

Carcake as a healthy and nutritious dessert

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Abstract

Vitamin A deficiency (VAD) is among the nutritional issues in Indonesia. Addressing the issue of vitamin A deficiency and food diversification are performed by making a product that uses available and cheap raw materials containing provitamin A such as the carrots. Carrots have various nutrients and chemical compounds such as antioxidants and carotenoids. This study aimed to determine the consumer acceptance of the carcake (carrot cake) with carrot flour as a substitute ingredient. This descriptive-analytical research relied on a valid experimental method using an analytic observational approach with a completely randomized design. The carcake is a modified cake using carrot flour substitution with different concentrations (100%, 80%, 70%, 60% and 50%). Friedman test was used to determine the most favorite formula. Based on hedonic testing, the values obtained for color, taste, aroma, and texture aspects were 36.76%, 38.86%, 39.39% and 36.42%, respectively, for each formula with carrot flour addition concentrations of 100%, 70%, and 60%. The selected formula of the carcake was 150 g of carrot flour in term of taste, aroma, color and texture. Substitution of carrot flour in carcake is acceptable as alternative to improve vitamin A intake.

1. Introduction

Vitamin A deficiency (VAD) is among the nutritional issues in Indonesia. Respiratory tract infections, diarrhea, and growth delay are diseases at risk for children with vitamin A deficiency. A severe vitamin A deficiency can lead to vision impairment, such as xerophthalmia and blindness (Pratiwi, 2013). The result of the Basic Health Research (Riset Kesehatan Dasar) in 2013 recorded that the prevalence of blindness and severe low vision was 0.9% on a national scale. However, Gorontalo Province reached a higher percentage of 1.1% (Badan Penelitian dan Pengembangan Kesehatan, 2013).

Vitamin A deficiency results from an inadequate dietary intake of vitamin A. Vitamin A with high biological value is mostly obtained from animal-source foods. Meanwhile, provitamin A is found in plant-source foods. Nevertheless, foods high in vitamin A are still difficult to access for underprivileged people due to their unaffordable price (Nadimin, 2011). For such a reason, alternatives are essential to develop and modify food products that are rich in vitamin A and provitamin A at relatively low prices.

The development and modification serve as one of the food diversification efforts. Foods made from only one ingredient cannot fulfill all the nutrients needed by the body. No food ingredient has complete nutritional content. Food diversification is among the strategies to fulfill all nutrients our bodies need. Food diversification can be carried out by looking for new or existing food ingredients, which are then developed into various food products. Thus, it is able to improve the nutritional quality of the foods (Badan Ketahanan Pangan, 2014).

The nutritional content and chemical compounds in carrots are diverse, such as antioxidants and carotenoids. Additionally, the nutrients and chemical compounds in carrots can function in immune response, help lower cholesterol levels, prevent the risk of cancer, support eye health, and prevent constipation (Rochimiwati *et al.*, 2011).

Carrots are root vegetables, typically reddish yellow or yellowish orange in color, tasty, crunchy and slightly sweet. They store their food reserves in the roots. According to Cahyono (2002), carrots are annual root vegetables (produced once and then die), a shrub in form that grows upright with a height of between 30-100 cm or more, depending on the variety.

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Carrots can be processed into flour, which can be used as an ingredient in cake making to address vitamin A deficiency. Carrot flour contains 5.6% moisture content, 17.63% carbohydrates, 7.89% protein, 1.13% fat, 2.56% ash and 7.79% fiber content (Sakti, 2018).

Cakes, as a popular food of all ages, are food products that can utilize carrots. Its sweet taste and beautiful shape make cakes a trend in the community. Cakes are made from wheat flour. However, the ingredients of making cakes are lately varied, or simply put, they do not only use wheat flour. Carrots can be made into flour, a cake ingredient to overcome the lack of vitamin A intake.

Several cases of visual impairment caused by a lack of vitamin A intake require alternative treatment in terms of food diversification. Utilizing carrot flour as a substitute ingredient in cake making is among the food diversification efforts. Carrots are a source of vitamin A, but they have an unpleasant aroma, especially if one eats them raw. Therefore, it is expected that processing carrots into flour for making cakes can resolve such a problem. The result will increase vitamin A intake and prevent vision impairment due to insufficient vitamin A intake.

This study aimed to determine consumer acceptance of the carcake (carrot cake) with carrot flour as a substitute ingredient.

2. Materials and methods

2.1 Research design

This research is a testing for preference levels using non-parametric Friedman test. The research conducted at the Culinary Laboratory of Bina Mandiri Health Sciences College from November to December 2020.

2.2 Research variables

This study uses two variables, namely the independent variable which is carcake with carrot flour substitution of 100%, 80%, 70%, 60% and 50%. Meanwhile, the dependent variable in this study is acceptability, including taste, aroma, texture and color.

