3	10.1	0.4
Max	10.0	11,1	1.5	10.0	11.5	1.5
MCV (fl)						
Mean 3.72	71.50	74,25	2.75	72,18	77.35	5,18
SD	4.78	5,36	3,13	3.72	5.54	4,26
Min 76	64	65	-2	62	65	0
Max	79	88	9	76	86	13
MCH (pg)						
Means	23.57	24,34	0.769	23.97	25.35	1.38
SD	1.50	1.83	0.95	1.18	1.68	1.18
Min	21,3	21,9	-0.3	20,6	21.5	-0.8
Max	26	29,3	3,3	25.5	27,8	3,5
MCHC (%)						
Means	32.94	32.94	0.00	33,12	32.94	-0.18
SD	0.99	0.92	1.21	0.78	0.65	1.07
Min	31	31	-3	31	32	-2
Max	34	34	2	34	34	2

Table 3: Average change in hemoglobin levels and erythrocyte index in the control group and the treatment group.

Variables	Mean ± SD	p
Hb treatment group	0.96 ± 0.40	0.000
control group MCV	2.75 ± 3.13	0.003
MCH control group	0.76 ± 0.95	0.006

Table 4: Average change in hemoglobin levels and erythrocyte index control group and treatment group.

Variables	Before Mean ±SD	Median Min-Max	After Mean ±SD	Median Min-Max	p
Hb control group	9.7±0.37	9,8 8.5-10.0	10.49±0.37	10.45 9,6-11,1	0.000
MCV treatment group	72.18±3.73	73 62-76	77.35±5.55	76 65-86	0.001
MCH treatment group	23.98±1.18	24,1 20.6-25.5	25.36±1.69	25,2 21.5-27.8	0.001
MCHC control group	32.94±0.99	33 31-34	32.94±0.93	33 31-34	0.943
MCHC treatment group	33.12±0.78	33 31-34	32.94±0.66	33 32-34	0.490

Table 5: The difference between the average hemoglobin level and the index control group and treatment group erythrocytes.

Variables	Control	Treatment	p
	Mean ±SD	Mean ±SD	
Hemoglobin	0.719 ± 0.36	0.97 ± 0.40	0.076
MCV	2.75 ± 3.13	5.18 ± 4.26	0.073
MCH	0.77 ± 0.96	1.38 ± 1.19	0.114
MCHC	0.00 ± 1.21	-0.18 ± 1.07	0.661

and in the treatment group it was 39%. The results of this study are in line with previous research conducted by,[18] that adults with deficits in nutritional needs are more at risk of experiencing anemia by 1.517 times (p = 0.044) and are more at risk of experiencing Iron Deficiency Anemia (IDA) by 1.776 times (p = 0.002).

The results showed that the average increase in hemoglobin levels in all research subjects was 0.84 g/dl. The mean increase in hemoglobin levels in the control group was 0.71 g/dl and the treatment group was 0.96 g/dl. The increase in hemoglobin levels in the control group was due to the amount of protein consumed in the control group more than the treatment group. The results of the food recall showed that the protein intake of the control group was 62% and the treatment group was 53%. The results of a food recall in the intervention group showed low intake of foods containing heme iron such as meat, fish and poultry while non-heme iron sources such as green vegetables and fruits. Several studies have stated that there are positive implications of protein intake on the incidence of anemia.[21]

Another study stated that intake of a protein-rich diet was proven to significantly increase Hb levels in electronic waste recycling workers (β = 0.155; 95% CI: 0.002, 0.309; p = 0.04)[22]. Protein plays a significant role in helping to transport iron in the body. In addition, protein also plays an important role in hematopoiesis, or the process of making blood cells and platelets, as well as in the transfer of body iron.[20] Excess protein is needed so that iron can move smoothly, whereas if protein intake is insufficient, the process of transporting iron can be disrupted and cause iron deficiency.[22,23]

The protein consumed by the control group comes from animal protein. Animal protein contains a lot of iron. Transferrin is a glycoprotein synthesized in the liver. Protein plays a central role in the body's iron metabolism because transferrin transports circulating iron to places where it is needed, such as from the intestine to the bone marrow to form new hemoglobin.[24] Animal protein contains amino acids which help the process of forming red blood cells in the bone marrow.[22]

Menstrual regularity was 75.76% regular and 24.24% irregular in the study subjects. Regular menstrual schedule has implications for hemoglobin levels in women. Research shows that women with irregular menstrual cycles tend to experience more significant fluctuations in hemoglobin levels compared to women who have regular cycles. Hormonal changes that occur during irregular menstrual cycles can affect the production and distribution of red blood cells and iron in the body, which in turn can affect hemoglobin levels.[25] World Health Organization[17,19] entitled "Iron Deficiency Anemia: Assessment, Prevention, and Control" also states that menstrual hormone fluctuations can contribute to the risk of iron deficiency and anemia in women of reproductive age. Therefore, maintaining regular menstrual cycles through a healthy lifestyle and proper medical care can help maintain stable hemoglobin levels and prevent the risk of anemia. The low intake of nutrients consumed and the bleeding experienced during menstruation can affect hemoglobin levels and productivity in worker.[27]

Iron supplementation with and without vitamin B12 can increase hemoglobin levels and erythrocyte index. Vitamin B12 and iron (Fe) have an important role in supporting the process of red blood cell metabolism in the bone marrow. Intermittent iron supplementation can reduce the risk of anemia by 0.65 times and can increase hemoglobin concentration.[27] Vitamin B12 is needed for DNA synthesis which is related to the formation of red blood cells, while iron is the main component of hemoglobin which helps in transporting oxygen throughout the body. The combination of these two nutrients works synergistically in maintaining health and sufficient red blood cell production.[27-33] Research by Zabun[28] emphasizes that a deficiency of vitamin B12 or iron can inhibit the process of red blood cell production, which in turn can cause hematological disorders such as anemia.

The mean intake of vitamin C in the control group was 12% and the treatment group was 13%, indicating a deficit need. Lack of intake of vitamin C which comes from vegetables and fruit. Oral administration of supplemental ascorbic acid may increase iron absorption. Numerous studies have shown that dietary vitamin C can significantly increase iron absorption. Taking 100mg of vitamin C with food can increase iron absorption by 67%.[29]

CONCLUSION

This study provides insight into dietary intake among female workers in the industrial sector, trends in the prevalence of anemia, the relationship between food intake and anemia, iron supplementation with and without vitamin B12 on hemoglobin levels and erythrocyte index and the impact of consumption of animal protein on hemoglobin levels. Further intervention studies for this group are important to see the impact on ferritin levels in research subjects.

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