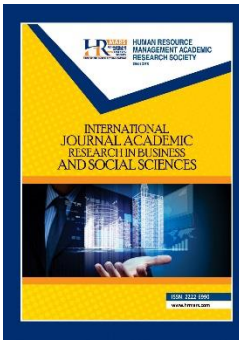
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Utilization of Plantain Peel Flour (Musa Paradisiaca L. AAB) in the Making of Dadar Gulung Skin (Kuih Ketayap)

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Abstract
This research aims to investigate the agro-industry by-product, which is plantain peel flour (Musa Paradisiaca L. AAB) to be used as a substitute for wheat flour in the making of "Dadar Gulung" skin or also known as "Kuih Ketayap." This research used the experimental method with a quantitative approach, where the results of the observation were analyzed for the likeliness and differences. Quantitative data is calculated using ANOVA test and post-hoc test (LSD and DMRT). In addition, the sensory analysis was done by five expert panelists. The results showed that the best formula is to substitute 20% of wheat flour with plantain peel flour where the appearance (except color which is one of the aspects in appearance), flavor and texture has the most likeliness to control. Therefore, this study suggested the substitution of wheat flour with a maximum of 20% plantain peels flour in the making of "Dadar Gulung" skin. TFor recommendation, advanced research should be conducted to investigate the quality of "Dadar Gulung" as a whole which has included its filling in consumer's perceptions.
Keywords: Food Experiment, Culinary Product, Plantain Peel Flour, Dadar Gulung Skin, Kuih Ketayap

Introduction

There were 1.9 million tons of banana produced in Indonesia in 1980. This number has increased to 7.3 million tons in 2015 (Pusdatin Kementrian Pertanian, 2016). Meanwhile, the production of banana itself has reached 114 million tons worldwide in 2016. Indonesia is the seventh banana producing country in the world. Nevertheless, the condition of its climate and fertile soil suitable to produce an even larger number of banana. Banana consumption is also increasing each year rapidly. It means that a million tons of banana peels are also being produced. Banana peels have maintained its role as a waste for a very long time. However, recently several researchers attracted to this agro-industry by product and did researches to increase its economic value. There are two types of banana specifically desserts bananas and cooking bananas (Lixandru, 2018). Desserts bananas known as Cavendish is a type of banana, which can be eaten at the ripe stage while cooking bananas or known

as plantain, is a banana, that often cooks to be consumed. Plantain develops and often found in Latin America, Africa or Caribbean culinary.

Furthermore, unlike Cavendish which tastes sweet and soft; plantain is dense, solid and starchy. Therefore plantains often cooked before it is consumed because it contains more starch than a sweet compound. Ripeness stages of Cavendish start with green color when it is unripe and then golden yellowish when it is ripe and has black spotted when it is overripe. The best stage to consume Cavendish is at the mature stage where starch has been converted into sugar. This conversion stage is the reason Cavendish is sweeter than plantain.

On the other hand, plantain is best cooked when it is unripe; because at this stage, the highest percentage of starch is contained. Plantain is green when it is immature, then turn into yellow when it is ripe and then has an overall black peel when it is overripe. However, in Indonesia, there are additional types of banana, which can either consume directly or cook, known as dual-purpose bananas. The examples of desserts bananas are pisang ambon lumut and pisang raja sereh. And the examples of plantain are pisang tanduk dan Pisang raja bulu (Paradisiaca, AAB).

Moreover, some researchers found that plantain peel flour contains nutritional benefits, which is functional as additional ingredients for human food (Ramli et al., 2010; Nasution et al., 2012; Akmal et al., 2015). Plantain peel flour, which is obtained from oven drying, contained 14.08% crude fiber, 16.02% carbohydrate, 57.62% protein and 11.5% fat (Akmal et al., 2015). Furthermore, it also contains essential amino acids, unsaturated fatty acids, phenolic, potassium and calcium (Vu et al., 2017). These nutrient compounds and its benefit often related to several common diseases such as cardiovascular disease, cancer, diabetes, obesity, and stress. Plantain peels account for one-third of its total weight. Therefore, with a high content of starch and carbohydrate plantain peel flour consider as a partial substitute or additional ingredient in human food production, and to increase its nutritional value.

