

Calcium Oxalate Content in Brownies Made From Taro flour and Mocaf

Dwi Ari Cahyani^{1*}, Lukmanul Hakim², Fanny Tri Raditya³
^{1,2,3}Program Studi D3 Agroindustri Politeknik Banjarnegara
Email: cahyanidwiari@gmail.com

Abstrack

Brownies are a food that is popular with people from various circles. In general, brownies are made from flour, sugar, fat and eggs and chocolate. Taro is a tuber plant that is widely cultivated in Banjarnegara district. Taro can be processed into flour to extend shelf life and increase economic value. One of the ingredients in taro that is not liked is the presence of calcium oxalate which can cause an itchy feeling on the tongue when consuming taro. Processing taro flour is expected to eliminate the calcium oxalate content in taro. The use of taro flour as a substitute for mocaf in making brownies is expected to create food diversification and increase the economic value of taro tubers. This research applies experimental research methods using taro flour, mocaf, fat, sugar, eggs and chocolate as ingredients. The experimental design used was a randomized block design of 12 treatments with 3 replications. The finished brownies are subjected to calcium and oxalate analysis, consumer preference test. The results of the analysis were then tested using ANOVA to determine the effect between treatments. Next, a follow-up test was used to determine whether there were real differences between the various treatments using the DMRT (Duncan Multiple Range Test). The research results showed that the composition preferred by the panelists was brownies made with a composition of 50% citric acid fermented taro flour and 50% mocaf flour. The highest oxalate content of 0.9364% was found in brownies made using 100% unfermented taro flour.

Keywords: Brownies, Calcium Oxalate, Mocaf, Taro Flour

A. Introduction

Taro is a tuber plant that is widely cultivated in Banjarnegara district. The lack of consumer interest in taro is due to the calcium oxalate content which can cause itching and can irritate the mouth and tongue when consuming taro. Brownies are a food that is popular with people from various circles. In general, brownies are made from flour, sugar, fat and eggs and chocolate. Based on how brownies are made, some are baked or steamed. The aim of this research is to determine the calcium oxalate content in the brownies produced, the exact composition of taro flour and mocaf brownies and the level of consumer preference for the brownies produced.

B. Literature Review and Hypothesis Development

Taro flour is flour produced from taro tubers. According to (Saputra et al., 2016) taro flour contains 104 calories, 1.9 grams of protein, 0.2 grams of fat and 23.7 grams of carbohydrates in every

100 grams of taro flour. The carbohydrate content in taro flour is around 70 -80% compared to other flours according to (Marchamtia Sarah Nur Awalia Fajari and Qurrohman, 2021). Taro flour has very small starch granules, namely 1 – 4 μm compared to other flours, so it is easy to digest according to (Nurjanatun and Balfas, 2019). The lack of consumer interest in taro is due to the calcium oxalate content which can cause itching and can irritate the mouth and tongue when consuming taro. The calcium oxalate content can be lost with ap The absorption level of taro flour is higher compared to other flours (Mulyati, 2015). According to (Setiawan, 2023), the highest protein in taro flour is produced using the Pratama 3 variety taro using fermentation treatment. The peeled taro is cut thinly and then fermented for 72 hours, then dried and ground. Beneng variety taro flour is equivalent to low protein wheat flour according to research (Rostianti et al., 2018) and has the characteristic of not being heat resistant. Taro flour can be used as a raw material or substitute material in various food processing. In research (Wahyuni and Ab-Latif, 2020) taro flour was used to make cookies given to toddlers. In research (Akbar, 2019), taro flour was used as raw material for making wet noodles. appropriate soaking and heating treatment (Aviana and Loebis, 2017). Brownies are generally made from wheat flour, but flour from tubers, corn and soybeans can also be made into brownies. According to (Mulyati, 2015), brownies are a type of cake that are blackish brown in color with a slightly harder texture than cake. Brownies are generally made from wheat flour, but flour from tubers, corn and soybeans can also be made into brownies. Based on research (Fizriani, Putri and Triandita, 2019), the higher the content of black soybean flour in brownies, the lower the liking level value for the texture attribute. Research on the calcium oxalate content in taro brownies has been studied by (Aviana and Loebis, 2017) but in the process of making brownies they only use taro flour and wheat flour as a comparison. The test results for the calcium oxalate content of all cookie and brownie products were undetectable. The best accepted cookie and brownie products are those that use taro flour treated with salt soaking. Making brownies using taro flour is still rarely done because people don't like the characteristics of taro which can cause itching and irritate the mouth and tongue of those who consume it. There has been a lot of research on the use of mocaf flour in making brownies, but no research has been done on brownies with the substitution of taro flour and mocaf. It is hoped that the substitution of taro flour and mochaf in making brownies can reduce wheat imports.

