

Formulation of yellow pumpkin cookies with mocaf (modified cassava flour) flour addition as a snack for the obese community

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Abstract

Cookies are generally made from wheat flour that provides high energy but low in fibre. Wheat flour can be substituted with yellow pumpkin flour to make cookies. Yellow pumpkin is an Indonesian local food which contains high beta carotene and fibre. The purpose of this research was to compare the yellow pumpkin and mocaf flour cookies with wheat flour cookies in terms of acceptability and nutrient content. For this experiment, two formulations were used: Formulation 1 (F1), 1: 2 ratio of yellow pumpkin flour to mocaf flour and Formulation 2 (F2), 1: 2 ratio of yellow pumpkin flour to wheat flour. Proximate analysis of the cookies was conducted. The results showed that the yellow pumpkin and mocaf flour cookies had a total energy content of 459.71 kcal/100 g, protein content of 1.12 g/100 g, fat content of 36.35 g/100 g, fibre content of 43.59 g/100 g and carbohydrate content of 31.94 g/100 g whereas the yellow pumpkin and wheat flour cookies had a total energy content of 587.72 kcal/100 g, protein content of 4.79 g/100 g, fat content of 40.87 g/100 g, fibre content of 21.42 g/100 g and carbohydrate content of 50.19 g/100. The data collected from the acceptance test conducted with 25 panellists showed that there was no difference in the colour, texture, taste and aroma for both formulated cookies.

1. Introduction

Yellow pumpkin is one of the abundant agricultural commodity products in Indonesia. The number of pumpkin productions in 2011 reached 150,000 tons/year in Indonesia and specifically on Java Island, the production number was 6100 tons/year (Statistics Indonesia, 2012). Yellow pumpkin is rich in β carotene, vitamins, minerals and fibre. Efforts to utilize the yellow pumpkin have been done by processing the fresh yellow pumpkin into flour. Pumpkin flour is currently being researched and used as a flour substitute in making bakery products such as cookies, muffins, brownies and cakes (Rismaya *et al.*, 2018).

Yellow pumpkin flour can be categorized as a high-fibre food because it meets the requirements whereby the minimum food fibre content should be 6 g/100 g (Foschia, 2013). The previous study showed that the total fibre content of pumpkin flour was 14.81%, whereas according to other studies, the total fibre content of pumpkin flour was higher, which was 21.39%-21.41 (Purnamasari and Putri, 2015). Mocaf (modified cassava flour) flour is also commonly used in bakery products to

substitute wheat flour in food product development. Mocaf flour is made from cassava fermented with lactic acid bacteria (LAB). Compared to wheat flour, the fibre content in mocaf flour is higher (Hanifa *et al.*, 2013) but low in gluten content (Tanjung and Kusnadi, 2015). In addition, cassava is affordable and widely available.

Obesity is one of the nutritional problems in Indonesia. Basic Health Research (2018) showed that the prevalence of obesity at >18 years old is 21.8%. Obesity is related to low fibre intake, sedentary lifestyle, high fat and high energy consumption. Bakery products are often high in energy and fat and the most consumed bakery products is cookies. Generally, cookies contain high energy, low level of other nutrition, and are made from wheat flour (Toan and Thuy, 2018). The substitution of wheat flour with high fibre flour can increase the fibre content in cookies (Jesmin *et al.*, 2016). Adequate fibre consumption is necessary to prevent the risk of cardiovascular disease, stroke, hypertension, and diabetes mellitus. Adequacy of fibre intake in various countries in the world is still less than the WHO recommendation of 25 g/day.

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Therefore, there is a need to develop high fibre foods with low energy content to overcome several diseases caused by lack of fibre (Rismaya *et al.*, 2018). Since cookies are favoured in Indonesia, the development of high fibre cookies should be given attention. Due to the high fibre content of yellow pumpkin and mocaf flour, these flours will be used to substitute wheat flour. The aims of this study are to develop high fibre cookies made from yellow pumpkin flour and mocaf flour and to evaluate the proximate analysis of the cookies. In addition, sensory evaluation of the cookies will be conducted to determine the acceptability.

