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The Effect of Adding Coconut Dregs (Cocos nucifera L.) on "Wajik" Characteristics

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A B S T R A C T

This study aims to determine the effect of adding coconut dregs on the characteristics of wajik based on organoleptic and chemical tests. The research design used was a Completely Randomized Design (CRD) with 5 treatments, namely A (without adding coconut dregs), B (addition of 1% coconut dregs), C (addition of 2% coconut dregs), D (addition of 3% coconut dregs), and E (addition of 4% coconut dregs) with 3 replications. The research data were statistically analyzed using Analysis of Variance (ANOVA) and continued with Duncan's New Multiple Range Test (DNMRT) analysis at the 5% level. The results showed that adding coconut dregs had a significant effect on, fat content, crude fiber, sucrose, total energy, and organoleptic including color, aroma, taste, and texture. However, it had no significant effect on ash content. The best treatment was "wajik" with the addition of 3% coconut dregs, with ash content of 0.78%, fat content of 14.31%, protein content of 2.58%, crude fiber of 6.42%, the total energy of 329.51 kcal, and a liking level for color 3.80 (like), aroma 3.84 (like), taste 3.60 (like), and texture 3.80 (like).

1. INTRODUCTION

1.1. Research Background

Traditional food, as a regional speciality, is one of the cultural elements in various regions in Indonesia. Specific communities usually consume traditional food with a distinctive taste and can be accepted by the community. Traditional food has a positive contribution to health because, in terms of its composition, it has a variety of different nutrients. One example of traditional food in Indonesia is Wajik.

"Wajik" is a semi-wet traditional food made from glutinous rice, brown sugar, and coconut milk with or without adding other ingredients. In some areas, Wajik is a dish for guests or celebration events or as a souvenir (Figure 1).

The main ingredient for making "wajik" is Sticky rice, commonly called white glutinous rice. Sticky rice (Oryza sativa glutinosa) is one of the rice varieties that belongs to the Graminae family. White glutinous rice has a high starch content of 90%. *Starch* is a glucose polymer with two forms: amylose and amylopectin. The amylose content in white glutinous rice is 1-2%, while the amylopectin content is 88-89% [1].

In the processing of "Wajik," quite a lot of brown sugar is used. The use of brown sugar in "Wajik" will affect the increase in blood sugar levels in the body. Excessive consumption of sugar and carbohydrates will cause an increase in blood glucose. So high sugar levels in the long term can cause diabetes [2].

Coconut dregs are a by-product or waste from coconut milk processing. Indonesia is one of the largest coconut producers in the world. The Central Statistics Agency noted that coconut production in Indonesia was 2.87 million tons in 2022 [3]. So far, coconut dregs have only udse as animal feed at a megeer product price. In addition, coconut dregs are used only to make Bongkrek Tempeh in Central Java. Considering the large amount of coconut dregs waste produced by the community, restaurants, and coconut milk processing businesses, coconut dregs are an alternative in food processing. Coconut dregs can be a potential food ingredient because of their nutritional content. Coconut dregs still contain many nutrients, such as protein, fat, and carbohydrates. Whereas dry coconut dregs (fat-free) contain 93% carbohydrates consisting of 61% galactomannan, 26% mannose, and 13% cellulose [4].

From the analysis carried out by [5], the processing of coconut dregs into semprong cakes contains crude fiber, protein, and fat, which were higher along with the addition of coconut dregs. It shows coconut dregs can increase fiber, fat, and protein levels. The high content of fiber, fat, and protein can slow down the food rate so that the gastric emptying rate will be slower. Thus, the blood glucose response will be lower, so it is suitable for people with diabetes to consume.

Based on the pre-research that was carried out, an attempt has been made to find a "Wajik" formulation so that a 1:2 formulation between white sticky rice and brown sugar was successfully formed and met the characteristics of the "Wajik" shape—then continued by determining the type of treatment, namely the addition of roasted coconut dregs. So, the treatment used in the study included adding coconut dregs: 0%, 1%, 2%, 3%, and 4%. If the addition is above 4%, the resulting "Wajik" does not blend with the coconut dregs, so it does not meet the characteristics of the "Wajik". Then in terms of taste, the addition above 4% produces an uncomfortable aftertaste in the throat.

1.2. Literature Review

White glutinous rice contains carbohydrates, proteins, minerals, and vitamins (especially in the aleuron part). The main carbohydrate component of glutinous rice is starch. Starch is a glucose polymer carbohydrate that has two structures, namely amylose and amylopectin. White glutinous rice has a higher amylopectin content than amylose, giving it the characteristic sticky properties of glutinous rice [6]. Rice grains consist of 3 tissues: endosperm, aleurone, and embryo. Aleurone and embryos contain protein, fat, vitamins, and fat.

