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EFFECT OF RED SPINACH EXTRACT (*Amaranthus tricolor* L) ALLOTMENT TO INCREASE HAEMOGLOBIN LEVELS OF POLITEKKES FIRST YEAR STUDENTS IN MEDAN

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among authors. Author ABS designed and carried out the research, analysed and interpreted the research data. Author NAM prepared research lab intruments and author RBS seeked the references, supported the research fund and proofread the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Anemia refers to deficiency of erythrocytes and haemoglobin (Hb) which do not fulfill their function. This study is aimed at measuring the effect of treatment towards respondents having low Hb level by the consumption of red spinach extract (*Amaranthus tricolor L*) to increase Hb levels. This study is a quasi-experimental design method with pre- and post-test group design. There are 84 female respondents as samples coming from first year from Medan Midwifery Politechnic (or Politekkes Medan in local name). Their Hb levels were checked before they were given the extract. The results show that, based on the statistical test of independent *t*-test, the percentage reached 95% in confidence level. The average Hb level before administration of red spinach extract was noted to 11.955 g/dL (8.7 g/dL minimum and 13.7 g/dL maximum) and the average Hb level after the extract consumption was about 12,404 g/dL (8.1 g/dL minimum and 16.7 g/dL maximum). It is concluded that red spinach extract can increase the respondents' Hb levels.

Keywords: Red spinach; *Amaranthus tricolor* L; extract; haemoglobin level.

1. INTRODUCTION

1.1 Background

Adolescence (between 13-21 of age) is a period of growth and of physical and mental development and teenagers or adults of this phase consume a large number of foods containing nutrients. One of the nutrients is iron which is needed for all body cells for physiological processes, such as the formation of hemoglobin (red blood cells) and enzyme function. Adolescent girls require 26 mg and their requirement is noted to be higher than boys because girls have ten times greater risk of suffering from anemia than boys; moreover, girls experience menstruation every month and often try to maintain their appearance to be slim and they limit their daily food intake; as a result, they are susceptible to infection and anemia. [1] anemia for girls brings an unfavorable impact, decreases concentration when learning and fitness levels, causes sleep because they often stay up late at night and causes less height. in addition, for girls, anemia may bring serious impact especially when are pregnant and are going to deliver babies who will take risk of

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maternal death, premature birth, and low birth weight (LBW) [2].

Anemia is a health problem throughout the world, especially for developing countries where it is estimated that 30% of the world's population suffers from anemia. Changes in the lifestyle of today's society also affect healthy eating patterns because of the existence of instant foods that are traded freely. Foods that should be eaten by young women include foods that contain protein, carbohydrates, minerals, fiber, and vitamins [3]. Of the 30% or 2 billion in the world, the status of anemia. As a developing country, in Indonesia the incidence of anemia is still quite high. The percentage of anemia in 2016 was 73.31%, a decrease compared to 2015 at 80.13%, so it can be seen that there was a decrease of 6.82% [4]. According to data from Riskesdas, the prevalence of anemia in Indonesia is 22.7% and the prevalence of anemia in women is higher than men; the prevalence of anemia in males is 18.4% and females is 23.9% [5]. Meanwhile, based on age group, the prevalence of anemia in adolescent girls in the age group 5-14 years is 26.4% and 15-21 years is 18.4%. The results of the study by Listiana showed that the prevalence of iron deficiency anemia in adolescent girls in the first year of menstruation was 27.5% [6].

The prevalence of anemia in Indonesia is 21.7% with anemic patients aged 5-14 years and at 26.4% and 57.1% in patients aged 15-24 years. Women have the highest risk of developing anemia, especially in adolescent girls [7]. According to the North Sumatra Health Office, in North Sumatra there are 322,000 young women experiencing symptoms of anemia [8]. From the 2013 Riskasdes data, the anemia rate in North Sumatra is very high, namely 25% of 1,329,920 young women [5]. Iron deficiency anemia is the most common anemia, especially in tropical countries or third world countries. This anemia affects more than a third of the world's population which has a very detrimental health impact and quite serious social impact [9].

