IEESE International Journal of Science and Technology (IJSTE), Vol. 5 No. 2 , June 2016, 1-5
ISSN : 2252-5297

The Effectivity Of Moringa Leaf Extract (Moringa Oleifera) Supplementation On Hemoglobin Level In Pregnant Women With Anemia In Purwodadi Community Health Center Working Area In Pasuruan

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Abstract. Low hemoglobin concentration during pregnancy causes anemia to mothers. The affecting factor is low consumption of iron rich food which makes hemoglobin formation not optimum. This research aims to find out the effectiveness of moringa leaves (Moringa Oleifera) supplementations on hemoglobin level of pregnant mothers with anemia in the working area of Purwodadi Community Health Center, Pasuruan. This research is a quasi-experimental research with hemoglobin level examination before and after the treatment. There were 32 pregnant mothers as samples who were taken through accidental sampling technique. The data were collected from August to October 2015. The variables being analyzed is hemoglobin levels before and after treatment as well as the difference. This research showed that the different mean of hemoglobin level before and after the intervention (1,2 ± 0,64 gr/dL) was higher than the mean in the control group (1,05 ± 0,86 gr/dL). However, based on the analysis, there was no significant difference on hemoglobin level change before and after the intervention between the experimental group and control group (p=0,579).
More comprehensive effort to prevent anemia during pregnancy needs to be continuously done. One of the many ways is through united movement with local products as the basis through the use of moringa leaves to fulfill pregnant mothers' nutritional needs and prevent anemia.

Keywords: *hemoglobin level, pregnant mothers, moringa leaf extract.*

1. Introduction

Nutrition is one of the important factors in pregnancy. Iron deficiency during pregnancy can cause the placenta not to be able to provide enough nutrition for the fetus which results in anemia for the mothers.[1] The result of Basic Health Research in 2013 showed that anemia prevalence in pregnant mothers in Indonesia is 37.1% (with hemoglobin level cutoff lower than 11,0 gram/dL) and the proportion of anemia cases found were almost the same in the urban area (36,4%) and in the rural area (37,8%).[2] Anemia prevalence in pregnant mothers in the working area of Purwodadi Community Health Center in 2014 was 19.4% based on the report from Health Department of Pasuruan Regency.

Anemia during pregnancy is influenced by low consumption of iron in mothers' daily diet as well as low consumption of iron supplementation.[3] Some previous researches showed that micro multi iron supplement is more effective in lowering anemia cases. This is common in developing countries where the majority of people consume plants as their staple food with low consumption of meat, causing vitamin B12, iron and copper required by the body is low and this may result in anemia in pregnant mothers with high nutritional needs.[4] There are so many plants in Indonesia which contain micro elements needed during pregnancy, one of which is moringa leaves. Moringa leaves which Latin name is Moringa oleifera is thought to have many benefits which can help fulfill the needs of micronutrients in pregnant mothers: beta carotene, thiamin (B1), Riboflavin (B2), niacin (B3), calcium, iron, phosphor, magnesium, zinc, vitamin C. Therefore, it can be an alternative for increasing nutrient status for pregnant mothers.[5]

Tackling anemia cases in pregnant mothers has been done. However, the prevalence of anemia cases is still high. Giving iron and folate supplementation during pregnancy is one of the efforts to decrease anemia cases in pregnant mothers in Indonesia.[6] Problems in distribution, inappropriate dosage, as well as undisciplined consumption of the supplements affect this effort. One of the efforts to prevent anemia cases in pregnant mothers is through united movement with local product/local wisdom. This effort is aimed at increasing family and society involvement in improving health standard [7], especially to decrease anemia cases in pregnant mothers. What we can do is to use moringa leaves to help fulfill pregnant mothers' nutritional needs because this moringa tree is a plant which can easily grow in almost every place in Pasuruan and almost every family has it, but its use for pregnant mothers' nutrition is still low. This research is to find out the effectiveness of moringa leaf extract (Moringa oleifera) supplementation on hemoglobin level of pregnant mothers with anemia.

2. Research Method

This research is a quasi experimental research design with pre-post test design study conducted in the working area of Purwodadi Community Health Center, Pasuruan. There were 16 samples for each group chosen using accidental sampling which met the inclusion criteria. The data about respondents' characteristics, iron folate consumption and moringa leaf extract consumption were obtained through interview, consumption pattern with Semiquantitative Food Frequency Questionnaire, Chronic Energy Deficiency (CED) status by measuring the Mid Upper Arm Circumference (MUAC), body height using microtoise, body weight using digital bathroom scale, and hemoglobin (Hb) level using Easy Touch GCHb (Bioptik Technology Inc, China).

The dose of moringa leaf extract for the experimental group is in capsules of 1500 mg consumed 3x500 mg. Moringa leaf capsule is a product of Herbal Life Indonesia (HLI). Oral doses are given to the control group in the form of iron folate tablets containing 200 mg of ferrous sulfate eksikatus (equivalent to 60 mg Fe elements) and 0.25 mg (250 mcg) Folic acid consumed 1x200 mg. Iron folate tablet is a product of Kimia Farma.

