



# Acceptance of Sponge Cakes Substituting Green Spinach Flour (*Amaranthus Viridis*) with Different Concentrations

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**Abstract.** Incorporation of spinach flour into the production process of sponge cakes exerts discernible effects on the resultant sponge cake products. This phenomenon stems from alterations in the fundamental physical attributes of sponge cakes, notably manifested through modifications in color, taste, texture, and aroma. The present study, conducted in July 2023, adopts a pre-experimental design and encompasses four distinct treatment groups denoted as P0, P1, P2, and P3. Each treatment group involves the substitution of wheat flour with spinach flour during sponge cake preparation, followed by organoleptic evaluations conducted by a panel of 25 assessors. The study is conducted within the Food Science Laboratory of the Nutrition Department at Kendari Health Polytechnic. Analysis of the organoleptic assessments reveals that treatment one (P1) garners the highest degree of acceptability across all evaluated attributes, including color (76.8%), aroma (65%), taste (81.6%), and texture (76%). Notably, the composite preference of the panelists favors product P1, formulated with a ratio of 180 grams of wheat flour to 20 grams of spinach flour, over alternative formulations represented by products P2 and P3. In light of these findings, future researchers are encouraged to explore the integration of spinach flour into muffin formulations, with an emphasis on investigating its potential impacts on nutritional profiles.

**Keywords:** Receptivity, Sponge cake, and amaranth flour

## 1. Introduction

Bolu is a bakery product made from wheat flour, sugar, fat and eggs. Bolu can be prepared in several ways, such as steaming or baking in the oven. The level of sponge expansion is the ability of the sponge to increase in size after the steaming or oven process. The development of sponge cake also depends on beating the eggs, besides that the gluten contained in wheat flour proteins indirectly affects the level of development. Bolu or sponge cake is a cake made from flour, sugar and eggs. Sponge cakes and cakes are generally prepared by baking in the oven, although there are also sponge cakes that are steamed [1] [2].

Spinach leaf flour is flour made from spinach leaves which is produced through a series of processes starting from washing, then taking the leaves and drying them in the sun until the vegetable's moisture content is in the range of 3-10%. After the drying process, the spinach leaves are crushed and sifted, spinach flour will be

obtained which can be used as an addition to other food ingredients so that it will increase its nutritional value [3]. Incorporating spinach flour into the production of sponge cakes will alter the outcomes of the final product. This is due to the resultant modifications in the overall physical characteristics of sponge cakes, including variations in color, flavor, texture, and fragrance, which stem from the inclusion of this particular vegetable in the flour mixture.

Spinach *Amaranthus* sp is a plant whose leaves are often consumed as a green vegetable. People usually know two types of red spinach, namely wild spinach and cultivated spinach. Wild spinach consists of 2 types, namely ground spinach and spiny spinach. Unlike wild spinach, cultivated spinach is the spinach that we often consume and consists of pulled spinach and sekul spinach [4].

Spinach leaf flour is flour made from spinach leaves which is produced through a series of processes starting from washing, then taking the leaves and drying them in the sun until the vegetable's moisture content is in the range of 3-10%. After the drying process, the spinach leaves are crushed and sifted, spinach flour will be obtained which can be used as an addition to other food ingredients so that it will increase its nutritional value [3].

Cake or bolu is a cake made from flour (generally wheat flour), sugar and eggs. Cakes are generally prepared by baking in the oven, baking with a special baking tool, and some are also steamed. Cake is a very popular food nowadays. The sweet taste and various shapes make cakes popular with the public [5], [6]. Cake can be served as a dessert and can also be served as a complement to a tea party. Cake is a product that tastes sweet, rich in fat and sugar obtained from baking. Cake dough contains flour, sugar, salt, eggs, milk, water, aroma and fat. In making cakes, a lot of fat and sugar are used to form the structure of the cake, for this reason, when making the dough, a soft and light dough must be obtained [7]. To make a cake requires precision. This is related to accuracy in weighing ingredients and dough mixing techniques [8].

