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INSTANT *TIWUL* WITH *KACANG TUNGGAK* (*VIGNA UNGUICULATA*) FLOUR SUBSTITUTION AS ADDITIONAL OF PROTEIN AND CALCIUM

Rosidah, Dyah Nurani,
Department of Family Welfare Vocational Education, Faculty of Engineering
Universitas Negeri Semarang
e-mail: rosidah@mail.unnes.ac.id e-mail: dyahnurani@mail.unnes.ac.id

Dewi Hanifah
Department of Family Welfare Vocational Education, Faculty of Enginee
Universitas Negeri Semarang

ABSTRACT

Instant tiwul is made from gaplek flour sprinkled with water, steamed, then dried. Pour hot water and steam for a while to enjoy the tiwul as a snack or rice substitution in the main course. This research attempted the creation of instant tiwul with the kacang tunggak flour substitution. The purposes of this research are; (1) to know the influence of kacang tunggak flour substitution towards the sensory quality of instant tiwul, (2) to know the content of protein and calcium in instant tiwul, and (3) to observe the level of likeness in the society towards instant tiwul with the kacang tunggak flour substitution. The object of this research is instant tiwul with the kacang tunggak flour substitution, by comparison of gaplek flour and kacang tunggak flour 90%:10%, 80%:20%, and 70%:30%. The method of data collection used subjective scoring for sensory and likeness tests. While the objective scoring was used to know the content of protein and calcium. The data analysis technique used in this research was Kruskal Wallis, Tukey test, descriptive analysis percentage and nutritional content test. The result shows that there is an influence of kacang tunggak flour substitution in the production of instant tiwul towards the quality of sensory in color, aroma, texture and stickiness. The likeness test shows the society responses towards instant tiwul of the kacang tunggak flour substitution 90%:10% with the presentation of likeness is 81.42%. The test of protein and calcium in control sample is protein 2.3% and calcium 64 mg, sample A protein 14.387% and calcium 353 mg, sample B protein 17.912% dan kalsium 364 mg dan sampel C protein 20.274% dan kalsium 397.4 mg.

KEYWORDS: *substitution, kacang tunggak flour, instant tiwul*

1. INTRODUCTION

The government's efforts to raise the tubers as food material into food that is in demand and needed by the community is continuously conducted, either through exhibition, competition and community development. This cannot be separated from the abundant food source of tubers and the simple and relatively safe from the damage cropping pattern. However, tubers have a weakness as a food ingredient which is the lack of protein and other important nutrients, thus the level of its utilization in society is still low. On the other hand, people's awareness of the importance of qualified food continues to increase, so that people still depend on rice as their main food and wheat flour as the main ingredient for snack. According to Susenas in 2010, there are 27 provinces in

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Indonesia with the consumption pattern of rice as the staple food, and the rest of the provinces consume corn, cassava and sago as the main food. To strengthen food security, the government issued Presidential Regulation no. 22 year 2009 on "acceleration policy of food consumption diversification based on local resources", with the general purpose of facilitating and encouraging the implementation of diverse food patterns, which has balanced nutrition and is safe. Related to this, local food diversification program is conducted to maintain national food security.

