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COMPARATIVE EFFECT OF GRATED COCONUT (COCOS NUCIFERA, L.) ON THE CHARACTERISTICS OF LADU CAKE

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ABSTRACT

Ladu cake is a traditional cake originating from the Pariaman area, which has a savory and crunchy taste and a unique shape. This study aims to determine the effect of the ratio of dry grated coconut on the characteristics of the Ladu cake, to determine the effect of the best comparison level in producing the best product and to determine the storage time of the best Ladu cake. This study was designed using a completely randomized design (CRD) with 5 treatments (comparison of rice flour and dry grated coconut 100%:0%; 95%:5%; 90%:10%; 85%:15%; and 80%:20 %) and 3 replicates. The results showed that the ratio of dry grated coconut affected moisture content, ash content, fat content, carbohydrate content, crude fiber content, friability, color, aroma, texture and taste. However, it had no significant effect on protein levels. Based on Ladu cake products' chemical, physical and sensory characteristics, the best product was produced with a combination of 10% dry grated coconut and 90% rice flour. The characteristics were 1.96% of water content, 2.42% of ash content, 19.55% of fat content, 7.56% of protein content, 68.86% of carbohydrate content, 2.73% of crude fiber content, and the average value of sensory analysis of 3.70 of aroma, 4.07 of color, 3.53 of texture and 3.97 of taste.

Keywords: *Dry grated coconut, Ladu cake, rice flour,quality*

INTRODUCTION

Ladu cake is a traditional cake originating from the Pariaman area and introduced by the indigenous people and other people who have lived in Pariaman. This cake is a typical snack from Pariaman City, West Sumatra which has a savory and crunchy taste and a unique shape. The unique form of the ladu cake is caused by the printing process that uses betel nut flowers to produce a jagged shape. The uniqueness of the ladu cake printing process is one of the attractions to become a typical souvenir of Pariaman City. In addition, Pariaman is also known as the largest producer of coconuts in West Sumatra.

The production of coconut plants in West Sumatra in 2017 was 84,121 kg/ha with a coconut plantation area of 90,433 ha. The production of coconut plants in Pariaman City in 2015 produced 2,856 tons of coconut plants with a productivity of 1,097 kg/ha and the number of farmers was 3,796 family cards (BPS-Statistics

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Indonesia, 2017). Many coconut productions can open up job opportunities from processing various derivative products from coconut (Subagio, 2011).

Coconut is a plant where all parts of the plant can be used to meet the Indonesian people's economic, social and cultural needs. Coconut is one of the plantation commodities with a vast utilization potential, ranging from skin, coir, leaves, water to coconut meat. Coconut meat is divided into various age levels, namely young coconuts, half old coconuts and old coconuts. Traditionally, coconut products are used for fresh consumption such as coconut milk, spices, copra, and VCO. Along with market developments and technological support, the demand for various coconut-derived products is increasing, as is the current practical condition in shell charcoal, activated charcoal, coir fiber, coconut flour and dry grated coconut.

Dry grated coconut is a product of processed coconut in small granules made from fresh coconuts with high quality to produce the best quality with pure white color (Lubis *et al*., 2014). According to Sirait (1986), dry grated coconut is fresh coconut meat grated and dried. Dry grated coconut still contains most of the oil and protein found in fresh coconut meat. According to (Palunkun, 1994), dry grated coconut contains 67.5% fat, 9.3% protein, 8.9% pentosan, 5.9% carbohydrates, and 3.9% fiber. Dry grated coconut is a semi-finished material used as a raw material for making ladu cakes. Ladu cakes sold today are made from a composition of rice flour, whiting, salt and water which causes the resulting ladu cake to have a distinctive taste and aroma from rice alone. Therefore, the addition of dry grated coconut to the ladu cake is expected to increase taste and aroma innovation, economic value and can increase nutritional value.

The addition of dry grated coconut to ladu cake is a form of food diversification. (Sumaryanto, 2009) states that food diversification is an effective way to reduce production risks due to climate change and provide opportunities to support the development of local resource-based processing industries. In this regard, food diversification is one way to achieve food security. The role of food diversification in macro aspects can be used as a policy instrument in reducing dependence on rice so that it is expected to increase national food security and can be used as an instrument to increase work productivity by improving community nutrition.