Meanwhile, the endosperm consists entirely of starch [7]. Coconut dregs are a by-product of coconut milk processing. Coconut dregs have a relatively high nutritional content, such as 5.78% protein, 38.24% fat, and 15.07% crude fiber [8]. Coconut dregs also contain pretty high cellulose. Cellulose is a dietary fiber that digestive enzymes cannot digest. Fiber in food can slow down the rate of food so that the rate of digestion into glucose becomes slower so that blood sugar levels are relatively lower. Coconut dregs contain high fiber and fat as a healthy food alternative. Several studies have shown that 100 g of roasted coconut dregs contain 48.72 g of fiber, 9.74 protein, 39.4 fat, 31.5 carbohydrates, and 5,468 Kcal of energy [4]. Wajik is a semi-wet food made from steamed glutinous rice, then cooked and mixed with coconut milk and brown sugar until the dough is oily and soft [9].

In making "Wajik" the caramelization process and Maillard reaction occur, which produce the brown color, flavor, and distinctive taste of “Wajik”. A change in color marks the caramelization process and Maillard's reaction. Sugar, a sweetener or preservative, causes this color change. When sugar is heated, its concentration and boiling point will increase. Caramelization will occur if molten sugar is heated continuously beyond its melting point. In addition, at high temperatures, a Maillard reaction will occur between reducing sugar and primary amine groups [10].

1.3 Research Objective

This study aims to study the effect of adding coconut dregs on the characteristics of white sticky rice in “Wajik” and determine the best product physically, chemically, and organoleptically.

2. MATERIALS AND METHODS

2.1. The Materials

The raw materials used in this study were white glutinous rice, coconut milk, coconut dregs, and palm sugar. The white glutinous rice and palm sugar come from the traditional market in Padang. The coconut milk and dregs used come from the pure coconut milk processing company Santan Peras Tata Melindo Kapalo Koto, Padang. The materials used for chemical analysis tests were distilled water and sodium Hydroxide (NaOH) pa. Smartlab, Hexane (Technical. Brataco), Hydrogen Chloride (HCl), Potassium Sulfate (K_2SO_4) (pa. Smartlab), Sulfuric Acid (H_2SO4) pa. Smartlab, Potassium Iodide (KI) solution, 96% Ethanol.

The tools used in making "Wajik" are scales, stoves, knives, steamers, frying pans, spoons, spatulas, glasses, molds, and plastic gloves. The tools used for chemical analysis are desiccators, cup clamps, beakers, measuring flasks, soxhlet extraction apparatus complete with condensers and fat flasks, electric heaters or steam baths, filter paper, kjedhal apparatus, distillation apparatus, burettes, erlenmeyers, analytical balances, droppers, test tubes, measuring cups, aluminium cups, porcelain cups, ashing furnaces, ovens, funnels, latex gloves, spatulas, vortexes, and beaker glasses.

2.2. The Design

This study uses a completely randomized design (CRD) with five treatments and three replications. The data were analyzed statistically using ANOVA (Analysis of Variance) and, if significantly different, continued with the DNMRT (Duncan's New Multiple Range Test) at a significance level of 5%. The treatment in this study was the difference in the concentration of coconut dregs added to the making of "Wajik".

The addition of coconut dregs in making "Wajik" in this study is as follows:
A = 0%
B = 1%
C = 2%
D = 3%
E = 4%

2.3. Research implementation

2.3.1. Making of Roasting Coconut Dregs.

The process of making roasted coconut dregs in the study involved grating the coconut flesh using a coconut grater and then squeezing it to produce coconut milk. Coconut milk and coconut dregs were separated using a sieve. The resulting coconut dregs were roasted for 20-25 minutes until they turned slightly brown and had a fragrant aroma.

2.3.2. Making of “Wajik”

Soak the white sticky rice for 2 hours and then drain it. Steam the sticky rice for 30 minutes. Prepare other ingredients, such as 100

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g of coconut milk, 50 g of palm sugar, and 0.5 g of salt, then cook while stirring for ± 15 minutes until thick. Put in the steamed sticky rice and stir. Put in the roasted coconut dregs according to the treatment. Then, stir until evenly distributed. After evenly distributed, the dough is put into a mold and cooled.