One form of local food diversification is by making instant *tiwul*, which is *tiwul* dried under the sun for about 10 hours until the water content reaches 10%, then packed so that it has a long enough shelf life. When it is about to be consumed, it simply needs to be enough watered and let it for few minutes then steamed again for 15 minutes. *Tiwul* as a substitute for food staple, does not have enough nutrition, particularly the protein which is equivalent to the one contained in rice. Protein contained in cassava flour as a base material for *tiwul* is only 1.1 g, and after processed into instant *tiwul*, the protein increases by 2.3 mg per 100 grams, while in the same amount of rice, the protein is 6.8 g. To equalize the protein content in instant *tiwul,* substitution of vegetative food sources of protein is required. Vegetative protein sources of food material that can be used as a substitute material is cowpea flour. Cowpea is selected as a substitution material because it is one of bean type the ingredients that has not been optimally utilized. 100 grams of cowpea contains 24.11 g of protein. Other than that, cowpea also contains high calcium as much as 77.0 mg per 100 grams. Protein is an important substance that the body needs for the process of growth, while calcium plays an important role in keeping the bones and teeth strong and not easily porous. Therefore, food that contains high nutrients will be more useful when consumed. The cowpea flour which will be used as substitution material is made through the process of germination first, by means of cowpea seeds are first sorted, then soaked in clean water at room temperature. After 18 hours, they are then washed and drained and then placed in a bamboo basket. The top of the basket is covered with a damp cloth and then covered again with a *tampah*. Cowpeas are watered 2-3 times a day. After 3 -4 days, sprouts can be collected, and then separated from the outer skin/husk and then dried on a temperature of 60 degrees celsius. Afterward, it is milled and sifted with 80 mesh. The process of germination on the cowpea will improve the aroma, softness and the good flavor. In addition, germination will also increase protein content and lower anti-nutritional compounds.

The purpose of this research is to know the effect of cowpea flour substitution on the sensory quality of instant *tiwul* observed from the aspect of color, aroma, texture, and stickiness, to know the proper percentage of comparison between cassava flour and cowpea flour to the instant *tiwul* sensory quality seen from the aspect of color, aroma, texture and stickiness, and to know the content of protein and calcium of instant *tiwul* with substitution of cowpea flour from the best experimental results, and to know the level of public's likeness toward instant *tiwul* with substitution of cowpea flour.

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2. METHODS

2 1 Tools

Winnow, measuring cup, cormorant, wooden spoons, large pan, thermometer and drumdryer.

2 2 Material

Table 1. Materials for instant *Tiwul* experiment with Substitution of Cowpea Flour.

Experiment Materials	Sample KT0	Sample KT20	Sample KT30	Sample KT30
Gaplek (dried cassava) flour (g)	1000	90	800	700
Cowpea Flour (g)	0	10	200	300
Tapioca Flour (g)	35	3	35	35
Baking Soda (g)	5	5	5	5
Water (ml)	700	70	700	700

2 3 Research Stage

The production process consists of preparatory stage which includes materials provision, tools provision, materials scaling. Furthermore, there is implementation stage which includes the mixing of materials, the formation of granules, steaming and drying, and the stage of completion which is the packaging of products. this study, the data were obtained by conducting sensory test, favorite test, protein content test and calcium content test. Sensory test used 20 slightly trained panelists, favorite test used 80 untrained panelists, protein content test used Kjedahl method conducted in Laboratory of Biology Department of Universitas Negeri Semarang and calcium content test used AAS method conducted in Chemistry Laboratory of Universitas Negeri Semarang,

Data of sensory test analysis is done with Krusal Wallis test method to know the effect of cowpea flour substitution on instant *tiwul* quality, continued with Tukey test to know the difference between instant *tiwul* samples, favorite test using descriptive percentage, protein content using proximate analysis and spectrophothemeter analysis for calcium content.

3. RESULT AND DISCUSSION

Data of sensory test result of instant *tiwul* with substitution of cowpea flour analyzed by using Kruskal Wallis test can be seen in table 2 below.

Table 1. Result of Kruskal wallis test analysis

Indicator	Significance	Remark
Raw Color	0,000 < 0,05	There is effect
Cooked Color	0,000 < 0,05	There is effect
Raw Aroma	0,000 < 0,05	There is effect
Basic Material Aroma	0,000 < 0,05	There is effect
Cowpea Aroma	0,000 < 0,05	There is effect
Texture	0,000 < 0,05	There is effect
Stickiness	0,000 < 0,05	There is effect

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The next analysis result is an assessment based on sensory quality using a numerical scale indicating the quality of each aspect ranging from 1 to 7, provided that the value of 7 is for the best criteria and the value of 1 means not good. The color aspect of instant *tiwul* can be seen in Figure 1.

