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A STUDY OF KLEPON AS AN INDONESIAN TRADITIONAL FOOD BY SUBSTITUTION OF YELLOW SWEET POTATO *(Ipomoea batatas* L.*)*

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ABSTRACT

Klepon is an Indonesian traditional food what generally made by glutinous rice flour is a major ingredient and filled with brown sugar at the ball shape. Research about grape sweet potato on klepon before shows that low score of klepon sensory. It is makes diversification of raw material required klepon in improve nutrition and score of sensory. The purpose of this research is to determine the effect of substitution of yellow sweet potatoes to klepon's quality to acquire the preferred substitutions of raw material. The method of research is experiment was using Completely Randomized Design (CRD) with five levels treatment and three level of replications. Followed technical analysis was Variation Analysis (ANOVA), continued Duncan Multiple Range Test (DMRT) when treatment was significantly different. The result shown that the substitution by yellow sweet potato in various substitution give effect to elasticity, water content, protein, and carbohydrate, hedonic quality of color, taste, flavor, texture, and hedonic taste, texture, and overall hedonic level (α=0.01 and α=0.05). The selective substitution by yellow sweet potatoes is 30%, with quality analysis result were elasticity score (4.5 gf), moisture content (67.54%), ash (1.97%), protein (5.65%), fat (4.5%), carbohydrate (23.99%), crude fiber (1.46%), and A vitamin (0.036 ppm). Sensory analysis result were white yellowing color (3.8), sweet (3.7), strong flavor of yellow sweet potatoes (3.7), chewy (3.8) and overall hedonic level is like (3.9). Ash content of the preferred of yellow sweet potato klepon had fulfilled in SNI 01-0349-1996.

***Keywords** : glutinous rice, flour, brown sugar, material.*

INTRODUCTION

Klepon is an Indonesian traditional food. It is a one of wet food groups that has been famous product and distributed in the community. Klepon has a rather chewy texture with a sweet taste. Generally klepon made by glutinous rice flour is a major ingredient and filled with brown sugar at the ball shape that coooked process by boiling water and served with coconat flake. The purpose of this research is to determine the affect of substitution of yellow sweet potatoes to klepon's quality to acquire the preferred substitutions of major raw material.

Research about klepon development has been done by Sari (2011) using grape sweet potato. The selected klepon with substitution of glutinous rice flour and grape sweet potato was 60 : 30, the substitution has the characteristics quality hedonic value somewhat chewy texture, hedonic test were somewhat like of color, flavor and overall hedonic product. It can conclude that sensory value of klepon substitution with grape sweet potato was still low. It is makes diversification of raw material required klepon in improve the nutritional value and score of sensory of klepon.

One of selected material is yellow sweet potatoes because it has many benefits for the human body, including it has high beta carotene. The function of beta carotene as pro vitamin A, and beta carotene of yellow sweet potatoes decreases about 40% the risk of heart diseases, lowers the risk of cancer, stroke, cataract, sunburn, muscle disorders (Widyaningtyas dan Susanto, 2015). Subtitution of yellow sweet potato, are expected to improve the nutritional and hedonic values of klepon.

METHOD

Materials

Raw materials in this study were glutinous rice flour, yellow sweet potato, brown sugar, coconut, salt and water. Material for analysis includes mineral water, K_2SO_4, HgO, sulfate acid, concetrated (H_2SO_4), concentrated NaOH, concentrated $Na_2S_2O_3$, H_3BO_3, HCl 0,002 N, hexane, K_2SO_4 10%, alcohol 95%, HNO_3, $HClO_4$, concentrated HCl, dan ethanol. The tools were used in analysis tools; texture analyzer, analytical balance, oven, desiccators, tube kjeldahl pack, extraction soxhlet, hot plate, high performance liquid chromatography and other glasses instruments.

Method

Research method was experiment which carried out using Completely Randomized Design (CRD) with five level treatments and three replications, continued Duncan Multiple Range (DMRT) when treatment was significantly different. Treatment research is substitution yellow sweet potato which varies the 0%, 10%, 20%, 30% and 40% (w/w). This research was conducted at the Laboratory of Food Technology, Sahid University South. Jakarta and Food Psycochem Laboratory of Research Center for Biological Resources of Technology of Institute Bogor Agricultural.