2. Materials and methods

2.1 Cookies preparation

Cookies were developed from two formulations whereby Formulation 1 (F1), 1: 2 ratio of yellow pumpkin flour to mocaf flour and Formulation 2 (F2), 1: 2 ratio of yellow pumpkin flour to wheat flour. The formulations of cookies are as shown in Table 1. Margarine and refined sugar were mixed for 10 mins. Egg yolk was then added and mixed until homogenous. Respective flours according to ratio were added in with corn starch, milk powder, baking powder, cinnamon, and oatmeal. Ground fried cashews were then added, and the dough was kneaded until smooth. The dough was portioned of 5 g and roasted at 140°C for 10 mins until cooked.

Table 1. Cookies formulation

Ingredients	Formula 1	Formula 2
Margarine	150 g	150 g
Alternative sweeteners	2 sachets	2 sachets
Egg yolk	1	1
Wheat flour	100 g	-
Mocaf flour	-	100 g
Yellow Pumpkin flour	50 g	50 g
Salt	¼ teaspoon	¼ teaspoon
Maize	30 g	30 g
Milk powder	30 g	30 g
Baking powder	¼ teaspoon	¼ teaspoon
Cinnamon powder	½ teaspoon	½ teaspoon
Oatmeal	50 g	50 g
Cashew nut	50 g	50 g

2.2 Nutrition analysis

The nutrition analysis test was conducted at the chemistry laboratory, Faculty of Science and Mathematics, Satya Wacana Christian University Salatiga including the fat analysis (AOAC Method No 900.02), protein analysis (AOAC Method No 934.01), carbohydrate analysis (AOAC Method No 960.52), and fibre analysis (AOAC Method No.991.43) (AOAC,

2000).

2.2.1 Carbohydrate

Carbohydrate analysis test used the anthrone method, anthrone, dehydro-ketoanthrone, regulates by selecting the turquoise colour and arranged uptake with a spectrophotometer.

2.3 Sensory analysis

A total of twenty-five panellists, consisting of the students of Ngudi Waluyo University in the nutritional study program, were invited to conduct the sensory analysis. Panellists were asked to evaluate the flavour, aroma, texture and colour using a 5-point hedonic scale (1 = dislike extremely – 5 = like extremely) for each attribute.

2.4 Statistical analysis

All statistical analysis was performed using SPSS 16 computer program from Windows. Mann Whitney test was used to determine the significant difference.

2.5 Ethical clearance

Request ethical clearance has been reviewed and approved by Faculty of Public Health Semarang State University with the certificate number 201/KEPK/EC/2019.

3. Results and discussion

3.1 Nutrition analysis

The results of nutrition analysis obtained nutritional content of pumpkin cookies with flour and pumpkin cookies with mocaf flour which can be seen in Table 2. A cookie recipe can produce sixty pieces weighing 5 g each. Figure 1 shows the pumpkin cookies with wheat flour (F1) and Figure 2 shows the pumpkin cookies with mocaf flour (F2). Table 2 shows that the protein content of pumpkin cookies with wheat flour was higher than the protein content of pumpkin cookies with mocaf flour. This can be influenced by the protein content of wheat flour which is higher than the mocaf flour. A previous study by Amanu and Susanto (2014) showed that the protein content of mocaf flour was 2.45 g/100 g while the protein content of wheat flour based on Indonesian food composition tables was 8.9 g/100 g (Indonesian Food Composition Table, 2018).