Based on the description above, the author has researched "The Comparative Effect of Dry Grated Coconut (Cocos nucifera, L.) on the Characteristics and Shelf Life of Ladu Cake."

METHODOLOGY

Materials and tools

The main ingredients used in this study were grated white fresh coconut with a medium maturity level of deep coconut varieties with the criteria of yellow coconut shell and rice flour. Additional materials used are water, Ca(OH)2, salt and cooking oil. The chemicals used were neutral alcohol, 1% starch, chloroform acetic acid (3:2), distilled water, 96% ethanol, H_3BO_3, red metal indicator, pp indicator, KI, 0.01 N HCl solution, H_2SO4 solution, K_2SO4 solution. 10%, 30% NaOH solution, $Na_2S_2O_3$, 0.1 N NaOH, and selenium mix.

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The tools used in the manufacture of this product are ladu cake moulds, pans, plastic containers and pans. The tools used for chemical analysis are aluminum crucible, porcelain dish, gegep, gerhardt brand hot plate, funnel, measuring cup, dropper, buchi brand soxhlet, neycraft brand kiln, acis brand scale, iwaki brand Erlenmeyer, iwaki brand desiccator, kjedhal flask , Mert brand incubator and Roche friabiliator.

Research design

The design used in this study was a completely randomized design (CRD) with 5 treatments and 3 replications. This treatment was determined based on the preliminary experiments that have been carried out. Observational data were analyzed by F test and continued with DNMRT (Duncan's New Multiple Range Test) test at 5% level.

The treatments carried out in this study were:

A = 100% rice flour : 0% dry grated coconut

B = 95% rice flour: 5% dry grated coconut

C = 90% rice flour: 10% dry grated coconut

D = 85% rice flour: 15% dry grated coconut

E = 80% rice flour: 20% dry grated coconut

Research Implementation

Raw Material Preparation

The raw materials used in this research are fresh coconut that has been grated with a medium maturity level and rice flour.

Dried Grated Coconut Production Stage (Lubis et al., 2014)

Fresh, white grated coconut was cleaned of foreign particles in the form of coconut shell granules, coconut fiber and other foreign particles. Then blanched at 800 ºC for 10 minutes. After blanching, then the roasting process is carried out at a temperature of 600 ºC until the grated coconut can be crushed. After that the dried grated coconut is allowed to stand for 3 minutes, then grinded with a blender until smooth.

Ladu Cake Making Stage (Saputri, 2018)

The stages of making ladu cake are as follows:

1. Mixing and stirring of materials. Coconut and rice flour that have been weighed according to the treatment are added with a mixture of 70 g of hot water, 2 g of salt and 0.3 g of whiting. After the ingredients are mixed then the dough is stirred until smooth.
2. Printing is done by forming the dough into a round, then flattened using a 5.2 cm diameter ladu mold.
3. Frying is done by putting the dough one by one into hot oil with a temperature of 1700C to 1900C and a frying time of 8 minutes until the product looks dry, solid and brownish.

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4. Ladu cakes that have been fried are left at room temperature for 30 minutes, with the aim of releasing the remaining hot steam.

RESULTS AND DISCUSSION

Raw material

The analysis was carried out on roasted dry grated coconut and roasted rice flour, namely water content, ash content, fat content, protein content, carbohydrate content by difference and crude fiber content. The results of the chemical analysis of dry roasted grated coconut and roasted rice flour can be seen in Table 1.

Table 1. Average Results of Analysis of Dry Grated Coconut and Roasted Rice Flour

Parameters (%)	Dry Grated Coconut	Roasted Rice Flour
Water content	0,97±0,56	0,88 ± 0,50
Ash content	2,43±0,19	0,44 ± 0,19
Fat content	62,89±1,12	0,71 ± 0,11
Protein content	8,34±0,27	3,49 ± 0,33
Carbohydrate content	25,37±1,42	94,48 ± 1,03
Crude fiber	5,98±0,58	0,99 ± 0,34

The water content of dry roasted grated coconut is 0.97%. Based on the Indonesian National Standard (BSN, 2000), the moisture content of dry grated coconut has met the requirements, namely a maximum of 3%. The moisture content of roasted rice flour is 0.88%. The water content of this rice flour has met the Indonesian National Standard (BSN, 2009), which is the maximum water content of 13% of rice flour. The decrease in water content in the material is due to the drying process. The use of materials with low water content can affect the final result of the water content of the ladu cake.

