Correlation of concentration of modified cassava flour for banana fritter flour using simple linear regression

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Abstract. The purpose of this study was to determine the correlation of different concentrations of modified cassava flour that was processed for banana fritter flour. The research method consists of two stages: (1) to determine the different types of flour: cassava flour, modified cassava flour-A (using the method of the lactid acid bacteria), and modified cassava flour-B (using the method of the autoclaving cooling cycle), then conducted on organoleptic test and physicochemical analysis; (2) to determine the correlation of concentration of modified cassava flour for banana fritter flour, by design was used simple linear regression. The factors were used different concentrations of modified cassava flour-B (y1) 40%, (y2) 50%, and (y3) 60%. The response in the study includes physical analysis (whiteness of flour, water holding capacity-WHC, oil holding capacity-OHC), chemical analysis (moisture content, ash content, crude fiber content, starch content), and organoleptic (color, aroma, taste, texture). The results showed that the type of flour selected from the organoleptic test was modified cassava flour-B. Analysis results of modified cassava flour-B component containing whiteness of flour 60.42%; WHC 41.17%; OHC 21.15%; moisture content 4.4%; ash content 1.75%; crude fiber content 1.86%; starch content 67.31%. The different concentrations of modified cassava flour-B with the results of the analysis provides correlation to the whiteness of flour, WHC, OHC, moisture content, ash content, crude fiber content, and starch content. The different concentrations of modified cassava flour-B does not affect the color, aroma, taste, and texture.

Keywords—banana fritter flour; concentration; modified cassava flour.

1. Introduction

Indonesia is one of the tropical countries. The country of Indonesia has abundant natural wealth, especially on local food crops of tubers. One of the most recognized tuber crops is cassava. Utilization of cassava is still very limited. Therefore, a series of studies are required to increase the potential of cassava as an alternative food source of carbohydrate tubers that are in demand by the community.

Program and activity of agricultural development of food crops in West Java Province in 2015-2019 is “Pajale” is one program that aims to develop cultivation of crops, one of which is cassava. Development sites will be conducted in several areas such as in Bandung, Bogor, Cianjur, Subang, Sukabumi, Sumedang, and Tasikmalaya.

Subang regency produces superior varieties of cassava. One of them is in Gandasoli Village, Tanjung Siang District. This region is one of the potential areas of cassava producers, and one of the most sought after varieties is manggu. The average of Tanjung Siang-Subang district's produce reaches 114.400 quintals per year [1].

Utilization of cassava into flour can increase the economic value of cassava. Cassava flour can be processed into a variety of processed food products one of them as a mixture of coated flour or seasoned flour for fried products. The National Standarization Agency defines seasoned flour as a food ingredient in the form of a mixture of flour and spices with or without the addition of other foodstuffs and allowable food additives [2].

The modified starch is a particular treated flour to provide better properties for improving the prior nature, particularly its physicochemical and functional properties or to alter some other properties [3]. The food industry has now begun to utilize the use of modified flour as a food aid for certain food products. The addition of modified flour to food products can enhance the superiority of the quality of food products. The advantage of modified flour that can make the product more crispy, better in terms of mouthfeel, color and flavor when compared with traditional ingredient products such as insoluble fiber [4].

The purpose of this research is to know the different types of processed cassava flour (cassava flour, modified cassava flour-A, and modified cassava flour-B) and the exact modified cassava flour of concentration against banana fritter flour which are expected to have color, aroma, taste, and texture favored by consumers.

2. Research methods

2.1. Materials, chemicals, and tools

The study is conducted at the Laboratory of Post-Harvest Development, Center for Appropriate Technology Development, Indonesian Institute of Sciences, Subang. The materials used in this study are cassava flour, modified cassava flour-A (using the method of the lactid acid bacteria), and modified cassava flour-B (using the method of the autoclaving cooling cycle), derived from cassava Manggu variety with harvesting age of 9 months, obtained from cassava farmer in the village district of Gandasoli, Tanjung Siang, Subang district. Supporting ingredients include: sago flour, corn starch, sugar, salt, baking soda, gum arabic, vanilla, kepok banana, and coconut oil. The chemicals used for chemical analysis are 1.25% H_2SO_4, 3.25% NaOH, 95% ethanol, distilled water, Luff Schoorl's Solution, HCl 9.5 N, concentrated HCl, universal pH indicator, H_2SO_4 6 N, KI, $Na_2S_2O_3$, and starch.

