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Test of Acceptability and Fe Levels Pancake "Bilor" Beetroot and Moringa Leaves as a Snack to Prevent Anemia in Adolescent Girls

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ABSTRACT

Iron deficiency anemia is a major health problem that occurs in adolescent girls. Prevention of anemia in adolescent girls is carried out with food innovations that are high in iron. This study aims were to determine the acceptability and content of Fe in beetroot and moringa "BILOR" pancakes as a snack to prevent anemia in adolescent girls. This type of research uses experimental research with a complete random design. There are three formulations with the addition of wheat flour:beet flour:moringa leaves flour, PB1 (85:0:0), PB2 (50:20:15), PB3 (50:25:10). A total of 2,700 grams of samples for 30 panelists were organoleptically tested using a hedonic scale and analyzed with the Kruskal Wallis test and the Mann Whitney test. Based on the results of the acceptability test on the PB1 control formulation was preferred by the panelists, while the PB3 treatment formulation with an iron content of 6.88mg was considered the best and qualified as a snack. It is hoped that the formulation of the "BILOR" pancake can be improved and developed again for better results.

INTRODUCTION

Anemia is a condition in which the body's red blood cells are unable to circulate oxygen throughout the body effectively[1]. Based on data from the Ministry of Health of the Republic of Indonesia (2023), a person is categorized as anemic if the level of Hemoglobin (Hb) is below the norm, which is <12g/dL[2]. This condition is generally caused by iron deficiency, characterized by symptoms such as weakness, fatigue, lethargy, inattention, and sluggishness. Anemia is still a problem that adolescents often face[3]. This problem occurs in various countries, not only in developing countries but also in developed countries[4]. Iron Deficiency Anemia is the most common health problem in adolescent girls. Rapid growth that occurs during adolescence or adolescence growth spurt requires a large intake of nutrients, one of which is iron[5]. During this period, adolescents are at high risk of developing anemia. This is due to the increasing need for the body for nutritional intake including iron, during the growth period iron is needed to support growth and development optimally[6].

In various developed and developing countries, the nutritional problem that is often encountered is anemia. According to the World Health Organization (2024), as many as 30% of women aged 15-49 years are affected by anemia[7]. Based on data from the Indonesian Helath Survey (2023), the prevalence of anemia in the 15-24 years old group reached 15.5%[8]. Meanwhile, data obtained from the East Java Provincial Health Office in 2020 revealed that 42% of adolescent girls in

the region were affected by anemia[9]. A study conducted by Sholikhah, et al (2021) reported that the prevalence among students in the city of Surabaya aged 19-21 years was 26.1% with an average Hemoglobin (Hb) level of 10.85 g/dl[10]. Based on observations made by the author on female students of the Department of Nutrition of Poltekkes Kemenkes Surabaya, as many as 6 out of 10 female students experienced anemia as seen from the condition of the palperal conjunctiva, abnormal or pale. Lack of oxygen in the body can affect the color of the palperal conjunctiva to become pale, which can indicate anemia[11]. Adolescent girls who are affected by anemia will have an impact on their health, such as difficulty concentrating, decreased productivity, and an increased risk of Low Birth Weight (LBW), babies born not by the estimated date of Birth (EDD), and death during childbirth[2].

An effort to prevent anemia in adolescent girls is to take Blood Supplement Tablets[12]. However, many teenagers are reluctant to consume it. Based on data Riskesdas (2018) the main reason adolescents do not take blood supplement tablets is because they feel they do not need them and the taste and smell are not preferred[13]. Therefore, other alternatives are needed to meet iron needs by consuming foods high in iron such as moringa leaves and beets[6]. Based on the problems and advantages of each of these ingredients, the author is interested in modifying a product in the form of snacks, namely pancakes mixed with beet flour and moringa leaves. The purpose of this study was to determine the acceptability and content of Fe in beetroot and moringa leaves *"BILOR"* pancakes as a snack to prevent anemia in adolescent girls.

MATERIALS AND METHODS

Research Design

The type of research uses experimental, which is carried out through two types of tests, namely subjective tests to test hedonic (color, aroma, texture, taste) and subjective tests to see iron (Fe) levels using the Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) method in pancake products *"BILOR"* with the addition of beet flour and moringa leaves flour. Meanwhile, the research design used a Complete Random Design with 1 control and 2 treatments.

