Formulation and characterization of bread using coconut-pulp flour and wheat flour composite with addition of xanthan-gum

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Abstract. Coconut-pulp flour is coconut flour made from by-product of coconut-milk based food products. The flour contains no gluten and high fibre, which can be considered as functional potential food. Bread made from composite-flour of coconut-pulp flour and wheat flour was studied for its physic-chemical and sensory characteristics. Addition of hydrocolloid, like xanthan-gum, was aimed to provide viscoelasticity for the dough which is essential for baked product. Composite-flour proportion used in this study was; 10CPF/90WF, 15CPF/85WF and 20CPF/80WF; and xanthan gum to total flour of 0,1% and 0,4%. Variable observed were; crumb-texture, crumb-colour, taste of coconut, preference and flavour; moisture, ash, fiber and soluble-protein contents. The research showed that addition of coconut-pulp flour in the composite-flour decreased specific volume value and increased the bread texture produced. It also increased the bread moisture-content, ash-content, fibre-content and soluble protein-content. Moreover, the xanthan-gum addition resulted in decreased specific-volume value and increased texture and fiber-content of the bread produced. Overall, the sensory characteristic of crumb colour, flavour and panellist preference revealed better than control bread made from wheat flour, however its crumb texture harder compare to control bread made from wheat flour. This study showed that coconut-pulp flour potential to be developed for production of functional food.

Keywords *: bread, coconut-pulp flour, fibre, functional-food, and gum-xanthan*

1. Introduction

Coconut-pulp flour (CPF) is coconut flour made from by-product of coconut milk based food products. One method to improve the nutritional and functional value of CPF prior to use is by modification through the fermentation process [3,5]. The flour contains no gluten and high fibre, which can be considered as functional potential food. The flour can provide not only value added income to the country, but also a nutritious and healthy source of dietary fiber [7,9]. The flour can be utilised to produce various food products, such as cokies, biscuit, brownies or bread [10]. Bread is a food product based on wheat flour (WF) which poses flexible use and appropriate to be vehicle of various ingredients like CPF through formulation of composite flour [7,8]. CPF contain no gluten, therefore produce bread with poor charcteristics. It requires the addition of other gluten-like

substances to optimize the characteristics of the resulting bread. Hydrocolloids compounds are often added in the manufacture of gluten-free bread, because hydrocolloids have the ability to bind starch grains, create a three-dimensional network and are emulsifiers [6,11]. The inclusion of CPF on WF to form composite flour will cause the decrease gluten content; it will decrease in development of the dough. This limitation can be overcome by the addition of colloid such as xanthan gum. The formulation of composite flour using CPF to bread with the addition of hydrocolloid such as xanthan-gum can be considered as innovation of new product by utilising the by – products from coconut. Nowadays, people were aware about the consumption of healthier food in their daily life. The innovation was in coherent with consumers demand for a healthier choice of food product [7]. Therefore, the present study was aimed to produce bread from composite flour of CPF and wheat flour (WF) with addition of xanthan gum.

2.Materials and methods

2.1 Preparation of CPF and composite flour formulation

The CPF was prepared as described in [2,4] and the formulation of the composite flour and the xanthan gum are presented in Table 1:

Tabel 1. The composite flour and the xanthan gum formulation

No. Formula	% Coconut pulp flour	5 Wheat flour	% Xanthan Gum
CIX1	10	90	0.1
C1X2	10	90	0.4
C2X1	15	85	0.1
C2X2	15	85	0.4
C3X1	20	80	0.1
C3X2	20	80	0.4

2.2 Prearation of the bread

The ingredients formulation of the bread were; *the composite flour*, *the xanthan-gum*, 1 yolk, 10% of Shortening (white margarine), 10% sugar, 0.1% yeast, 0.1% salt, 5% full cream milk and 50 mL of cold water (ice) (modification of [2]).

The bread was prepared straightly through dough preparation method. All the ingredients were mixed using mixer for 4 min. The dough was fermented for 60 min at room temperature (28 ± 2^{o}C), weighed to 100 g, rolled, shaped, and baked in pre-heated oven operating at 250^{o}C for 15 min. The bread loaves produced then allowed to cool then packed in low density PE bags for subsequent analysis. Bread prepared use the same ingredients, but only wheat flour and without xanthan-gum was used as the control.

2.3 Analysis

Sensory evaluation of coded samples bread was carried out by twenty semi-trained panelists of students of Food Science and Technology University of Jenderal Soedirman, Purwokerto. The characteristics evaluated were; crumb-colour, texture, flavour, taste of coconut and panellist preference. Scoring was done in 4 scales. Hedonic scale of 4 represent extremely like and scale of 1 represent extremely dislike. In addition, moisture, ash, fibre and soluble-protein contents were determined according to the standard AOAC [1] methods.

Data obtained was analysed using Analysis of variance and the samples means were separated using Duncan Multiple Range Test at 5% level.

3. Results and discussion

3.1.Sensory characteristics of bread crumb produced

The sensory evaluation of the bread produced showed that overall sensory characteristics better than control in colour and panellists preference Data regarding the organoleptic evaluation is presented in figure 1.

