

Utilization Potentials of *Moringa oleifera* Leaves Syrup in Prevention of Anemia

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ABSTRACT

Background: Anemia is still remains as the main nutritional problem in Indonesia. Based on Indonesia basic health research 2018, the prevalence of anemia in Indonesia was 23,7%. The prevalence of anemia in children under 5 years was 38.5%, and in pregnant women was 48,9%. Indonesia has a large number of natural plants that contain rich of nutrients such as *Moringa oleifera*. The leaves are 25 times more iron than spinach.

Aims: This study aims to analyze the content of Fe level and the organoleptics of *Moringa oleifera* leaves syrup as an alternative food product in prevention of anemia.

Methods: This was an experimental study using a completely randomized design (CRD) consisting of one factor and 3 repetitions. The samples were: *Moringa oleifera* leaves mixed with pineapple as treatment samples and *Moringa oleifera* leaves without pineapple as control. The 5 points hedonic scales were conducted for the organoleptic test: dislike extremely, dislike, neither like nor dislike, like, like extremely assessed by 30 panelists. The Fe level assessed by spectrophotometers.

Results: The highest average of color preference, aroma, taste test and Fe level was Sample 1. The treatment samples had good aroma and a acceptable taste because they were mixed with pineapple which contains Bromelin enzyme which can reduce the bitter taste of *Moringa oleifera* leaves.

Conclusions: Syrup of *Moringa oleifera* leaves mixed with pineapple could be an alternative food product in prevention of anemia.

Keywords: syrup, *Moringa oleifera*, prevention, anemia

INTRODUCTION

Anemia is still remains as the main nutritional problem in the world. [1,2] Anemia is characterized by a decreased quantity of red blood cells (RBC), often accompanied by diminished hemoglobin levels or altered red blood cell morphology. [3,4] The WHO defines anemia as hemoglobin concentrations below 12 g/dL in women and 13 g/dL in men. [3,5] It is a major and global public health problem that affects maternal and child mortality, physical performance, and referral to health-care professionals. [2,6] In the developing countries, the burden of anemia accounts for 89%. [1] Children under 5 years, women of childbearing age, and pregnant women are particularly at risk. [3,4,6] It is estimated that half of the anemia cases are due to iron deficiency. [3]

Indonesia has many nutrition problems, and one of them is anemia. [7] Based on Indonesia basic health research 2018, the prevalence of anemia in Indonesia was 23,7%. [8] The prevalence of anemia in children under 5 years was 38.5%, and in pregnant women was 48,9%. [8] Anemia is more prevalent among women than men, the prevalence of anemia in women was 27.2% while men was 20.3%. [8] A research that conducted in Muaro Jambi District, Jambi Province, Indonesia found that the prevalence of anemia in senior high school was 46.7%. [9]

Indonesia has a large number of natural plants that contain rich of nutrients such as *Moringa oleifera*. [10,11] The leaves are rich in minerals, high vitamins and other

essential phytochemicals. [12-15] *Moringa oleifera* leaves contain high amount of vitamin A, vitamin B complex, vitamin C calcium, protein, potassium, and iron. [10,12,15,16] This plant is cultivated for its leaves, which nutritional potential is exploited to fight against malnutrition problem. [10,13,16,17] However, not much people know about of its benefits so the utilization of the plant still very low in the community [10] due to the unpleasant taste when eaten. [13-16] Several studies have been conducted due to the utilization of *Moringa oleifera* as food products such as yoghurt, bread, biscuits, cheese, and soup as anemia prevention, but none as syrup. [14,15] To improve the unpleasant taste, it can be done by mixing it with pineapple.

This work aims to analyze the content of Fe level and the organoleptics of *Moringa oleifera* leaves syrup mixed with pineapple as an alternative food product in prevention of anemia.

METHODS

Study site

This research conducted in 2 (two) sites between May and December 2018 in Jambi City, Jambi Province, Indonesia. The first site was in the Laboratory of Health of Jambi for assessing the Fe level in the treatment and control samples. The second site was the Laboratory of Faculty of Public Health Universitas Jambi for assessing the organoleptic (color preference, aroma, and taste test) by 30 panelists.