Anemia can cause fatigue, decreased learning concentration so that learning achievement is low and can reduce work productivity in adolescents. In addition, anemia can also reduce the body's resistance so that it is susceptible to infection. The high prevalence of anemia in adolescents if not handled properly will continue into adulthood and contribute greatly to maternal mortality, premature births, and babies with low birth weight [10]. One of the efforts to prevent anemia is to consume foods rich in iron, easily available in the community, such as red spinach. Red Spinach (Amaranthus tricolor L) is a vegetable that has many benefits because it contains vitamins A, C and E [11]; in addition, red spinach also contains components such as antioxidants, namely batalain, carotenoids, flavonoids, and plephenols [12]. People usually consume red spinach by means of vegetables or sauteed. However, people do not know how much red spinach should be consumed, which can increase hb to prevent anemia and some people, especially teenagers, are lazy to eat vegetables, so they need red spinach extract for teenagers to be able to consume it every day without having to bother cooking it.

1.2 Problems and Objectives

Based on the background, the researcher is interested in conducting research on: what are effects of giving red spinach extract to hemoglobin levels for female students majoring in midwifery at Politekkes Medan? General objective of this study is to apprehend the effect of red spinach extract to increase female students' Hb levels and the specific objectives are written in the followings:

- To discern female students' average Hb level during treatment held before red spinach extract is given;
- To perceive female students' average hb level during treatment after red spinach extract consumption;
- To know difference in Hb level among female students' before and after red spinach extract giving;
- To identify the effect of red spinach extract allotment to the female students' hemoglobin level before and after the treatment.

1.3 Significance and Originality

The results of the study are expected to help increase female students' hemoglobin levels and to meet adequate nutritional intake, so they can be prevented from anemia. This research significance is to develop scientific knowledge and experience regarding the administration of red spinach extract. This research is original after it has been compared to the following researches carried out by researchers such as Endah [13], Triwinarni and Susilo [1], Wayan and Ida [9], and by Umi et al. [14]. This research is different since its dependent and independent variables are related to red spinach extract, female students as respondents, and research locations.

2. LITERATURE REVIEW

2.1 Adolescence and How It Is Defined

Adolescence is a period of transition from children to adults, marked by physical and mental changes.

Physical changes can be seen from menstruation for females and wet dreams for males; their physical organs grow very quickly, especially females undergo some physical changes, such as a) body getting bigger, b) grow breasts, c) wide hips, d) hair growth in armpits and pubis, e) skin is getting smoother, f) acne, g) growing pubic hair, and h) menarche (first menstruation) [15]. Adolescence lies between 12-19 years of age and the growth rate of female adolescents accelerates first because their bodies should prepare for reproduction and their peak growth in weight and height of women is reached at the age 19.

2.2 Anemia

2.2.1 What anemia means

Anemia is a condition in which the circulation of erythrocyte mass and hemoglobin mass cannot fulfill their function to provide oxygen for body tissues [16]. Anemia is defined as a condition in which the level of hemoglobin (Hb) in the blood is lower than the normal value for groups of people according to age and sex. Nutritional anemia is a condition with blood hemoglobin levels that are lower than normal as a result of the inability of the red blood cell-forming tissue in its production to maintain hemoglobin levels at the national level. Iron nutritional anemia is anemia that arises due to iron deficiency so that the formation of red blood cells and other functions in the body is disrupted [17]. According to WHO, as cited by Fillah, anemia is a condition in which the concentration of hemoglobin or the number of red blood cells is below normal. While the definition of nutritional anemia is the state of hemoglobin, hematocrit, and red blood cell counts that are lower than normal. Nutritional anemia is caused by a deficiency of one or more of the nutrients needed for the formationn of hemoglobin, such as iron, vitamin B12, folic acid, protein, and vitamins. Based on research in Indonesia stated that the main cause of iron nutritional anemia in adolescents is a lack of iron, called iron nutritional anemia (AGB) [18].

2.2.2 Anemia demarcation

To comprehend the definition of anemia, it is necessary to set a cut-off point for hemoglobin or hematocrit which is considered to have anemia. Table 1 illustrates the normal limits of Hb levels which are different between males and females.

