

Duration of Soaking and Different Concentration of Order Against Crude Fiber Levels, Total Sugar and Organoleptic Quality of Okra Pudding (*Abelmoschus esculentus*)

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ABSTRACT

*Okra pudding is one of the dessert foods prepared from agar ingredients. Making okra as a pudding is expected to have more vitamin content than pudding in general. This study aims to determine the effect of different soaking time and agar concentration on crude fiber content, total sugar and organoleptic quality of okra pudding (*Abelmoschus esculentus*). This study used a Completely Randomized Design (CRD) with two factors, namely immersion time of okra (2, 3 and 4 hours) and agar concentration (2, 3 and 4%) each treatment was repeated 3 times. Determination of the best treatment of all research parameters was carried out using the effectiveness test. The results of the study showed that different lengths of fertilization and concentration had a significant effect on crude fiber content, total sugar and organoleptic quality.*

Keywords: *Okra Pudding (*Abelmoschus esculentus*), Rough Fiber and Total Sugar.*

INTRODUCTION

Pudding is included as dessert prepared from agar-based ingredients. The process of making pudding is done by mixing gelatine with water and heating it to form a gel with a soft texture. In this process, fruits or vegetables can be added to add flavour to the pudding. Using okra as the main ingredient, it is expected that the vitamins contained in okra can add nutritional value to the final product.

The purpose of this study was to determine the effect of soaking time and concentration that resulted in the different quality of the chemical and organoleptic of the okra pudding and determine the perfect soaking time and concentration combination that can produce a good okra pudding. It is assumed that different immersion times, different concentrations, and different interaction between soaking time and concentration can influence the chemical quality and organoleptic of the okra pudding.

METHODS

The research design used was a completely randomised design (CRD) consisted of two factors and three levels, namely immersion time (2, 3, and 4 hours) and agar concentration (2, 3, and 4%) obtained by nine treatments in which each treatment are repeated three times. The variables observed in this study includes fibre content testing using the Gravimetric method, total sugar using the Luff School method and organoleptic analysis using Hedonic Test/Favourite Test, which included colour, aroma, taste, and elasticity using a minimum of 20 panellists with a scale of preference namely 1 = very dislike, 2 = dislike, 3 = rather dislike, 4 = neutral, 5 = rather like, 6 = like, 7 = really like.

The agar as the main ingredient of this research uses Swallow Globe Brand. The tools utilised are knives, plates, basins, trays, pudding packaging cups, spoons, digital scales, and pans.

RESULTS AND DISCUSSION

The results of the study on various soaking duration and different concentrations of agar to the levels of crude fibre, total sugar, and organoleptic quality of okra pudding (*Abelmoschus esculentus*) showed that the duration of soaking of okra mucus was different and the interaction between soaking time and concentration had a significant effect on crude fibre content and total amount of okra pudding.

Crude Fibre Levels

The table below shows the soaking time of okra with concentrations so that the different values give the value of crude fibre of okra pudding at 1.4633 - 2.8533%. The table also shows the treatment of different immersion time of 2 hours, 3 hours, and 4 hours with low agar concentration of 2% gives the same effect on the value of crude fibre content of okra pudding which is equal to 1.5667, 1.5867 and 1.6267%. On the contrary, on the treatment of different immersion time of 2 hours, 3 hours, and 4 hours with agar concentration of 4% gives the same effect on the value of crude fibre content of high okra pudding of 2,4200, 2,3567 and 2,85633%.

Table 1. Average Okra Pudding Crude Fibre Levels

Crude Fibre	Level Samples (%)
Okra Soaking Time 2 Hours: Agar Concentration 2%	1.5667 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	1.4633 ^a
Okra Soaking Time 2 Hours: Agar concentration 4%	2.4200 ^b
Okra Soaking Time 2 Hours: Agar Concentration 2%	1.5867 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	2.1533 ^b
Okra Soaking Time 2 Hours: Agar concentration 4%	2.3567 ^b
Okra Soaking Time 2 Hours: Agar Concentration 2%	1.6267 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	2.6833 ^b
Okra Soaking Time 2 Hours: Agar concentration 4%	2.8533 ^b

Description: The letter behind the number is the same as the notation in each column showed no difference in the DMRT test.

