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Public Preferences of *Manggadong* Rice as a Local Wisdom to Support Food Security in Sumatera Utara Province

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Abstract: There are many food as source of carbohydrate such as whole grains (rice), tubers like purple sweet potato and corn: but 90% of people in Indonesia have made rice as the main source of carbohydrates and became a staple food. The total national rice consumption today is as high as 26.8 million tons per year, in addition to the consumption of rice per capita per year is also very high at 113 kg/capita/year in which Indonesia became the largest rice consuming country in the world (Statistic Office, 2010). *Manggadong* is a local wisdom in Sumatera Utara province that has been abandoned. *Manggadong* is the habit of eating cassava before eating rice so that the amount of rice consumed is reduced. This study aims at modifying rice with four types of cassava when cooked that call *Manggadong* rice and know the preferences of the community as an effort to reactivate *Manggadong* rice. The results showed that the addition of four kinds of cassava flour with rice showed no significant difference to the odor and color of *Manggadong* rice flour but showed a significant difference to the flavor and texture of rice cassava flour. Based on the odor and color of the indicator most preferred is rice modified by purple sweet potato. While the indicator is based on the taste and texture is rice modified by red sweet potato flour.

Key words: Preferences, *Manggadong* rice, cassava flour, purple sweet potato, red sweet potato

INTRODUCTION

Diversification program though had long recommended but has not shown the expected results. It is seen from national food balance sheet which shows that the contribution of energy from grains such as rice exceeds the ideal standard, while the energy contribution from the tubers are still less than ideal recommendation (Food Security Agency, 2008).

In an effort to support the accelerated diversification of food consumption based on local resources, development of sources of carbohydrate food group, especially tubers need attention because of their potential such as: (1) carbohydrate source after rice and maize, (2) high productivity, (3) many diversification of products, (4) contains a variety of nutrients, (5) potential market demand both locally, regionally and increasing exports (Sibuea, 2012).

One effort realized the diversification of food consumption based on local resources is reviewing existing local wisdom. It is based on the premise that it is not easy to change people's food consumption habits that has lasted a long time. *Manggadong* stands for "*Mangalang gadong*" (eating cassava) is a custom that has long been done by the people of North Sumatera which consume cassava before eating rice. This habit in the past was due to the low purchasing power of the rice so as to reduce the consumption of rice is cassava. When the cassava are consumed before eating rice, so

that automatically will feel full when eating rice, so that rice will be slightly consumed. Habit in the past is an indigenous North Sumatera and when associated with diversification is very precise and can reduce dependence on rice and can help the realization of food security in household.

Socialization *Manggadong* as public policy in Sumatera Utara province had been done in September 2011 conducted by Governor of North Sumatera and Food Security Agency along with thousands of new students in University of North Sumatera that consume both cassava and sweet potatoes. Unfortunately this is not done in community. Base on this, it is necessary to have the real *Manggadong* action in the community continuity. Ease to consume cassava is also crucial to the desire to make cassava as a food that is consumed daily consumption like rice. Efforts food technology to make flour from many types of cassava, then mixed when cooking rice is a way to reactivate the local wisdom *Manggadong*.

Based on this, need research that may increase people's desire to consume cassava in the form of cassava flour as staple food consumption. This research is to see how far public acceptance by using organoleptic test including odor, color, flavor and texture. This research was conducted at Deli Serdang District as a center of cassava production in Sumatera Utara province.

Problems: It is not known how the public preference of *Manggadong* rice consisting of four kinds of organoleptic test i.e., odor, color, flavor and texture.

MATERIALS AND METHODS

This is an experimental study to make flour from some of cassava mixed with rice in food consumption society as a form of food technology in *Manggadong* program, then assessed preferences and public acceptance of *Manggadong* rice. *Manggadong* rice interventions conducted over 4 days to assess barriers and opportunities in *Manggadong* rice. This study was conducted at one of the District 's largest cassava production center in North Sumatra is Deli Serdang District. The population is all households in Deli Serdang District, while the sample is assigned 100 households (minimum sample for survey research) and panelist is mother. Primary data consist of household socio-economic characteristics were obtained by interviews, preferences and public acceptance of *Manggadong* rice obtained by organoleptic test.

The material used is rice and 4 types of cassava: white sweet potato, purple sweet potato, orange sweet potato and cassava with specific characteristics: does not rot, does not change the color of the original and fresh condition. The fourth type of cassava used as flour to be mixed with rice when cooking the rice that have ratio rice and cassava is 10:1.