The ash content of dry roasted grated coconut was 2.43%. Palunkun (1994) also stated that the ash content of dry grated coconut was 2.4%. The ash content in dry grated coconut is high because coconut contains minerals including phosphorus, calcium, and iron. The ash content obtained in roasted rice flour is 0.44%. The ash content obtained in rice flour is lower than the research results (Hutabarat, 2001), which is 0.8%. The low ash content of a material indicates that the inorganic residue content in the material is also typical.

The fat content of dry roasted grated coconut was 62.89%. The results have met the Indonesian National Standard (BSN, 2000), namely the fat content of dry grated coconut was at least 61%. According to Barlina (2004), the types of fat found in coconut include lauric, myristic and palmitic acids. The fat content of rice flour obtained was 0.71%. The analysis of the fat content obtained in rice flour is higher than the fat content according to (Ministry of Health, 2006), which is 0.5%.

The protein content of dry roasted grated coconut was 8.34%. This protein content has met the Indonesian National Standard (BSN, 2000), namely the protein content of dry grated coconut is at least 5%. The results of the analysis of the protein content obtained in rice flour were 4.49%. The protein content

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obtained in rice flour was lower compared to protein content in protein standard that of 7%. The low protein content obtained in rice flour depends on the processing process.

Carbohydrates are one of the primary sources of energy for the body. Carbohydrates that are widely found in food products are starch, sugar, pectin, and cellulose. In the body, carbohydrates help protein and fat metabolism (Winarno, 2004). Dry grated coconut raw material has a carbohydrate content by difference method of 25.37%, while the carbohydrate content of rice flour is 94.48%. The carbohydrate content of a food by difference depends on the composition of water, ash, fat, and protein in the material.

Crude fiber is a residue from food or agriculture after being treated with boiling acid and alkali and consists of cellulose with a small amount of lignin and pentosan (Yenrina, 2015). The analysis of dry grated coconut crude fiber obtained was 5.98% and rice flour was 0.99%. Crude fiber has no nutritional value for humans because humans do not have cellulase enzymes to digest it. But this fiber plays a role in avoiding constipation (difficulty defecating), diluting toxic substances in the colon and absorbing carcinogenic substances in the digestive tract which will then be excreted from the body (Silalahi, 2006).

Water content

Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry coconut and rice flour is significantly different on the moisture content of the resulting ladu cake. The results of the analysis of the water content of the Ladu cake can be seen in Table 2.

Table 2. Average Value of Ladu Cake's Moisture Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Water Content(%)
A (0 : 100)	3,11 ± 1,07 a
B (5 : 95)	2,12 ± 0,23 b
C (10 : 90)	1,96 ± 0,31 b
D (15 : 85)	1,76 ± 0,81 b
E (20 : 80)	1,59 ± 0,50 b
KK = 4,76%	

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

The highest water content was found in treatment A (without the addition of dry grated coconut) with an average of 3.11% while the lowest water content was found in treatment E (with the addition of 20g dry grated coconut) with an average of 1.59%. It shows that the more the amount of dry grated coconut is added, the water content of the Ladu cake decreases and the less the amount of dry grated coconut is added, the water content of the Ladu cake increases.

Ash Level

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Ash content roughly describes the mineral content of a food. Ash is the residue left after a portion of food is burned until it is free of carbon. Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the ash content of the resulting ladu cake. The analysis of the ash content of the Ladu cake can be seen in Table 3.

Table 3. Average Value of Ladu Cake's Ash Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Ash content (%)		
A (0 : 100)	2,86 ± 0,17	a	
B (5 : 95)	2,65 ± 0,20	a	b
C (10 : 90)	2,42 ± 0,28	a	b c
D (15 : 85)	2,26 ± 0,02		b c
E (20 : 80)	2,06 ± 0,50		c
KK = 2,31%			

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

The results showed that the more the amount of dry grated coconut added, the higher the ash content of the Ladu cake. The ash content of a material describes the number of unburned minerals into volatile substances. The greater the ash content of a food ingredient, the higher the minerals contained in the material (Hendarwati, 2003). The amount of dry grated coconut influences the ash content of the Ladu cake.

Fat level

Fat is a macro compound with the highest energy value compared to carbohydrates and proteins (Winarno, 2004). Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the fat content of the resulting ladu cake. The results of the analysis of fat content can be seen in Table 4.