Meanwhile, Dadar gulung is a traditional food similar to rolled crepes filled with sweet grated coconut filling (enten) widely known from Java, Indonesia. Although the origin of the food itself is difficult to be determined because some similar foods are also found in other regions (such as East Borneo (Kutai) by the name of Jajak Dadar and Malaysia by the name of Kuih Ketayap.) In the modern culinary world, Dadar gulung allied with crepes and pancakes are categorized as griddlecakes, which has round shape, extremely thin (crepes) and may be consumed as sweet or savory dishes (Labensky, 2016). It is made from batter and cooked over flat pan (griddle pan) with high heat (Rinsky & Rinsky, 2009). Moreover, there is no specific provision to serve Dadar gulung. Dadar gulung is a snack, which contains a high amount of moisture (damp snack) and survives until today. It is found easily and prone to be consumed at any time; as it is a snack, but not a dessert or specific meal. Dadar gulung skin is made from a mixture of wheat flour, tapioca flour and coconut milk with a strong pandan flavor, has as pea green color from juice of blended suji leaves, filled with enten resulting in a savory and sweet taste.

The skin of Dadar gulung should be elastic, not easily torn and hardened. The main reason this research initiated was that of the characteristics of the banana. Banana has starch substance, better nutrient, easily available, and reasonable price. This study emphasized on the banana skin as the primary objective to prevent bias, especially on taste and flavor aspects.

Literature Review

Dadar Gulung

Dadar gulung consists of two main parts, namely skin, and filling. Dadar gulung skin is made from wheat flour, tapioca flour, coconut milk, eggs, salt, suji leaves, pandan, and vanilla. Meanwhile, for the filling, it is a mixture of grated coconut and sugar or palm sugar. This ingredient is cooked together until the coconut dries. To obtain elasticity of Dadar gulung skin and soft structure, the type of flour used is wheat flour with medium protein content. This type of flour is selected because of the higher protein content that will give hard and tough Dadar gulung skin. With lower protein content the skin will be tendered and easily breaks when it is rolled and folded. To prevent this from happening, tapioca flour serves as the glue to create a stable mixture and improve the elasticity of the skin.

Plantain Peel Flour

Banana peel waste is one of the growing research in agro-industry (Carvalho & Conti-Silva, 2017). The amount of banana peel covers 1/3 of the weight of the fruit and is mostly disposed of as a waste that has no economic value, while this waste can be used as flour as a substitute for wheat flour in the manufacture of food

Indonesia is one of the largest banana producers with up to 6 million tons of production per year (Ahmad, 2017). Of these, 90% is consumed for domestic needs, and the rest is exported to various countries. Indonesia itself has 300 types of bananas (Rhin-B, 2015) where banana raja bulu belong to the superior varieties of bananas in Indonesia. Banana raja bulu is also known as Banana Raja (King), Banana Raja Maenten superior with its yellow and fat flesh, not easily rotten, sweet and not easily detach from the stem comb. This banana has the Latin name Musa Paradisiaca (L. AAB), having a curved and seedless fruit with thick yellow skin. Each comb consists of 14-16 bananas with an average weight of 110-120 grams (Rhin-B, 2015).

Bananas Raja Bulu has a low glycemic index of 54%; this figure is lower than the usual sugar consumed. Therefore this type of banana can be consumed by people with diabetes. It is also useful to reduce stress levels and overcome fatigue because it contains serotonin (Rhin- B, 2015). With the abundant amount of consumption and the potential to increase banana raja bulu production, then, waste generated by the plantains will also be abundant.

Based on research conducted by Akmal, et al. (2015), oven-dried plantain peel flour has 14.08% water content, 16.02% crude fiber content, 57.62% carbohydrate, 5.14% protein, and 11.5% fat. Plantain peel flour is obtained by chopping the banana peel into a small, then soaked with sodium metabisulphite with 0.1% or 1 gr / ltr (Naning, 2012) solution for one hour to prevent the oxidation process on the skin so that the plantain skin will turn less brown, then dried by drying method using an oven with a temperature of 60^{o}C for approximately 12 hours. After it reaches approximately 14%

of moisture content, it is then milled or crushed using a hammer mill or collision before sieving. The oven drying was chosen to avoid any contamination to comply with Indonesian National Standard 3741:2009 on bacterial contamination of wheat flour which should not exceed 1 million colonies/gram for safety consumption (Akmal et al., 2015). The resulting flour is stored in airtight jar or container, stored within room temperature and not exposed to sunlight to avoid any flavor and aroma changes.