The fat content in pumpkin cookies with wheat flour is higher than the pumpkin cookies with mocaf flour, the fat content of both formula cookies was from margarine and the added milk. The maximum fat requirement for a weight loss diet is 50 g/day (Lysen and Israel, 2017), the pumpkin cookies made from F1 (16.34%) and F2

Table 2. Nutritional value of pumpkin cookies

Nutrient	F1/100 g	F1/40 g	F2/100 g	F2/40 g
Energy	587.72 kcal	117.54 Kcal	459.71 kcal	91.94 kcal
Protein	4.79 g	0.95 g	1.12 g	0.22 g
Fat	40.87 g	8.17 g	36.35 g	7.27 g
Carbohydrate	50.19 g	10.03 g	31.94 g	6.38 g
Fibre	21.42 g	4.2 g	43.59 g	8.7 g

(14.54%) can meet the requirement.



Figure 1. Pumpkin cookies with wheat flour (F1)



Figure 2. Pumpkin cookies with mocaf flour (F2)

The carbohydrate content of wheat flour and mocaf flour is not much of a difference. The carbohydrate content of wheat flour is 77.3 g/100 g while the mocaf flour is 75.49 g/100 g but the carbohydrate content of pumpkin cookies with wheat flour (4.05%) turns out to be higher than pumpkin cookies with mocaf flour (2.57%). The recommended carbohydrate requirement for weight loss is 50-55% of the total daily energy or 225 g - 247.5 g for an energy requirement of 1800 kcal/day. From the conversion energy of the protein, energy and fat content, the energy content produced by pumpkin cookies with wheat flour is 587.72 kcal while the energy content of pumpkin cookies with mocaf flour is 459.71 kcal. The serving portion of pumpkin cookies is 20 g which is equivalent to the serving size of existing commercial cookies that are claimed for weight loss diets. The nutritional value of each serving size can be seen in Table 2.

The food contains low energy if it only contains 40 kcal (Food and Drugs Administration, 2019). According to nutrient analysis, pumpkin cookies are not included in low-energy snacks because they have an energy content of more than 40 kcal for each serving. However, when

compared with the recommended maximum snack for obesity which is 150 kcal, pumpkin cookies can be one of the alternative snacks for consumption. The energy content per serving (20 g) of pumpkin cookies with Mocaf flour is 91.94 kcal and fibre 8.7 g. If we compared with commercial cookies product, the content energy is 100 kcal/serving and the fibre is 2 g/serving, the pumpkin cookies with mocaf flour have lower in energy and higher in fibre.

Minister of Health Regulation of the Republic of Indonesia No. 75 of 2013 article 4 states that the total energy needs of the average Indonesian population is 2150 kcal/person/day (Permenkes, 2013). Thus, the serving size (20 g) of cookies can meet 5.4% (F1) and 4.2% (F2) of the average energy needed by the Indonesian population per person per day. The recommended energy requirement for obesity is 1200 - 1800 kcal/day, so pumpkin cookies can meet 6.5% and 5.1% of the maximum needs of obese individuals (Lysen and Israel, 2017).

The fibre content of pumpkin cookies with mocaf flour is higher than pumpkin cookies with wheat flour, the fibre content can be influenced by the addition of pumpkin flour and oats. Fibre component of the pumpkin consists of pectin, cellulose, hemicellulose and lignin (Wongsagonsup *et al.*, 2015). The fibre content of mocaf flour is higher than wheat flour, therefore, pumpkin cookies with mocaf flour have higher fibre content. If the fibre content in a portion of food contains 3 g/100 g, it is classified as a food source of fibre and high in fibre as the food fibre content is as much as 6 g/100 g (Indonesian Food and Drug Administration, 2016). The daily fibre required is 25 g/day and the consumption of pumpkin cookies can help to meet the requirement as they contain fibre as much as 16.8% (F1) and 34% (F2). Meal replacement therapy for obesity should also meet the fibre requirement which is at least 5 g/serving. Hence, pumpkin cookies with mocaf flour can be recommended as a snack for obese consumers.