Production method of cassava flour: Four types of cassava peeled and cleaned (washed). These cassava sliced thin and dried with an electric oven for drying homogenize until totally dry (± 12 h). Furthermore milled into flour until smooth in a blender and filtered (sifted) flour using a sieve. Finally ready to use as cassava flour in *Manggadong* rice.

Implementation of the test preferences (appearance): Preference test is often referred to as organoleptic tests to determine preference of food using sensory organs. Preference test of color using vision organ, odor using nose, taste using tongue, texture using skin with hedonic scale very like (score 4), like (score 3), less like (score 2) and do not like (score 1). Panelists in this study were 100 housewives in accordance with the number of samples with healthy criteria (not impaired organ primarily for testing) and can work together. The steps on the organoleptic test (Khoiriyah Nur and Amalia Leily, 2014):

- 1: Invited panelists sit in a room that has been provided
- 2: Describes how to perform organoleptic test and how to fill the form
- 3: Distribute 4 types of samples with specific code, water and assessment forms

- 4: Invited panelist start and write a review on the assessment form sheets
- 5: Collect the completed form panelists
- 6: Analyzed by using analysis of variance to determine which cassava flour is most preferred by the panelists

Processing and data analysis: To determine whether there is a difference in each cassava flour then used analysis of variance and Duncan test. To determine the acceptability of panelists conducted a qualitative descriptive analysis of the percentage of panelists that obtained qualitatively analyzed in advance to be quantitative data.

Score is a percentage value:

$$\% = \frac{n}{N} \times 100$$

%: Percentage scores

n: No. of scores obtained

N: Ideal score (highest score x number of panelists)

To change the percentage scores into grades, the same analysis with qualitative analysis with different values as follows:

Highest value	= 4 (like)
Lowest value	= 1 (do not like)
No. of specified criteria	= 4 criteria
No. of panelists	= 100

a. Maximum score	= No. of panelists x highest values
	= 100 x 4 = 400

b. Minimum score	= No. of panelists x lowest value
	= 100 x 1 = 100

c. Maximum (%)	= $\frac{\text{Maximum score}}{\text{Maximum score}} \times 100\%$
	= $\frac{400}{400} \times 100\%$
	= 100%

d. Minimum (%)	= $\frac{\text{Maximum score}}{\text{Maximum score}} \times 100\%$
	= $\frac{100}{400} \times 100\%$
	= 25%

e. Interval	= Maximum-Minimum (%)
	= 100-25% = 75%

f. Percentage interval	= Interval: No. of criteria
	= 75%: 4 = 18.75%

Based on the results of the calculation made the interval of percentages and criteria.

Table 1 describe percentage of panelist score based on score in organoleptic test. The percentage divided into 4 preferences i.e., very like, like, less like and dislike.

After learning of the panelist acceptance in Table 1, then determine whether there is a difference with the organoleptic test variant analysis (ANOVA) as in Table 2 (Sunyoto Danang, 2012).

Formula:

Degrees of freedom (df):

- a. df treatment : r-1
- b. df panelists : t-1
- c. df error : (r-1) x (t-1)
- d. df total : (rt-1)

Factor correction (FC): Factor correction:

$$\frac{(\sum Yi)^2}{r \times t}$$

Sum of squares (SS):

- a. Treatment sum of squares : $\frac{(Yi)^2 \times (Yi)^2}{t} - FC$
- b. No. of panelists squared : $\frac{(\sum Yi)^2}{r} - FC$
- c. No. of panelists squared : SS total-treatment-panelists

Average sum of squares:

- a. Treatment sum of squares: SS treatment: df treatment
- b. No. of panelists squared: SS panelists: df panelists
- c. Sum of squared errors: SS error: df error

F calculate: Compare F calculate with F Table:
 If F Calculate > F Table = Ho rejected, Ha accepted
 If F Calculate < F Table = Ho accepted, Ha rejected
 If F Calculate > F Table, means no difference between treatments

To determine the effect of differences in each treatment then continued with Test Duncan (Duncan Multiple Range Test). With Duncan's multiple test knowable treatment are most different from the other treatments and which treatments are most is slightly different from other treatments:

$$Sy = \frac{\sqrt{KT \text{ error}}}{\text{No. of groups}}$$

Then proceed to calculate the real rate of 5% range to see where the error degrees of freedom obtained LSR = Range x Sy (standard error mean).