## **2. Research Method**

The research conducted utilized a pre-experimental approach, employing a basic experimental design in which two randomly selected groups were included. Two groups are included in this study: the control group and the experimental group. The group that receives therapy is referred to as the experimental group. The group that received no treatment was referred to as the control group. The goal of this study is to replace spinach flour with sponge cake. The participants in this research were all students enrolled in the Department of Nutrition at the Kendari Ministry of Health Polytechnic. Students from the nutrition department of the Kendari Ministry of Health Polytechnic, representing levels 1, 2, and 3, served as the study's samples. The percentage of sponge cake objects with spinach flour substituted is using a percentage of 10%, 20%, 30%. The sampling technique in this research will be carried out randomly (random sampling) by giving several different codes to each sponge cake object with the substitution of spinach flour which is closed and only known to the researcher [9].

## **3. Results and Discussion**

**Table 1.** Sample Acceptability Based on

Category	Nuggets							
	123		231		312		321	
	(n)	%	(n)	%	(n)	%	(n)	%
Very interesting	18	72	6	24	4	16	2	8
Interesting	5	20	12	48	8	32	11	44
Neutral	2	8	4	16	5	20	2	8
Not attractive	0	0	3	12	7	28	9	36
very uninteresting	0	0	0	0	1	4	1	4
<b>Amount</b>	25	100	25	100	25	100	25	100

Table 1 shows the largest percentage of panelist acceptance in the very attractive category for the color attribute, namely sample code 123 (72%). Furthermore, the sample code is 231 (24%), the sample code is 312 (16%) and the sample code is 321 (8%). In the interesting category, the percentage of panelist acceptance was sample code 231 (48%) and sample code 321 (44%), then sample code 312 (32%) and sample code 123 (20%). If the very very interesting category and the interesting category are combined, the percentage of panelist acceptance respectively is 123 sample codes (92%), 231 sample codes (72%), 321 sample codes (52%) and 312 sample codes (48%).

**Table 2.** Sample Acceptability Based on Aroma Attributes

Category	Nuggets							
	123		231		312		321	
	(n)	%	(n)	%	(n)	%	(n)	%
Very fragrant	15	60	3	12	4	16	3	12
Fragrant	9	36	10	40	3	12	5	20
Neutral	1	4	6	24	7	28	4	16
Not fragrant	0	0	6	24	9	36	9	36
Not very fragrant	0	0	0	0	2	8	4	16
<b>Amount</b>	25	100	25	100	25	100	25	100

Table 2 shows the largest percentage of panelist acceptance in the very fragrant category for the aroma attribute, namely sample code 123 (60%). Furthermore, the sample code is 312 (16%). Furthermore, the sample code is 231 (12%) and the sample code is 321 (12%). In the fragrant category, the percentage of panelist acceptance was sample code 231 (40%) and sample code 123 (36%). Furthermore, the sample code is 321 (20%) and the sample code is 312 (12%). If the very fragrant category and the fragrant category are combined, the percentage of panelist acceptance is 123 sample codes (96%), 231 sample codes (52%), 321 sample codes (32%) and 312 sample codes (28%).

**Table 3.** Sample Acceptability Based on Taste Attributes

Category	Nuggets							
	123		231		312		321	
	(n)	%	(n)	%	(n)	%	(n)	%
Very delicious	16	64	9	36	2	8	2	8
Nice	7	28	11	44	6	24	7	28
Neutral	2	8	3	12	9	36	4	16
Not good	0	0	2	8	6	24	8	32
Very unpleasant	0	0	0	0	2	8	4	16
<b>Amount</b>	25	100	25	100	25	100	25	100

Table 3 shows the largest percentage of panelist acceptance in the very good category for the taste attribute, namely sample code 123 (64%). Furthermore, the sample code is 231 (36%). Furthermore, the sample code is 312 (8%) and the sample code is 321 (8%). In the delicious category, the percentage of panelists' acceptance was sample code 231 (44%). Furthermore, the sample code is 123 (28%), the sample code is 321 (28%) and the sample code is 312 (24%). If the very, very tasty and delicious categories are combined, the percentage of panelist acceptance is 123 sample codes (92%), 231 sample codes (80%), 321 sample codes (36%) and 312 sample codes (32%).