The tools used in the processing of banana fritter flour are a digital balance, slicer, cabinet dryer, vibrator screen, plastic packaging, frying pan, and spoon. The tools used for physicochemical analysis include: cup, spatula, digital balance sheet, eksikator, tang krus, oven, furnace, filter paper, funnel, erlenmeyer 500 mL, stirring rod, bath, porcelain cup, centrifuge tube, centrifuge, Kett Electric Laboratory C-100-3 Whitenessmeter, burette, 500 mL dilution flask, clamp, stative, dropper, stirer, and measuring pipette.

2.2. Formulation of banana fritter flour

Preliminary research is the determination of the types of flour (50% cassava flour, 50% modified cassava flour-A, and 50% modified cassava flour-B), other ingredients (20% sago flour, 15% corn starch, 10% sugar, 1.2% salt, 0.7% baking soda, 0.9% gum arabic, and 2.2% vanilla). Selected flour is done by organoleptic test, then the selected flour is analyzed to whiteness of flour, WHC, OHC, moisture content, ash content, crude fiber content, and starch content [5].

The process of making for banana fritter flour through the stages: weighing the material according to the formulation (50 g types of flour, 20 g sago flour, 15 g corn starch, 10 g sugar, 1.2 g salt, 0.7 g baking soda, 0.9 g gum arabic, 2.2 g vanilla), mixing ingredients, applying to fried bananas, mixing with water, banana coating, frying, and incision.

Main research is the determination of different concentrations of the selected flour to be used as banana fritter flour. Then performed the analysis of WHC, OHC, whiteness of flour, moisture content, ash content, crude fiber content, starch content [5], and organoleptic test [6] applied to banana fritter flour.

The process of making for banana fritter flour through the stages: weighing the material according to the formulation (selected flour 40%; 50%; 60%), sago flour 20%, corn starch 15%, sugar 10%, salt 1.2%, baking soda 0.7%, gum arabic 0.9%, vanilla 2.2%), mixing of ingredients, applying to fried bananas, mixing with water, banana coating, frying, and incision.

2.3. Treatment and data analysis

The treatment design used consisted of two variables, those are the independent variable and the dependent variable. The independent variable (X) of this experiment consisted of flour concentration with three levels: (X_1) 40%, (X_2) 50%, and (X_3) 60%. The dependent variable (Y) of this experiment consisted of seven treatment methods (Y_1) WHC, (Y_2) OHC, (Y_3) whiteness of flour, (Y_4) moisture content, (Y_5) ash content, (Y_6) crude fiber content, and (Y_7) starch content.

The research design model used is simple linear regression with two variables measured, ie selected flour concentration to: WHC, OHC, whiteness of flour, moisture content, ash content, crude fiber content, and starch content. Furthermore each data obtained results plotted to the curve, then performed a simple linear regression analysis to determine the relationship between variables measured by processing methods, the equation is: $Y = a + bX$

Y = Concentration of selected flour
a = Constants
b = Regression coefficient (increase if positive value or decrease if negative value)
X = Measured variable (WHC, OHC, whiteness of flour, moisture content, ash content, crude fiber content, and starch content).

Physical responses include: water holding capacity (WHC), oil holding capacity (OHC), and whiteness of flour. Chemical responses include: moisture content, ash content, crude fiber content, and starch content. Organoleptic response using hedonic method [6]. Assessment is given to the color, aroma, taste, and crisp texture of 30 somewhat trained panelists. Quantitative qualitative data obtained are performed using numerical scales: (1) strongly dislikes, (2) somewhat dislikes, (3) dislikes, (4) rather likes, (5) likes, (6) very likes.

3. Results and discussion

3.1. Preliminary research result on organoleptic response

Banana fritter flour is made from different types of flour but uses the same concentration, then organoleptic testing on color, aroma, taste, and texture. Results on organoleptic response from the panelists were presented in Table 1.