RESULTS

Descriptive panelists: Panelists were 100 mothers who are mostly farmers and housewives with age ranged between 19-57 years. At the time of preferences test, the panelists are not in a state of ill vision (without a doctor's

examination) and not impaired in the organs used in judging, as well as in a stable emotional state.

Odor preference analysis of rice with addition flour of purple sweet cassava (A1), cassava (A2), orange sweet cassava (A3) and red sweet cassava (A4): Table 3 describe odor preference tests showed that rice A1 and A4 has the highest total score is 282 (70.6%). Based on table 1 showed that rice A2 and A3 have less like criteria, while rice A1 and A4 have like criteria. The analysis of variance showed that the F value < F table so it can be concluded that there was no difference in the odor of each treatment.

Color preference analysis of rice with addition of purple sweet cassava (A1), cassava (A2), orange sweet cassava (A3) and red sweet cassava (A4): Table 4 described color tests showed that rice A1 has the highest total score is 274 (68.6%). Based on Table 1 showed that rice A1, rice A3 and A4 have criteria like, while rice A2 has less like. The analysis of variance shows that the F value < F table so it can be concluded that there is no color difference in each treatment.

Flavor (Taste) preference analysis of rice with addition of purple sweet cassava (A1), cassava (A2), orange sweet cassava (A3) and red sweet cassava (A4): Table 5 describe flavor tests showed that rice A4 has the highest total score is 272 (70.5%). Based on Table 1 showed that rice A1 and A4 have criteria like, while rice A2 and A3 have less criteria like. The analysis of variance shows that the F count > F table so it can be concluded that there is a difference in taste in each treatment. Based on the results of Duncan test as the above table, it can be concluded that the preference level panelists about taste is same between A1 and A4 rice that is like criteria but unlike to A2 and A3. In addition, it can be concluded that rice A4 is preferable to rice A1, A2 and A3.

Texture preference analysis of rice with addition of purple sweet cassava (A1), cassava (A2), orange sweet cassava (A3) and red sweet cassava (A4): Table 6 described texture tests showed that rice A4 has the highest total score is 277 (69.3%). Based on Table 1 showed that A2 rice, A3 rice and A4 rice have liked criteria whereas A1 rice criterion has less like. The analysis of variance shows that the F count > F table so it can be concluded that there are differences in texture on each treatment. Based on the results of Duncan test as the above table, it can be concluded that the preference level of the texture of the rice panelists same A4 to A2, but in contrast to the A3 and A1. In addition, it can be concluded that the rice A4 is preferred over rice A1, A2 and A3.

DISCUSSION

Based on odor indicators that rice A1 can be seen that the most favored with the highest score of 282 (70.6%). Criteria based on the percentage, rice A2 and A3 has less preferred criteria, while rice A1 and A4 have criteria like. This suggests that the public acceptance of this *Manggadong* recommend rice A1 as the first priority and the second priority rice A4 when the review is based on odor preference. Statistically by analysis of variance did not show any differences in preferences based on the scent of the four types of cassava. In general it is the scent of the four types of cassava is no different and has a good reception because the scent of carbohydrates (starches) are dominant in the cassava is very well known and is not much different from the odor of the food sources of carbohydrates such as rice, taro, or wheat.

In *Manggadong* rice, cassava flour just as the amount is less than the amount of rice so that the odor of *Manggadong* rice still dominates. Purple sweet potato and red sweet potato are more preferred than cassava and orange sweet potato. This is due to the scent of purple sweet potato and red sweet potato is more fragrant than cassava and orange sweet potato are more unpleasant odor.

Based on organoleptic indicators of color can be seen that the most preferred rice A1 with the highest score of 274 (68.6%). Criteria based on the percentage of A1 rice, rice A3, A4 rice had preferred criteria, while rice criterion A2 has less like. The color of food is crucial because consumer preferences lead to the assumption that tasty and attractive for consumption. Colors tend to be not as interesting as opaque (dull), not typical (not usually) for a type of food will lead to the rejection of foods. *Manggadong* with purple sweet potato is preferred because of the color purple shows an interesting color to be consumed with rice flour which is colored purple very interesting and unique so it makes a great appeal to the panelists. In contrast to rice cassava and sweet potatoes red color that gives the impression of opaque (dull) rice that is so unattractive.

On the other hand, rice with orange sweet potato shown rice color light orange or yellow color so that the impression also not attractive. Some panelists expressed rice with cassava, sweet potato red and orange sweet potato color as rice in not good quality (stale). Statistically by analysis of variance did not show any differences in color preferences based on the four kinds of cassava.