Table 1. Formulation of "Wajik"

Raw material	Treatment				
	A	B	C	D	E
White Glutinous Rice (g)	100	100	100	100	100
Coconut Dregs (g)	0	2.50	5.01	7.51	10.02
Palm Sugar (g)	50	50	50	50	50
Coconut Milk (g)	100	100	100	100	100
Salt (g)	0.5	0.5	0.5	0.5	0.5

2.4. Observations

2.4.1. Observation on the Raw Materials

Observations made on the raw materials in this study, namely roasted coconut dregs, include water, fat, and crude fiber content.

2.4.2. Observation on "Wajik"

Observations made on "Wajik" are chemical analyses consisting of ash content, fat content, crude fiber content, sucrose content, and total energy. Furthermore, organoleptic tests are carried out, by using panellist acceptance levels.

3. RESULT AND DISCUSSION

3.1. Roasted Coconut Dregs Analysis

The raw materials added to the "Wajik" formulation in this study were roasted coconut dregs. The analysis of the roasted coconut dregs is in Table 2.

Table 2. The Roasted Coconut Dregs Analysis

Analysis	% (Mean ± SD)
Water Content	2.78 ± 0.51
Ash Content	0.56 ± 0.19
Fat Content	27.89 ± 0.51
Crude Fiber	28.75 ± 1.71

The water content of roasted coconut dregs is 2.78%, according to the water content in SNI 01-3715-2000, where the maximum water content of dry grated coconut is 3%. This water content can be achieved by roasting slowly using medium heat. The longer a material is in contact with heat, the lower the water content will be [11]. The smaller the material size, the better the surface contact with heat, so the water content will also be low [12].

The ash content obtained in roasted coconut dregs was 0.56%. This result is higher than that of the study by Ref. [13]. which was 0.48%. This difference in ash content is thought to be due to the different types of coconut used. The fat content in this study was 27.89%. This result is not very different from the analysis conducted by [14]. which was 26.50%. Fat and oil are found in almost all food ingredients with different contents [15]. The crude fiber content is 28.75%. This result is lower than that of the study conducted by [4]. which was 33.64%—this difference is due to the type and age of the coconut used.

3.2. Chemical Characteristics of "Wajik"

3.2.1 Ash Content

Ash is an inorganic substance that is the residue of burning organic matter in food. Food comprises 96% inorganic matter and water [16].

Table 3. The Ash Content

Treatment	(%) Mean ± SD
A (0%)	0.56 ± 0.19
B (1%)	0.67 ± 0.33
C (2%)	0.78 ± 0.19
D (3%)	0.78 ± 0.19
E (4%)	0.89 ± 0.19
CV =3.1 %	

The variance analysis showed that the concentration of coconut dregs addition was not significantly different at the level (α) of 5% on the ash content of the resulting product. The mineral content of the coconut dregs used can cause this increase in ash content. Coconut dregs contain many minerals such as Calcium (Ca), Magnesium (Mg), Potassium (K), Sulfur (S), Sodium (Na), and others. When coconut dregs are added, these minerals will also enter the "wajik", which results in more minerals being contained along with the increasing percentage of coconut dregs.

3.2.2 Fat Content

Fat is a macro compound that produces much more energy than carbohydrates and proteins. Fat in food, in addition to functioning as a source of energy, also functions as a flavor and texture [17].

Table 4. The fat Content

Treatment	(%) Mean ± SD	
A (0%)	10.81 ± 0.34	a
B (1%)	12.85 ± 0.16	b
C (2%)	13.36 ± 0.34	b
D (3%)	14.31 ± 0.87	c
E (4%)	15.45 ± 0.50	d
CV = 3.7 %		

Note**:** Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple

Table 4. shows that the difference in adding coconut dregs produces a significantly different fat content in "Wajik" at the level (α) 5%. The fat content increases with the increase in coconut dregs. It may be due to the use of coconut dregs as a raw material, which has a relatively high fat content, 27.89%, thus affecting the fat content of the Tajik produced. This study is in line with the study of [18], namely dry cakes with the addition of

coconut dregs flour where the fat content increases with the increase in coconut dregs flour.

3.2.3 Crude Fiber Content

Fiber is a part that cannot be hydrolyzed by chemicals (sulfuric acid and sodium hydroxide) [19]. Table 5 shows that the difference in adding coconut dregs is significantly different at the level (α) of 5% on the crude fiber content. The crude fiber content increases with the increasing concentration of coconut dregs. Crude fiber content in the raw material of roasted coconut dregs is relatively high, at 28.75%. According to [20], the main advantage of coconut dregs is the very high fiber content, which contains crude fibers such as cellulose and lignin. The results of this analysis align with the research of [21], namely the analysis of the crude fiber content of white bread increased with the increasing concentration of coconut dregs.