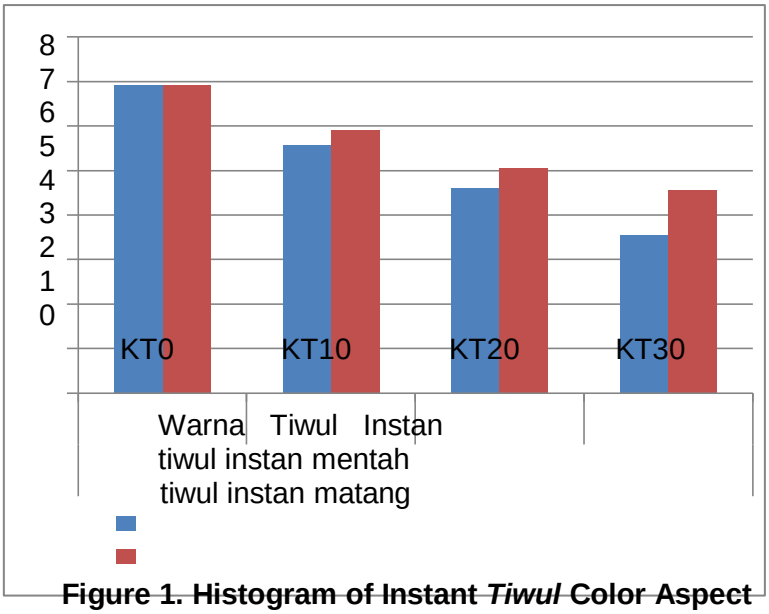

Figure 1. Histogram of Instant *Tiwul* Color Aspect

Based on the result of sensory test for color aspect in instant *tiwul,* raw and cooked, the highest mean of KT0 sample is 6,95, which belongs to the best color criteria. Then, instant *tiwul* KT10 (10% cowpea flour substitution), raw or cooked, belongs to good color criteria since it is in 5.55 -5.95 mean range. Meanwhile, raw KT20 instant *tiwul* sample has a mean of 4.6 which means slightly better color criteria. Likewise, cooked instant *tiwul* even though the mean is higher which is 5.05 but still included in the slightly better criteria. As for color aspect of raw instant *tiwul* KT30 is in rather good critera with mean of 3.55, while mean for cooked instant *tiwul* is 4.55 which belongs to slightly better color criteria. Color on instant *tiwul* of experiment result is influenced by raw material in the form of cassava flour and cowpea flour. The control samples made from raw cassava flour without substitution has the best color while KT10, KT20 and KT30 samples with substitution of cowpea flour produce color with decreasing quality.

The substitution of cowpea flour affects the quality of the color on the instant *tiwul*, since the dull white color of cowpea flour is not as white as cassava flour, thus the more the amount of cowpea flour substituted in instant *tiwul* making, it will produce darker instant *tiwul*. Cowpea contains Polyphenol/Tanin substances in its skin. The darker the color of the cowpea shows the higher the polyphenol content. Polyphenols are relatively heat-resistant and difficult to remove (Laurena et al, 1984). Apart from the raw materials, the decline in color quality is also caused by the process as well as a number of chemical and biochemical reactions that occur during the processing (Maskan, Kaya and Maskan, 2002 in Joardder et al., 2013). During the instant

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tiwul-making process, Maillard reaction occurs in which the formation of color is the main characteristic of Maillard's reaction. Maillard's reaction is highly dependent on the food matrix composition and reaction technology conditions (Wang et al.2011). While foods are processed or cooked at high temperatures, chemical reaction between amino acids takes place and it reduces sugar resulting in different flavors and brownish color (Tamanna and Mahmood, 2015). High protein content in cowpea flour when cooking with high temperatures will produce brown color on the product.