With the high content of carbohydrates, the plantain peel flour can be used as an alternative in addition to daily energy needs. Characteristic of plantain peel flour are a brownish color, has a banana scent, slightly tasteless flavor, but it creates a sense of wholeness after it is swallowed. It also has a soft texture like flour, although it also depends on the size of the strainer. The use of plantain peel as flour is chosen because plantain peel has high starch, this starch substance may contribute to the formation of structure in food.

Plantain peel flour has been used in the manufacture of some food products, to replace some if not all of the wheat flour or rice flour as in the manufacture of cookies or pastries, donuts, and noodles. Plantain peel flour also contains vitamin C, B, calcium, protein and also fat so it can increase the nutritional value of food produced. Plantain peel has to be in three-quarters full with fruit ripeness of 75-80% to get a high starch content. If it is too ripe, then banana peel will be too soft resulted in high acid and tannin levels so it will taste bitter and has a sense of sap (Twaesti, 2013). However, there are now available ready-made plantain peels flour because the production of the flour itself takes a long time.

Appearance, Flavor, and Texture

Characteristics of food products are largely accepted based on how our eyes are seeing the objects and sense of smell. To assess the aspect of appearance, we can use more holistic view by using the concept of the overall appearance that includes color, darkness, size, shape and visible texture. Furthermore, flavor or this characteristic is a combination of taste and aroma. It is also affected by vision. Then, there are three components of flavor composers, namely basic taste such as sweet, salty, sour, bitter and umami. The tongue and the entire space in the mouth receive this aspect.

Moreover is aroma, which is the most important, because for food most of the flavor comes from the aroma. And the last component is the trigeminal effect. It is the sensation given after the food goes through the oral cavity such as menthol sensation of mint leaves, spicy flavor from pepper (Figoni, 2011). Meanwhile, movement and touch influence texture. The most important way of evaluating texture is to touch the food and record what the skin feels, then how the food products react when in contact with the heat in the mouth and how the response of the food when squeezed, chewed, or other treatments related with the structure of the food itself.

Research Methodology

This study uses experimental methods where a special treatment was given to the experimental group by looking for its influence and compare it with the control group (Sugiyono, 2013). In this study, the authors used a significance test to examine whether the given treatment gives a significant

difference. The author conducted self-observation and then translated in the form of ordinal data that is the data in the form of rank or levels (Irwan & Siti, 2015). The rank or levels are in the form of numbers with different descriptions for each number depending on the characteristics assessed. There are five treatments (substitution of P1-20%, P2-40%, P3-60%, P4-80% and P5-100%) with five times repetitions for each treatment. Ordinal data is then converted into interval data that with the same distance but has 0 value (zero) absolute (Irwan & Siti 2015) through an application system called MSI (Method of Successive Interval). Then, the data that has been transformed into interval data is processed using ANOVA (F-test) on the SPSS system, to examine if there are any differences resulted from all treatments. Then advanced statistical analysis or post-hoc analyses are being conducted in particular DMRT and LSD; to determine which treatment experienced similarities and differences. Furthermore, the product is compared with the control product and assessed by expert panelists to perform the organoleptic or sensory analysis. Hence, collected data from researcher and expert panelist are combined before a conclusion can be made.

Results

Based on the observations, it is known that P1 (20% substitution of plantain peel flour) is the most resembles P_0 (control). This result is considered a threshold in the replacement of wheat flour with plantain peel flour that gives the best organoleptic properties from the aspects of appearance, flavor, and texture. It can be evident in the LSD test that no significant difference in results from treatment P_1 compared to P_0, as well as the Duncan test results where P_1 is within the same group with P_0 on flavor and texture aspects. It also shares different group or subset only on the aspect of appearance (especially color). Thus P_1 is the best sample to be followed with the sensory analysis given to expert panelists.