Table 5. The Crude Fiber Content

Treatment	% (Mean ± SD)
A (0%)	3.39 ± 0.79 a
B (1%)	4.40 ± 0.29 b
C (2%)	6.00 ± 0.70 c
D (3%)	6.42 ± 0.24 cd
E (4%)	7.06 ± 0.47 d
CV = 9.95 %	

Note**:** Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

3.2.4 Sucrose Content

The analysis of variance showed that adding coconut dregs produced significantly different sucrose levels at the (α) 5% level. (Table 6) The more coconut dregs added, the lower the " Wajik " sucrose content. The decrease in sucrose in "Wajik" is thought to be due to the increasing concentration of coconut dregs used, increasing the total weight of the ingredients so that the sucrose concentration in the ingredients decreases. According to the material balance principle, increasing one of the ingredients added to the mixture will reduce other components [22].

Table 6. The Sucrose Content

Treatment	(%) Mean ± SD
E (4%)	54.43 ± 0,65 a
D (3%)	54.60 ± 0.64 a
C(2%)	54.66 ± 1.23 a
B (1%)	56.55 ± 1.01 b
A (0%)	57.57 ± 0.88 b
CV = 1.63 %	

Note**:** Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

High sucrose levels can cause an increase in blood sugar. Palm sugar contains inulin fiber, which can slow down the rate of glucose digestion and ultimately control blood sugar [23]. white or granulated sugar contains sucrose without fiber. Palm sugar is expected to be a sweetener and preservative and can also control blood sugar.

Palm sugar, a natural sugar derived from the sap of the sugar palm or coconut tree, is primarily composed of sucrose. The sucrose content in palm sugar ranges from 80-85% while glucose and fructose make up 4-5% [24]. This composition allows palm sugar to provide a sweet taste that is almost identical to pure sucrose. Sucrose, a disaccharide, not only imparts a sweet taste to food but also influences the formation of texture and stability in "Wajik", making it an important ingredient in the production of this traditional snack.

3.2.5 Total Energy

The total energy of "Wajik" is obtained using the Atwater method, which converts the amount of protein, fat, and carbohydrates into energy. The variance analysis results show that adding coconut dregs has a significantly different effect at the level (α) of 5% on total energy (Table 7).

Table 7. The Energy of 100 g of "Wajik"

Treatment	(Kcal) Mean ± SD
A (0%)	320.61 ± 4.48
C (2%)	326.29 ± 2.94
B (1%)	328.35 ± 5.51
D (3%)	329.51 ± 5.23
E (4%)	333.28 ± 3.96
CV = 1.37 %	

The energy value increases with the addition of coconut dregs. The content of macronutrients in the ingredients, such as fat, protein, and carbohydrates, can influence the energy value. Energy value from carbohydrates is counted by reducing the total fiber contained in the ingredients. Fiber cannot be digested and absorbed by the digestive system, so it cannot contribute to total energy. Coconut dregs contain very high energy. According to [25], coconut dregs contain 515 kcal/100 g of ingredients. Coconut dregs contain pretty high fat. The fat content in coconut dregs can provide around nine Kcal/g; higher than carbohydrates and proteins, which only provide four Kcal/g.

The energy needs that must be consumed by each person vary depending on age, gender, weight, and health goals [26]. Low-calorie intake can be beneficial for diabetics.

3.3. Organoleptic of "Wajik"

3.3.1. The Preference on the Color

Color is a visual component observed by the human sense of sight toward the product. Color is one of the important factors found in food ingredients. Table 8 shows that adding coconut dregs affects the acceptance of the color of "Wajik" at a level of 5%. The color produced in this "Wajik" is dark brown to slightly faded brown (Figure 1).

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Figure 1. Wajik with the addition of coconut dregs

Table 8. The Preference on The Color

Treatment	Mean ± SD
E (4%)	3.48 ± 0.51 a
D (3%)	3.80 ± 0.41 b
B (1%)	3.88 ± 0.33 b
C (2%)	3.88 ± 0.33 b
A (0%)	3.92 ± 0.40 b
CV = 10.6 %	

Note**:**
Description: 1 = really don't like it; 2 = don't like; 3 = normal; 4 = like; 5 = really like it. Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

The resulting color is caused by a non-enzymatic browning reaction, namely caramelization, which causes the brown color in the "Wajik." The more coconut dregs added, the more the brown color produced will fade; that was caused by the coconut dregs absorbing palm sugar during mixing so that the resulting color fades slightly. Treatments A to D have the same acceptance.