Product Formulation

The amount of adding the proportion of beet flour and moringa leaves flour is different in each formulation, namely PB1 (85g wheat flour: 0g beet flour: 0g moringa leaves flour), PB2 (50g wheat flour: 20g beet flour: 15g moringa leaves flour), PB3 (50g wheat flour: 25g beet flour: 10g moringa leaves flour).

Statistical Analysis

The three formulations will be tested for preference the organoleptic test results will be analyzed using the Kruskal-Wallis method to see the differences between the three formulations in the *"BILOR"* pancake product. Meanwhile, the Mann-Whitney Test was used to compare the difference in acceptability in two formulations between the control formulation and the treatment formulation based

on the acceptability test. The repetition of formulation uses Federer's formula to determine the number of experiments in experimental research. Based on this formula, the number of repetitions of each treatment is 3 repetitions with the aim of minimizing errors that may occur during product manufacturing.

Time And Place

This research has obtained permission from the Poltekkes Kemenkes Surabaya, which was carried out in September 2024 - May 2025. The manufacture and testing of the acceptability of beetroot and moringa leaves *"BILOR"* pancakes was carried out at the Department of Nutrition of the Politeknik Kementerian Kesehatan Surabaya, Jalan Pucang Jajar Selatan No. 24B and Testing of Iron Content (Fe) at the Laboratory of PT. Saraswati Indo Genentech, AMG Tower, 19th-20th Floor, Jalan Dukuh Menanggal No 1 Surabaya.

Acceptability Test

The method used in data collection in this study is the experimental method of adding beetroot flour and moringa leaves flour to pancakes using the Hedonic Scale Test. The test involves liking or disliking the color, aroma, texture, and taste of the pancakes. The assessment criteria for this test are (1) very dislike, (2) dislike, (3) quite like, (4) like, (5) very like. The number of panelists used was 30 people with the category of panelists being somewhat trained. Each panelist was given a sample of 30 grams for each formulation. The number of samples of *"BILOR"* pancakes of beets and moringa needed for the receptivity test was 2,700 grams.

Iron Content Test

To test the iron (Fe) content in "BILOR" pancakes using the Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES) tool. the iron level test sample needed for two repetitions is 200 grams with details of the control formulation of 200 grams and the best formulation of the organoleptic test results of 200 grams. So, the total sample of *"BILOR"* pancakes needed for iron level testing is 400 grams. The number of samples needed for both types of tests is 3,100 grams.

RESULTS

The result of the study, the characteristic respondent, the characteristics of the pancake "BILOR" formulation, the average acceptability test of the pancake "BILOR" formulation, the result of the Kruskal-Wallis pancake "BILOR" test, the result of the Mann-Whitney pancake "BILOR" test, and the result of the pancake "BILOR" iron content.

Table 1. Age Characteristics of Teenage Girl Panelists

Age	Frequency	Percentage
19 Years	7	23.3
20 Years	20	66.7
21 Years	3	10
TOTAL	**30**	**100**

Source: Primary Data, 2025

A total of 30 moderately trained panelists in adolescent girls can be seen that most panelists are 20 years old with a total of 20 people (66.7%). Panelists aged 19 years were 7 people (23.3%) while panelists aged 21 years were 3 people (10%).

Table 2: Characteristics of Beetroot and Moringa Leaves *"BILOR"* Pancake

Indicator	Formulation		
	PB1	PB2	PB3
Color	Brownish yellow	Brownish red	Brownish red
Texture	Soft and tender	Soft and slightly dense	Soft and denser
Aroma	Strong vanilla aroma	Characteristic aroma of beetroot and moringa	Characteristic aroma of beetroot and moringa leaves
Taste	Slightly less sweet	Sweet and more bitter taste	Sweet and slightly bitter

Source: Primary Data, 2025

The difference in the characteristics of the "BILOR" pancake formulation (beetroot and moringa leaves) is that the control formulation with code PB1 produces a brownish-yellow color with a soft and tender texture, a strong vanilla aroma, and a slightly less sweet taste. The PB 2 treatment formulation yields a reddish-brown color, a soft and slightly dense texture, a distinctive aroma reminiscent of beetroot and moringa leaves, and a sweet yet slightly bitter taste. The PB 3 treatment formulation yields a reddish-brown color, a soft and denser texture, a distinctive aroma reminiscent of beetroot and moringa leaves, and a sweet yet slightly bitter taste.