Table 1. Results on organoleptic response

Sample	Organoleptic response			
	Color	Aroma	Taste	Texture
1. Cassava flour (50%)	4.39	4.95	4.28	4.30
2. Modified cassava flour-A (50%)	4.34	5.09	4.92	5.05
3. Modified cassava flour-B (50%)	4.76	5.22	4.98	5.19

The result of the test of the color of banana fritter flour get a high value of 4.76 from sample modified cassava flour-B, with the response from the panelist stated rather like. The color produced from the banana fritter flour as a coating is influenced by the banana color used, resulting in a non enzymatic browning reaction with maillard reaction. When aldose /ketose is exposed to heat and reacts with the amino group, there is the production of various components such as flavour and dark-colored polymers [7]. According to [8], the reaction of carbohydrates, especially reducing sugar with the primary amino group, produces a brown material, for example in the process of frying banana fritter flour.

The result of organoleptic tests on the aroma of banana fritter flour showed a high value of 5.22 from sample modified cassava flour-B, with a response from the panelists states like. The aroma contained in the banana fritter flour is affected by the distinctive aroma of vanilla addition. Aroma of food is caused by the formation of volatile compounds [9] from vanilla.

The result of organoleptic test on banana fritter flour taste showed a high value 4.98 from sample modified cassava flour-B, with criterion of response from panelist states rather like. The taste found in banana fritter flour is influenced by the addition of sugar, which provides a savory taste and the use of oil in the frying process. The taste is influenced by aromas, foodstuffs, crispness, and food maturity levels [9].

The result of organoleptic test on banana fritter flour texture shows a value of 5.19 from sample modified cassava flour-B, with criteria of response from panelists express likes. Crispy texture on bananas fritter flour is influenced by the addition of corn starch, so banana fritter flour tend to be more crunchy and easily broken when bitten. In line with the results of research [10] that in the process of making wet noodles by using modified cassava flour, need the addition of corn flour to get a good noodle texture.

The result of organoleptic testing showed that the selected type of flour is modified cassava flour-B (using the method of the autoclaving cooling cycle), the results of physicochemical analysis of modified cassava flour-B are presented in Table 2 below.

Table 2. The results of physicochemical analysis of modified cassava flour-B

Parameter	Analysis results	SNI No. 01-2997-1992 for cassava flour	Explanation
Whiteness of flour	60.42%	Min 85%	Not yet
Water Holding Capacity	41.17%	-	-
Oil Holding Capacity	21.15%	-	-
Moisture content	4.40%	Max 12%	Fulfill
Ash content	1.75%	Max 1.5%	Not yet
Crude fiber content	1.90%	Max 1.5%	Not yet
Starch content	68.56%	Min 75%	Not yet

The result of the analysis of modified cassava flour-B refers to Indonesian National Standard (SNI) No. 01-2997-1992 [11] for cassava flour. Moisture content of modified cassava flour-B already meets SNI, but for whiteness of flour, ash content, crude fiber content, and starch content have not fulfilled Indonesian National Standard.

3.2. Main research results against physicochemical response of banana fritter flour

The results of physicochemical analysis of different concentrations of modified cassava flour-B to be used as banana fritter flour are presented in Table 3 below.

Table 3. Results of physicochemical analysis of banana fritter flour

Parameter	Concentration of modified cassava flour-B (%)		
	40%	50%	60%
Water Holding Capacity	22.06	25.47	31.20
Oil Holding Capacity	18.05	17.39	16.33
Whiteness of flour	84.80	81.60	76.10
Moisture content	9.46	8.41	7.98
Ash content	2.75	2.52	1.86
Crude fiber content	1.66	2.14	2.61
Starch content	66.40	67.36	70.37

3.2.1. Water holding capacity. WHC is used to measure the ability of flour to retain water absorbed, the WHC value is influenced by the water content in the food. Water added to flour for doughs of coating, will affect physical properties and processing. The absorption of water in flour is also influenced by the size and structure of the starch granules, wherein the smaller starch granules will increase solubility and increase water absorption [12]. An increase in WHC value in the use of more concentration of flour (60%), because with the increasing use of modified cassava flour, the moisture content of banana fritter flour will be lower, causing the flour to absorb more water so that the water holding capacity also higher.

The ability of flour to absorb and retain water is not only influenced by the moisture content in the ingredients, it is also influenced by several factors, those are the amylose content, the size of the starch granules, and the fat content of the ingredients. Water absorbed in starch molecules is caused by the physical properties of the granules as well as intramolecularly bound [13].