3.3.2. The Preference on the Aroma

Aroma is a distinctive smell of a product that arises after going through a processing process. Aroma is one of the critical factors in the level of consumer acceptance when determining the deliciousness of a food ingredient.

Table 9. shows that adding coconut dregs has a significant effect of 5% on the level of preference for the aroma of the "Wajik" produced. The aroma formed is due to the addition of roasted coconut dregs. This increase in the aroma is due to the Maillard reaction that occurs during the cooking of Tajik. The Maillard reaction is a reaction between reducing sugars and amino acids, which will produce melanoidin compounds. This compound later forms the aroma.

Along with the increasing percentage of coconut dregs, the protein produced also increases. Protein contains amino acids, so the possibility of a Maillard reaction will also increase, which causes the aroma produced to be stronger. Coconut milk contains nonylmethylketone compounds, and processing using high temperatures will produce volatile properties and a pleasant smell [27]. The higher the fiber in food ingredients, the more pungent the aroma produced. This aligns with [28], which states that the more coconut dregs added, the stronger the aroma is produced.

Table 9. The Preference on The Aroma

Treatment	Mean ± SD
A (0%)	3.48 ± 0.51 a
B (1%)	3.56 ± 0.51 a
C (2%)	3.72 ± 0.46 ab
D (3%)	3.84 ± 0.37 b
E (4%)	3.88 ± 0.33 b
CV = 10.17 %	

Note**:**
Description: 1 = really don't like it; 2 = don't like; 3 = normal; 4 = like; 5 = really like it. Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

3.3.3. The Preference on The Taste

Taste is a significant factor in determining the final decision of consumers to accept or reject a food product. Table 10. shows that adding coconut dregs affects taste acceptance at a level of 5%. According to [16], high-fat content will increase the savory taste of the product. The more coconut pulp added, the savorier the "Wajik" produced. However, along with the increasing concentration of coconut dregs, it can provide an uncomfortable aftertaste in the throat, so panellists prefer products still acceptable in the mouth.

Table 10. The Preference on The Taste

Treatment	Mean ± SD
E (4%)	3.32 ± 0.48 a
D (3%)	3.60 ± 0.65 ab
B (1%)	3.64 ± 0.57 b
A (0%)	3.68 ± 0.48 b
C (2%)	3.80 ± 0.41 b
CV = 10,9%	

Note**:**
Description: 1 = really don't like it; 2 = don't like; 3 = normal; 4 = like; 5 = really like it. Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

3.3.4. The Preference on The Texture

Texture is an attribute used to assess the quality of a food ingredient. Texture related to the taste when chewing the product [11]. Table 11 shows the effect of adding coconut dregs on the acceptance of the diamond texture, where the more coconut dregs are added, the higher the level of acceptance of the texture, up to treatment D, and then it drops again. Adding too much coconut dregs will result in the resulting texture being less dense or easily crushed. According to [29], water content can affect the texture of a food; the lower the water content of a food, the more complex and rougher the texture will be, and vice versa, the higher the water content, the softer and softer the resulting texture will be.

Table 11. The Preference of Texture

Treatment	Mean ± SD
E (4%)	3.48 ± 0.51 a
D (3%)	3.64 ± 0.57 ab
C (2%)	3.80 ± 0.41 bc
B (1%)	3.80 ± 0.41 bc
A (0%)	3.96 ± 0.35 c
CV = 11.13%	

Note**:**

Description: 1 = really don't like it; 2 = don't like; 3 = normal; 4 = like; 5 = really like it. Numbers in the same column followed by different lowercase letters, show significant differences at the 5% Duncan's New Multiple Range Test (DNMRT) level.

4. CONCLUSION

Based on the research that has been done, it can be concluded that the difference in the addition of coconut dregs has a significant effect on chemical properties such as fat content, fiber, sucrose, and organoleptic analysis of color, aroma, taste, texture and has no significant effect on ash content and total energy. The best treatment of "Wajik" with coconut dregs is treatment D (addition of 3% coconut dregs) with the characteristics of an average ash content (0.78%), fat (14.31%), crude fiber (6.42%), sucrose (54.60%), Total energy (329.51 kcal), and organoleptic acceptance values for color 3.80 (like), aroma 3.84 (like), taste 3.60 (like), and texture 3.80 (like). Based on the research that has been conducted, it is suggested that researchers conduct further tests on the analysis of the glycemic index, starch digestibility, and shelf life of "Wajik".

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