Table 3. Average Acceptability Test Results of *"BILOR"* Beetroot and Moringa Leaves Pancakes

Parameters	Formulas Pancake *"BILOR"*		
Color	**PB1**	**PB2**	**PB3**
Color	4,3	3,3	3,5
Texture	3,9	3,6	3,4
Aroma	4,2	3,2	3,3
Taste	3,7	2,6	3,1
Average	4	3,2	3,3

Source: Primary Data, 2025

Notes : (1) very dislike, (2) dislike, (3) quite like, (4) like, (5) very like.

Based on table 3 above, the results of the *"BILOR" pancake* acceptance test were obtained with an organoleptic test assessment using a hedonic scale, so that the results of general panelist preferences based on indicators of color, texture, aroma, and taste can be known. The *"BILOR" pancake* formulation that has the highest or most favorable score is the PB1 code control formulation with an average result of 4 included in the like category. While the second most preferred formulation by panelists, namely the PB3 code formulation, obtained an average result of 3.3 including in the category quite like.

Table 4. Kruskal-Wallis Test Results

No.	Indicator	Kruskal Wallis Test Values
1.	Color	0,000
2.	Texture	0,171
3.	Aroma	0,000
4.	Taste	0,001

Source: Primary Data, 2025

Based on table 4 above, the *Kruskal Wallis* test results show that the color, aroma, and taste indicators get a *p-value* <0.05 which indicates that the hypothesis is accepted and there are differences in color, aroma, and taste. As for the texture indicator, the p-value> 0.05 indicates that the hypothesis is rejected and there is no difference in texture in the *"BILOR" pancake* formulation.

Table 5. Mann Whitney Test Results

No.	Indicator	Mann Whitney Test Value		
		PB1 : PB2	**PB2 : PB3**	**PB1: PB3**
1.	Color	0,000	0,285	0,000
2.	Aroma	0,000	0,769	0,000
3.	Taste	0,000	0,134	0,030

Source: Primary Data, 2025

Based on table 5, the results of the mann whitney test on *"BILOR"* beetroot and moringa leaves pancakes show that the color, aroma, and taste indicators in the PB1: PB2 and PB1: PB3 formulations have a p-value <0.05, which means that the hypothesis can be accepted and there is a significant difference between these formulations. Meanwhile, in the formulation PB2:PB3 all indicators show a p-value>0.05, which means that the hypothesis is rejected and there is no significant difference in color, aroma, or taste indicators.

Table 6. Analysis of Iron Content of *"BILOR"* Beetroot and Moringa Leaves Pancakes

Formula	Weight (gram)		Iron Content	
	Mg/100gr	**1 serving**	**Mg/100gr**	**1 serving**
PB1	100 grams	30 grams	2,25	0,67
PB2	100 grams	30 grams	6,88	2,06

Source: Primary Data, 2025

Based on Table 6 above, the analysis of iron content of *"BILOR" pancakes* obtained the highest result of 6.88 mg/100g in the formulation with the code PB 3 between wheat flour: beetroot flour: moringa leaves flour, namely 50: 25: 10. While the lowest result was 2.25 mg/100g in the formulation with the code PB 1 between wheat flour: beetroot flour: moringa leaves flour which is 85: 0: 0. In 1 serving of 30 grams in PB1 formulation has an iron content of 0.67 mg, while in PB3 as much as 2.06 mg.

DISCUSSION

The problem limitation in this study was determined so that the focus of the discussion remained directed and did not widen to other aspects outside the scope of the study. Therefore, this study only limited itself to testing the acceptability of "BILOR" pancake products formulated with the addition of beetroot flour and moringa leaves. The aspects of acceptability assessed included four organoleptic parameters, namely color, aroma, texture, and taste, which were tested using the hedonic scale method by semi-trained panelists. In addition, this study was also limited to analyzing the iron (Fe) content of each pancake formulation.