This indicates that the more number of cowpea flour in the substitution of instant *tiwul* making, the protein content is increasing and impact on the decreasing quality of *tiwul* instant color because the color is getting dark

Instant *tiwul* scent aspect can be seen in Figure 2

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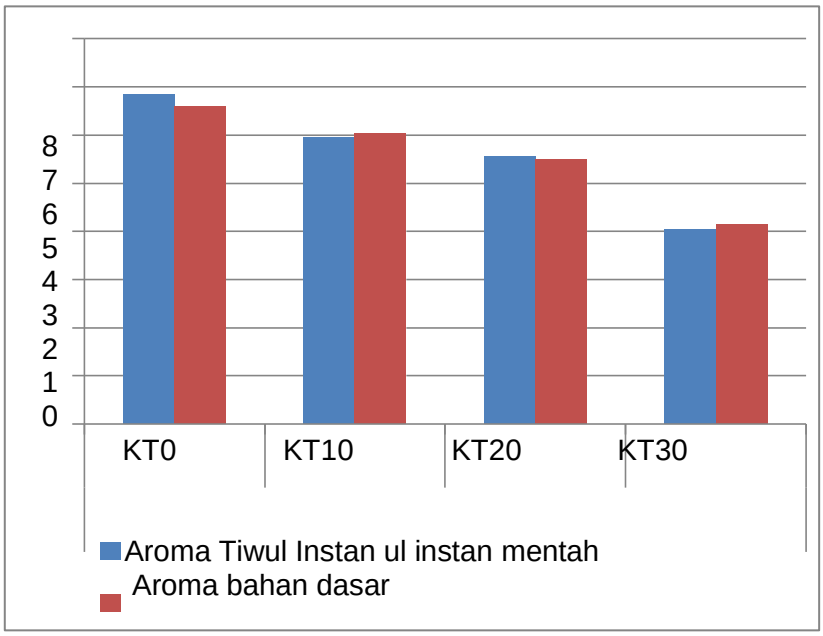

Figure 2. Histogram of Instant *Tiwul* Aroma Aspect

Based on the results of sensory tests on raw *tiwul* instant aroma, the highest mean is in the sample KT0 which is 6.95 and belongs to the best aroma criteria, it also applies for the coked instant *tiwul* aroma. Samples of raw instant *tiwul* with substitute of cowpea flour KT10 has mean of 5.95 and KT20 has mean of 5.5. Both samples are in the same mean range so that the aroma of the two samples belong to better aroma criteria. Meanwhile, raw KT30 *tiwul* instant sample obtaines 4.05 which means that it belongs to quite good criteria. Furthermore, on the instant *tiwul* aroma test, based on sensory test result for instant *tiwul* with substitution of cowpea flour, it shows that the highest average is in KT10 sample with mean of 6.05 thus it belongs to better aroma criteria, as well as KT20 sample with mean of 5,5 which belongs to better aroma criteria, while KT30 sample with mean of 4.15 belongs to quite good criteria. The effect of cowpea flour substitution on the aroma of the instant *tiwul* is due to

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enzymatic or non-enzymatic reactions or called Maillard reaction. The reaction produces smell or strong aroma. In addition, cowpeas have beany flavor (langu) caused by the presence of volatile and non-volatile compounds (Aminah, 2004). The next aspect to be discussed is the texture of instant *tiwul*

