

CHEMICAL AND ORGANOLEPTIC CHARACTERISTICS OF CHICKEN NUGGET BASED ON COMPOSITE FLOUR FROM MOCAF, BROWN RICE AND CORN STARCH

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ABSTRACT

One of the most favorite food is nugget which is a fast-food group with meat-based ingredients. In this study, MOCAF, brown rice flour and corn starch were used as an alternative fillers of wheat flour substitution as a means of reducing dependence on wheat flour as an imported product and increasing the nutritional content of nuggets. The purpose of this study was to determine the effect of variations of the formulation of materials on the organoleptic characteristics and to determine chemical content of the nuggets that was preferred by the panelist. This research began with the nugget formulation, followed by organoleptic testing and chemical characterization of the nugget formula that was preferred by the panelists. The average results of the affection test showed that nugget B was preferred to nugget A with the materials formula having a ratio of MOCAF, brown rice flour and cornstarch, namely 4:1:3 (60g:15g:45g). The preferred nugget contains water content as much as 57.553%, fat content of 1.055%, ash content of 1.955%, protein content 29.195%, crude fiber content of 16.064%, and carbohydrates by different of 10.205%. By not using wheat flour as the main materials, these nuggets can be regarded as product with a high in fiber because of the content in carrots, brown rice flour, and MOCAF.

Keywords: Alternative Food, Nugget, Composite Flour, Corn Starch

INTRODUCTION

In this fast-changing era, people are preferring food that is practical, economical, and quickly to prepare. Fast food is food that is served in a short time and can be consumed easily (Ratnaningsih, 1999). One of the processed ready-to-eat foods whose people like is nuggets.

Nugget is one of the food products that processed meat by utilizing meat restructuring technology and using low-quality meat. This process can also increase the added value of meat (Khomairah, 2012). Nuggets were processed not only by using meat as raw materials, but also can be added with vegetables to increase their nutritional value of nuggets. Nuggets are

often consumed by the people because they are easy to process.

In the nuggets manufacture process, flour serves as a filler and binder. The flour commonly used as nugget materials was wheat flour. Wheat flour contains protein in the form of gluten. The wet gluten content in wheat reaches 24-36% (Aptindo, 2012). According to Sudarminto (2015), the main difference of wheat flour and MOCAF especially in the nutritional value is that MOCAF does not contain gluten. Most people avoid gluten for health reasons, especially those with celiac disease (an allergy to the gluten protein that causes immunodeficiency). So that, food

diversification become solution for the limitation usage of the wheat flour.

One solution that can be used to reduce the use of flour is to use composite flour. Composite flour is a mixture of various types of flour, such as tuber flour (cassava, sweet potato), with or without high protein flour (soy flour, peanut flour), with or without grain flour (rice flour, sorghum flour, corn flour), with addition of wheat flour or without addition of wheat flour (Bantacut and Saptana, 2014). Composite flour can be used as a substitution for wheat flour in the development of processed food products such as chicken nuggets.

Nuggets can be processed by substituting wheat flour with MOCAF, brown rice flour and corn starch. In this study, brown rice flour, MOCAF and corn starch were used as substitutes for wheat flour. This is done to increase the nutritional content of chicken nuggets compared to existing nuggets products, besides to reducing the use of wheat flour also. The purpose of this study was to determine the effect of variations in the formulation of materials on the organoleptic characteristics and to determine the chemical content of the nuggets that were most favored by the panelists.

MATERIALS AND METHODS

Materials and tools

The materials used in this study were chicken meat, corn starch, ice cubes, MOCAF, carrots, brown rice flour, garlic, salt, pepper, mushroom broth, oyster sauce, isolated soy protein (ISP), sodium triphosphosphate (STPP) and bread flour. Materials and reagents used for chemical analysis include hexane, filter paper, vaseline, nugget samples, labels, 96% ethanol, 1.25% sulfuric acid, 3.25% NaOH, CuSO₄, K₂SO₄, 2% boric acid, NaOH 40 %, methyl red indicator, 0.1 N HCl, NaCl powder.