2.2.3 Causes and causative factors of anemia on adolescents

In general, anemia is caused by nutritional and non-nutrient factors; the first factors might include protein deficiency, folic acid, vitamin B12, vitamin A, copper, selenium, and among others. The causes of non-nutritional factors include malabsorption due to diarrhea, increased iron requirements that occur during infancy, adolescence, pregnancy and lactation, and increased excretion due to excessive menstrual bleeding. [18] wrote factors causing anemia in female adolescents.

a) Nutritional status

Nutritional status in adolescents refers to a state of balance between consumption and absorption of nutrients in the body. The increased needs for micronutrients, especially iron, is used to replace lost iron. Good nutritional status during adolescence for female adolescents will support them to be the best prospective mother. Abnormal nutritional status among them affects the iron status in the body. Hence, nutritional status is one of the factors causing nutritional anemia.

b) Long menstruation

Female adolescents need more iron to replace the one which is lost during menstruation. Several studies have proven that the amount of loosing blood during one menstrual period ranges from 20-25 cc and the iron loses ranging from 12.5-15 mg/month or approximately 0.4-0.5 mg/day and if it is included with basal loss, the total amount of iron spent is 1.25 mg per day. If discharge during menstruation is very large, iron anemia occurs.

c) Intake of iron (Fe) and protein

The main cause of iron anemia is caused by inadequate intake of iron from food. In general, iron needs will not meet if young women consuming more plant-based foods, but not animal-based food, that contain little iron and often eating reduced diets because they want to be slim.

d) Iron malabsorption

Malabsorption of nutrients in the gastrointestinal tract due to gastritis, papptic ulcers, diarrhea, the presence of hookworm parasites can also cause anemia.

e) Infectious diseases

Infectious diseases can cause various nutritional problems and this occurs because of symptoms such as vomiting and diarrhea and decreased appetite and infectious diseases can slow the formation of Hb in the blood.

2.2.4 Symptoms of anemia and adolescents

In general, anemia brings impacts on the declining quality of human resources, for instance, a) easily

tired, b) irregular heartbeat, c) easy to get angry, d) cold or numb hands and feet, e) dizziness and dizzy eyes, f) Heart beats fast when doing light activities, g) lower learning ability and concentration, h) reduction in physical ability of sportswomen, and i) pale face [15].

2.2.5 Impacts of anemia on adolescents

Dieny argues that anemia may cause various adverse effects on female adolescents, namely, a) lower immune system so that people with anemia are susceptible to infectious diseases, b) decreased fitness and agility to think due to lack of oxygen to muscle cells and brain cells, and c) decreased learning achievement and working productivity/performance [18].

2.2.6 Preventing female adolescents from anemia

Anemia can be prevented by consumption of foods being rich in vitamin C (oranges, melons, broccoli, strawberries, and tomatoes), vitamin B12 (meat, cheese, cereals, tofu, tempeh, and milk), Fe tablets and red spinach extract [12].

2.3 Red Spinach (*Amaranthus tricolor L)*

2.3.1 Taxonomy of red spinach (*Amaranthus tricolor L)*

The classification of plant nomenclature (systematics) data of red spinach plants is as follows: a) Kingdom classification: Plantae (plants), b) Sub-kingdom: Tracheobionta (vascular plants), c) Super division: Spermatophyta (producing seeds), d) Division: Magnoliophyta, e) Class: Magnoliopsida, f) Sub-class: Hamamelidae, g) Order: Caryphyllales, h) Family: Amaranthaceae, i) Genus: Amaranthus, j) Species: Amarantus tricolor L [19].

2.3.2 Mechanism of red spinach

Vegetables contribute mainly vitamins A and C, as well as fiber which is very important for the body and vegetables are classified as horticultural crops [20]. Red spinach (Amaranthus tricolor L) contains a lot of protein, fat, carbohydrates, calcium, manganese, phosphorus, iron, amarantin, rutin, purines, vitamins (A, B1, B2, C), carotene, chlorophyll, and sapoins. It is also rich in high iron content and efficacious to increase blood. Iron is a mineral needed to transport oxygen throughout the body and its deficiency in the body can decrease man's immune system and he often feel lethargic because of anemia. Therefore, it is necessary for man to consume red spinach when he has less Hb levels in the body [21]. Spinach (Spinacia Oeracea) is one of the best vegetables because it is packed with many health benefits and nutritional value; one serving of spinach (100 grams) contains 2.3 grams of protein, 3.2 grams of carbohydrates, 3 grams of iron and 82 calcium. Red spinach is also rich in various vitamins and minerals, niacin, thamine, phosphorus, riboflavin, sodium, potassium, magnesium. In addition, red spinach also contains antioxidants and phytochemicals that help protect the body against various diseases [22,23].