Moreover, the appearance of P_1(20%) has a different subset with P_0 (control) which is caused by plantain peel flour basic color. The difference happened due to the high ash content of the banana peel flour. Therefore, with the addition of pandan paste, the mixture of green and brown color yields, the color of P_1 similar to green moss. The visible black spots appear on the layer of the skin caused by the size of the particles of banana peel flour. Furthermore, to obtain porous skin of Dadar gulung, the consistency of the batter should not be too thick. Therefore, batter needed to be adjusted with the addition of water. The reason for this particular matter is because the excessive amount of banana peel flour crude fiber resulted in the high ability of water absorption, and then swelled, hence increasing the viscosity of batter. However, when the batter was being contacted with the heat from frying pan, the water contained easily evaporated, thus required a proper cooking technique to create proportional rounded shape.

Moreover, the existence of 80% wheat flour admits the skin to look soft and moist due to the gluten content. P_1 skin looks shinier than P_0 aside from the color contrast which is produced by P_0 compare to pea green color produced by P_0. It is also due to the ability of plantain peel flour retention of oil. Therefore, after it is cooked, some oil looks logged in some parts of large pores. However, the characteristics of inner and outer part of the skin are moist, soft and shiny with large porous resembles P_0. The five expert panelists also confirm that regarding shape proportions, the

appearance of moisture and softness of skin and flashes or reflections of light resemble P_0, only colors that look less attractive.

Afterward, flavor examined included taste, aroma and trigeminal effect. No flavor aroused when P_1 skin touched the tongue, as well when it was chewed, the flavor of plantain peel flour is very subtle. However, it produced trigeminal effect described as a blend of banana flavor and coconut milk. Although banana plantain peel flour tastes bland, nevertheless, after it is mixed with coconut milk and cooked, the blended taste appeared because of cooked starch contained in plantain peel flour. Meanwhile, the resulting aroma has uniqueness where it is described as a blend of banana, coconut milk and pandan scent, tastier than P_0. Two out of five panelists say that the resulting aroma is similar to the vanilla aroma in contrast to the aroma produced by the P_0's skin where pandan scent is dominant. Three of them say that the aroma is tempting, which is better than the aroma produced by P_0 skin.

But regarding the trigeminal effect, three of the five panelists feel a little bit rough. Resulted from uneven maturity level of plantains, some plantains have exceeded the level of 75%, shown with visibility of plantain peel color. The plantain peel turned black in some parts of the skin. The rough feel derived from the sap that occurs from plantain peels during the drying process is carried out and fused into the resulting flour. However, the feeling is not too subtle and is expected to disappear when Dadar gulung skins are given enten or filling.

The P_1 skin texture feels soft, moist and elastic when touched. It is because the availability of gluten content in the dough obtained from wheat flour is more dominant than plantain peels starch. Moreover, large and oily pores occurred because of banana peel flour can repel the frying oil retention, with less use of oils in the frying pan, may reduce the clogged oil. The slightly gritty texture tastes when the skin is chewed, this is also due to the size of the banana peel particles that are still too large. However, all expert panelists argued that when skin is given enten or filling, this sandy texture will be disguised. In addition, the resulting elasticity of P_1 creates skins structure which resembles the skin of P_0 hence the process of rolling and folding is easy and difficult to torn. Nevertheless, the presence of coarse fiber from plantain peel flour reduce the strength of skin structure, whereby when P1 skin is pressed after folding, the skin has a slight tear. Subsequently, the high ash content of plantain peel flour also reduces the stability level of the skin. However, expert panelists argued that it would not have too much impact on the quality of the resulting rolled Dadar gulung because enten or filling will strengthen the foundation of the inner-skin rolls.

Conclusion

The use of banana peel flour as a substitution of wheat flour in the making of Dadar gulung skin gained the best results with a substitution of 20% (P_1). Therefore, this percentage is believed to be a threshold in utilizing banana peel flour as wheat flour substitution in the making of Dadar gulung skin based on results of analysis on appearance, flavor, and texture. Hence, banana peel flour could not be used as 100% wheat flour substitution because several functions of wheat flour are lacked in banana peel flour. Then, further research is needed on the aspect of flavor when Dadar gulung skin is given enten or filling to examine whether the resulting sense of wholeness still exists. Future study

can also examine the distinctive aroma and savory flavor that can improve the quality of flavor from Dadar gulung as a whole. Further research on Dadar gulung shelf life made from plantain peel flour will provide necessary information about the durability of the resulting product.

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