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Mocaf bread enriched with Mung Bean (*Vigna radiata L.*) as a source of protein

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***Abstract*—** this study aim to determine the effect of substitution Mocaf (Modified Cassava Flour) and mung bean flour on bread making. The treatments used were A (60% Wheat flour: 40% Mocaf), B (60% Wheat flour: 35% Mocaf: 5% mung bean flour), C (60% Wheat flour: 30% Mocaf: 10% mung bean flour), D (60% wheat flour: 25% Mocaf: 15% mung bean flour).The results showed that the substitution Mocaf and mung bean flour significantly different influence on the increase of water content, ash content, protein content, colour, flavour, degree of development and reduced levels of carbohydrates, sugar. But the influence did not differ significantly to fat content, aroma and texture. The results of organoleptic tests and chemical analysis showed the product D was the best product with the average preference for colour, flavour, texture and taste (3.63 to 32.90), moisture content (27.19%), ash content (1, 36%), protein content (9.57%), fat content (7.79%), carbohydrate content (52.67%), sugar (14.37%) and degree of development (57, 23%).

***Keywords*— Bread, Mocaf, Mung bean fruits.**

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INTRODUCTION

Bread is food product made of wheat flour fermented with yeast (*Saccharomyces cereviciae*) addition of water and other foods and then baked. Sugar, salt, milk, fats, egg, emulsifiers and others materials such as chocolate, cheese and raisins can be added. The main ingredients consist of flour, water, yeast and salt. Baking Process According to Buckle, et al. (1987) there are three important stages in the manufacture of bread that is: a) Dough Mixing and Stirring, the process material is mixed together so that the starch and protein in the flour can absorb water to form dough and form a gas barrier structure which makes high-volume bread. b) Dough fermentation, Fermentation of the dough can be used proofer or steam (steam room) or outdoors as long as the dough covered with plastic or a damp cloth so that the dough does not dry. Dough fermentation was conducted at a temperature of 30-36 ° C with a humidity of 80-85% and will decline at an ambient temperature of 43 ° C. c) Toaster Baking of bread made in the oven at a temperature of 150-180ºC ± 15-30 minutes. Dough volume increase in the first 5-6 minutes and the evaporation of water occurs at 8-10%. Bread is considered ripe when golden brown occur.

Wheat flour contains starch in complex form of carbohydrates. It also contains proteins in the form of gluten that play a role in making the dough tough and elastic. Advantages compared to other flour on the properties of physical chemistry especially the ability of proteins in the form of gluten. The nature of the elasticity of gluten occurs due to a reaction between proteins in flour with water due to mixed, twisted, and slam (Suhardjito, 2005).

Mocaf is processed using modify cell tuber cassava with fermentation, where lactic acid bacteria microbial cells predominate during the fermentation of cassava flour. Mocaf price is relatively cheaper than wheat flour so that the cost of making the product can be minimized. Mocaf can reduce the use of flour import. Mocaf has a calorie content equivalent to wheat in the same unit weight is 363 kcal, while wheat flour 365 kcal (Subagio, 2010). To increase the protein content of Mocaf, the flour should be added nuts, to reaches protein content 23-40%. Mung beans have a protein content of 22.9% which may increase protein to mocaf.

MATERIALS AND METHODS

The research was conducted at the Laboratory of Technology of Agricultural Andalas University of Padang West Sumatera. Materials used on Mocaf bread making were mocaf, salt, sugar, yeast (instant Staff), skim milk powder, margarine, bread improver and eggs. While Mocaf was obtained from *Payakumbuh* and mung bean flour is processed. Chemicals for the chemical analysis, H_2SO_4, NaOH 50%, distilled water, n-hexan, and other analysis materials. Equipment used includes: spoon, bowl, knife, baking, oven, 60 mesh sieve and analysis tools such as chemistry and physics Erlenmeyer, burette, volumetric flask, glass cup, porcelain cup, oven, desiccator, Kjeldahl flask, Soxhlet, and other glass tools.