The tools used in this research include tools for nugget production and for

nugget analysis (chemical and organoleptic). Tools used for production include scales, pans, stoves, plastic containers, measuring spoons, trays, ice boxes or thermos, table covers plastic, and freezer. The tools used for chemical analysis include porcelain dishes, crucibles, desiccators, analytical balances, oven, spatula, mortar, hotplate, scissors, bottle, bucket, bowl, grinder, glassware, water bath, stove, furnace, condenser, destructor, soxhlet extractor, and kjedahl machine. The tools used for organoleptic testing include questionnaire sheets, stationery, cell phones.

Research methods

This research was carried out in several stages, namely nuggets processing, and product organoleptic testing using the affection method with organoleptic test types, with untrained panelists. Furthermore, the nuggets with the best formulation were subjected to chemical analysis.

Nugget processing

The stages of making nuggets begin with thawing ground chicken which is still frozen. Meat that has gone through the thawing process is weighed, then mixed with a marinade and emulsifier. Chicken meat is mixed with marinade ingredients (seasoning) to strengthen and add flavor to the resulting nuggets. Seasonings such as garlic, salt, pepper, mushroom broth, oyster sauce, are added to give chicken nuggets a taste. Next added STTP, ISP, and ice. After everything is mixed, carrots, MOCAF, rice flour, corn starch are added to the dough. The mixing process is carried out until well mixed and formed with a smooth consistency and the mixing time has been running for ± 15 minutes. The next stage is forming, where the dough is shaped into a rectangular resembling a stick by manual cutting using a knife. Then the nugget dough is steamed until half cooked for further coating. Wet coating with flour adhesive (batter) is a mixture consisting of

water, starch, and seasonings for dipping the product. Then proceed with the second coating with bread flour. The purpose of this coating process with breadcrumbs is to obtain an attractive appearance and a crispier texture of the nuggets. The next process is the primary packaging process (packing). Nuggets are put in Polypropylene (PP) plastic packaging which is equipped with a zipper lock and food container. Finally, low temperature storage is intended as a heat shock treatment to kill microbial activity and extend the shelf life of nuggets. The process of making nuggets is presented in Figure 1.

Procedure Analytics

The organoleptic test was carried out by the hedonic test method. Based on Setyaningsih (2010), organoleptic parameter includes changes that occur in color, aroma, texture, and taste. This test was conducted by 30 untrained panelists. The scale used is a number from 1 to 5, where 1 = very dislike, 2 = dislike, 3 = normal, 4 = somewhat like, 5 = like. The best formula was then analyzed by proximate analysis. The proximate analysis was carried out in duplo based on the National Standardization Agency of Indonesia number 01-2332-3-2006 (2006) which included water content, ash content, protein content, crude fiber content, fat content, and carbohydrates content by difference.

Data analysis

Organoleptic testing nugget, using the affection method with the type of hedonic test. This test was chosen because we wanted to find out which of the 2 formulations was preferred by the panelists based on the parameters of color, aroma, texture, and taste. The test was conducted with 30 untrained panelists. In formulation A, the ratio of MOCAF, brown rice flour and cornstarch is 6:1:1 (90 g:15g:15g). Formulation B has a ratio of MOCAF, brown rice flour and cornstarch which is 4:1:3 (60g:15g:45g). Determination of this

formulation is based on the results of previous experiments. The data that has been obtained were analyzed using Microsoft Excel 2016 edition. To find out more accurate results, a one-way ANOVA calculation was carried out using the SPSS 25 edition application.