The result of linear regression analysis shows the correlation of the difference of flour concentration to WHC from banana fritter flour, which can be seen in Figure 1. The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, Y = 3.41+(0.45x) with correction coefficient (r) is 0.9894. This shows that between different concentrations of flour and WHC on banana fritter flour have a very strong correlation, so the increase of flour concentration from banana fritter flour affects the WHC produced, because if the correlation coefficient value of 0.8 - 1 indicates very strong correlation.

Perfect linear relationship with positive slope, this is indicated by a positive slope of 0.9894 means that the higher the concentration of flour the higher the value of WHC produced.The result of the 40% flour concentration analysis method resulted in lower average WHC compared with a 60% concentration resulting in a high WHC average.

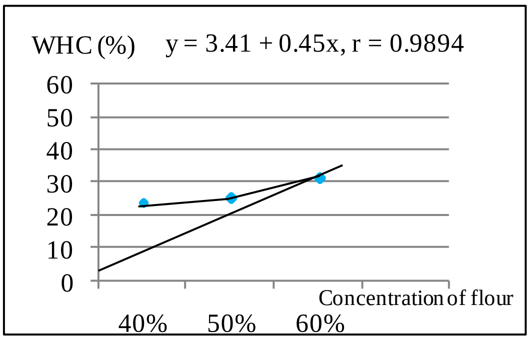

Figure 1. Graph of linear regression method of treatment of water holding capacity

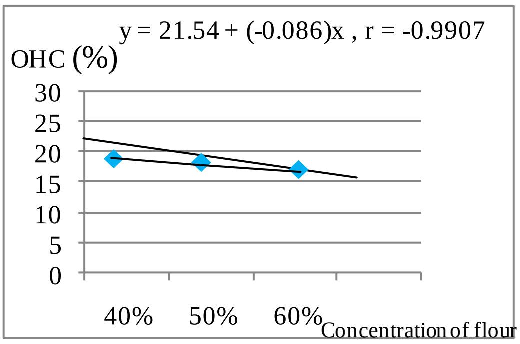

Figure 2. Graph of linear regression method of treatment of oil holding capacity

3.2.2. Oil holding capacity. OHC is used to measure the ability of flour to retain the oil it absorbs. This ability is determined by the presence of fat and fiber content. Fat can form a layer that is hydrophobic on the surface of the fiber network while the fiber has the ability to absorb oil. The low fat content in the flour will make the flour absorb more oil from the outside. High fiber content in flour will make the flour has the ability to absorb and retain more oil.

Oil holding capacity is due to oil trapped in a porous starch matrix or in the structure of the amylose helix or amylopectin due to the formation of the amylose-lipid complex. The changes of hydrophobic groups are more amyloid-lipid complex due to high temperature [14]. The decline in OHC value in the use of more concentration of flour (60%), this occurs because the ability of banana fritter flour to absorb and retain oil is affected by the frying process. Flour that has a greater OHC value will absorb more oil and hold the oil used for frying, this causes the cooking oil used quickly run out.

The result of linear regression analysis showed the correlation of different concentration of flour to OHC from banana fritter flour, which can be seen in Figure 2. The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, Y = 21.54+(-0.086x) with correction coefficient (r) is 0.9907. This shows that between different concentrations of flour with OHC on banana fritter flour has a very strong correlation, so the decrease of flour concentration from banana fritter flour has an effect on the resulting OHC, because if the correlation coefficient value of 0.8 - 1 indicates very strong correlation .

The perfect linear relationship with slope is indicated by a negative slope (-0.9907), meaning that the higher the flour concentration, the lower the resulting OHC value. The results of the 60% flour concentration analysis method resulted in lower average OHC value compared with 40% concentration resulting in a high average OHC. According to [15 and 16] the ability to absorb high oils on flour shows the flour has a part that is lipophilic.

3.2.3. Whiteness of banana fritter flour. The whiteness of flour is strongly influenced by the process of starch extraction, the more pure starch extraction process then the resulting flour will be white [17]. The white density of modified cassava flour as raw material is 60.42%, after going through the formulation process with the supporting material to become banana fritter flour has increased the whiteness of flour, which can be seen in Table 3.

The result of linear regression analysis shows the correlation of the difference of flour concentration to the whiteness of banana fritter flour, which can be seen in Figure 3. The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, is Y = 102.5833-(-0.043x) with correction coefficient (r) is 0.9885. This shows that between different flour concentration and whiteness on banana fritter flour have a very strong correlation, so that the concentration of flour from the banana fritter flour affects the degree of white produced, because if the correlation coefficient value of 0.8 - 1 indicates correlation very strong.