Diana (2016) revealed that a process that involves heating can reduce some of its main nutritional components that not resistant to heat and easily soluble in water. The quality requirements of crude fibre in okra pudding have not been found yet, but if the okra pudding is classified into jelly, the quality requirements of crude fibre are not listed (Badan Standardisasi Nasional, 1994) so that the crude fibre contained in okra pudding can serve as functional food.

Total Sugar Level

The table below shows that the soaking time of okra with concentration using different values give the total sugar content of okra pudding at 3.0533 - 4.5367%. Also seen in the table, the different immersion times are 2 hours, 3 hours, and 4 hours with the concentration of 2% gives the same effect on the value of the total sugar content of okra pudding equal to 3.0533, 3.1033, and 3.1076%. On another value, different immersion times of 2 hours, 3 hours and 4 hours with the concentration of 3% and 4% gave the same effect on the value of total levels of high okra pudding sugar, which measured at 3.2467, 3.5300, and 3.4300 for 3% concentration and 3.7900, 4.0133, and 4.5367% for 4% concentration.

Boiling mucus will break the carbohydrates into lower compounds such as simple sugars, so the more carbohydrates that are overhauled will produce more simple sugars. Winarno (2004) reveals that heating processing in food can decompose complex compounds and constituents of ingredients food into more compounds.

The total quality requirement for sugar in the okra pudding has not been found yet, but if the okra pudding is classified into jelly, then the total sugar quality requirements which are specified in SNI 01-3552-1994 (Badan Standardisasi Nasional, 1994) stipulates that the amount of sugar should be at least 20%. Using the aforementioned standard, the total sugar of the okra pudding is far lower than the specified quality requirement.

Table 2. Average Total Level of Okra Pudding Sugar

Sample	Total Sugar Level (%)
Okra Soaking Time 2 Hours: Agar Concentration 2%	3,0533 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	3,2467 ^b
Okra Soaking Time 2 Hours: Agar concentration 4%	3,5300 ^b
Okra Soaking Time 2 Hours: Agar Concentration 2%	3,1076 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	3,4300 ^b
Okra Soaking Time 2 Hours: Agar concentration 4%	3,7900 ^b
Okra Soaking Time 2 Hours: Agar Concentration 2%	3,1033 ^a
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,0133 ^b
Okra Soaking Time 2 Hours: Agar concentration 4%	4,5367 ^b

Description: The letter behind the number is the same as the notation in each column showed no difference in the DMRT test.

Fun for Colour

Winarno (2004) reveals that colour is a quality parameter that can be captured by the five senses when observing it, so it is very important to determine consumer's acceptance. The test results for the colour preference of okra pudding as can be seen in Appendix 9, which shows the soaking times and concentration levels for different colours give values ranging from 4.1 to 6.2, which means the colour of the okra pudding is considered to be a neutral panellist to like.

Table 3. Average Colour of Okra Pudding

Sample	Colour Average
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,2
Okra Soaking Time 2 Hours: Agar Concentration 3%	5,5
Okra Soaking Time 2 Hours: Agar concentration 4%	4,9
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,1
Okra Soaking Time 2 Hours: Agar Concentration 3%	5,0
Okra Soaking Time 2 Hours: Agar concentration 4%	5,0
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,1
Okra Soaking Time 2 Hours: Agar Concentration 3%	5,0
Okra Soaking Time 2 Hours: Agar concentration 4%	4,1

The clear colour of okra pudding is due to carbohydrates contained in okra which is 7.45%, and 20% during boiling using a temperature of $100 \pm 20\text{C}$ causes a caramelization reaction that produces a brown colour. But because carbohydrates undergo slight levels of change, the appearance of brown colour is still very vague so the original colour of okra pudding, which tends to be clear, is still dominant. On the contrary, more mucus is produced and the higher the concentration of the caramelization reaction produces the bright colour of beige. The colour of the okra pudding histogram can be seen in Figure 1.