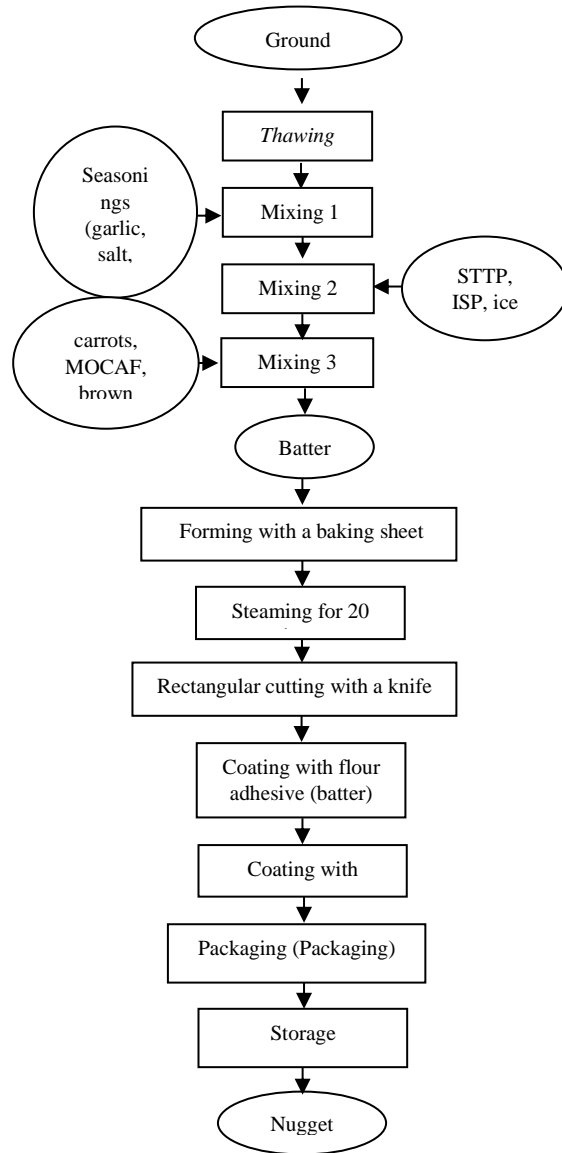


Figure 1. Nugget Making Flowchart

RESULTS AND DISCUSSION

The nuggets in this study used a composite MOCAF, brown rice and corn starch. The characteristics of MOCAF are similar to the wheat flour, that make MOCAF can be used as a substitute or a mixture of flour (Kurniati et al., 2012). MOCAF (modified cassava flour) can be

used as an alternative raw material in food for people with celiac disease because it does not contain gluten. MOCAF has a higher viscosity and dissolves easily than wheat flour (Hanifa et al., 2013). Besides that, MOCAF has several advantages, namely the soluble fiber content is higher than cassava flour, calcium content is higher than rice and wheat flour, it has the same swellability as type II wheat (medium protein content), has higher digestibility than cassava tapioca (BKP3 Bantul, 2012).

Based on Rahmah and Mustika (2018), vegetable nuggets added with 20% MOCAF produced nuggets with the best sensory and chemical properties. Vegetable nuggets with the addition of 20% MOCAF have sensory characteristics that have been accepted by the panelists. In addition, with the addition of 20% MOCAF has chemical characteristics which is better than other treatments, because it has a higher value.

Besides that, wheat can also be replaced with corn flour. The replacement of wheat flour with corn flour is caused by several things, including the provision of food products for people with gluten intolerance. corn was widely used as raw materials in Indonesian food industry because Indonesia has corn production

averages of 23.95 million tons of dry matter in 2020. The use of corn flour can reduce raw material and production costs and can reduce dependence on the use of wheat flour raw materials. The largest component in corn flour is starch. Based on research (Juniawati, 2003), corn flour has a starch content of 68.2%.

In a study conducted by Yuanita and Silitonga (2014) using corn starch as the manufacture of nuggets, the water content and ash content produced will be lower than using flour, while in terms of protein and fat content, corn starch has a higher content than wheat flour used for making nuggets. So that, the addition of corn starch for nuggets can increase the yield of better nuggets.

Brown rice flour is a processed product of brown rice, which can be used as a raw material in the manufacture of food products. Brown rice flour has the advantage of being high in fiber content. Fiber in food commonly called dietary fiber is very good for human health. The term dietary fiber is used to distinguish dietary fiber from crude fiber, namely all polysaccharides and those that are not hydrolyzed by the action of human intestinal enzymes (Kusharto, 2006).