2.3.3 Materials and method of red spinach extract making

2.3.3.1 Making of simplisia powder

Simplicia powder is a traditional medicinal preparation in the form of homogeneous granules with the appropriate degree of fineness, made from simplicia or a mixture with extracts which are used by brewing with hot water [24]. Simplicia powder is made from whole simplicia or fine pieces of simplicia that have been dried through the process of making powder with a tool without causing damage or loss of the required chemical content and sieved to obtain powder. The degree of fineness of simplicia powder for extracting is fine simplicia with a sieve number of 60 with a nominal width of 0.105 mm, a diameter of 0.064 and a size of 250 m [25].

Table 1. Normal limits of Hb levels based on age and gender

Population age	Non-anemia (g/dL)	Anemia (g/dL)		
		Light	Medium	Heavy
6–59 months	11	10,0 – 10,9	7,0 – 9,9	< 7,0
5–11 years old	11,5	11,0 – 11,4	8,0 – 10,9	< 8,0
12–14 years old	12	11,0 – 11,9	8,0 – 10,9	< 8,0
<15 years old (unpregnant female)	12	11,0 – 10,9	8,0 – 10,9	< 8,0
Pregnant woman	11	10,0 – 10,9	7,0 – 9,9	< 7,0
<15 years old (males)	13	11,0 – 12,9	8,0 – 10,9	< 8,0

Source: Kemenkes Kesehatan Republik Indonesia, 2016

2.3.3.2 Making of extract

Making extracts from simplicia powder by maceration uses a solvent that can filter most of the secondary metabolites contained in simplicia powder plus 70% ethanol: a) put one part of dry simplicia powder into the macerator, b) add 10 parts of solvent, c) soak for the first 6 hours, stirring occasionally, then let stand for 18 hours, d) separate the macerate by precipitation, centrifugation, decantation, or filtration, and e) repeat the filtering process at least twice of the same type and the same solvent.