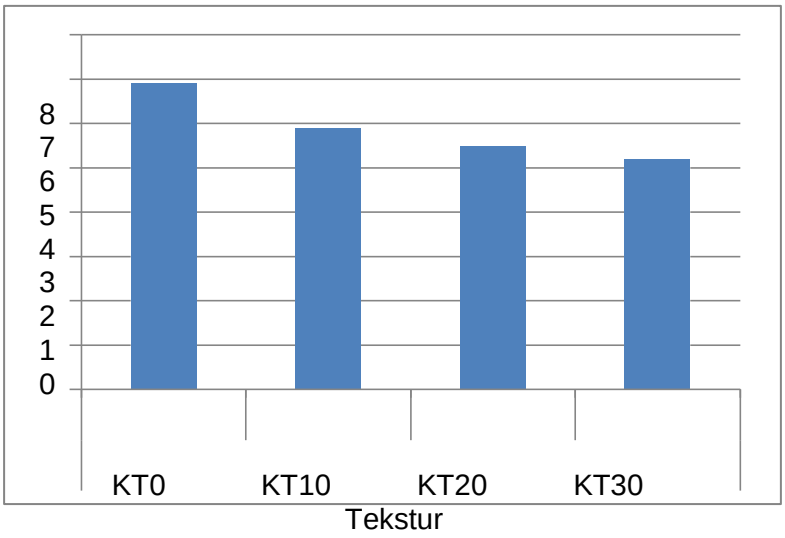

Figure 3. Histogram of Instant *Tiwul* Texture

Considering the above result about texture of instant *tiwul* with cowpea flour substitution, it shows that the highest mean is obtained by KT0 sample with mean of 6,9, which belongs to good criteria, sample KT10 with mean 5,9 belongs to better criteria, as well as KT20 sample with mean of 5,5 and KT 30 with mean of 5.2 which also belongs to the same better criteria.

A good texture of instant *tiwul* is elastic and the level of elasticity in instant *tiwul* is due to the amylose and amylopectin content present in the raw material. According to Winarno (2002), amylose has a high water binding ability, but tends to be released again, thus affecting the viscosity stability and gel consistency which tends to be soft. Amylose composed of 20% starch gives a hard effect in food because it is easily soluble in water or hot water but does not form gel, while Amylopectin is made up of 80% starch, has a water soluble and forming gel properties. Amylose and amylopectin are commonly found in tubers (cassava, sweet potatoes, taro and so on), while they are not found on beans, including cowpeas. Therefore, instant *tiwul* of cassava flour without substitution has a chewy texture. The more cassava flour in it, the more the starch level and this causes the higher rehydration level and gives a softer texture. High rehydration coefficient means instant *tiwul* is easy to bind water, so when cooking with water vapor or when mixed with water, the texture is easy to soft, and cooked *tiwul* is easy to chew. On the contrary, substitution of cowpea flour against cassava flour in the production of instant *tiwul* will reduce the amount of amylopectin which is replaced with cowpea that does not contain amylopectin, so that the resulting texture becomes less chewy. This indicates that the more cowpea flour used as substitution material (cassava flour) in the

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making of instant *tiwul,* it will more affect the texture quality of instant *tiwul* which is decreasing.

Instant *tiwul* stickiness aspect can be seen in the picture below.

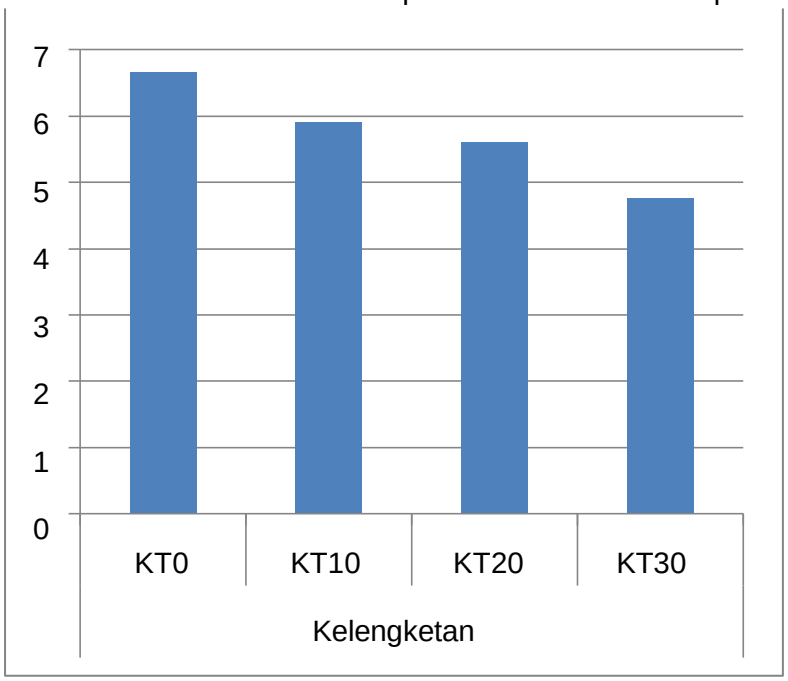

Figure 4 Histogram of Instant *Tiwul* Stickiness

Based on the results of sensory tests for stickiness level, it can be seen that the highest mean among the experimental samples is in KT0 sample with mean of 6.8 which belongs to the best criteria, then KT10 sample with mean of 5.9, belongs to better stickiness criteria, as well as KT20 which has mean of 5.7 and also belongs to better stickiness criteria. Meanwhile, KT30 sample with mean of 4.75 fall into less good stickiness criteria.