Based on organoleptic indicators of sense (taste) it can be seen that the most preferred rice A4 with the highest score of 272 (70.5%). Criteria based on the percentage of the rice A1 and A4 have criteria like, while rice A2 and A3 has less preferred criteria. Based on the analysis of variance is known that there is a difference in taste in each treatment, which is equal to the level of preference

Table 1: Percentage interval dan like criteria (Preference)

Percentage (%)	Like criteria (Preference)
81,25-100,00	Very like
62,50-81,24	Like
43,75-62,49	Less like
25,00-43,74	Dislike

A1 and A4 but different from A2 and A3. It is claimed that the rice A4 is preferred over rice A1, A2 and A3. Rice mixed with red sweet potato is preferred because of the taste sweeter red sweet potato (containing higher sugar content) than cassava, sweet potato or yam orange purple. Naturally, the sweet taste has preferences higher than the salty taste or plain taste. The sweetness of rice with red sweet potato not changed drastically since the rice is not concentrated sweetness, even make rice more palatable so that acceptance by panelists taste very good.

Based on organoleptic indicators of texture can be seen that the most preferred rice A4 with the highest score of 277 (69.3%). Criteria based on the percentage of the rice A2, A3 rice and rice A4 have preferred criteria, while rice A1 has less preferred criteria. Based on the analysis of variance is known that there are differences in texture on each treatment, which is equal to level A2 and A4 but different from A1 and A3. It is claimed that the rice A4 is preferred over A1, A2 and A3 rice. Rice with red sweet potatoes have the texture of the rice is preferred because the rice is not too soft and not too hard. In the rice with purple sweet potatoes and orange sweet potato produced more mushy rice (too soft). While the rice with cassava produces a sticky glue-like texture. This is due to the content of amylopectin on characteristics such as cassava starch (glue).

Jairani research (2011) stated that rice mixed with flour purple sweet potato ratio 3:7 has the highest preference level compared with a ratio of 1:9 and 5:5. Sibuea (2011) in celebration of world food security day in Sumatera Utara province disseminate rice that cooked mixed with purple sweet potato steamed with a ratio of 70:30. In this event, all participants consumed purple rice to popularize non-rice food.

Tubers processing technology in Indonesia is not yet fully developed, in contrast to grain processing technology is already very advanced. Food technology innovation plays an important role in reducing dependence on rice that is to produce new food products. The existence of a variety of new food products should be disseminated to the public and developed in a sustainable manner so as to improve food security. Sibuea (2012) makes analog rice that is white rice mixed with purple sweet potato with extruder technology to produce grains like rice but not as white as the color of the rice paddy. However, the preference for analog rice has not been studied.

In addition, the Institute's research and community service field of University Santo Tomas in Medan has

Table 2: Analysis of variance

Sources	Df	SS (Sum of squares)	SSA (Sum of square average)	F	F
Treatment	r-1	SST	$\frac{SS \text{ treatment}}{(r - 1)}$	$\frac{SSA \text{ treatment}}{(SSA \text{ error})}$	F,5%
Panelists	t-1	SS Error	$\frac{SS \text{ error}}{(t - 1)}$		
Error	(r-1) x (t-1)	SS total-SS treatment-SS panelists	$\frac{SS \text{ treatment}}{SS \text{ error}}$		
Total	rt-1	SS Total			

df: degrees of freedom, JK: The sum of squares, F: F test, t: Number of panelists, r: Number of treatment

Table 3: Organoleptic test of rice with addition of cassava flour by odor

		Rice											
		A1			A2			A3			A4		
Criteria	Score	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%
Very like	4	12	48	12.0	8	32	8.0	6	24	6.0	13	52	13.0
Like	3	69	207	51.8	45	135	33.8	56	168	42.0	62	186	46.5
Less like	2	8	16	4.0	31	62	15.5	16	32	8.0	19	38	9.5
Dislike	1	11	11	2.8	16	16	4.0	22	22	5.5	6	6	1.5
Total		100	282	70.6	100	245	61.3	100	246	61.5	100	282	70.5

Table 4: Organoleptic test of rice with addition of cassava flour by color

		Rice											
		A1			A2			A3			A4		
Criteria	Score	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%
Very like	4	4	16	4.0	5	20	5.0	1	4	1.0	10	40	10.0
Like	3	69	207	51.8	34	102	25.5	60	180	45.0	55	165	41.3
Less like	2	24	48	12.0	56	112	28.0	32	64	16.0	31	62	15.5
Dislike	1	3	3	0.8	5	5	1.3	7	7	1.8	4	4	1.0
Total		100	274	68.6	100	235	59.8	100	255	63.8	100	271	67.8