2.4 Conceptual Framework

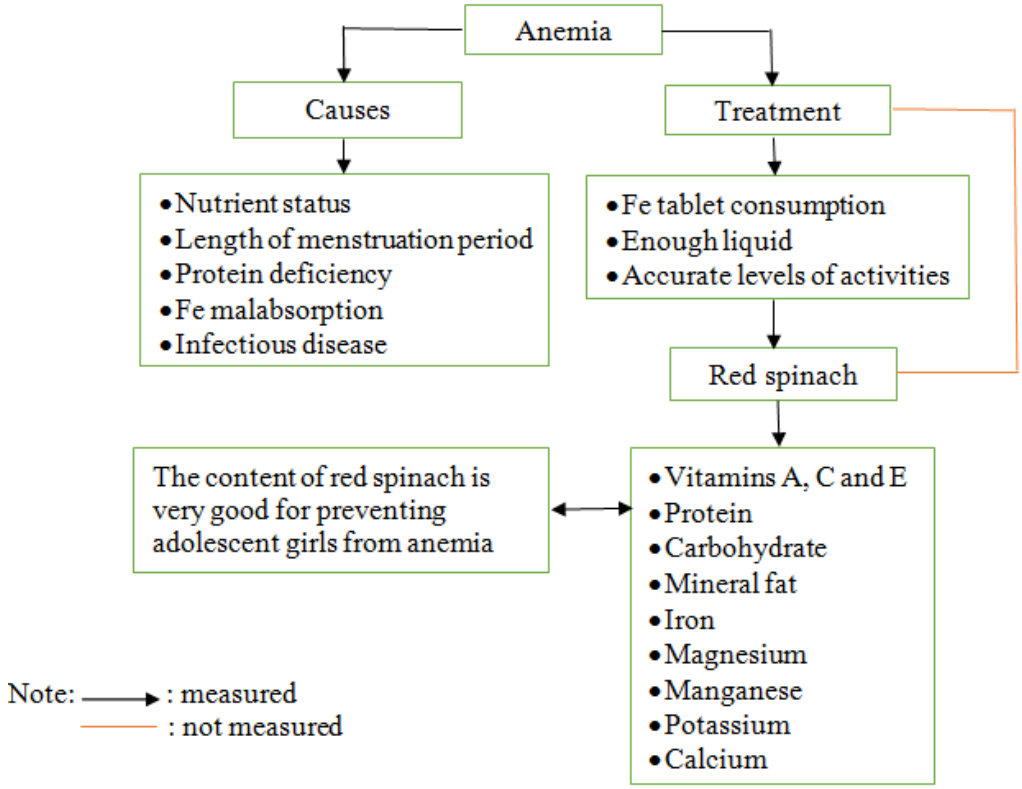

Fig. 1. Conceptual framework

2.5 Research variables

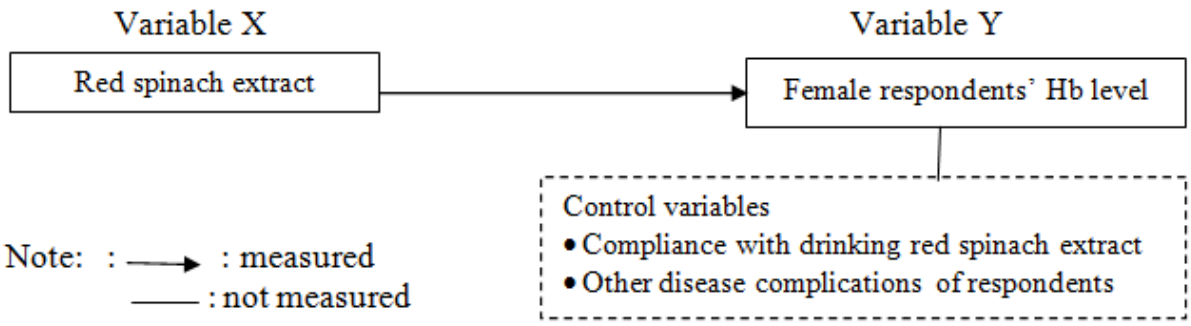

Fig. 2. Research variables

2.6 Operational Definitions

a) Red spinach extract

Red spinach that has been processed into extract and packaged in capsules with a dose of 260 mg can be consumed. Process and packaging is done in collaboration with the USU Pharmacy Lab of Universitas Sumatera Utara and is helped by Mr. Awal.

b) Hb level of adolescent girls

Hemoglobin levels in the blood of young women in grams %/dL were measured before and after red spinach extract allotment with a ratio scale.

c) Compliance with taking medication

Every morning adolescent girls were directly controlled for their compliance in taking drugs with supervision. Use the control sheet regularly within 30 days.

d) Complications of other diseases

Young women did not suffer from other diseases that could interfere with the increase in Hb levels such as kidney, HIV/AIDS, tuberculosis, syphilis, bone infection, and heart infection.

2.7 Research Hypothesis

There is an effect of giving red spinach extract in increasing Hb levels in Medan Midwifery Department students in 2019.

3. RESEARCH METHODS

3.1 Research Type and Design

This study used a quasi-experimental type of research, namely to identify the effect of red spinach extract on the increase in hemoglobin levels in female students at the Midwifery Department of Medan. The design of this study was Pre and Post Test Group Design to determine the effect of giving red spinach extract to increase hemoglobin levels in students of the Medan Midwifery Department.

3.2 Research Location and Time

Considering the location of the study is close, the population is available and all parties involved in the study gave a very good response. This research was conducted from January to May 2019.

3.3 Population and Sampling

The population of the study was all Level 1 Teenage Girls in the Midwifery Department of Medan as many as 106 people who were in the dormitory. The sample size taken is calculated by the slovin formula. Sampling is a probability sampling with a systematic random sampling approach by determining the number of samples with certain considerations. With the sample criteria affected by anemia, such as, easily sleepy in the morning not due to staying up late, weak, easily tired, dizzy.

$$n = \frac{N}{N + 1\,(d)^2}$$

Explanation:

n = Sample Size
N = Population
d = 90% Confidence Level or (0,1)