Age characteristics of adolescent female panelists need to be done to test acceptability which includes color, aroma, taste, and texture. In addition, the age characteristics of young women panelists are carried out to find out how much the fulfillment of iron needs in *"BILOR" pancakes* as a snack to prevent anemia. Based on Table 2 above, the characteristics of panelists based on age were mostly 20 years old, namely 20 panelists (66.7%), 19 years old as many as 7 panelists (23.3%), and 21 years old as many as 3 panelists (10%).

Acceptability test using the liking test by utilizing the five senses of panelists to provide an assessment of liking for 4 indicators, namely color, texture, aroma, and taste in each formulation. The type of panelists used were moderately trained panelists who came from students majoring in Diploma 3 Nutrition at the Politeknik Kementirian Kesehatan Surabaya, totaling 30 people. The formulations tested were 3, namely the control formulation (PB1) and the treatment formulations (PB2 and PB3). The formulas have different ratios of wheat flour: beetroot flour: moringa flour, for PB1 (85:0:0), PB2 (50:20:15), and PB3 (50:25:10). The results of the level of liking for the three *"BILOR"* pancake formulations of beetroot and moringa leaves were obtained from personal panelist responses.

Color is an important aspect in the assessment of a product because it is the first impression captured by the sense of sight[14] [15]. In general, pancakes have a brownish yellow color that comes from a mixture of wheat flour, milk, margarine, and eggs that are baked. The roasting reaction is called the Maillard reaction, which is a reaction between carbohydrates and amino acids during heating[16]. The addition of red beetroot flour and green moringa leaves flour affects the basic color of pancakes. The addition of the two flours and the effect of baking at high temperatures produce a reddish brown color that tends to be dark[17]. The results of the acceptability test showed that the PB2 formulation with a brownish yellow color received the highest score of 4.3 in the like category, while PB2 and PB3 which were reddish in color received low scores of 3.5 and 3.2 respectively in the quite like category.

This color difference is what causes panelists to prefer brightly colored pancakes, which are found in the control formulation code PB1 with a brownish-yellow color. This color gives the impression of optimal maturity and is more attractive to panelists. On the other hand, pancakes made with beetroot flour and moringa leaves have a reddish-brown color, which tends to be too dark for panelists liking. This finding is in line with experiments conducted by Destiana et al. (2024), which state that the

dark color of pancake products is due to the reddish color of beet flour itself; the more beet flour is added, the darker the color, which can reduce the visual appeal of panelists[17].

Texture is one of the important aspects in organoleptic assessment because it relates to the tenderness and crispness of a food product[18]. This assessment controls the sense of touch through the process of touching, biting, and sifting[19]. In *"BILOR"* pancakes, the results of the palatability test showed that the texture was still acceptable to the panelists. Formulation PB1 obtained the highest score of 3.9 with a soft and tender texture, PB2 was worth 3.6 with a soft but slightly dense texture and PB3 was worth 3.4 with an overtime texture but denser.

This difference is due to the addition of beetroot flour and moringa flour in PB2 and PB3 which function as a source of iron and have a high crude fiber content and do not contain gluten[20]. So that the dough becomes denser and less fluffy[17]. Whereas in PB1 only using wheat flour has a lighter texture due to the gluten content in wheat flour and the use of meringue techniques that help produce an elastic and perfectly fluffy dough structure[17].

Aroma has an important role in organoleptic assessment because it can give the first impression of a food product. A fragrant aroma not only attracts interest but also arouses the panelists' appetite to taste the product[21]. Therefore, the sense of smell is one of the sensory aspects that is influential in forming initial perceptions of taste. The results of the PB1 acceptability test obtained the highest score of 4.2, including in the category of liking with a neutral aroma and dominated by vanilla aroma, while PB2 and PB3 were worth 3.2 and 3.3 respectively, including in the category of moderately liking with a distinctive aroma of beetroot like soil and moringa flour with a languorous aroma. So that if the two flours are made into one, the aroma will be more dominant beetroot flour and moringa leaves flour and panelists are still not familiar with the aroma of the two flours.