Research design used in this study was Complete Randomized Design (CRD) consisting of four treatments and three replications. Level of treatment that is used is the rate of substitution Mocaf and green bean flour for making Mocaf Bread. The treatments were:

A = 60% Wheat Flour: 40% Mocaf
B = 60% Wheat Flour: 35% Mocaf: 5% mung bean flour
C = 60% Wheat Flour: 30% Mocaf: 10% mung bean flour
D = 60% Wheat Flour: 25% Mocaf: 15% mung bean flour

Formula based on preliminary research, if the substitution Mocaf reduced and green bean flour is added, it will result in the development of the dough and nutrients are better because the green beans have a high enough protein. A Mocaf Bread formulation refers to the Bogasari Baking Centre. Mocaf formulations used in this study presented in Table 1.

Table.1Formulation Mocaf Bread

Material (g)	A	B	C	D
Wheat flour	600	600	600	600
Mocaf	400	350	300	250
Mung Bean	-	50	100	150
yeast	30	30	30	30
Water	460	460	460	460
Sugar	260	260	260	260
Salt	15	15	15	15
Milk powder	100	100	100	100
Margarine	150	150	150	150
Yolk	40	40	40	40
White	15	15	15	15
Bread Improver	3	3	3	3

Sources: Bogasari (2004)

The research was conducted in two phases:

a. Mung bean Flour Making. First green beans are sorted and washed, then soaking with clean water for 10 hours and drained. Then steamed for 30 minutes. Then dried in an oven of 60 C for 10 hours. Dry Mung bean grinder and sifted by using sieve 60 mesh.
b. Mocaf bread Making, Mocaf bread making according to Tilawati (2005) are modified as follows :
   1. All the ingredients (flour, green beans and MOCAF comply with treatment) skim milk powder, yeast, bread improver and refined sugar except the salt and butter stirred until flat, then put the remaining ingredients and stir until dough are dull
   2. Dough is fermented for 60 minutes at temperature of 33 º C so that the dough expands.
   3. Dough is weighed 50 grams, rounded and fermented for 30 minutes in a closed space and humid.
   4. Then the dough is pressed, grinded and rounded back, then arranged on a baking sheet has smeared butter. Subsequently left the final fermentation temperature expands on 330° C for 15 minutes until the dough expands.
   5. Then the dough is baked in the oven at a temperature of 180^{o}C for 20 minutes until bread is golden brown colour.

OBSERVATIONS

1. Observations were to mung bean flour and mocaf bread, include yield and chemical analysis, i.e., water content, ash content, levels of protein and fat levels.
2. Mocaf bread observation consists of physical and chemical analysis of water content, ashes levels, levels of protein, fat, carbohydrate levels by difference method and sugar levels. Organoleptic test that includes colour, flavour, taste and texture.

RESULT AND DISCUSSION

The chemical analysis on mocaf and Mung bean flour can be seen as table 2 below:

Table.2 Characteristic of Mocaf Bread and Mung bean

Analysis (%)	MOCAF	Mung Bean
Water content	12.28	9.36
Ash	0.37	1.61
Protein	2.65	23.43
Fat	1.73	1.86

Table 3 Moisture content of Mocaf Bread with Mung bean (wet basis)

Treatment	Water content (%)
A	24.57 b
B	26.13 a
C	26.64 a
D	27.19 a
CV = 2,10	

The significance is according to DNMRT 5%.

Moisture content obtained qualified SNI 01-3840-1995 Bread is a maximum of 40% of wet weight. Water content affect water uptake and starch gelatinization on the elasticity of the dough to produce soft bread texture. If the moisture content is low, the number of hydroxyl groups in the starch molecules increases the ability to absorb water so high and an increase in viscosity, as well as the starch was gelatinized. Increase in water content is caused by the level of substitution of flour used (Winarno, 2004).

Table 4. Ash content of Mocaf Bread

Treatment	(%)
A	1.18 a
B	1.19 a
C	1.31 b
D	1.37 b
CV = 2,09	

The significance is according to DNMRT 5%.

Ash content obtained qualified SNI 01-3840-1995 bread that is a maximum of 3% ash content. Mung bean flour is thought to have a higher mineral content than the mocaf. One is calcium mung bean flour, namely (223 mg/100g)

(Rukmana, 1997) and mocaf (58 mg/100g) (Anonymous, 2009).