Table 5: Organoleptic test of rice with addition of cassava flour by flavor (taste)

		Rice											
		A1			A2			A3			A4		
Criteria	Score	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%
Very like	4	5	20	5.0	9	36	5.0	5	20	5.0	14	56	14.0
Like	3	59	177	44.3	38	114	28.5	48	144	36.0	50	150	37.5
Less like	2	30	60	15.0	44	88	22.0	35	70	17.5	30	60	15.0
Dislike	1	6	6	1.5	9	9	2.3	12	12	3.0	6	6	4.0
Total		100	263	65.8	100	247	57.8	100	246	61.5	100	272	70.5

Table 6: Organoleptic test of rice with addition of cassava flour by texture

		Rice											
		A1			A2			A3			A4		
Criteria	Score	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%	Panelist	Score	%
Very like	4	6	24	6.0	8	32	8.0	6	24	6.0	11	44	11.0
Like	3	51	153	38.3	62	186	46.5	55	165	41.3	60	180	45.0
Less like	2	24	48	12.0	25	50	12.5	25	50	12.5	24	48	12.0
Dislike	1	19	19	4.8	5	5	1.3	14	14	3.5	5	5	1.3
Total		100	244	61.1	100	273	68.3	100	253	63.3	100	277	69.3

made 48 purple sweet potato derived products such as juice, ice cream, cookies, crackers and others, but the preference for this food also has not been investigated (Sibuea, 2013). Non-rice food diversity that exist in Indonesia, coupled with innovative technology will produce a variety of food products that can achieve food self-sufficiency.

Socialization of non-rice food is often done mainly at the event to celebrate the global food security. But thanks to the power of non-rice food served has not been

investigated so scientifically proving non-rice food acceptance in society becomes weak.

In Kompas newspaper (10 October 2008) reported that the governor of Sumatera Utara province for 3 years from 1963-1965 consumed rice mixed with sweet potatoes, taro or corn because not afford to buy rice. This is also done in a lot of people due to poverty. An increase in the economy is slowly but surely making people leave the consumption of sweet potatoes, taro and corn because of the assumption that if you do not eat rice then

classified as poor people. Food consumption behavior in the long period ago is proved to be a very supportive local wisdom to diversify food consumption as an important pillar in achieving food security.

This is evidenced by the high consumption of rice in North Sumatera that is 130 kg/capita/year compared with Japan 60 kg/capita/year. In other hand conclude that food consumption does not vary, shown from consumption the group of grains especially rice which dominates energy consumption is 61.7%; ideally a maximum of 50% rice. This situation is very risky for the occurrence of food insecurity if the level of dependence on one type of food such as rice is too high (Food Security Agency in Medan, 2010). When associated with health and nutrition, we conclude that community have nutritional imbalance so that a variety of health effects due to the high consumption of rice that can occur (Sibuea, 2011).

Sumatera Utara province has the potential to develop a purple sweet potato because according to the texture of the soil and climate for productivity purple sweet potato, so beneficial to the community and to reduce rice imports. On 1 hectare of land can produce 30 tons of potatoes in 3.5 months with a selling price of Rp 1500/kg. Whereas rice per hectare only produce 4.5 tons. In addition, purple sweet potato also has a good nutritional value due to its content of vitamin A, vitamin B, beta-carotene and fiber which is very good for the digestive system (Sibuea, 2011).

Conclusions:

- 1: The addition of four kinds of potato flour with rice showed no significant difference to the scent and color, which means there is no difference in preference based on odor and color to the rice flour mixed with purple, cassava, sweet orange and red sweet potatoes
- 2: The addition of four kinds of potato flour with rice showed a significant difference to the flavor and texture, which means that there are differences in preferences based on taste and texture of the rice flour mixed with purple, cassava, sweet orange and red sweet potatoes
- 3: Based on the indicator odor, rice most preferred is rice with purple sweet potato flour

- 4: Based on the color indicator, rice most preferred is rice with purple sweet potato flour
- 5: Based on the indicator taste, rice most preferred is rice with red sweet potato
- 6: Based on the texture of the indicator, rice most preferred is rice with red sweet potato

Recommendations:

- 1: The need for socialization in the community to utilize purple sweet potato flour and red sweet potato flour became rice with purple sweet potato flour and red sweet potato flour
- 2: Improve the texture of rice with purple sweet potato flour and red sweet potato flour in order to have a better preference in society

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