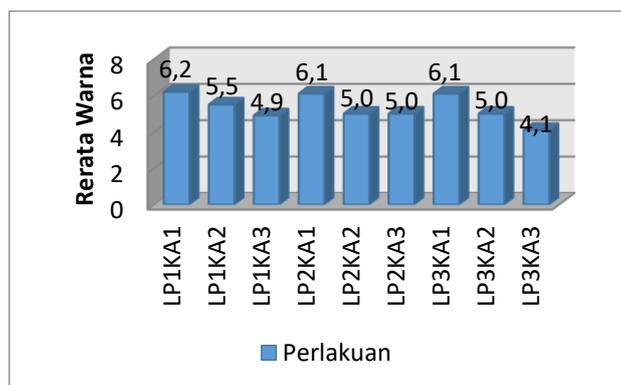


Figure 1. Okra Pudding Color Histogram

Hermanianto (2008) revealed that the heating process with temperature reaches 1000 degrees centigrade and above can affect the formation of colour in food because of the caramelization reaction on sugar and Maillard reaction on protein and sugar. When linked to the quality requirements of pudding classified in the jelly group set out in SNI 01-3552-1994 (Badan Standardisasi Nasional, 1994) which states that the colour is normal, the colour of the okra pudding matches the specified quality requirements.

Loving the Aroma

The aroma is one of the main attractions of food. Julianto (2016) revealed that food can produce aromas because they contain volatiles compounds that can cause a distinctive aroma.

Table 4. Average Aroma of Okra Pudding

Sample	Aroma Average
Okra Soaking Time 2 Hours: Agar Concentration 2%	4,6
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,7
Okra Soaking Time 2 Hours: Agar concentration 4%	4,9
Okra Soaking Time 2 Hours: Agar Concentration 2%	5,2
Okra Soaking Time 2 Hours: Agar Concentration 3%	5,4
Okra Soaking Time 2 Hours: Agar concentration 4%	5,2
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,0
Okra Soaking Time 2 Hours: Agar Concentration 3%	6,0
Okra Soaking Time 2 Hours: Agar concentration 4%	5,9

The addition of agar with a concentration of 2% and 3% makes the aroma of the okra pudding stronger because it binds water during the boiling process of okra mucus. The decreasing the moisture content of the okra pudding, the percentage of the cell composition components, and the forming components are the causes of the sharp taste. Winarno (2004) revealed that the reduction of water to food due to warming resulted in an increase in the constituent components of cells. Conversely, soaking time of 2 hours with 2% concentration gives the adequate or not too sharp aroma of okra pudding because short soaking time produces little okra mucus so that the flavour that appears on the okra pudding becomes weak.

When linked to the quality requirements of pudding classified in the jelly group set out by SNI 01-3552-1994 (Badan Standardisasi Nasional, 1994) which states that the aroma is should be normal, the aroma of okra pudding is in accordance with the specified quality requirements.

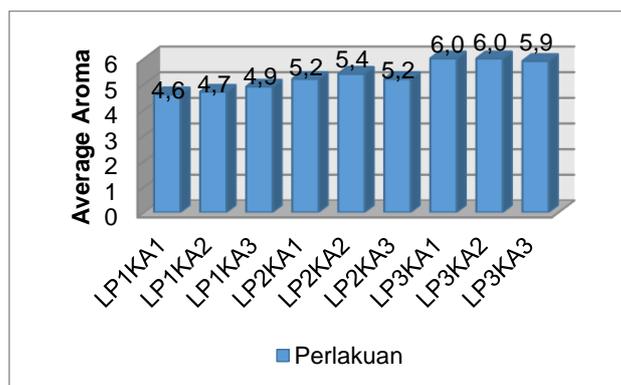


Figure 2. Okra Pudding Aroma Histogram

Passions towards taste

Ayustaningwarno (2014) stated that taste is one of the consumer's attractiveness towards a flavoured food product that is produced by a food product produced from materials used in the process of making these products, namely raw materials and food additives. Most consumers assess the quality of a food product from the taste, the more delicious a food product is, the more it favoured by the consumers.