The effect of substitution of cowpea flour on instant *tiwul* on stickiness is due to the high bio-adhesive properties of flour (Zhang, 2005). Flour from cassava has high amylopectin. In addition, the amount of water addition also affects the level of stickiness in instant *tiwul*. This is in accordance with the opinion of Astawan (2002) which states that starch will expand in the presence of water. In the instant *tiwul* with substitution of cowpea flour, the number of the starch content decreases as the number of substitutes of the cowpea increases, thus the degree of stickiness also decreases.

This indicates that the more the amount of cowpea flour in the substitution of instant *tiwul* making, the more influence on the quality of instant *tiwul* on the decreasing stickiness indicator (not sticky). Laboratory test results of instant *tiwul* protein content with cowpea flour substitution of experimental results can be seen in Table 2.

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Table 2. Data of instant *tiwul* protein content with cowpea flour substitution.

No.	Sample	Protein Level (%)
1.	KT10	14,387
2.	KT20	17,912
3	KT30	20.274

Based on table 2 above, it can be seen that the more substitution of cowpea flour on instant *tiwul,* the more the protein content increases.The increase of protein content in instant *tiwul* with substitution of cowpea flour compared to instant *tiwul* protein content without substitution in the market, where the protein content is 2,3% per 100 grams, shows that substitution of cowpeas gives big contribution of protein in experiment result. Increased protein content on cowpea flour is caused by germination during the process of cowpea flour making. Prior to the germination, the cowpea protein content is 24.11%, then after germination the protein content increased to 26.84% of the basic ingredients (Sutanti et al, 2013). This affects the increase of protein in instant *tiwul* with substitution of cowpea flour, which means the more the substitution increases the protein content.

The results of instant calcium *tiwul* calcium analysis of experimental results can be seen in the following table

Table 3. Data of calcium content in instant *tiwul* with substitution of cowpea flour

Sample	Calcium Content (mg/L)
KT10	353
KT20	364
3.KT30	397,4

From Table 3. it can be seen that more substitution of cowpea flour in instant *tiwul,* then the calcium content will increase.The calcium content of instant *tiwul* of the experimental results is higher than the calcium content of instant *tiwul* on the market which contains of 64 mg of calcium per 100 grams. This is because of the combination of high calcium cowpea flour as a substitution ingredient of instant *tiwul* making can increase the calcium content in the instant *tiwul*. The requirement of calcium per day of Indonesian people according to Regulation of Ministry of Health of Republic of Indonesia Number 75 Year 2013 is about 1000-1200 mg, while the calcium content in instant *tiwul* with substitution of cowpea flour in 100 grams is sufficient for 1/3 of calcium requirement per day. Calcium in cowpea is included in the type of plant calcium that functions as a process for hormone formation, an enzyme that regulates digestion and metabolism. If the calcium intake is low, it can cause osteomalasis or bone becomes soft because the matrix is lack of calcium. Meanwhile, excessive calcium can cause kidney stones and hypercalcaemia.

The result of data analysis of the level of people's likeness on instant *tiwul* of experimental result was done on 80 untrained panelists and shows that

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sample KT10 is included in preferable criteria with percentage of 81,42. Then, sample KT20 belongs to rather preferable criteria with the percentage of 72.58. KT30 sample is included in the neutral criteria with a percentage of 61.51. More details can be seen in the following radar graph

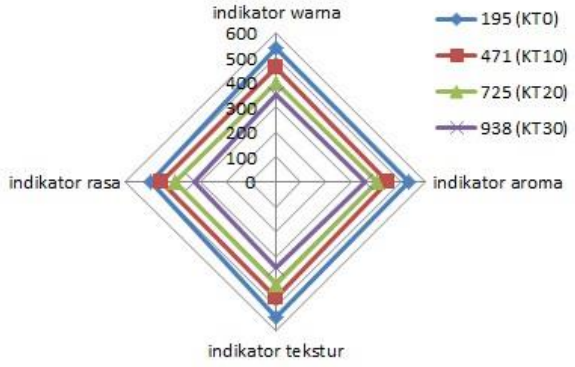

Figure 5. Radar Graphic of Likeness Test of of Experimental Result Instant *Tiwul*.