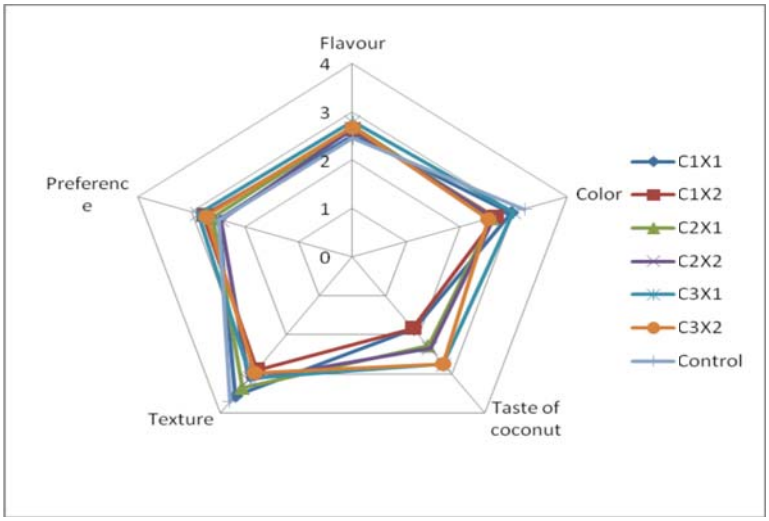

Figure 1. Sensory characteristics of the bread produced

Statistical analysis showed that the treatments combination gave significantly different on the bread crumb colour. The color scale of the bread produced were between 2.53 – 3 (yellowish white). The highest colour was obtained from C3X1 treatment. However, that the treatments combination gave no different on the bread flavor. The flavor scores of the bread of 2.53 (rather delicious) to 2.81(delicious), while for the control of 2,47(rather delicious). Furthermore, in this study the taste of coconut revealed that the scores increased with the increase of CPF concentration on the composite flour; the highest score was obtained from C3X1 and C3X2. These result can be related to panelist preference on the bread; in which showed increased with the CPF concentration on the composite flour. The highest panellists preference score given by C3X1 and C3X2; that were 2.89 and 2.73; respectively, while 2.50 for the control.

3.2. Effect of utilization of coconut-pulp flour and xanthan-gum on physico-chemical characteristics of the bread produced

Table 2. Physico-chemical characteristics of the bread produced

Formulation	Specific volume, mL/g	Texture, N	Moisture-content, %	Ash-content, %	Soluble-protein, %	Crude fiber, %
C1X1	5.57^{a}	0.19^{a}	36.19	0.87	2.89	6.56^{a}
C1X2	5.33^{ab}	0.31^{abc}	38.41	0.89	2.53	7.05^{ab}
C2X1	5.00^{ab}	0.21^{ab}	38.18	0.86	2.73	6.17^{ab}
C2X2	4.73^{ab}	0.41^{bc}	37.57	0.83	2.53	6.62^{a}
C3X1	4.07^{b}	0.29^{abc}	37.54	0.91	2.73	6.46^{ab}
C3X2	4.33^{ab}	0.47^{c}	37.13	1.00	2.76	8.34^{b}

Note : * Mean values with the same *superscript* letters within the same column do not differ significantly at 5% significant level. Values are means of triplicates.

Specific volume produced from the bread are between 4.07 – 5.57 mL/g; which is lower than that of control of 6.8 mL/g. The decrease of its specific volume was relate to the increase of CPF concentration on the composite flour. The more the CPF addition the lower the specific volume; that because of the decrease on gluten availability on the composite flour, which contributed from WF. In addition, the decrease on gluten availability on the composite flour also affect the texture of bread produced. The CPF addition also affect the bread moisture content; that relate to crude fibre content of the CPF. The moisture content of the bread produced were between 36.19% to 38.41%. The values was higher than that of control. The crude fibre content of CPF > that of WF; while xanthan-gum also contributed on the increase of the bread moisture content. In this study the water content of bread produced also influenced by the addition of xanthan-gum at concentrations of 0.1% and 0.4%. Xanthan-gum is a hydrocolloids which capable to form gel when interacting with water [6]. Xanthan-gum also has the ability to retain moisture [11]. The addition of xanthan-gum, resulted in the formation a gel structure in the bread dough which capable to bind and retain water, therefore in the baking not much water that evaporates which resulted the moisture content of bread becomes quite high. As the xanthan-gum addition was mean to overcome the limit on gluten content because of the use CPF; however, the study resulted that the increase xanthan-gum addition , decrease the specific volume of the bread produced.

4. Conclusion

In conclusion, the addition of CPF on the preparation of bread resulted in significant improvement of crude-fibre and soluble protein content. However, its decrease the specific volume, increase in the bread texture .Furthermore, the addition of xanthan-gum on the bread preparation also increase of its crude-fibre, decrease the specific volume and increase the texture of bread produced. Overall, the combination treatments has increase the crude fibre content and soluble protein of the bread produced, and has sensory characteristics better than control in colour and panellist preference.

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