**Table 4.** Sample Acceptability Based on Texture Attributes

Category	Nuggets							
	123		231		312		321	
	(n)	%	(n)	%	(n)	%	(n)	%
Very soft	17	68	5	20	1	4	3	12
Gentle	4	16	14	56	6	24	11	44
Neutral	3	12	2	8	12	48	6	24
Not soft	1	4	4	16	5	20	5	20
not verysoft	0	0	0	0	1	4	0	0
<b>Amount</b>	25	100	25	100	25	100	25	100

Table 4 shows the largest percentage of panelist acceptance in the very soft category for the texture attribute, namely sample code 123 (68%). Furthermore, the sample code is 231 (20%) and the sample code is 321 (12%). Furthermore, the sample code is 312 (4%). In the soft category, the percentage of panelist acceptance was sample code 231 (56%) and sample code 321 (44%). Furthermore, the sample code is 312 (24%) and the sample code is 123 (16%). If the very, very soft and soft categories are combined, the percentage of panelist acceptance is 123 sample codes (84%), 231 sample codes (76%), 321 sample codes (56%) and 312 sample codes (28%).

**Table 5.** Level of Acceptability of Sponge Cake Products

Category	Muffin			
	123	231	312	321
Appearance	4.64	3.84	3.28	3.08
Aroma	4.36	3.25	2.8	2.72
Flavor	4.52	4.08	3	2.92
Texture	4.44	3.8	3	3.36
Total	17.96	14.97	12.08	12.08
Average	4.49	3.74	3.02	3.02

Table 5 shows that based on the average score, a combination of all appearance, aroma, taste and texture attributes, it can be seen that the biggest score is for sponge cake with sample code 123 (with a ratio of 100% wheat flour: 0% spinach flour) with a total of average score 4.49. Because the sponge cake with sample code 123 does not contain the addition of spinach flour, the sponge cake with sample code 231 (with a ratio of 80% wheat flour: 10% spinach flour) has an average score of 3.74, which means that product 231 is the most preferred. by panelists, then products 312 (3.02) and 321 (3.02).

The acceptability of sponge cake from the color aspect shows that on average the panelists liked 2 types of product treatment. Based on the results of research on the color attribute, panelists' acceptance of the Very Like and Like categories was P0 (92.8%) and P1 (76.8%). Of the four treatments, panelists preferred P0 because there was a combination of wheat flour, eggs and spinach flour so that during the baking process the resulting color was more attractive with a combination of bright brownish green [10].

The results of research on aroma characteristics showed that the largest percentage of panelist acceptance in the Very Like and Like categories was at P0 (87.2%). P0 was preferred by panelists because it is a combination of wheat flour, granulated sugar and eggs which gives the sponge cake a distinctive aroma. P1, P2 and P3 have acceptability in the neutral category, this is because the aroma of spinach flour is like the aroma of burnt dry leaves, this happens because the method of making spinach flour uses the roasting method in the oven [11].

Based on the results of research on panelist acceptance of flavors in the Very Like and Like categories combined, the largest percentage of panelist acceptance was P0 (94%) and P1 (81.6%). P0 was preferred by panelists because it contained the main ingredients, namely 180 grams of wheat flour and 20 grams of spinach flour. P2 and P3 have the addition of spinach in larger quantities so that the distinctive taste of spinach flour prepared using the roasting method is very large so it is less attractive to panelists.

The results of research on the texture characteristics of the largest percentage of acceptance by panelists in the Very Like and Like categories combined mean that the percentage of panelist acceptance is P0 (88.8%) and P1 (76%). P1 is preferred by researchers because it uses less spinach flour than treatments P2 and P3, so that spinach flour processed using the oven roasting method can be adjusted to wheat

flour, so that the texture in treatment P1 has the right softness [4].

Based on this research, it shows that the average score, based on the attributes of appearance, aroma, taste and texture, can be seen that the largest score is found in the P0 sponge cake (with a ratio of 200 grams of wheat flour and 0 grams of spinach flour) with the average number score 89.8, because the P0 sponge cake is the control treatment in this study, the P1 sponge cake (with a ratio of 180 gr wheat flour and 20 gr spinach flour) has the largest score with an average score of 74.9%, which means the P1 product most liked by panelists, then P2(60.4%), and P3 (60.4%).

#### 4. Conclusion

Based on the color attribute, it appears that the panelists preferred the sample of product P1 from the spinach sponge cake. Based on the aroma attribute, it appears that the panelists preferred the sample of product P1 from the spinach sponge cake. Based on the taste attributes, it appears that the panelists preferred the sample of product P1 from the spinach sponge cake. Based on the texture attribute, it appears that the panelists preferred the sample of product P1 from the spinach sponge cake. Based on the combination of all attributes, panelists preferred the sample to product P1 with an average value of 3.74.

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