The perfect linear relationship with slope is indicated by a negative slope of -0.9885 meaning that the higher the flour concentration the lower the whiteness of the resulting flour. The result of the 60% flour concentration analysis method yields a low average whiteness of flour value compared to the 40% concentration resulting in a high average white degree. This is influenced by the addition of sago flour with 89.9% white grade, on banana fritter flour formulation, the higher concentration of modified cassava flour (60%), less concentration of sago flour, compared to modified cassava flour concentration (40%), then the concentration of sago flour more.

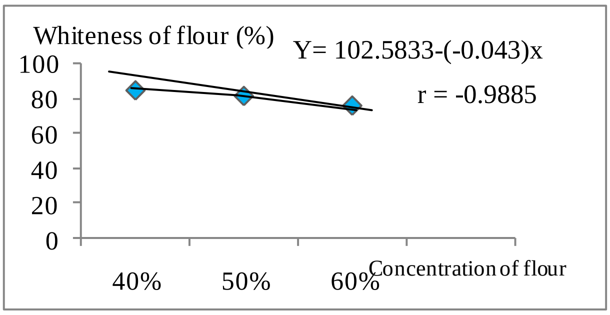

Figure 3. Graph of linear regression method of treatment of whiteness of flour

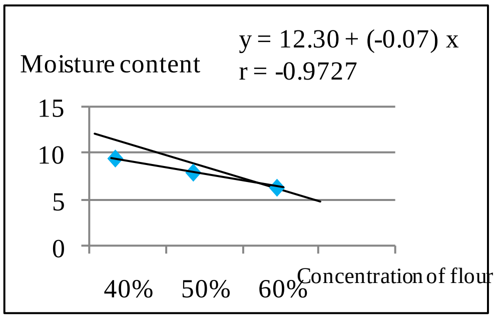

Figure 4. Graph of linear regression method of treatment of moisture content

3.2.4. Moisture content. Water is a major component of food, which plays an important role in determining the various reactions and quality of food. The moisture content in food is related to food damage by microorganisms [18]. High moisture content in flour product will greatly disrupt the stability of the product, which may result in flour agglomeration during storage [19]. The decrease in banana fritter flour moisture content in the use of more flour concentration (60%), due to the influence of moisture content of modified cassava flour (4.4%) added to the formulation. The increasing concentration of modified cassava flour used, the lower the resulting moisture content. The result of linear regression analysis shows the correlation of flour concentration to moisture content of banana fritter flour, which can be seen in Figure 4.

The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, is Y = 12.30+(-0.07x) with correction coefficient (r) is 0.9727.

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This shows that between different concentrations of flour and moisture content in banana fritter flour has a very strong correlation, so that the concentration of flour from banana fritter flour affects the moisture content produced, because if the correlation coefficient value of 0.8-1 indicates correlation very strong. The perfect linear relationship with slope is indicated by a negative slope of -0.9727 meaning that the higher the concentration of flour the lower the moisture content of the flour produced.

The result of the 60% flour concentration analysis method resulted in average low moisture value compared with a concentration of 40% resulting in a high average moisture content. This is influenced by the addition of modified cassava flour (4.4% moisture content) added to the formulation. The increasing concentration of modified cassava flour used, the lower the moisture content of the banana fritter flour formulation. According to [20] that increasing of moisture content can cause the product loss of crispness.

3.2.5. Ash content. The content of starch ash is related to the mineral content in it. Ash content is strongly influenced by the type of materials, age of materials, and others. According to [21], the content of flour ash varies from 0.30 - 1.40% (ww). The greater the ash content of a food, the greater the mineral content contained in the food. In the formulation of banana fritter flour is added salt and baking soda which is inorganic salt, so it is still left as ash when it is done. The result of linear regression analysis shows the correlation of flour concentration to ash content of banana fritter flour, which can be seen in Figure 5.

The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, is Y = 4.59+(-0.043)x with correction coefficient (r) is 0.9613. This shows that between different flour concentration and ash content on banana fritter flour have a very strong correlation, so that the concentration of flour from banana fritter flour affects the content of ash produced, because if the correlation coefficient value of 0.8-1 indicates correlation very strong.