The first process of making klepon is done by stripping yellow sweet potato and washing it with clean water. Then, the yellow sweet potato were steamed until soft. The next process is done by mixing glutinous rice flour, water and salt. The dough is shaped like balls and filled with brown sugar. Brown sugar previously cut into small pieces. After the filling process is complete, the next step is the process of boiling klepon at a temperature of 100°C for 5 minutes. Once cooked or the klepon cook will float indicating that klepon has matured. The Klepon is served with grated coconut flakes.

Yellow sweet potato percentage was based on 100% combination between glutinous rice flour and yellow sweet potato. If substitution of yellow sweet potato increasing, so concentration of glutinous rice flour is decreasing in klepon formulation. Klepon raw material formulation can be seen at Table 1.

Table 1. Klepon Formulations

Materials	Percentage (%)				
	0	10	20	30	40
Glutinous rice flour	42.16	37.94	33.73	29.51	25.3
Yellow sweet potato	0	4.22	8.43	12.65	16.86
Salt	1.35	1.35	1.35	1.35	1.35
Water	33.72	33.72	33.72	33.72	33.72
Brown sugar	7.59	7.59	7.59	7.59	7.59
Coconut flakes	15.18	15.18	15.18	15.18	15.18

The parameter which was observed were the physical, chemical, and sensory properties. The physical property was elasticity; chemical properties were water content, ash content, protein content, fat content,

carbohydrate content, crude fiber content and sensory properties were color, aroma, flavor, and texture. This research also measured the A vitamin concentration of the selective klepon. In Indonesia, klepon does not yet have quality standards. The closest product is another traditional Indonesian cake, namely layer cake. Therefore, for comparison of quality the klepon quality standard refers to the quality terms of the layer cake SNI number 01-4309-1996 (National Standardization Agency, 2009).

RESULT AND DISCUSSION

Elasticity

Based on observations (Table 2), the various substitutions of yellow sweet potato significantly different on klepon elasticity at α 0.01 in each treatment, while at the concentration of 0 to 20%; 30 and 40% were not significantly different. The elasticity of the klepons ranged from 4.19 to 4.77 gf.

Table 2 Physic and Chemical Properties of Klepon with Varied Concentrations

Parameter	0%	10%	20%	30%	40%	Sig
Elasticity (g/mm^2)	4.19±0.07^a	4.26±0.11^a	4.28±0.03^a	4.50±0.15^b	4.77±0.20^b	0.001 **
Moisture Content (%)	57.67±0.84^a	60.25±1.02^b	62.06±0.80^b	62.54±0.10^c	63.76±0.46^c	0.000 **
Ash Content (%)	1.65±0.22	1.96±0.53	2.07±0.07	1.97±0.83	2.54±0.96	0.55
Protein content (%)	6.71±0.35^a	5.98±0.11^a	5.80±0.21^a	5.65±0.23^a	5.69±0.17^b	0.001 **
Fat content (%)	4.92±0.07	4.61±0.12	4.57±0.14	4.50±0.17	4.13±0.66	0.686
Carbohydrate (%)	25.99±0.72^a	25.53±0.78^a	25.33±0.48^b	23.99±0.70^b	23.87±0.56^b	0.008 **
Crude fiber (%)	1.57±0.23	1.47±0.05	1.46±0.02	1.41±0.10	1.36±0.06	0.295

Discription :

**Different levels between letters showed highly significant effect between treatment α = 0.01

Based the data at Table 2, increasing number of yellow sweet potato and the decreases the number of glutinous rice flour then there is an increase in klepon elasticity (more chewy). This is presumably because the amylase capacity in yellow sweet potato is higher than the amylase holding glutinous rice flour. Amylase content in yellow sweet potato is 38% (Margaret, 2010), while amylase content of glutinous rice flour is 2% (Gruben dan Partohardjono, 1996). Prasetya (2011) stated that starch

with high amylase tend to have high elasticity while starch with higher amylopectin content will manufacture harder products.