The following treatments were performed:

F1 = formula of carcake without wheat flour and 100% carrot flour (250 g)

F2 = formula of carcake with 80% carrot flour (200 g)

F3 = formula of carcake with 70% carrot flour (175 g)

F4 = formula of carcake with 60% carrot flour (150 g)

As total of 176 untrained panelists did the organoleptic test with the following criteria such as do

not have allergies to the ingredients used in the making of carcake; have a good sense of taste (not currently experiencing a cold); are willing to participate as panelists without any coercion.

2.3 Tool preparation

This study used some tools: a digital scale, measuring spoon, strainer, stainless bowl, balloon whisk, cake pan, spatula, and small plate.

2.4 Ingredient preparation

Ingredients used in this research are presented in Table 1 and Figure 1.

Table 1. Carcake ingredients and compositions

Ingredients	Compositions			
	F1	F2	F3	F4
Wheat flour (g)	0	50	75	100
Egg yolk (item)	8	8	8	8
Sugar (g)	265	265	265	265
Vegetable oil (g)	125	125	125	125
Sweetened condensed milk (g)	63	63	63	63
Fresh milk (g)	195	195	195	195
Vanilla essence (g)	5	5	5	5
Baking powder (teaspoon)	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
Powdered whole milk (g)	15	15	15	15
Egg white (g)	390	390	390	390
Cream of tartar (teaspoon)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$
Carrot flour (g)	250	200	175	150

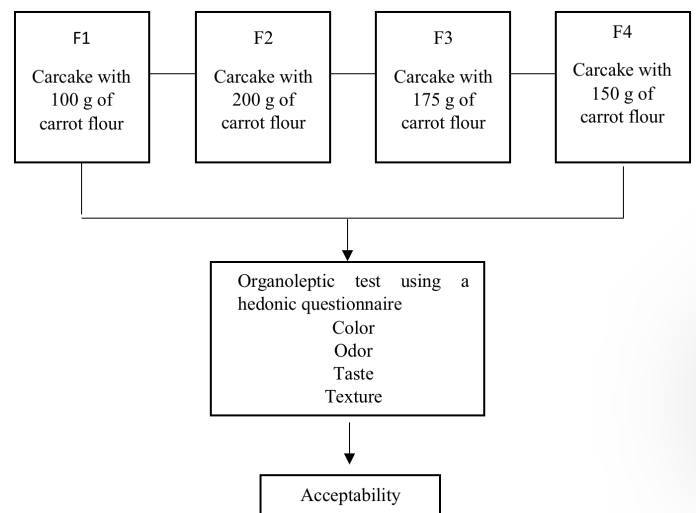


Figure 1. Diagram of research process

2.5 Data collection

The data were collected from an organoleptic test given to the 176 panelists. Samples were presented randomly by assigning a code to each sample without the panelists knowing the true identity. Panelists were asked to respond to the product regarding the rating of color, taste, aroma and texture aspects. The responses were filled in with the questionnaire sheet provided.

The data statistical analysis method employed a

hedonic questionnaire divided into the following categories: very like for scores 52.9 - 70.4, like for scores 35.3 - 52.8, somewhat like for scores 17.7 - 35.2, and dislike for scores less than 17.6.

3. Results and discussion

3.1 Liking level test

The average value of the liking level test using the Hedonic test can be seen in the Table 2. The results of the organoleptic assessment in terms of color, taste, aroma, and crispness were analyzed using the Friedman test. Based on the Friedman test results, the selected formula for taste, aroma, and texture is F4, which is the formula with 150 g of carrot flour substitution. However, in terms of color, the selected formula is F3, which is the formula with the addition of 175 g of carrot flour.

3.1.1 Carcake

Cakes are baked dough made from flour, sugar eggs and fat. Meanwhile, a carrot cake, called carcake in this study, is dough modified with carrot flour. Cakes can be made with additional ingredients, including salt, leavening agents, shortening, milk and aroma enhancers. These ingredients are combined to produce fine crumbs, soft texture, attractive colors and pleasant aroma (Faridah *et al.*, 2008).

Factors affecting the quality of a cake are the ability to form a protein matrix, absorb and bind water, and emulsify and form foam from the ingredients in the formula, which will then cause a gas expansion in the dough during baking (expansion volume) (Subagio *et al.*, 2003).

Carcake was made by adding carrot flour to the cake formula at various concentrations. The basic formula of the Carcake was as follows: 250 g of carrot flour, eight egg yolks, 265 g of sugar, 125 g of vegetable oil, 63 g of sweetened condensed milk, 195 g of fresh milk, 5 g of vanilla essence, 1.25 g of baking powder, 15 g of powdered whole milk, 390 g of egg whites, 1/4 teaspoon of cream of tartar, and carrot flour with 100%, 80%, 70% and 50% from the wheat flour weight.

The carcake was a modified cake using carrot flour substitution with different concentrations (100%, 80%, 70% 60% and 50%). It was to increase the nutritional value, especially vitamin A. Thus, the end product of this research can be used as a variety of snacks with balanced nutrition.

3.1.2 Liking level of carcake

The liking level test was given to the 176 semi-trained panelists of lecturers and students in Universitas

Bina Mandiri Gorontalo. The panelists' liking level towards the carcake product is rated based on the organoleptic properties.