The result of data analysis of the public's likeness level on the color aspect shows that KT10 samples obtains the highest mean of 5.71 which means that KT10 samples are the most preferred samples among the three experimental samples tested. The color on experiment result instant *tiwul* is influenced by raw materials of cassava flour and cowpea flour. Experiment result instant *Tiwul* have different level of brown color criteria, and KT10 sample is rated by community to have a color which is similar to the control sample.

The result of data analysis of the public's likeness level on the aroma aspect shows that the KT10 samples obtained the highest mean of 5.61 which means that KT10 samples are the most preferred samples among the three experimental samples tested. The aroma in the experimental result instant *tiwul* is influenced by the raw materials of cassava flour and cowpea flour, in which cowpea flour has a characteristic aroma. Experiment result instant *Tiwul* have different levels of aroma criteria, and KT10 sample has a scent that is similar to the scent of the control sample.

The result of data analysis of the public's likeness level on the texture aspect shows that the KT10 samples obtained the highest mean of 5.77 which means that KT10 samples are the most preferred samples among the three experimental samples tested. The texture of the experiment result instant *tiwul* is influenced by the substitution of cowpea flour with low amylopectin content. Amylopectin is soluble in hot water and forms gel. Experiment result instant *Tiwul* have different texture criteria, and KT10 samples have a more chewy texture than other experimental samples.

The result of data analysis of the public's likeness level on the flavor aspect shows that the KT10 samples obtained the highest mean of 5.7 which means that KT10 samples are the most preferred samples among the three experimental samples tested. The taste of a food can be derived from the material itself and when it has been treated or processed, it can be influenced by the mix of flavors created by the existing components (Aminah, 2004). Flavor in experiment result instant *tiwul* is influenced by raw materials in

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the form of cassava flour and cowpea flour. Experiment result instant *Tiwul* have flavor criteria with different levels, KT10 samples are favored by the community based on the taste aspect because it has a taste approaching the control sample which has a plain taste. People prefer an instant *tiwul* with a plain taste or no additional flavor from other ingredients.

4. CONCLUSION

There is an effect of cowpea flour substitution on the quality of instant *tiwul* on the aspect of color, aroma, texture and stickiness. The best quality of instant *tiwul* with substitution of cowpea flour is KT10 sample, i.e. instant *tiwul* with 10% cowpea substitution. Based on community's likeness, KT10 sample is preferrable, KT20 sample is slightly preferable and KT30 sample is neutral. Based on the amount of protein content in instant *tiwul*, KT10 sample is 14,387%, KT20 sample is 17,912% and KT30 sample is 20,274%. Based on calcium content in instant *tiwul,* KT10 sample is 353 mg, KT20 sample is 364 mg and KT30 sample is 397.4 mg.

5. SUGGESTION

There is a need for further tests on the nutritional content of instant *tiwul* with substitution of cowpea flour in order to know the nutritional content other than protein and calcium, particularly vitamin B, moisture, and storage capacity. Further research is needed to improve the sensory quality of instant *tiwul* with substitution of cowpea flour that can use other cowpea flour manufacturing techniques (e.g. steaming or boiling the cowpea sprouts) or mix it with other food ingredients (e.g. jelly powder) that can improve the quality of instant *tiwul* with substitution of cowpea flour. KT10 instant *Tiwul* sample needs to be socialized in the community because, in the senses aspects, it is almost close to the control sample of *tiwul* instant. Furthermore, with the substitution of 10% cowpea, the protein and calcium content have exceeded the protein and calcium in rice.

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