Table 4. Average Value of Ladu Cake's Fat Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Fat content (%)		
A (0 : 100)	20,80 ± 1,53	a	
B (5 : 95)	20,38 ± 1,15	a	
C (10 : 90)	19,55 ± 0,08	a	
D (15 : 85)	18,94 ± 3,30	a	
E (20 : 80)	12,87 ± 2,44		b
KK = 2,19%			

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

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The results showed that the more the amount of dry grated coconut added, the higher the fat content of the Ladu cake. The fat content of the ladu cake will decrease if rice flour is added because the fat content in the rice flour is lower when compared to the fat content of dry grated coconut. From the raw material analysis, dry grated coconut has a higher fat content of 62.89% compared to rice flour, which is 0.71%.

Protein Level

Proteins are an essential group of food molecules because they provide carbon and hydrogen and nitrogen and sulfur. (Gunawan and Azhari, 2010). Based on the analysis of variance at the 5% level, it showed that the effect of the ratio of dry grated coconut and rice flour was not significantly different on the protein content of the resulting ladu cake. The results of the analysis of the protein content of the Ladu cake can be seen in Table 5.

Table 5. Average Value of Ladu Cake's Protein Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Protein content (%)
A (0 : 100)	7,98 ± 0,15
B (5 : 95)	7,72 ± 0,20
C (10 : 90)	7,66 ± 0,21
D (15 : 85)	7,56 ± 0,36
E (20 : 80)	7,50 ± 0,58
KK = 0,88%	

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

The protein content increased as the more dry grated coconut was added, but this increase did not have a significant effect. The protein content in ladu cakes also comes from rice flour. From the raw material analysis, dry grated coconut has a higher protein content compared to rice flour. There was a decrease in the protein content of the ladu cake due to the processing process. The high temperature of frying might cause the degradation of the protein. The effect of high temperature can cause protein denaturation. Protein denaturation occurs due to the breaking of hydrogen bonds and changes in the secondary and tertiary structures (Rauf, 2015).

Carbohydrate Level

Carbohydrates are one of the cheap human food sources, which provide about 40-75% of energy intake, which serves as an energy reserve in the human body and fiber source (Kusnandar, 2011). Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the carbohydrate content of the resulting ladu cake. The results of the analysis of carbohydrate content can be seen in table 6.

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Table 6. Average Value of Ladu Cake's Carbohydrate Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Carbohydrate Content (%)
A (0 : 100)	74,86 ± 3,16 a
B (5 : 95)	68,86 ± 3,71 a
C (10 : 90)	68,86 ± 0,88 a
D (15 : 85)	67,79 ± 1,16 a
E (20 : 80)	67,21 ± 2,14 b
KK = 0,71%	

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

Carbohydrate content is strongly influenced by other components such as water content, ash content, fat content, and protein content. The higher the elements contained in other elements, the lower the carbohydrate content (Sudirman and Ninsix, 2015). According to Saputri (2018), the carbohydrate content of the areca nut cake was influenced by the raw materials used, namely dry grated coconut and rice flour. Carbohydrate compounds found in ladu cake are starch and fiber.

Crude Fiber Content

Crude fiber is a residual component resulting from the hydrolysis of a food ingredient with a strong acid, which is then hydrolyzed with a strong base, resulting in a loss of cellulose of about 50% (Tensiska, 2008). Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the crude fiber content of the resulting ladu cake. The analysis of the fiber content of Ladu cake can be seen in Table 7.

Table 7. Average Value of Ladu Cake's Fiber Content

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Fiber content (%)
E (20 : 80)	6,26 ± 0,36 a
D (15 : 85)	5,58 ± 0,50 a
C (10 : 90)	2,73 ± 0,55 b
B (5 : 95)	1,83 ± 0,33 c
A (0 : 100)	0,97 ± 0,35 d
KK = 2,45%	

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

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The fiber content of the Ladu cake obtained was higher than the results of the study (Saputri, 2018), which stated that the fiber content of the Ladu cake ranged from 1.45% - 3.57%. The high content of crude fiber of Ladu cake in the addition of dry grated coconut with rice flour is caused because the raw material used in making Ladu cake is dry grated coconut which has a reasonably high crude fiber content of 5.98%.

Fragility

The level of fragility indicates the ability of product parts to separate from the parent material due to impact, fall, and friction against the material. The parts have been damaged (broken, broken, torn, broken) (KBBI, 2018). Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the brittleness of the resulting ladu cake. The results of the brittleness analysis of Ladu cake can be seen in Table 8.