C. Research Methods

This research applies experimental research methods using taro flour, mocaf, fat, sugar, eggs and chocolate as ingredients. The experimental design used was a randomized block design of 12 treatments

with 3 replications. The finished brownies were subjected to calcium oxalate analysis and a hedonic test to determine the level of consumer preference with 30 semi-trained panelists. The results of the analysis were then tested using ANOVA to determine the effect between treatments. Next, a follow-up test was used to determine whether there were real differences between the various treatments using the DMRT (Duncan Multiple Range Test).

D. Discussion

The resulting brownies were tested for calcium oxalate content levels, where it was found that brownies made with 100% taro flour without fermentation produced the highest oxalate content of 0.936% and the lowest at 0.061% in brownies made with 50% taro flour and 50% mokaf. The brownies produced were subjected to a hedonic test to determine the level of consumer preference for color, taste, aroma, texture, overall, itching sensation and tickling or burning sensation that occurs in the throat. The results of the hedonic test for brownies with various treatments can be seen in Table 1.

Treatment	Color^{tn}	Flavor^{tn}	Aroma^{tn}	Texsture	Overall^{tn}	Itching^{tn}	Ceklit-Ceklit^{tn}
Non-fermented taro brownies (100%)	3.5333	3.4000	3.1333	2.9667a	3.2333	1.2667	1.4333
Non-fermented taro brownies (50%) + mokaf (50%)	3.6333	3.5333	3.3000	2.9667a	3.2333	1.5333	1.6000
Salt fermented taro brownies (100%)	3.6667	3.5333	3.3333	3.1333a	3.3333	1.7000	1.6000
Salt fermented taro brownies (50%) + mokaf (50%)	3.6667	3.5667	3.4333	3.1333a	3.3333	1.8000	1.8000
Sitrat acid fermented taro brownies (100%)	3.7000	3.8333	3.5000	3.2333a	3.4000	1.8667	1.8667
Sitrat acid fermented taro brownies (50%) + mokaf (50%)	3.7333	3.9000	3.6000	3.8333b	3.5333	2.0667	2.1667

Explanation: tn = not real

Figure 1. Brownies Hedonic Test Results

The results of the hedonic test showed that the parameters of color, taste, aroma, overall, itching and tickling sensation in the study were not significantly different. Only the texture of the brownies showed a real difference between treatments. Based on the level of panelists' liking for the color of brownies, overall they liked it with an average value of 3.6556. The overall level of panelists' liking for the taste of the brownies produced was that they liked it with an average value of 3.6278. The overall level of panelists' liking for the aroma of the brownies produced was that they liked it with an average value of 3.3833. The overall level of panelists' liking for the texture of the brownies produced expressed liking with an average value of 3.1111. The overall level of panelists' liking for the overall brownies produced expressed liking with an average value of 3.3444. The overall level of panelists' liking for the itchy taste of brownies resulted in them not liking it with an average value of 1.7056. The resulting brownies still have an itchy taste on the tongue. The level of panelists' liking for the sensation of tickling brownies produced overall stated that they did not like it with an average value of 1.7445. The resulting brownies cause tickling at the base of the tongue and throat. The presence of itching and tickling may still contain calcium oxalate from taro which is used as raw material for brownies. The sensation of itching and tickling that occurs after consuming taro brownies is closely related. The twitching sensation referred to is a sensation like being pricked by a small needle. This condition commonly occurs in taro and its processed products, due to the presence of oxalate residue (Putri and Pulungan 2024). Evaluation of the relationship between brownie formulations made using variations in the use of taro flour and consumer acceptance was also carried out using principal component analysis (PCA) techniques with the help of XLSTAT Premium Trial v.2024 software. The results of the analysis can be seen in Figure 2 and Figure 3.