Table 5 shows that the 4-hour soaking time with a concentration of 2% gives the highest okra pudding flavour value of 6.3, which means the aroma of okra pudding is mainly preferred by the panellists, while the soaking time is 2 hours with a concentration of 4% giving the aroma value of pudding the lowest okra of 4.2, which means it is considered neutral by the panellists.

Table 5. Average Sense of Okra Pudding

Sample	Sense Average
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,0
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,9
Okra Soaking Time 2 Hours: Agar concentration 4%	4,2
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,2
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,8
Okra Soaking Time 2 Hours: Agar concentration 4%	4,3
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,3
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,6
Okra Soaking Time 2 Hours: Agar concentration 4%	4,4

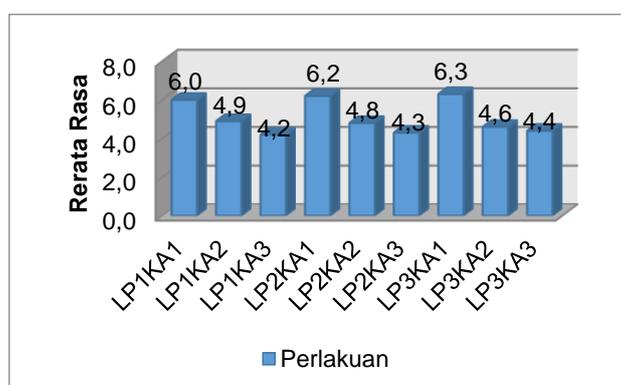


Figure 3. Okra Pudding Flavour Histogram

The above histogram shows that the longer the immersion conducted in the okra, the higher the level of preference of the panellists for taste, indicated by the value of 6. This

happens because the longer the mucus soaked, the more okra produced and the taste of the okra is sharper, and the addition of 2% concentration makes the flavour of the okra pudding stronger. On the contrary, soaking time of 2 hours with 3% concentration gives a less sharp taste of okra pudding. This is caused by quicker soaking of the okra so the flavour components contained in mucus okra are not sharp enough. This particular treatment was considered neutral by the panellists.

When linked to the quality requirements of pudding classified in the jelly group set out in SNI 01-3552-1994 (Badan Standardisasi Nasional, 1994) which states that the taste should be normal, the taste of the okra pudding is calculated from 4.2 to 6.3 according to the specified conditions.

Flavour of elasticity

Putri, Basito, and Widowati (2013) revealed that pudding is one of a variety of closing dishes in a set of menus or as a tea companion, so that the pudding should be sweet and of soft texture.

Table 6. Average Okra Pudding Strength

Sampel	Strength Average
Okra Soaking Time 2 Hours: Agar Concentration 2%	5,7
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,7
Okra Soaking Time 2 Hours: Agar concentration 4%	4,3
Okra Soaking Time 2 Hours: Agar Concentration 2%	5,7
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,4
Okra Soaking Time 2 Hours: Agar concentration 4%	4,2
Okra Soaking Time 2 Hours: Agar Concentration 2%	6,5
Okra Soaking Time 2 Hours: Agar Concentration 3%	4,6
Okra Soaking Time 2 Hours: Agar concentration 4%	4,5

The table above shows that the immersion time of 4 hours with a concentration of 2% gives the highest elasticity value of 6.5, which means the elasticity of the okra pudding is judged to be liked by the panellists, while the soaking time of 3 hours with a concentration of 4% giving the lowest aroma value, measured at 4.2, which means it is considered neutral by the panellists. The histogram of okra pudding can be seen in Figure 4.