Study setting

This was an experimental study using a completely randomized design

(CRD) consisting of one factor and 3 repetitions. The samples in this study were: *Moringa oleifera* leaves syrup mixed with pineapple as treatment samples and *Moringa oleifera* leaves syrup without pineapple as control (Sample C). The treatment samples divided into 3 groups, they were the Sample 1, Sample 2, and Sample 3. Sample 1 was *Moringa oleifera* leaves syrup mixed with pineapple with a ratio of 100 grams of *Moringa oleifera* leaves with 500 grams of pineapple. Sample 2 was *Moringa oleifera* leaves syrup mixed with pineapple with a ratio of 100 grams of *Moringa oleifera* leaves with 1,000 grams of pineapple. While Sample 3 was *Moringa oleifera* leaves syrup mixed with pineapple with a ratio of 100 grams of *Moringa oleifera* leaves with 1,500 grams of pineapple.

Data collection procedure

The hedonic scale consists of 5 statements were conducted. The 5 points hedonic scales were: dislike extremely, dislike, neither like nor dislike, like, like extremely. All the 30 panelists were asked to fill in their assessment into the hedonic scale form. The 30 panelists were students of Faculty of Public Health Universitas Jambi selected randomly.

Data analysis

We then analysis both treatment and control samples of the color preference, aroma, taste test and Fe level. For the color preference, aroma and taste test will be assessed by 30 panelists. While the Fe level will be assessed by spectrophotometers.

RESULTS

Color Preference Test

Table 1. Measurement result of color preference test

Name of samples	Extremely dislike n (%)	Dislike n (%)	Neither like nor dislike n (%)	Like n (%)	Extremely like n (%)	Average
Sample C	0 (0)	15 (50)	6 (20)	9 (30)	0 (0)	2.80
Sample 1	0 (0)	3 (10)	11 (36.7)	15 (50)	1 (3.3)	3.47
Sample 2	0 (0)	0 (0)	4 (13.3)	20 (66.7)	6 (20)	4.07
Sample 3	1 (3.3)	7 (23.3)	3 (10)	12 (40)	7 (23.3)	3.57

Based on Table 1 it can be seen that the most preferred color was the Sample 1 (66.7%) while the most not preferred color was Sample C (50%), and the highest average preference color test was Sample 1 (4.07).

Aroma Test

Table 2. Measurement result of aroma test

Name of samples	Extremely dislike n (%)	Dislike n (%)	Neither like nor dislike n (%)	Like n (%)	Extremely Like n (%)	Average
Sample C	4 (13.3)	13 (43.3)	8 (26.7)	4 (13.3)	1 (3.3)	2.50
Sample 1	1 (3.3)	7 (23.3)	7 (23.3)	14 (46.7)	1 (3.3%)	3.23
Sample 2	0 (0)	5 (16.7)	10 (33.3)	14 (46.7)	1 (3.3%)	3.37
Sample 3	3 (10.0)	9 (30.0)	5 (16.7)	10 (33.3)	3 (10%)	3.03

Based on Table 2 it can be seen that the most preferred aroma test were Sample 0.5 and Sample 1 (46.7%) while the most not preferred aroma test was Sample C (43.3%), and the highest average aroma test was Sample 1 (3.37).

Taste Test

Table 3. Measurement result of taste test

Name of samples	Extremely dislike n (%)	Dislike n (%)	Neither like nor dislike n (%)	Like n (%)	Extremely Like n (%)	Average
Sample C	4 (13.3)	13 (43.3)	3 (10)	7 (23.3)	3 (10)	2.73
Sample 1	0 (0)	8 (26.7)	5 (16.7)	15 (50.0)	2 (6.7)	3.37
Sample 2	1 (3.3)	6 (20.0)	3 (10.0)	15 (50.0)	5 (16.7)	3.57
Sample 3	6 (20.0)	7 (23.3)	3 (10)	3 (10)	11 (36.7)	3.20

Based on Table 3 it can be seen that the most preferred sample taste were Sample 0.5 and Sample 1 (50%) while the most not preferred sample taste was Sample C (43.3%), and the highest average taste test was Sample 1 (3.57).