Table 5 Fat content of Mocaf Bread

Treatment	Fat (%)
A	7.70
B	7.77
C	7.88
D	7.90
CV = 2,68	

The significance is according to DNMRT 5%.

Table 6 Carbohydrate of Mocaf bread

Treatment	Carbohydrate (%)
A	58.98 a
B	57.32 a b
C	54.93 b c
D	52.67 c
CV = 2.14	

The significance is according to DNMRT 5%.

Carbohydrates have an important role in determining the characteristics of foodstuffs, such as flavour, colour, texture and aroma. Proximate analysis is an analysis in which the carbohydrate content including crude fibre known not by analysis but by calculation, by subtracting one hundred precent minus the fat content, moisture content, ash content and protein content (Winarno, 2004).

Table 7. Sugar content of Mocaf bread

Treatment	Sugar (%)
A	17.58 a
B	14.13 b
C	14.36 b
D	14.37 b
CV = 7,39	

The significance is according to DNMRT 5%.

The sugar content in accordance with SNI 01-3840-1995 i.e. bread sugar levels at least 10% (dry weight). This is due to mocaf have a higher carbohydrate content than the green bean flour. So that less substitution mocaf the higher levels of sugar produced.

Table 8. Proofing of Mocaf beard

Treatment	Proofing (%)
A	56.08 a
B	56.60 b
C	56.84 a b
D	57.23 c
CV = 0,34	

The significance is according to DNMRT 5%.

According Widowati (2003) cit Tilawati (2005), gluten has a very important role in generating the development of good bread. If the flour is substituted with mocaf the decline that led to the development of gluten and dough elasticity properties decrease. However the different mung bean flour protein the nature of the protein gluten in wheat flour, but the high amount of protein in mung bean flour Mocaf influence on the development (US Wheat Associates, 1983).

Tabel 9. Sensory analysis of Mocaf bread

Treatment	Color	Aroma	Texture	Taste
A	3,67	3,38 a b	2,92	3,50 ab
B	3,65	3,10 b	3,05	3,30 a b
C	3,55	3,35 a b	2,85	3,10 b
D	3,79	3,84 a	3,63	3,90 a
CV=22,87				

The significance is according to DNMRT 5%.

Colour is affected by the level of substitution of flour, green pea flour is yellow-green while the white mocaf. The higher the green bean flour substitution wills Mocaf rather dark -collared or brownish beige.

Mocaf has flavour that is almost comparable to wheat. If processed, the resulting product is not less interesting than wheat flour. Aroma of bread is determined by kissing her thoroughly. The smell of food plenty determine the food delicacy (Winarno , 2004) .

Mung bean flour substitution mocaf softer texture makes for higher protein content than Mocaf. According to the U.S Wheat associates (1983), texture is the perceived nature of the network when held in a bakery or bread section was cut or sliced . The desired properties of the bread are soft and elastic. Circumstances bread composition can be determined by pressing with a finger and touched the surface of the bread. Each food has its own texture. It depends on the physical, the size and shape of the cells it contains.

The addition of green bean flour gives a better flavour than Mocaf made without the addition of mung bean flour. This is because the higher the addition of mung bean flours then the green beans taste more pronounced in Mocaf and panellists preferred. According Winarno (2004), flavour is affected by several factors, namely chemical, temperature, concentration and interaction with other flavour components. Flavour compounds in the product can provide sensory stimulation to the receiver when sipped.

CONCLUSIONS

1. The addition of mung bean flour increase levels of Mocaf bread protein, ash and moisture, bread colour and taste but does not affect levels of fat bread mocaf, flavour and texture.
2. The organoleptic test against colour, flavour, texture and taste of mocaf bread is accepted by the panel about 3 – 4 point namely is at standard slightly like to like.
3. Mocaf on treatment D (60% wheat flour: 25% mocaf: 15% mung bean flour) Is the best products because in terms of organoleptic favoured by the panel and having the content of nutrition is a good enough. Test results of treatment of D obtained an average value of colour, flavour of texture and taste (3.63-3.9), moisture content (27.19%), ash (1.37%). Protein (9.57%), fat (7.79%), Carbohydrate (52.67%), sugar (14.37%) and dough development (57.23%). With the substitution of mung bean flour

can increase the flavour and nutritional value on the mocaf bread.

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