The data on consumption patterns is processed using *Nutrisurvey software* to obtain the nutrient value and then it is compared with Recommended Dietary Allowance (RDA). Data analysis is conducted with Bivariate analysis using *independent sample t-test* with data analysis software that has a significance level (α) 0.05. This research has gained ethical conduct from The Committee of Ethics Health Polytechnic Ministry of Health Malang.

3. Research Result

The results of the analysis about the difference of respondent's characteristics between experimental group and control group as presented in Table 1 shows that mean of age, parity, birth spacing, weight, height and MUAC between experimental group and control group were not statistically different (p> 0.05). It was also found that there was no statistically significant difference in education (p> 0.05). This shows that the respondents in this study were homogeneous.

Table 1. Distribution of Respondent's Characteristics

Characteristics	**Experimental** Mean ± SD	**Control** Mean ± SD	***p*-value**
Age	27 ± 4,39 years	27,25 ± 5,31 years	0,886*
<20 or >35 years old	1 (6,25)	1 (6,25)	
20-35 years old	15 (93,75)	15 (93,75)	
Education			0,365**
Elementary	12 (75)	14 (87,5)	
Secondary	4 (25)	2 (12,5)	
Parity	0,56 ± 0,63 children	1 ± 1,1 children	0,176*
>2 children	0	1 (6,25)	
≤2 children	16 (100)	15 (93,75)	
Birth spacing	3,90 ± 4,63 years	5,25 ± 5,17 years	0,445*
≤2 years	1 (6,25)	0 (0)	
>2 years	15 (93,75)	16 (100)	
Weight	51,69 ± 10,71 kg	48,94 ± 6,40 kg	0,385*
Height	151,34 ±4,25 cm	153,42 ±2,96 cm	0,120*
MUAC	25,31 ± 3,29 cm	25,84 ± 3,38 cm	0,656*
CED	3 (18,75)	3 (18,75)	
Non-CED	13 (81,25)	13 (81,25)	

* Data were analyzed by t-test, ** Data were analyzed by chi-square

The results of the analysis on the difference of nutrition adequacy means as presented in Table 2 show that the means of level of energy adequacy, protein, carbohydrates, vitamin C, vitamin B12, iron and copper has no significant difference in the experimental and in control group. This shows that the respondents in this study have relatively similar diets.

Table 2. Level of Respondent's Nutrition Adequacy Mean in the Beginning of the Research

Nutrients	**Experimental** Mean ± SD (%)	**Control** Mean ± SD (%)	***p*-value**
Energy	80,81 ± 18,7	78,38 ± 17,42	0,706
Protein	119 ± 37,77	115,69 ± 34,32	0,797
Carbohydrate	76,44 ± 22,1	70,75 ± 13,47	0,386
Vitamin C	96,19 ± 44,4	108,34 ± 47,41	0,150
Vitamin B12	132,5 ± 74,53	121,44 ± 91,20	0,710
Iron	65,19 ± 27,78	72 ± 29,02	0,503
Copper	123,94 ± 54,29	109,63 ± 55,81	0,468

The results of the analysis on the difference of hemoglobin level mean as presented in Table 3 shows that the mean of hemoglobin level before treatment in the experimental group (9.21 ± 0.96 g/dL) is lower than that of the control group (10.11 ± 0.69 g/dL). The mean of hemoglobin level after treatment in the experimental group (10.41 ± 1.30 g/dL) is lower than that of the control group (11.16 ± 0.77 g/dL). The analysis results show that there is a difference in the mean of Hb level before treatment in experimental group and in control group (p=0.005), but after treatment it is found that there is no significant difference in both groups (p=0.058).

The mean change in Hb levels before and after the intervention in the experimental group (1.2 ± 0.64 g / dL) is higher than that in the control group (1.05 ± 0.86 g / dL). Although there are differences, but based on the results of the analysis it is shown that changes in Hb levels before and after the intervention have no significant difference in the group given the intervention and in control groups (p = 0.579).

Table 3 Hb level Mean and Changes in Hb levels Before and After Intervention

Hb Levels	**Experimental** Mean ± SD	**Control** Mean ± SD	***p*-value**
Before	9,21 ± 0,96	10,11 ± 0,69	0,005
After	10,41 ± 1,30	11,16 ± 0,77	0,058
Change in Hb levels	1,2 ± 0,64	1,05 ± 0,86	0,579

Table 4. Anemia Category before and after Intervention

Anemia Category	**Before Intervention**		**After Intervention**	
	Experimental	Control	Experimental	Control
Intermediate Anemia	2 (12,50)	1 (6,25)	1 (6,25)	0
Mild Anemia	14 (85,50)	15 (93,75)	8 (50)	5 (31,25)
No anemia	-	-	7 (43,75)	11 (68,75)