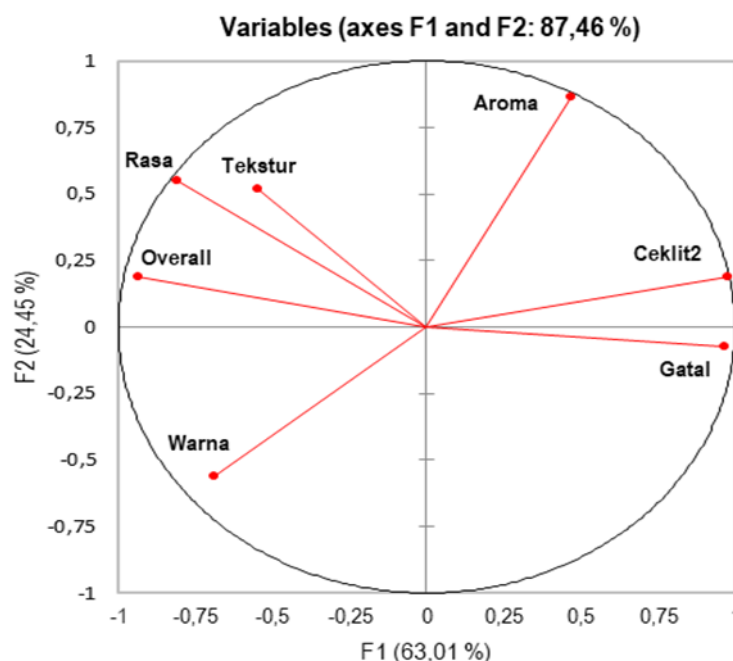


Figure 2. PCA Variables for Brownie Samples

Overall consumer acceptance of taro brownie products is greatly influenced by taste and texture parameters. These two parameters are key parameters that are deemed necessary to be further optimized if consumer acceptance is to be increased. This condition is in line with that reported by Khalilah, Surhaini, and Suseno (2021). Color and aroma parameter assessments tend not to be positively correlated with other sensory evaluation parameters. This indicates that consumers tend not to mind these two parameters and do not make them a significant consideration in overall acceptance of brownies. that brownies produced using non-fermented taro flour have the most positively correlated tickling sensation compared to other brownie samples. This is possible because without a fermentation process it is possible that the oxalate residue in the resulting brownie product is highest. The absence of a fermentation process also has a positive correlation with the aroma produced due to the minimal degradation process in the folate compounds of taro products. This condition can actually be a characteristic of taro brownie products. However, for consumers who don't like the distinctive aroma of taro, of course this needs to be a special concern. This condition is in line with the research results of Muthiahwari and Manalu (2020).

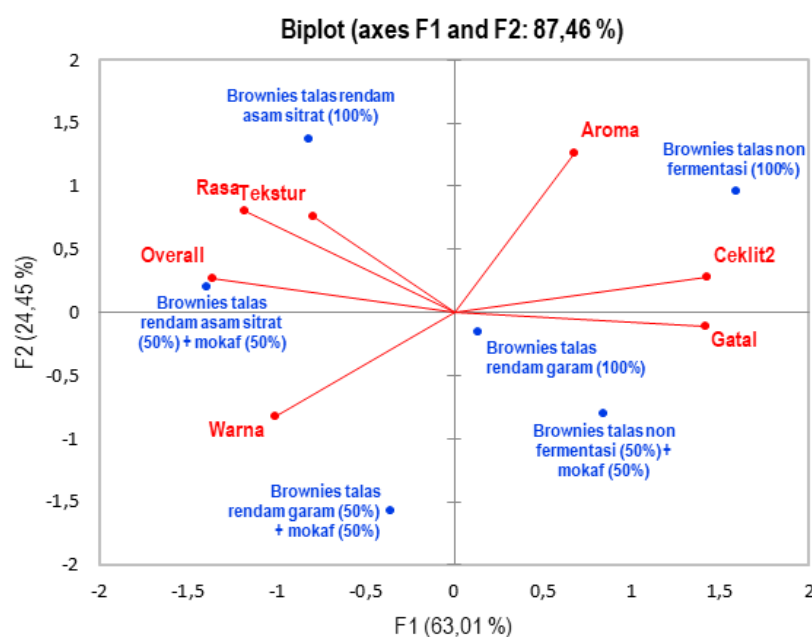


Figure 3. PCA Biplot of Brownie Samples

The picture shows that of the several variants of taro brownies produced, the brownies with taste, texture and overall assessment parameters that are most positively correlated with consumer acceptance are brownies made using 100% taro flour soaked in citric acid and brownies made using a combination of 50% taro flour soaked in citric acid and 50% mocaf flour. Brownies made using taro and soaked in salt were still positively correlated with the emergence of an itchy sensation. This condition is in line with brownies made using a combination of 50% non-fermented taro flour and 50% mocha flour. Researchers suspect that this phenomenon could occur because the ability of salt to reduce oxalate residues in products is not as optimal as acetic acid. Brownies made with 100% taro flour soaked in salt are in the same quadrant as brownies made using non-fermented taro flour. The brownies with the most potential for further development are brownies produced using a combination of 50% taro flour soaked in citric acid and 50% mocaf flour and brownies produced using 100% taro flour soaked in citric acid. This condition is mainly because these two types of brownies have a positive correlation with the panelists' overall assessment.

E. Conclusion

Brownies with 100% taro flour without fermentation produced the highest oxalate content of 0.936% and the lowest at 0.061% in brownies made with 50% taro flour and 50% mocaf. The results of the research showed that there were no real differences between the brownie treatments seen in the level

of panelists' preferences for color, aroma, taste, overall, itchy and ticklish. Only in the texture of the brownies produced were there significant differences between treatments. The composition preferred by the panelists is brownies made with a composition of 50% citric acid fermented taro flour and 50% mocaf flour. Overall, the panelists liked the brownies produced in terms of color, taste, aroma, texture and overall. However, the resulting brownies still had an itchy taste and a tickling sensation which the panelists didn't like.

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