Solution:

$$n = \frac{106}{106\,(0,1)l^{2+}1}$$

$$n = \frac{106}{106\,(0,0025) + 1}$$

$$n = \frac{106}{0,265 + 1}$$

$$n = \frac{106}{1,265}$$

n = 83,73 Dibulatkan menjadi 84 Orang

Systematic random sampling:

Sampling formula: $\frac{\text{Sampling X number of class members}}{\text{Total number}}$

Class 1-A

$\frac{84}{106}$ x $31 = \frac{2604}{106} = 24,56 / 25$

Class 1-B

$\frac{84}{106}$ x $38 = \frac{3192}{106} = 30,11 / 30$

Class 1-C

$\frac{84}{106}$ x $37 = \frac{3108}{106} = 29,32 / 29$

The number of classes and the total number of respondents amount to 84 (they are calculated on the basis of Class A + Class B + Class C = 25 + 30 + 29 = 84 respondents). Samples were taken on the basis of random sampling in which each respondent was given a small paper sheet containing an Arabic number in it and the number of sheets were the same as the number of respondents per class. Respondents who received a sheet with Arabic number in it was then chosen as a respondent.

3.4 Research Procedures

3.4.1 Procedures of red spinach extract making

a) Making simplicia

Red spinach leaves collected from the morning tax (purposive sampling) amounted to 8 kg, which were then washed under tab, drained, and weighed. The leaves were put in the stainless container until they were dry (to test was by kneading and when they were easily broken into pieces meaning they were dry) and they were weighed after being dry; then, they were stored in plastic bag and tied.

b) Making medicinal plant extracts

Medicinal plant extracts were made using Maceration (FHI, 203) method on the basis of the following procedures:

- Weigh 1300 g of simplicia powder and put it in a closed container;
- Add 23 liters of 70% ethanol and stir for the first 6 hours. Let stand for 18 hours, stirring occasionally;
- For filter, cotton and filter paper were used, tamping the filtrate (maserat I);
- Repeat the process of extracting the dregs using 6.5 liters of 70% ethanol (96%) until maserate II was obtained. Combine the two maserates;
- Evaporate the maserate using a Rotavapor at a temperature of 40^0C or with a water bath at a temperature of 90^0C while stirring to obtain a thick extract;
- The thick extract obtained was put into a plastic pot.

c) Capsule preparation

Spinach extract were determined as materials and each capsule contained red spinach extract 260 mg as the dosage. The number of red spinach extract capsules to be made amounted to 2600 capsules and the red spinach extract capsule formula was written as follows: R/ Red spinach extract 200mg; Amilun Manihot 5%; Amylum Maidis 5%; Sacrum Lactis qs ad 500 mg; and m.f caps. Did no M.

3.4.2 Production procedures

The procedures to produce spinach extract are carried out in the following:

- Weigh the 260 g red spinach extract into the mortar;
- Homogenize by adding little by little the Sakrum Laksit while grinding;
- Add the Manihot Starch and Maidis Starch into the mortar while grinding;
- Sift the mass with a sieve and dry it in the oven;
- Remove the dry mass and then weigh it;
- Test the weight of the capsule contents using 6 empty capsules;
- Remove the contents and weigh then calculate the average weight multiplied by 1000 to obtain the capsule mass;
- Weigh the capsule mass and, if the capsule mass is not enough, then add enough lactis sacrum to the resulting mass and dry;
- Stir until evenly distributed;
- Enter the mass into the capsule filling device which has been filled with capsule shell No. 0 and flatten, so that all the mass enters;
- Cover the capsule with the upper shell;
- Clean the capsule preparation with cotton and put it in a suitable container;
- To make a placebo, it is enough to fill the carrier material in the form of sacrum lactis without extract into capsule shell no. 0 and give a label on each preparation.

3.4.3 Lab procedures

The followings are the Lab Procedures of this research which was carried out at the Midwifery Department of Poltekkes Medan from February to March with a sample of 84 female respondents who were anemic.

- First year students who agreed to the study and signed the informed consent;
- Checking adolescent respondents' Hb levels with the Quik-Chek Hemoglobin Testing System before the study was doene;
- After the Hb level checking, the respondents were given red spinach extract for 30 days and they consumed in the morning;
- After 30 days, they were re-examined for Hb they had.