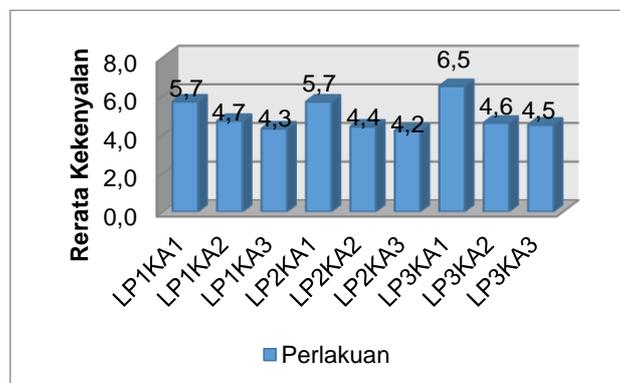


Figure 4. Okra Pudding Histogram

The above histogram shows that the longer the immersion conducted, the higher the level of preference of the panellists for elasticity. It is indicated by the value of 6.5 (most liked by the panellists) when the researcher conducts the aforementioned treatment. This happens because the longer the mucus is soaked, the more it is made. And added by the concentration of 2% makes the okra pudding soft or not too hard. On the contrary, soaking time of 3 hours with a concentration of 4% gives a high concentration of the okra pudding compounds because the addition of too much agar (as many as 4%), which makes the texture of the okra pudding tend to be hard or dense and is considered neutral by panellists.

When linked to the quality requirements of pudding classified in the jelly group set out in SNI 01-3552-1994 (BSN, 1994) which states that the elasticity is should be normal, the elasticity of the okra pudding is estimated at 4.2 to 6.5, according to the specified quality requirements.

Effectiveness Test

The determination of the effectiveness test on all research variables which include chemical tests and organoleptic tests is shown in Table 7.

Table 7. Test of Effectiveness in Research Variables

Variable	Result Values (NH) of Treatment								
	LP ₁ KA ₁	LP ₁ KA ₂	LP ₁ KA ₃	LP ₂ KA ₁	LP ₂ KA ₂	LP ₂ KA ₃	LP ₃ KA ₁	LP ₃ KA ₂	LP ₃ KA ₃
Crude Fibre Levels	0,02	0	0,14	0,02	0,10	0,13	0,03	0,18	0,20
Total Sugar Level	0	0,03	0,07	0,05	0,02	0,10	0,01	0,13	0,20
Elasticity	0,10	0,03	0,01	0,10	0,01	0	0,16	0,03	0,02
Color	0,16	0,10	0,04	0,15	0,05	0,05	0,15	0,05	0
Taste	0,12	0,05	0	0,13	0,04	0	0,14	0,03	0,01
Aroma	0	0,01	0,03	0,06	0,08	0,06	0,14	0,14	0,13
Total	0,40	0,21	0,29	0,51	0,30	0,35	0,61	0,55	0,57

Based on the determination of the effectiveness test on all research variables which included chemical testing and organoleptic tests, it showed that the immersion time of 4 hours with a concentration of 2% was the best treatment with Value Results (NH) which is 0.61 with the parameter criteria of elasticity equals 6.5 (likes), fibre content equals to 1.63%, total sugar content equals to 3.10%, colour of 6.1 (like), aroma of 6.0 (like) and flavour of 6.3 (like).

CONCLUSION

The results of the study on soaking duration and different concentration of concentration of crude fibre levels, total sugar, and organoleptic quality, it can be concluded that the soaking time treatment with different agar concentration and interaction between soaking time and concentration significantly affected crude fibre content and total content sugar in the okra pudding. The different concentration has a significant effect on the level of crude fibre and the total sugar content of okra pudding. The organoleptic test results showed that the soaking time with a different concentration had a significant effect on the colour, aroma, taste, and elasticity of the okra pudding. Based on the effectiveness test, the best treatment is for the 4-hour okra immersion with a concentration of 2% with the highest Value (NH) of 0.61 with the criteria for crude fibre content equals to 1.63%, total sugar content 3,

10%, colour equals to 6.1 (likes), aroma equals to 6.0 (likes), taste equals to 6.3 (likes), and elasticity of 6.5 (likes).

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