Sensory evaluation of sorghum cakes: Substituting sorghum flour for rice flour, sticky rice flour and wheat flour

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Abstract. The research objective was the development of the potential of sorghum as an alternative food source to support the Diversification and Food Security Program, by developing various wet cake products, the substitution results of sorghum flour with various other flour, namely: rice flour, sticky rice flour and wheat flour. Specific target: get sorghum-based cakes and various formulations and products that can be accepted by consumers, including quality in terms of physical aspects and organoleptic aspects. The results of these studies are useful for the formulation of the next phase of technical studies, namely obtaining appropriate technology that can be applied to the community. The selected treatment was sorghum "nogosari" cake with S1B1 treatment (combination of sorghum flour 30% and rice flour 70%), sorghum "mendut" cake with S1K1 treatment (combination of sorghum flour 30% and sticky rice flour 70%), while sorghum "bolu" cake with S1T2 treatment (combination of sorghum flour 40% and wheat flour 60%).

1. Introduction

Sorghum (Sorghum Sp) is one of the potential alternative food sources that can be developed to support diversification and food security programs. Sorghum can be used as raw material for semi-finished products which is directed at enriching the potential of sorghum, namely sorghum flour, one form of its use is sorghum cake, which usually uses rice flour, sticky rice flour and wheat flour [1-5].

Sorghum has good nutrition, the nutrient content of sorghum compared to other staple foods such as rice, wheat (wheat), corn and cassava, has sorghum calories of 332cal per 100g, slightly lower than rice (360cal), flour (365cal) and corn (361cal), and the carbohydrate content of sorghum of 73g per 100g is also less than rice (78.9g) and flour (77.3g). But these grains have a high protein content (11g per 100 g) compared to flour (8.9g), rice (6.8g), corn (8.7g) or even cassava (1.2g), he said. Calcium content (28 mg per 100 g), iron (4.4 mg), Phosphorus (287 mg), vitamin B1 (0.38 mg). The protein content of 1 g of sorghum is 1.6 times that of rice. Sorghum also has an iron content of 5.5 times that of rice, 2.05 fold

of phosphorus, 3.1 times as much vitamin B1, 4.7 times fat and 4.6 times as much calcium. Besides sorghum also contains phenol and tannin with high composition [6-10].

One of the cakes made from rice flour is "nagasari" cake, a cake made from sticky rice flour is a "mendut" cake, while a cake made from wheat flour is a "bolu" cake. This research aims to sensory evaluation of sorghum cakes: substituting sorghum flour for rice flour, sticky rice flour and wheat flour.

2. Methodology

This research used sorghum flour of KD4 variety from Lamongan district, rice flour, sticky rice flour and wheat flour. In the first stage, optimization was performed "nagasari" cake substitution of sorghum flour and rice flour by using a one factor randomized block design (RBD), with three replications [11]. The factor was performed by applying combination of sorghum flour and rice flour (SB) are as follows:

S_1B_1 = 30%: 70%; S_2B_2 = 40 %: 60%

The second stage, optimization was performed "mendut" cake substitution of sorghum flour and sticky rice flour by using a one -factor randomized block design (RBD), with three replications. The factor was performed by applying combination of sorghum flour and sticky rice flour (SK) are as follows:

S_1B_1 = 30%: 70%; S_2B_2 = 40 %: 60%

The third stage, optimization was performed "bolu" cake substitution of sorghum flour and wheat flour by using a one -factor randomized block design (RBD), with three replications. The factor was performed by applying combination of sorghum flour and wheat flour (ST) are as follows:

S_1B1 = 30%: 70%; S_2B_2 = 40 %: 60%

The aspects observed included physical and sensory analysis. When analyzing the data, physical analysis with statistical description, and sensory analysis was performed by using Friedman test. Furthermore, selection of alternatives was done to determine the best alternative process. The selection was performed based on the concept of value acquisition of expectation. The mathematical equations for the expected pay-off values are as follows [12]:

$$E_{pj} = \sum_{i=1}^{n} P(x_i) \,.\, f(x_i, d_j) \quad (1)$$

Note:

E_{pj} = The expected pay off value
$P(x_i)$ = Probability of basic state xi
x_i = Different basic state
d_j = Decisions are taken into account
$f(x_i, d_j)$ = Acquisition on the basic state and decision dj

The process of making "nagasari" cake, "mendut" cake, and "bolu" cake, can be seen in Figure 1.

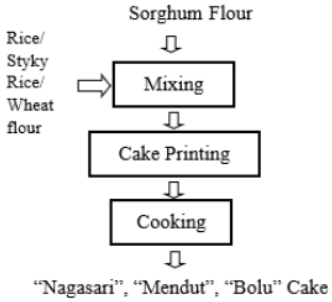

Figure 1. Flowchart sorghum-based process of making "nagasari", "mendut", and "bolu" cake.

Note: In making the "nagasari" cake mixing sorghum flour and rice flour, making the "mendut" cake mixes sorghum flour and sticky rice flour, making "bolu" cake is made mixing sorghum flour and wheat

flour, after that each printing, cooking and then producing to produce "nagasari" cake, "mendut", and "bolu" cake sorghum.