3.4.4 Instruments and research materials

The research tools in this research include the observation sheets, the hemoglobin level test tool used is the Essay Touch Blood Hemoglobin the control list of female respondents who consumed red spinach extract, and the red spinach extract.

3.4.5 Data analysis

Data was processed by both univariate and bivariate analysis. The first was carried out by descriptive analysis which monitored the characteristics of each variable being studied. The results were reviewed in the form of a distribution table. The second analysis determined the average difference before and after administration of red spinach extract which was used for independent *t* test (pair / related using SPSS).

4. RESULTS AND DISCUSSION

4.1 Results

4.1.1 General description of research location

The Medan Health Polytechnic (or Poltekkes Medan) is located on Jamin Ginting Street, Medan Tuntungan. First year students majoring in Midwifery Diploma stayed in the dormitory and got food and beverages there. Living in the dormitory they must be adjusted to the dormitory rules, such as, predetermined times such as meal times, rest hours, biological clock.

4.1.2 Everage Hb level

4.1.2.1 Everage Hb level during pre-red spinach extract consumption

In case of Hb level Table 2 shows the respondents' health conditions, such as Hb rate, anemia level, and Hb level. Table 2 also shows that the average of Hb level before red spinach extract was given was noted to 11.955 g/dL (minimum = 8.7 g/dL and maximum = 13.7g/dL).

4.1.2.2 Average Hb levels after red spinach extract giving

Table 3 displays the average Hb level after administration of red spinach extract to the respondents. The average Hb level before giving red spinach extract was recorded at 12,404 g/dL (minimum = 8.1g/dL and maximum = 16.7g/dL).

4.1.2.3 Different Hb levels during pre- and post- red spinach extract giving

Table 3 also shows different Hb levels during pre- and post- administration of red spinach extract. The difference is related to an increase in Hb levels by 58 respondents (69.1%) and a decrease by 26 (30.9%).

4.1.2.4 Effect of red spinach extract giving

Before testing the effect of giving red spinach extract to increase Hb levels, data normality test was carried out and this test was used to see whether or not the data has a normal distribution. In this study, the method used to detect residuals that are normally distributed or not, was the Kolmogorov-Smirnov Test.

The Kolmogorov-Smirnov Test describes that the Hb level before administration of red spinach extract with *P*-value was 0.130 > 0.05 so the decision in the Kolmogorov-Sminov normality test can be concluded that the data is normally distributed. The Hb levels after administration of red spinach extract with *P*-value is 0.630 > 0 0.05 then the decision in the Kolmogorov-Sminov normality test can indicate that the data is normally distributed so that the test used to see the effect of red spinach extract in increasing Hb levels by the T-test. To see the effect of red spinach extract to increase Hb levels can be seen in Table 4.

The effect of giving red spinach extract to the increase Hb levels was tested by paired T-test statistics. The test obtained P-value of 0.002 < = 0.05, meaning Ho was rejected; thus, the effect of giving red spinach extract to increase Hb levels existed.

Table 2. Average Hb levels during pre-red spinach extract allotment

Hb rate	Anemia level						Highest Hb	Lowest Hb	Total
	Non-Anemia 12%		Light 10.9-11.0		Medium 8.0-10.8				
	F	%	F	%	F	%			
Pre-	63	75	4	4.76	17	20.23	13.7	6.7	
Total	63	75	4	4.76	17	20.23			84

Table 3. Average Hb levels after red spinach extract allotment

Hb rate	Anemia level						Highest Hb	Lowest Hb	Total
	Non-Anemia 12%		Light 10.9-11.0		Medium 8.0-10.8				
	F	%	F	%	F	%			
Post-	70	83.33	3	3.57	11	13.09	16.0	8.1	
Total	70	83.33	3	3.57	11	13.09			84

Table 4. Effect of red spinach extract allotment

Variable	Mean	Std. Deviation	Mean gap	*P value*	Pre- and Post- SD
Pre-	11.955	1.1452	0.45	0.002	1.28
Post-	12.404	1.5327			

4.2 Discussion

4.2.1 Respondents' hemoglobin levels

The results showed that the average Hb level before administration of red spinach extract was 11,955 g/dL with a minimum Hb level of 8.7g/dL and a maximum of 13.7 g/dL and after administration was of 12,404 g/dL with a minimum Hb level of 8.1 g/dL and a maximum of 16.0 g/dL. All this indicates that the Hb levels during pre- and post-administration had moderate anemia. However, pre-administration showed that the average Hb level increased. This is in accordance with what Astuti (2015) found on the effect of red spinach juice consumption to increase Hb levels in pregnant women. The Hb before treatment was 11.210 gr%, the average value of Hb levels after treatment in the first week was 11.850 gr% and the average value (mean) after the second week of treatment was 12.140 gr%. The average (mean) increase in Hb levels for two weeks of treatment was 0.93gr%.