The perfect linear relationship with slope is indicated by a negative slope of -0.9613 meaning that the higher the concentration of flour the lower the ash content of the flour produced. The result of the 60% flour concentration analysis method yielded an average low ash content value compared to a concentration of 40% resulting in a high average ash content. This is influenced by different concentrations in the addition of modified cassava flour (ash content of 1.75%). The addition of salt and baking soda which is inorganic salt does not give a real effect, because it is added at the same concentration. The addition of sago flour containing ash content of 4.86% in banana fritter flour formulation has an effect on ash content. Due to the lower concentration of modified cassava flour, the addition of sago flour is higher.

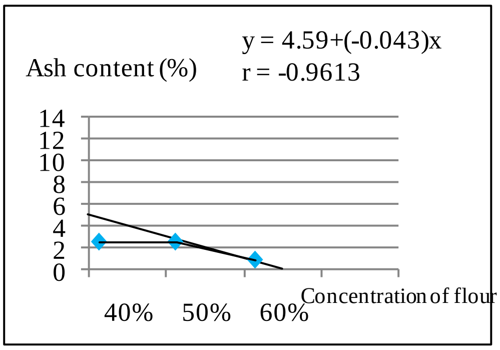

Figure 5. Graph of linear regression method of treatment of ash content

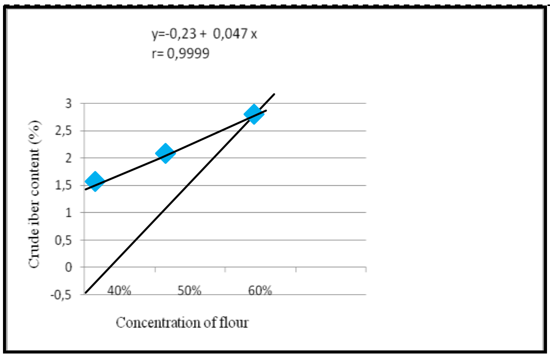

Figure 6. Graph of linear regression method of treatment of crude fiber content

3.2.6. Crude fiber content. Fiber is a component of plant tissue that is resistant to hydrolysis by enzymes in the stomach and small intestine [22]. The crude fiber is determined from the residue after

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the food is treated with acids and strong bases. The result shows that with the increasing concentration of modified cassava flour, the crude fiber content is increasing. The result of linear regression analysis shows the correlation of the difference of flour concentration to the crude fiber content of banana fritter flour, which can be seen in Figure 6.

The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, ie Y = (-0.23+0.047x) with correction coefficient (r) is 0.9999. This shows that between different flour concentration and crude fiber content in banana fritter flour has a very strong correlation, so that the concentration of flour from the banana fritter flour affects the crude fiber content produced, because if the correlation coefficient value is 0.8-1 shows very strong correlation.

The perfect linear relationship with slope is indicated by a positive slope of 0.9999 meaning that the higher the concentration of flour the higher the crude fiber content produced. The result of the 60% flour concentration analysis method yielded a mean value of high crude fiber content compared with a concentration of 40% yielding a low average crude fiber content. This is influenced by different concentrations in the addition of modified cassava starch (1.90% fiber content).

3.2.7. Starch content. The composition of starch is an important factor in determining the texture and characteristics of the coating flour. Starch is composed of two main fractions, those are amylose and amylopectin [23]. Amylose plays a role in the absorption of oil during frying, high flour amylose content can be used to reduce oil absorption due to its ability to form film [24].

The increase of banana fritter flour starch content in the use of more flour concentration (60%), due to the effect of modified cassava flour concentration added to the formulation. The increasing concentration of modified cassava flour used, the higher the resulting starch content. The result of linear regression analysis shows the correlation of flour concentration difference to starch content of banana fritter flour, which can be seen in Figure 7 below.

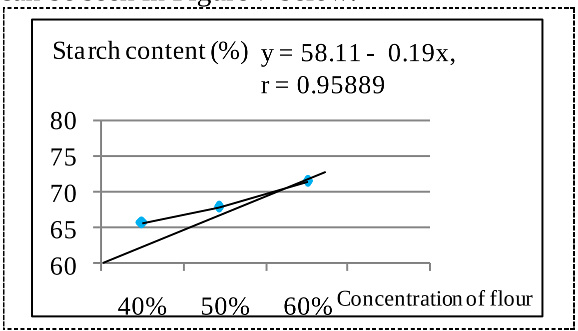

Figure 7. Graph of linear regression method of treatment of starch content

The correlation between different flour concentration on banana fritter flour processing, shown by **r** value of linear regression equation, is Y = 58.11–0.19x with correction coefficient (r) is 0.9588. This shows that between different flour concentration and starch content in banana fritter flour have a very strong correlation, so that the increase of flour concentration of banana fritter flour has an effect on the starch content produced, because if the correlation coefficient value of 0.8-1 indicates correlation very strong.