In the last stage, sorghum cake products: "nagasari", "mendut" and "bolu" sorghum were carried out by sensory testing, probability testing, and decision analysis to determine the best treatment combination of each sorghum cake [13-19].

3. Results and discussion

Results of evaluation of sorghum-based wet cake sensory test: "nagasari", "mendut", and "bolu" with scores, percentages, and probabilities (taste, color, taste, and appearance parameters) are presented in Table 1 and alternative selection (expectation value) in Figure 2.

Table 1. Value score, the percentage of each sensory test parameters and test probability sorghum cake.

Sensory test Parameters	The name of the cake / code		
	Nagasari S_1B_1	Mendut S_1K_1	Bolu S_1T_2
Taste	(score 4,6 95%) * 40%	(score 4,7 78%) * 38%	(score 4,8 60%) * 41%
Colour	(score 4,4 73%) * 17%	(score 4,5 65%) * 15%	(score 4,6 83%)* 15%
Flavor	(score 4,35 85%) 28%	(score 4,4 72%) 30%	(score 4,6 70%) * 27%
Appearance	(score 4,6 73%) * 15%	(score 4,5 63%) * 17%	(score 4,7 86%) * 17%

Information: * Significant Friedman Test 5%

Table 1 shows that the highest scores for "nagasari", "mendut", and "bolu" sorghum cake taste, color, flavor, and appearance parameters were obtained from S_1B_1, S_1K_1, and S_1T_2 treatments, this is indicated by the value of the average sensory test score and its percentage value, for the probability test for successive "nagasari" cakes is taste, flavor, color, and appearance, while the "mendut" cake and "bolu" cake are taste, flavor, appearance, and color. The existing alternative process was compared to determine the optimal process. This alternative selection was conducted by calculating the expected value which was obtained from each alternative process [20-27].

Friedman "nagasari" test results showed that taste parameters (Sig 0.022 <0.05), color parameters (Sig 0.038 <0.05), and appearance parameters (0.041 <0.05) were significantly, while flavor parameters (Sig 0.152> 0, 05) not significantly. This means that the sorghum "nagasari" cake for taste, color, and appearance parameters is influenced by a combination of sorghum flour and rice flour.

The Friedman "mendut" cake test results showed that taste parameters (Sig 0,043 <0,05), color parameters (Sig 0,031 <0,05), and appearance parameters (0,021 <0,05) were significantly, while flavor parameters (Sig 0,173> 0,05) not significantly. This means that sorghum "mendut" cake for taste, color, and appearance parameters are influenced by a combination of sorghum flour and sticky rice flour.

Friedman's test of sorghum "bolu" cake showed that taste parameters (Sig 0,037 <0,05), color parameters (Sig 0,038 <0,05), flavor parameters (Sig 0,032 <0,05), and appearance parameters (Sig 0,035<0,05) significantly. This means that sorghum "bolu" cake for taste, color, flavor and appearance parameters is influenced by a combination of sorghum flour and wheat flour [28-33].

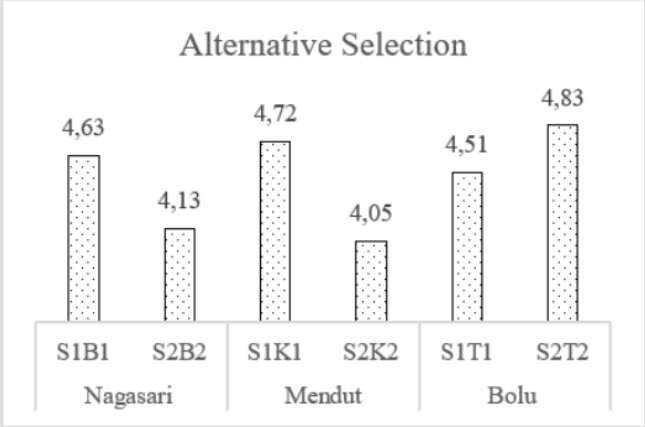

Figure 2. Selection of alternative sorghum cake.

Figure 2 shows that the selection of the best treatment combination of sorghum cake based on the calculation of the expected value of each treatment is sorghum "nogosari" cake with S_1B_1=4,63 (combination of sorghum flour 30% and rice flour 70%), sorghum "mendut" cake with S_1K_1= 4,72 (combination of sorghum flour 30% and sticky rice flour 70%), while sorghum "bolu" cake with S_1T_2= 4,82 (combination of sorghum flour 40% and wheat flour 60%). This means that treatment was based on the best quality if compared to the other treatment [34-37].

4. Conclusion

The Friedman "bolu" cake showed all parameter is significant, and "nagasari" and "mendut" cake test showed taste, color, flavor is significant. Based on the research findings, it can be concluded that: sorghum wet cakes are an alternative product diversification based on sorghum flour. The combination of the best treatment for sorghum "nogosari" cake with S_1B_1 (combination of sorghum flour 30% and rice flour 70%), sorghum "mendut" cake with S_1K_1 (combination of sorghum flour 30% and sticky rice flour 70%), while sorghum "bolu" cake with S_1T_2 (combination of sorghum Sflour 40% and wheat flour 60%).

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