The elasticity of food is also determined by the water content. Increasing number of yellow sweet potato on klepon then there is decreasing in klepon elasticity, this is because the moisture content of yellow sweet potato is 68.78% greater than moisture content of glutinous rice flour (11.05%). Moisture content that supposedly affects the texture of food because the higher the moisture content, the texture will become decreasing in elasticity (Singgih and Harjono, 2015). Then, lower moisture levels because the texture is more dense and compact (Pabesak, et al., 2013). The elasticity ranged klepon at 4.19 to 4.77 gf and there is no standard determination of the elasticity in klepon to the SNI 01-4309-1996 numbers layer cake quality requirements.

Moisture content

Based on observations (Table 2), the various substitutions of yellow sweet potato significantly different on klepon moisture content at α 0.01 in each treatment, while at the concentration of 10 and 20%; 30 and 40% were not significantly different. The moisture content of the klepons ranged from 57.67 to 63.76 gf.

Based the data at Table 2, increasing number of yellow sweet potato decreases and the number of glutinous rice flour then there is a increase in moisture content klepon. This is presumably because the moisture holding capacity in yellow sweet potato is higher than the moisture holding glutinous rice flour. Yellow sweet potato higher moisture content is 68.78% (Suprapta et al., 2003) of the glutinous rice flour moisture content (11.05%) (Immaningsih, 2012), resulting in klepon with a combination of glutinous rice flour more, tend to have a lower moisture content compared with the combination klepon a number of yellow sweet potato more. The result of this research is consistent with the results of Sari research (2011), the increasing number of grape sweet potato then there is a increase in moisture content klepon.

There is a relationship between moisture content and elasticity. As previous elasticity data can be stated increasing the substitution of yellow sweet potato, the higher the moisture content of klepon then there is a increase elasticity klepon. When compared with the quality requirements of SNI 01-4309-1996 numbers layer cake, klepon moisture content of (57.67 - 63.76%) is in not conformity is a maximum of 40%.

Ash content

Based on observations of ash content klepon (Table 2) shows that the ash content is not different from one another at α 0.01 in each treatment, the average value of ash content ranged from 1.65 to 2.54%. It is means the various substitutions of yellow sweet potato not give significantly effect on klepon ash content. When compared with the quality requirements of SNI 01-4309-1996 numbers layer cake, klepon ash content of 1.65 to 2.54% is in conformity is a maximum of 3%.

The protein content

Based on observations (Table 2), the various substitutions of yellow sweet potato significantly different on klepon protein content at α 0.01 in each treatment, while at the concentration of 0% to 30% were not significantly different. The protein content of the klepons ranged from 5.65 to 6.71%.

Based the data at Table 2 increasing number of yellow sweet potato and the decreases the number of glutinous rice flour then there is a decrease in the protein content of klepon. This is presumably because the protein holding capacity in yellow sweet potato is higher than the protein holding glutinous rice flour. Yellow sweet potato higher protein content is 68.78% (Suprapta *et al,* 2003) of the glutinous rice flour protein content (11.05%) (Immaningsih, 2012), resulting in klepon with a combination of glutinous rice flour more, tend to have a lower protein content compared with the combination klepon a number of yellow sweet potato more.

The result of this research is consistent with the results of Sari research (2011), the increasing number of grape sweet potato then there is a decreasing in protein content klepon. The protein content ranged klepon at 5.65 to 6.71% and there is no standard determination of the protein in klepon to the SNI 01-4309-1996 numbers layer cake quality requirements.

Fat content

Based on observations (Table 2) increasing number of yellow sweet potato and the decreases the number of glutinous rice flour shows that the fat content is not different from one another, the average value of fat content ranged from 4.13 to 4.92%. It is means the various substitutions of yellow sweet potato not give significantly effect on klepon fat content. When compared with the quality requirements of SNI 01-4309-

1996 numbers layer cake, klepon fat content of 4.13 to 4.92% is not in conformity is a maximum of 3%.

Carbohydrate

Based on observations (Table 2), the various substitutions of yellow sweet potato significantly different on klepon carbohydrate content at α 0.01 in each treatment, while at the concentration of 0% and 10%; 20 and 30% were not significantly different. The carbohydrat content of the klepons ranged from 5.65 to 6.71%.