The perfect linear relationship with slope is shown with a positive slope of 0.9588 means the higher the concentration of flour, the higher the starch content produced. The result of the 60% flour concentration analysis method yielded an average high starch content value compared to a concentration of 40% resulting in a low average starch content. This is influenced by different concentrations in the addition of modified cassava flour (67.31%), and addition of corn starch containing 88% starch content. According to [25] starch with high amylopectin content tend to give fragile and crispness product characters, while amylose give of texture and violence more resistant.

3.3. Main research result on organoleptic response

Banana fritter flour from modified cassava flour-B with a concentration of 60%; 15% sago flour; 10% corn starch; 10% sugar; 1.2% salt; 0.7% baking soda; 0.9% gum arabic; and 2.2% vanilla, selected from the simple linear regression based on WHC, OHC, whiteness of flour, moisture content, ash content, crude fiber content, and starch content.

Banana fritter flour color after the coating process on banana of kepok and frying process has a golden yellow color. The result of organoleptic testing on the color of banana fritter flour from sample modified cassava flour B (60%), gets value of 4.49, with the response from the panelists say rather like. Different concentrations of modified cassava flour have no effect on color parameters. According to [26] decreasing of brightness and brown color in product due to the frying process.

The aroma found in banana fritter flour is influenced by the distinctive aroma that arises from banana and the addition vanilla of banana fritter flour formulation. The result of organoleptic testing on the aroma of banana fritter flour from sample modified cassava flour B (60%), gets value of 5.22, with the response from the panelists say like. Different concentrations of modified cassava flour have no effect on flavour parameters. According to [27] vanilla aroma is included into a group of volatile compounds that are not heat resistant.

The result of organoleptic testing on the taste of banana fritter flour from sample modified cassava flour B (60%) gets value of 4.33, with the response from the panelists say rather like. Different concentrations of modified cassava flour have no effect on taste parameters. Sweet and savory of banana fritter flour flavors are influenced by the addition of sugar in the formulation of banana fritter flour and the use of cooking oil in the frying process. When flour is fried then the water molecules will evaporate and be replaced by oil that makes air cavities in the food, so resulting in the product of swelling and crunchy [28]

The result of organoleptic testing on the texture of banana fritter flour from sample modified cassava flour B (60%) gets the value of 4.41, with the response from the panelists say rather like. Different concentrations of modified cassava flour have no effect on texture parameters. The crunchy texture of banana fritter flour is influenced by the addition of corn starch and baking soda ($NaHCO_3$) to banana fritter flour formulation. According to [29] corn starch when the frying process provides a more crunchy texture and easily broken when bitten, corn starch is recommended for use as a coating material (fried products). The addition of baking soda will make the banana fritter flour expand and increase the crispness, because at the time of heating/frying, baking soda will release carbon to form a fragile and crunchy structure [19].

4. Conclusion

The modified cassava flour-B selected from the organoleptic test to be used as the main ingredient of banana fritter flour has whiteness of flour (60.42%), WHC (41.17%), OHC (21.15%), moisture content (4.4 %), ash content (1.75%), crude fiber content (1.86%), and starch content (67.31%), which approached SNI quality of cassava flour (SNI No. 01-2997-1992).

Banana fritter flour from modified cassava flour-B with a concentration of 60%; 15% sago flour; 10% corn starch; 10% sugar; 1.2% salt; 0.7% baking soda; 0.9% gum arabic; and 2.2% vanilla, selected from the simple linear regression based on WHC, OHC, whiteness of flour, moisture content, ash content, crude fiber content, and starch content. The results of physicochemical analysis for banana fritter flour formulation are water holding capacity 31.20%; oil holding capacity 16.33%; whiteness of flour 76.10%; moisture content 7.98%; ash content 1.86%; crude fiber content 2.61%; and starch content 70.37%

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