Taste is one of the most important indicators to assess the acceptability of a food product[22]. The senses used, namely the sense of taste on the tongue, are able to taste various types of sweet, salty, sour, and bitter flavors[23]. These four components can determine whether panelists accept or reject a food product. The results of the acceptability test showed that the PB1 formulation had the highest value of 3.7 and was followed by PB3 with a value of 3.1, both of which were included in the moderately liked category. Meanwhile, the PB2 formulation received the lowest score of 2.9 and fell into the dislike category. Panelists considered that the taste in PB1 formulation was still less sweet due to the low sugar composition. In PB2, the taste is less preferred due to the dominance of moringa flour which causes a more bitter taste while in PB3 it is more preferred because of the slightly low composition of moringa flour and more composition of beetroot flour which makes the bitter taste less. This is in line with the results in table 2, the more moringa leaves flour is added, the more bitter the taste[24].

It can be seen in Table 6 where the higher iron content is found in PB3 formula with the formulation of wheat flour: beetroot flour: moringa leaves flour (50:25:10), which is the average iron content of 6.88 mg/100gr. While PB1 (control) formulation with the formulation of wheat flour: beetroot flour: moringa leaves flour (85:0:0) is the average iron content of 2.25 mg/100gr. This happens because there is the addition of beetroot flour and moringa leaves flour which are rich in iron [25 26].

In one recipe of *"BILOR" pancakes* in the control formulation with the code PB1 weighing 330 grams produces 11 *pancakes* with a weight per serving of 30 grams, so that in 1 serving of *"BILOR" pancakes* has an iron content of 0.67 mg. Meanwhile, the PB3 formulation with a weight of 330 grams produces 11 *pancakes* with a weight per serving of 30 grams, so that in 1 serving of *"BILOR" pancakes* has an iron content of 2.06 mg.

According to the Regulation of the Minister of Health of the Republic of Indonesia Number 28 of 2019 concerning Nutritional Adequacy Rates recommended for adolescents aged 19-21 years requires iron of 18 mg/day[27]. If the snack is given 2x a day with a portion of 10% of the daily requirement, the iron requirement in the snack is 1.8 mg/day. In order for adolescent girls to avoid anaemia, they can consume 1 serving of *"BILOR" pancakes* a day with an iron value of 2.06 mg.

Estimated cost in 1 recipe of *"BILOR" pancakes*: with the weight of one recipe 330 grams so that it can produce 11 servings of *pancakes* with a weight per serving of 30 grams. The total cost of making *"BILOR" pancake* snacks in one recipe is Rp. 37,600, while the total price in 1 serving of *"BILOR" pancakes* is Rp. 3,424.

The bias in this study lies in the formulation proportion and baking process of "BILOR" pancakes using a combination of beetroot and moringa leaves, both of which have strong and distinctive flavour and aroma characteristics. Variations in the proportions of beetroot flour and moringa leaves can affect the intensity of the bitter taste, languid aroma, and final color of the product, which indirectly affects the panelists perception of taste, aroma, and appearance. In addition, the baking process, which involves a certain temperature and time, can cause different Maillard reactions in each formulation, resulting in non-uniform taste and color between samples. These factors have the potential to cause bias in organoleptic assessment as differences in product finish may be more attributable to processing techniques and ingredient composition rather than pure panelist preference for flavour.

CONCLUSION

This study shows that "BILOR" pancakes made from beetroot and moringa leaves have the potential to be a snack that prevents anemia in adolescent girls. Formulation PB3 is the most preferred treatment formulation by the panelists based on color, aroma, and taste aspects, and has the highest iron content of 6.88 mg/100g. Consuming one serving (30g) of PB3 pancakes can contribute

approximately 2.06 mg of iron, thereby contributing to meeting the daily iron requirements of adolescent girls.

Modifications to the recipe are needed by adjusting the proportions of beetroot flour and moringa leaves, and adding additional ingredients such as cocoa powder, cinnamon, butter, and natural sweeteners to improve panelists acceptance of the color, aroma, and taste of the “BILOR” pancake.

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