Based on observations (Table 2) of increasing number of yellow sweet potato and decreases the number the glutinous rice flour then there is a decrease in carbohydrate content of klepon. This is presumably because the carbohydrate holding capacity in glutinous rice flour is higher than the carbohydrate holding yellow sweet potato. Glutinous rice flour higher carbohydrate content is 81.05% (Immaningsih, 2012) of the glutinous rice flour carbohydrate content (27.9%) (Suprapta *et al*, 2003) resulting in klepon with a combination of glutinous rice flour more, tend to have a higher carbohydrate content compared with the combination klepon a number of yellow sweet potato more.

The result of this research is consistent with the results of Sari research (2011), the increasing number of grape sweet potato then there is a decreasing in carbohydrate content klepon. The carbohydrate content ranged klepon at 23.87 to 25.99% and there is no standard determination of the carbohydrate in klepon to the SNI 01-4309-1996 numbers layer cake quality requirements.

Crude fiber content

Based on observations (Table 2) increasing number of yellow sweet potato and the decreases the number of glutinous rice flour shows that the crude fiber content is not different from one another, the average value of crude fiber content ranged from 1.36 to 1.57%. It is means the various substitutions of yellow sweet potato not give significantly effect on klepon fat content. There is no standard determination of the crude fiber content in klepon to the SNI 01-4309-1996 numbers layer cake quality requirements.

Sensory quality

There were four parameters that were measured in sensory quality in hedonic quality and hedonic test. They were color, taste, flavor, and elasticity. The level of likes and dislikes called hedonic scale e.g like very much, like, slightly like, dislike, and dislike very much. The mean values of hedonic quality and hedonic klepon can be seen in Table 3.

Table 3. Sensory Scores of Klepon with Varied Yellow Sweet Potato Concentrations

Parameter	0%	10%	20%	30%	40%	Sig
Color quality hedonic	2.9 ± 0.2^{a}	3.3 ± 0.5^{a}	3.6 ± 0.1^{a}	3.8 ± 0.2^{b}	3.3 ± 0.4^{b}	0.023*
Color hedonic	3.0±0.4	3.1±0.1	3.4±0.1	3.4±0.1	3.5±0.2	0.055
Flavor quality hedonic	3.1 ± 0.2^{a}	3.5 ± 0.0^{bc}	3.4 ± 0.2^{bc}	3.7 ± 0.2^{bc}	3.5 ± 0.2^{bc}	0.014**
Flavor hedonic	3.5±0.1	3.6±0.3	3.3±0.4	3.6±0.2	3.2±0.1	0.271
Taste quality hedonic	3.6 ± 0.2^{a}	3.7 ± 0.1^{a}	3.9 ± 0.2^{a}	3.7 ± 0.1^{a}	3.3 ± 0.1^{b}	0.006**
Taste hedonic	3.1 ± 0.1^{ab}	2.8 ± 0.1^{a}	3.1 ± 0.1^{ab}	3.8 ± 0.2^{c}	3.4 ± 0.2^{b}	0.001**
Elasticity quality hedonic	2.8 ± 0.1^{a}	3.1 ± 0.1^{a}	3.6 ± 0.4^{b}	3.8 ± 0.1^{b}	3.7 ± 0.2^{b}	0.001**
Elasticity hedonic	3.3 ± 0.1^{a}	3.7 ± 0.2^{b}	3.1 ± 0.2^{a}	3.5 ± 0.4^{ab}	3.0 ± 0.3^{a}	0.042*
Overall hedonic	2.5 ± 0.3^{a}	2.7 ± 0.1^{ab}	2.8 ± 0.1^{ab}	3.9 ± 0.1^{c}	2.9 ± 0.1^{ab}	0.013*

Discription :

**Different levels between letters showed highly significant effect between treatment $\alpha = 0.01$

*Different levels between letters showed significant effect between treatment $\alpha = 0.05$

Color: 1=white; 2= yellowish white; 3=yellow; 4=brownish yellow; 5=brownish
Flavor: 1=highly not sweet potato flavor; 2=not sweet potato flavor; 3=Slightly sweet potato flavor; 4= Sweet potato flavor; 5=Highly sweet potato flavor

Taste: 1=highly not sweet; 2=not sweet, 3=Slightly sweet; 4= Sweet, 5=Highly sweet

Elasticity: 1= Highly not chewy; 2= Not chewy; 3= Slightly chewy; 4=Chewy; 5= Highly chewy

Hedonic : 1=dislike very much; 2=dislike, 3= slighty like; 4=like, 5=like very much

Color

The hedonic quality scores of klepon color with various substitutions of yellow sweet potato significantly different at α 0.05 in each treatment, while at the concentration of 10% and 20%, 30% and 40% were not significantly different. Increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour then there is a increase in color of klepon (more yellow). This is presumably because the yellow or orange color on the yellow sweet potato is caused beta-carotene compounds which are beneficial for body health because they can function as pro vitamin A (Mayne, 1996).

The increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour shows that the preferred color score by panelist is not different from one another. The average preferred color score content ranged from 3.0 to 3.5 (slightly like to like).

Flavor

The hedonic quality scores of klepon flavor with various substitutions of yellow sweet potato significantly different at α 0.05 in each treatment, while at the concentration of 20% and 30% were not significantly different. Increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour then there is increase in strong flavor of yellow sweet potato on klepon. This is presumably because the yellow sweet potato has a flavor.

The increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour shows that the preferred flavor score by panelist is not different from one another at α 0.05. The average preferred taste score content ranged from 3.2 to 3.6 (slightly like to like).

Taste

The hedonic quality scores of klepon taste with various substitutions of yellow sweet potato significantly different at α 0.01 in each treatment, while at the concentration of yellow sweet potato 10%, 20% and 30% were not significantly different. Increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour then there is a increase in taste of klepon (more sweet). This is presumably because the yellow sweet potato has a sugar content which causes sweetness.

Elasticity

The hedonic quality scores of klepon elasticity with various substitutions of yellow sweet potato significantly different at α 0.05 in each treatment, while at the concentration of 0 and 10%, 20 to 40% were not significantly different. Increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour then there is increase in elasticity of yellow sweet potato on klepon (more chewy).

There is a relationship between elasticity in physical test result and sensory test. As previous elasticity data can be stated increasing the number of substitution of yellow sweet potato, the higher the physical test elasticity of klepon then there is increase elasticity in sensory test.

The increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour shows that the preferred elasticity score by panelist is different from one another at α 0.05. Increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour then there is decrease in hedonic elasticity on klepon. The average preferred elasticity score content ranged from 3.0 to 3.7 (slightly like to like).

Table 3 shows that varied substitution of yellow sweet potato give effects klepon overall preferred score (α = 0.05). The increasing number of yellow sweet potato and the decreasing the number of glutinous rice flour shows that the decrease in overall hedonic. The selected klepon with substitution yellow sweet potato 30%. It has characteristics were elasticity score (4.5 gf), moisture content (67.54%), ash (1.97%), protein (5.65%), fat (4.5%), carbohydrate (23.99%), crude fiber (1.46%), and A vitamin (0.036 ppm). Sensory analysis result were white yellowing color (3.8), sweet (3.7), strong flavor of yellow sweet potatoes (3.7), chewy (3.8) and overall hedonic level is little preferred (3.9).

Vitamin A

The selected klepon is klepon with substitutions of yellow sweet potato 30%. It contains vitamin A of 0.036 ppm. Women aged 19 years and over are advised to consume 1.300 micrograms of vitamin A per day (Kardjati and Alisjahbana, 2005). Thus eating a klepon with substitution of yellow sweet potato 30% dish cannot be sufficient for rate Recommended Dietary Allowances (RDA) of vitamin A.

CONCLUTION

There is a difference to the quality of the psycho chemical elasticity, moisture, protein, carbohydrate), hedonic quality of color, flavor, taste and elasticity, hedonic of taste, elasticity and the overall hedonic product klepon. Klepon with a substitution of yellow sweet potato was 30%, the substitution has the characteristics of elasticity score (4.5 gf), moisture content (67.54%), ash (1.97%), protein (5.65%), fat (4.5%), carbohydrate (23.99%), crude fiber (1.46%), and A vitamin (0.036 ppm). Sensory analysis result were white yellowing color (3.8), sweet (3.7), strong flavor of yellow sweet potatoes (3.7), chewy (3.8) and overall hedonic level is

like (3.9). Ash content of the selected of yellow sweet potato klepon had fulfilled in SNI 01-0349-1996.

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