Fe Level

Table 4. Measurement result of Fe levels

Name of samples	Repetition 1 (mg/100 g)	Repetition 2 (mg/100 g)	Repetition 3 (mg/100 g)	Average (mg/100 g)
Sample C	1.066	1.099	1.060	1.075
Sample 1	2.776	2.711	2.822	2.776
Sample 2	4.086	3.246	3.667	3.667
Sample 3	2.434	2.322	2.229	2.322

Based on Table 4 it can be seen that the highest average Fe level was the syrup Sample 1 (3.667 mg/100 g) while the lowest Fe level was the Sample C (1.075 mg/g).

Recapitulation of Measurement

Table 5. Recapitulation of measurement

Name of samples	Average of color preference	Average of aroma	Average of taste	Average of Fe level
Sample C	2.80	2.50	2.73	1.075
Sample 1	3.47	3.23	3.37	2.776
Sample 2	4.07	3.37	3.57	3.667
Sample 3	3.57	3.03	3.20	2.322

Based on Table 5 it can be seen that the highest average of color, aroma, taste test and Fe level was Sample 1.

DISCUSSION

Anemia is a nutritional problem and is mainly contributed by iron deficiency, consequently impairing the capacity of the blood to transport oxygen around the body. [1-3,6] Iron is a mineral that is naturally present in many foods (animal foods and plant foods), added to some food products (iron fortification), and available as a

dietary supplement. [3,7,18] Iron is an essential component of hemoglobin, an erythrocyte (RBC) protein that transfers oxygen from the lungs to the tissues. [18,19]

Dietary iron has two main forms: heme and non-heme. [18,19] Heme iron derived from hemoglobin and myoglobin of animal food sources such as meat, seafood and poultry is better absorbed by the body.

[19] While non-heme iron is found in plant foods, such as *Moringa oleifera*, spinach and beans, grains, vegetables, fruits, nuts, and seeds. [10,15,18]

Plant foods that contain rich of iron is *Moringa oleifera*. [11-15,17] Indonesia has a large number of *Moringa oleifera* locally named as *kelor*. [10] The leaves are 25 times more iron than spinach. [12,15,16,18] One of the benefits of *Moringa oleifera* leaves is very good in consumption for pregnant women, breastfeeding and toddlers. [12,17] However, *moringa oleifera* leaves can give an unpleasant taste when eaten. [13,14,16] Therefore, to improve the unpleasant taste, it can be done by marking it in the form of syrup which mixed with pineapple.

The most preferred color, aroma and taste test were the Sample 1 while the most not preferred color was Sample C. The results of this study indicated that the control sample (Sample C) was a syrup sample with the original color, aroma and taste of *Moringa oleifera* leaves. When the color of the control sample was compared to the color of the treatment samples, it was obtained that the panelists more prefer the color of the treatment samples because the control sample has the original color of *Moringa oleifera* leaves which looks less attractive than the treatment sample which has a yellowish color. [13,16] The treatment samples had good aroma and a sweet (acceptable) taste because they were mixed with pineapple which contains Bromelin enzyme which can reduce the bitter taste of *Moringa oleifera* leaves. [14,16,20]

Bromelain is an enzyme mixture found in pineapple. [20,21] It is the generic name given to the set of derived endopeptidases belonging to members of the *Bromeliaceae* family, which belongs to the pineapple, being able to break the peptide bond, separating proteins and amino acids. [20,21]

CONCLUSION

The highest average of color preference, aroma, taste test and Fe level was Sample 1 (*Moringa oleifera* leaves

syrup mixed with pineapple with a ratio of 100 grams of *Moringa oleifera* leaves with 500 grams of pineapple). This syrup could be an alternative food product in prevention of anemia.

Recommendation

It is recommended to use *Moringa oleifera* leaves syrup mixed with pineapple with a ratio of 100 grams *Moringa oleifera* leaves: 1000 grams pineapple as an alternative drinks in the household level. There is a need for further study of the nutritional content to find out how much other nutrients in the syrup of *Moringa oleifera* leaves mixed with pineapple.

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