4. Discussion

Iron is needed during pregnancy for the baby, placenta, and the increase of the red blood cell number in a pregnant woman to cover the needs of iron. If the iron reserve is empty, the total amount of iron required during pregnancy should be met from the diet and supplementation (Seri-Ani, 2013). The quantity and quality of food need to be considered, including food absorption. Most of Indonesia's population consumes vegetables with a low absorption power than food that comes from animal. This will affect the need for nutrients in the body, one of which is iron.[8] Low iron content in the diet and low bioavailability can lead to a decrease in hemoglobin level of pregnant women.[9]

The analysis shows that the mean of age, parity, birth spacing, weight, height and MUAC between experimental group and control group are not statistically different ($p > 0.05$). In education it is also found that there is no statistically significant difference ($p > 0.05$). This shows that the respondents in this study are homogeneous, so it will minimize bias in this study. In this study the mean level of adequacy of energy, protein, carbohydrates, vitamin C, vitamin B12, iron and copper has no significant difference in the experimental group and in control group. This indicates that in this study the level of nutrient adequacy for pregnant women is not diverse, so it can be interpreted that the diet of pregnant women in Community Health Center in Purwodadi is similar. Lower micronutrient intake than the recommended amount can increase the risk of the incidence of micronutrient deficiencies, so the high prevalence of vitamin B12, iron, and copper deficiency will impact on the high prevalence of anemia, especially in pregnant women who have an increasing need for those nutrients.[4] Good nutrition arrangement will have a positive influence. Malnutrition in pregnant women will cause risks and complications in the mothers, one of them is anemia in pregnant women.[10]

There are two forms of iron in food, namely the heme iron and nonheme iron. The ability of human body's to absorb iron is influenced by iron bioavailability from both sources of iron.[11] Heme iron has high bioavailability and it can be found in meat and fish, while the bioavailability of non-heme iron is low and it is sourced from plants.[12],[13] In food, iron is predominantly in the form of ferry (Fe^{3+}) which is strongly bound to organic molecules in the stomach. At a pH level less than 4, Fe^{3+} can dissociate and react with compounds of low molecular weight, such as fructose, ascorbic acid, citric acid, and amino acids to form complex structures that can enable Fe^{3+} to remain soluble in neutral pH of intestine liquids.[14]

One of the foods that contain high iron is the moringa plant. Moringa plant has high iron content. 100 grams of moringa leaf extract powder contain 28.2 mg iron[15]. Normally, iron requirement in pregnant women is 26 mg per day in the first trimester, 35 mg in the second trimester, and 39 mg in the third trimester.[16] In this study 1500 mg of moringa leaf extract in the form of capsules containing 423 mg of iron was given. Moringa leaf is one of the foods that contains vegetable protein. Plant proteins have lower quality than animal proteins because plant proteins are difficult to digest by our digestion system.[17] In regular food consumption, iron absorbed by the body is less than 10% .[14] Therefore, by giving a capsule containing 423 mg of iron, only 42.3 mg of iron can be absorbed by the body, so in normal pregnant women it can meet the needs of iron per day and in pregnant women with anemia it can increase hemoglobin levels. Moringa leaves also contain other multi micronutrients needed by pregnant women, such as beta carotene, thiamin (B1), Riboflavin (B2), niacin (B3), calcium, phosphorus, magnesium, zinc, vitamin C, so it can be an alternative to improve the nutritional status. This plant can be consumed as a food source that is rich in protein, amino acids, minerals, and vitamins. In 100 grams of moringa leaves, the vitamin C content is seven times vitamin C content in oranges, four times the vitamin A in carrots, four times calcium in milk, three times potassium in banana, and twice the protein in an egg.[5]

In this study the changes in Hb levels before and after the intervention have no significant difference in the group given the intervention and in control group ($p=0.579$). In this study the characteristics and the diet of pregnant women in the experimental and control groups are also examined. It is found that the characteristics and the diet of pregnant women are homogeneous, but there are differences in the mean of Hb levels before treatment in the experimental group (9.21 ± 0.96 g/dL) which are lower than mean Hb levels of the control group (10.11 ± 0.69 g/dL). This makes no difference in the change of hemoglobin levels before and after treatment. Based on the result of descriptive analysis, the mean change in Hb levels before and after the intervention in the experimental group (1.2 ± 0.64 g/dL) is higher than that in the control group (1.05 ± 0.86 g/dL). The results of this research should be followed up although statistically it is not significant because various research results have shown that Moringa plant is naturally rich in nutrients, and it is very good and safe for pregnant women. In addition, Moringa plant is easily cultivated, so everyone can take advantage of this plant. Moringa leaf cultivation is found in almost every house in Pasuruan, and with the results of this study people realize that consuming Moringa leaves can prevent or decrease the incidence of anemia.

5. Conclusion

In this study, there is a difference in the mean Hb levels before treatment in the group given the intervention and in control group, but after treatment no difference is found. The mean change in Hb levels before and after the intervention in experimental group is higher than that in the control group, but based on the results of analysis it is found that changes in Hb levels before and after the intervention have no significant difference in the group given the intervention and in control group.

6. Acknowledgment

Acknowledgements is given to the Department of Health, Pasuruan regency and midwives at Community Health Center Purwodadi that serves as research site, also to the respondents who participated in this study.

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