3.2 Sensory analysis

The hedonic test results on cookies based on the Mann Whitney statistical test showed that there were no statistical significant difference in texture, taste, colour and aroma in the pumpkin cookies with wheat flour (F1) and pumpkin cookies with mocaf flour (F2). Table 3

shows that the preference level of panellist for the pumpkin cookies and most panellists are able to accept the cookies. The differences between two cookie formulations are in the amount of wheat flour and mocaf flour added. Based on the hedonic test, the two cookie formulations are liked by panellists. Therefore, mocaf flour can replace wheat flour and pumpkin flour can be used as the basis for making cookies.

Table 3. Sensory evaluation of pumpkin cookies

Formula	Texture	Flavour	Colour	Aroma
F1	3.12±0.78	3.36±0.81	3.44±0.82	3.76±0.83
F2	3.16±0.85	3.28±0.61	3.52±0.71	3.52±0.77
Result	p= 0.92	p=0.96	p=0.52	p=0.26

Values are mean±standard deviation

The preferred texture of cookies is crispy when it is broken. The Mann-Whitney test showed a result of $p > 0.05$ which showed that there was no difference in texture in pumpkin cookies with mocaf flour or wheat flour. Cookie texture is formed by fat and amylose content. The fat in cookies will break down the amylose structure then cover the starch and gluten to produce crispy cookies (Oktaviana *et al.*, 2017). In this research, the wheat flour and mocaf flour used was 50 g and they produced a texture that is preferred by panellists, so it can be concluded that the mocaf flour can provide the same crispy texture as wheat flour.

The taste of food is strongly influenced by the composition of the ingredients used. The Mann-Whitney test showed $p > 0.05$ which showed that there was no difference in taste in pumpkin cookies with mocaf flour or wheat flour. The taste of pumpkin cookies is influenced by a pumpkin that has a sweet basic taste. The use of less sugar does not add excessive energy value and the taste will not be too sweet so that it can be liked by panellists. Other basic ingredients that affect the taste are the addition of eggs, margarine, and mocaf flour or wheat flour.

Colour is the first factor in assessing a food preference test because it is a visual appearance. The Mann-Whitney test showed $p > 0.05$ meaning that there was no colour difference in pumpkin cookies with mocaf flour or wheat flour. The colour of pumpkin cookies is yellow because of the ingredients. The comparison of pumpkin and flour by 1: 2 in both formulations of cookies gave a yellow effect that is not concentrated, but when it went through the roasting process with the same temperature and time, the pumpkin cookies with wheat flour has a brownish colour compared to pumpkin cookies with mocaf flour.

The Mann-Whitney test showed $p > 0.05$ which showed that there was no difference in aroma in

pumpkin cookies with mocaf flour or wheat flour. Pumpkin has a distinctive aroma. Besides, the aroma of cookies is influenced by the starch content of wheat flour and mocaf flour so that a Maillard reaction occurs. Maillard reactions that occur during the roasting process produce a distinctive and preferred product aroma. The higher the protein content of the material used, the stronger the aroma produced from the Maillard reaction. The aroma of cookies is also strengthened by the use of margarine in the dough. Fat is an important component in making cookies because it functions as an aroma enhancer (Maerunis, 2012).

4. Conclusion

According to the colour, aroma, texture and taste, the acceptance of pumpkin cookies with mocaf flour is no different from pumpkin cookies with wheat flour. The result showed that the use of wheat flour in bakery products in making cookies can be substituted by mocaf flour. The energy content of pumpkin cookies with mocaf flour substitution is lower than pumpkin cookies with wheat flour. The fibre content of the pumpkin cookies with mocaf flour is higher than the pumpkin cookies with wheat flour. Pumpkin cookies with mocaf flour are qualified as a high-fibre food with the fibre content of 6 g/serving. The energy content of pumpkin cookies with mocaf flour is lower than the energy content of commercial cookies for weight loss diets.

Conflict of interest

The authors declare no conflict of interest.

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