The measured organoleptic properties comprise color, aroma, taste and texture. Substitution of carrot flour in making the carcake influences the acceptability of the cake.

3.1.3 Color

The panelists' liking level of the carcake color ranges from like slightly to like. The selected formula of the Carcake is 150 g of carrot flour. The higher the carrot flour substitution concentration, the reddish the color. This reddish color is not preferred by the panelists, so that it lowers the rating.

The reddish reaction results from a chemical process of reducing sugar derived from wheat flour and carrot flour, which react with the primary amine of egg white protein. It is better known as the Maillard reaction (Winarno, 2002).

3.1.4 Taste

Following the hedonic test, the panelists' liking level of the carcake taste generates the highest value in treatment F4 (formula of 150 g of carrot flour). The lowest value is in treatment F2 (formula of 200 g of carrot flour). It is assumed that the panelists dislike the taste due to the increasingly felt distinctive taste of carrots when more carrot flour is added.

A decrease in the liking level for the carcake taste with the addition of carrot flour has been proven by studies on the addition of different types of carrot flour in cake making. Those studies have proven that the higher the concentration of carrot flour addition or substitution in cakes, the lower the liking level of the taste (Astarina, 2010; Nurbillah, 2012; Utami, 2015; Arofah, 2017; Sakti, 2018). It is affected by the distinctive taste of carrots which the panelists do not like.

3.1.5 Aroma

Aroma is one of the rating factors of food acceptability. The expected aroma of a food product is the one that can arouse appetite. Basic and additional ingredients used in the manufacturing process contribute to the aroma of food ingredients (Winarno, 2002).

Based on the test of the liking level of the carcake aroma, the selected formula is F4 (a substitute for 150 g of carrot flour). The acceptability of aroma aspect that the panelists dislike the most is F6, the carcake with 250 g of carrot flour. The more substitutes for carrot flour,

Table 2. The average value of the Liking Test (Hedonic)

Treatment	Ingredient and Composition	Parameter																		Description						
		Color						Taste						Odor							Texture					
		SS	S	AS	TS	RT	SS	SS	S	AS	TS	RT	SS	SS	S	AS	TS	RT	SS		S	AS	TS	RT		
F1	TT 250 g TW 0 g	70	56	35	15	36.76%	65	79	15	17	34.72%	49	23	60	44	36.74%	71	65	30	10	34.26%	S				
F2	TT 50 g TW 200 g	40	48	77	11	29.09%	58	24	45	49	35.71%	70	40	13	53	34.26%	64	45	50	17	35.00%	SS				
F3	TT 75 g TW 175 g	56	15	44	61	25.28%	71	65	30	10	38.86%	58	65	48	5	39.38%	58	24	45	49	32.84%	SS				
F4	TT100 g TW 150 g	64	45	50	17	36.42%	80	62	30	4	35.00%	90	33	7	46	32.84%	40	61	44	31	36.42%	SS				
F5	TT 125 g TW 125 g	24	34	63	55	35.80%	64	73	9	30	32.84%	77	31	6	62	36.42%	56	15	44	61	35.80%	S				
F6	TT 0 g TW 250 g	66	48	54	8	34.89%	40	61	44	31	36.42%	67	10	17	82	35.80%	40	48	77	11	34.89%	S				

TT: wheat flour, TW: carrot flour, SS: like very much, S: like, AS: like slightly, TS: dislike, RT: average value.

the lower the liking level for aroma because the distinctive aroma of carrots is strong.

The aroma produced in the carcake is influenced by the concentration of carrot flour substitution. A study by Listiana (2016) argued that carrot flour substitution significantly contributed to a cake aroma. The high concentration of carrot flour substitution resulted in an aroma that the panelists disliked even more (Listiana, 2016).

From the perspective of panelists' disliking level of the carcake aroma, it can be concluded that they are not familiar with the distinctive carrot aroma. It is consistent with a previous study mentioning that panelists are unfamiliar with carrot cake since it is not widely circulated in the community (Fitri and Purwani, 2017).

3.1.6 Texture

The texture referred to in this study is the texture of the Carcake measured by the finger touch, in which the observed factor is whether or not the carcake is hard to break. The result of the organoleptic assessment shows that the highest liking level of the panelists towards the texture is in treatment F4 (formula of 150 g of carrot flour).

The crunchiness level in the F4 formula is due to the composition of the ingredients used. Wheat flour as the basic ingredient can affect the softness of the carcake. This is because the gluten content as a component of wheat protein in wheat flour can affect the texture of the product's elasticity (Arvianto *et al.*, 2016).

In addition to gluten in wheat flour, amylose and starch in carrot flour also play a role in determining the crunchiness level of the carcake. The less the amylose and starch content, the softer the cake will be click or tap here to enter text.. A high content of amylose will make starch hygroscopic, so that the product will tend to be less crunchy (Asyik *et al.*, 2018). Substitution of carrot flour in carcake is acceptable as alternative to improve vitamin A intake.

Conflict of interest

The authors declare no conflict of interest.

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