The state of Hb levels after administration underwent a decrease; this is not caused by a condition that after consuming red spinach extract resulted in a decrease in Hb levels but maybe due to chance or there were other factors that resulted in a decrease, for example giving red spinach extract was not able to increase Hb levels. Actually, the Hb levels can be due to the consumption of nutritional intake that is less than respondents when measuring Hb levels coincides with menstruation or just after menstruation.

4.2.2 Effect of giving red spinach extract

The results showed that pre- and post- administration of red spinach extract underwent an increase in Hb hemoglobin levels for 58 respondents (69.1%) and a decrease for 26 people (30.9%). Giving red spinach extract were carried out in the dining room of the dormitory and monitored by dormitory landlady. The results from the statistical *t*-test obtained p value = 0.002 < = 0.05, meaning Ho is rejected which indicated that there was an effect of red spinach extract consumption, that is, to increase Hb levels of the respondents. This fact showed that hemoglobin levels after red spinach extract allotment significantly increased to reach 69.1%; this situation means that the extract is effective.

Red spinach contains a lot of protein, fat, carbohydrates, calcium, manganese, phosphorus, iron, amarantin, rutin, purines, vitamins (A, B1, B2, C), carotene, chlorophyll, and sapoins. It also has high iron content which is efficacious to increase blood and iron itself becomes a mineral needed to transport oxygen throughout the body. Iron deficiency in the body can make a person experience a decreased immune system and often feel lethargic which causes anemia. Therefore, it is necessary to consume red spinach for those who have lower Hb levels. In addition, the mineral content, for instance Fe, in spinach is quite high, in which Fe can prevent fatigue due to anemia. Red spinach is easily processed into a variety of foods or herbal extracts that are more varied than other food ingredients containing Fe. Iron levels can help the formation of chem and globin in the body.

According to Faralia (2012) that red spinach contains a lot of protein, fat, carbohydrates, potassium, calcium, manganese, phosphorus, iron, amarantin, rutin, purines, niacin and vitamins (A, B1, B2, C), carotene, chlorophyll and saponins. From the results of the examination of Hb levels after treatment, it was proven that consumption of red spinach extract had an effect on increasing Hb levels. Observations of increasing Hb levels were carried out on students from the Department of Midwifery at the Medan Poltekkes who were given red spinach extract.

The results of this study are also in line with similar researches carried by Setiyani [26] who found that red

spinach was useful for treating anemia and increasing the work of the kidneys, cleaning the blood after childbirth, dysentery and strengthening hair roots and by Astuti (2015) who recorded that red spinach juice consumption once a day for two weeks increased Hb levels of pregnant women in the third trimester with significance value of $p<0.05$ meaning that there was a significant effect. The researchers assumed that Hb level can increase significantly (69%) after red spinach extract consumption reaching 69.1% [13].

5. CONCLUSION

The average of hemoglobin level average before and after the red spinach extract is given to respondents is noted as 11.955 g/dL and 12.404 g/dL respectively. Differences in hemoglobin levels before and after administration of red spinach extract shows an increase in hemoglobin levels. Effect is found to increase hemoglobin levels after red spinach extract allotment.

ETHICAL APPROVAL AND CONSENT

In conducting this research, the researchers first submitted a research proposal to the Head Department and sent a letter of permission to the dormitory landlady for a preliminary study. Then, after the ethical clearance from the Department, the researchers conducted research based on the data from taken preliminary study. In case of informed consent to get sample, the prospective respondents were given an agreement sheet where the researchers explained what their contribution in the research. If they agreed to be respondents, they should sign a consent form as one of the requirements to be sample of respondents.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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