Table 8. Average Value of Ladu Cake's Fragility

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Fragility (%)
A (0 : 100)	6,78 ± 0,26 a
B (5 : 95)	5,48 ± 0,28 b
C (10 : 90)	2,30 ± 0,36 c
D (15 : 85)	**1,73 ± 0,48 c d**
E (20 : 80)	1,65 ± 0,20 d
KK = 1,841%	

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

The high content of polysaccharides (starch, pectin, cellulose and hemicellulose) and the gelatinization process that occurs during frying might influence the fragility of the ladu cake (Harahap *et al*., 2017).

Sensory Analysis

Panelist's acceptance of ladu cake products is done by hedonic test or sensory preference test of panelists. This test is a factor that can determine the level of preference of the panelists to the Ladu cake made from dry grated coconut and rice flour produced by observing the color, taste, aroma, texture. Based on the analysis of variance at the 5% level, it shows that the effect of the ratio of dry grated coconut and rice flour is significantly different on the sensory analysis of the resulting ladu cake. The results of the Ladu Sensory Analysis can be seen in Table 9.

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Table 9. Sensory Analysis Results of Ladu Cake

Treatments (Dry Grated Coconut: Roasted Rice Flour)(%)	Aroma	Color	Texture	Taste
A (0% : 100%)	3,33	3,53	2,70	3,07
B (5%: 95%)	3,67	4,23	3,37	3,30
C (10%: 90%)	3,70	4,07	3,40	3,87
D (15% : 85%)	3,77	3,63	3,53	3,90
E (20%: 80%)	4,07	2,53	4,03	3,97
KK	22,72%	22,73%	30,92%	23,98%

Description: 1 = dislike very much, 2 = dislike, 3 = normal, 4 = like, 5 = very much like

Note: The numbers in the same column followed by lowercase letters are not the same, significantly different at the 5% level according to Duncan's Multiple Range Test (DNMRT)

The drier grated coconut is added, the sharper the coconut aroma in the ladu cake will be. The aroma in the Ladu Cake is caused by the addition of dry grated coconut in making Ladu Cake, so the drier grated coconut is used, the more pronounced the coconut aroma produced in Ladu Cake. The distinctive aroma of coconut occurs due to the reaction between amino acids and reducing sugars, forming complex compounds (Tarigan *et al*., 2015).

The color of the resulting ladu cake is pale white to brownish-yellow. Basically, dry-grated coconut has a brown color. The resulting brown color is due to the roasting process. Roasting causes the Maillard reaction which produces a brown color in the presence of heat so that the ladu cake created with rice flour is increasingly brownish.

The panelists' preference for the texture of the Ladu cake ranged from 2.70 (ordinary) to 4.03 (like). The lowest value for the texture of Ladu cake was treatment product E of 2.70 and the highest value for the color of Ladu was the treatment of product A of 4.03. The more the addition of dry grated coconut, the lower the texture value of the ladu cake.

The panelists' preference for the taste of Ladu cake ranged from 3.07 (ordinary) to 3.97 (like). The lowest value of Ladu cake taste preference is treatment product E of 3.07 and the highest value of Ladu cake taste is treatment C of 3.97. Panelists liked the ladu cake produced with 0% - 10% dry grated coconut, while 15% - 20% dry grated coconut decreased the panelists' acceptance rate. The drier grated coconut in the ladu cake, the higher the oil content in the ladu cake, causing the oil taste to stick to the tongue.

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CONCLUSION

Based on the research that has been done, it can be concluded as follows: The difference in the effect of the ratio of grated coconut on the Ladu cake is having a significant impact on water content, ash content, fat content, carbohydrate content, crude fiber content, friability, color, aroma, texture and taste. While no significant effect on protein levels.

Based on the chemical, physical and sensory characteristics of the acceptance of the Ladu cake product, the best effect was obtained in the treatment with a ratio of 10% dry grated coconut: 90% rice flour with the characteristics of this treatment being 1.96% water content, 2.42% ash content, fat content 19.55%, protein content 7.56%, carbohydrate content 68.86%, crude fiber content 2.73%, brittleness 2.30%, aroma 3.70 (like), color 4.07 (like), texture 3.53 (like) and taste 3.97 (like).

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