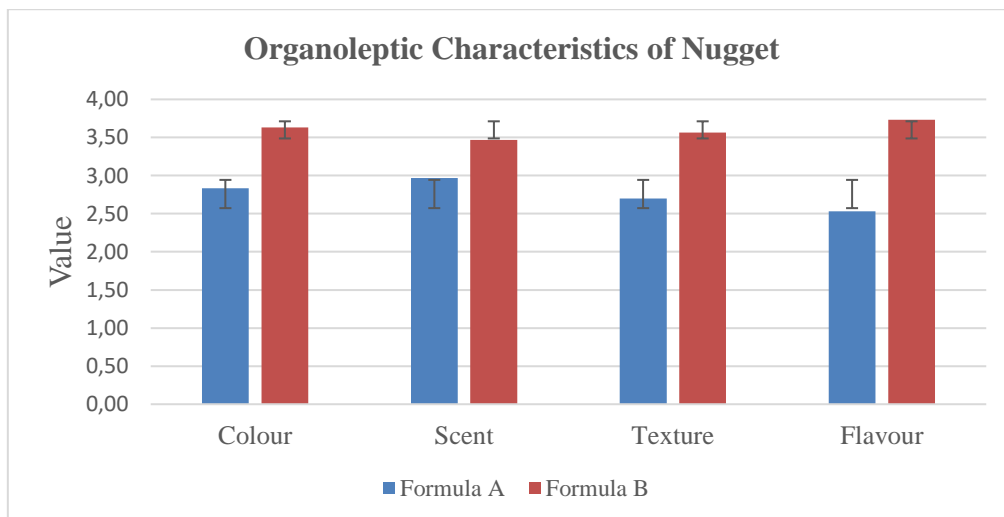


Figure 2. Organoleptic characteristics

Organoleptic Test

Organoleptic test is an analysis method that aims to measure the level of preference or level of the panelist acceptance of the product. Organoleptic tests include color, texture, aroma and taste. The hedonic method was used the level of preference. The result of hedonic test can be seen in Table 1.

Table 1. Average panelist assessment

Nuggets	Color	Scent	Texture	Flavor
A	2.83 ^a	2.97 ^A	2.70 ^x	2.53 ^X
B	3.63 ^b	3.47 ^B	3.57 ^y	3.73 ^Y

The results show that on 30 panelists, the average value on sample A are 2.83 on color, 2.97 on aroma, 2.70 on texture, and 2.53 on taste; on sample B, the average values are 3.63 for color, 3.47 for aroma, 3.57 for texture, and 3.73 for taste. Analysis data using Ms. Excel show that panelists prefer sample B to sample A. According to the panelists, the taste of sample A is sourer than sample B.

Table 2. Results of ANOVA Analysis

	Sum of square	Df	Mean square	f	Sig.
Color	9,600	1	9,600	20,521	.000
	27,133	58	.468		
Scent	3,750	1	3,750	4,684	.035
	46,433	58	.801		
Texture	11,267	1	11,267	23,619	.000
	27,667	58	.477		
Flavor	21,600	1	21,600	33,557	.000
	37,333	58	.644		

The result of ANOVA analysis using the SPSS application show that the value of F on color, taste, aroma, and texture parameters are more than the value of F table value of 0.01% and 0.05%. It means that formulas A and B are

significantly different. It is caused by the amount of mocaf flour added is more and made the taste sour on sample A and panelist dislike. Panelist also gave advice to make nugget that have crunchy on the outside and soft on the inside.

Chemical Characteristics

The proximate analysis includes water, ash, fat, protein, crude fiber and carbohydrate contents. The results of this analysis can be seen in Table 3.

Table 3. Chemical Analysis Results

Parameter	Value (%)	SNI 6683:2014
Water content	57.553	Max 50%
Fat level	1.055	Max 20%
Ash	1.955	-
Protein	29.195	Min 12%
Crude fiber	16.064	-
Carbohydrate	10.205	20% max

Table 3 shows the results of the analysis of the water content in chicken nuggets, which is 57.553%. The value of water content is less than water content's value in the Indonesia National Standard (SNI) number 6683:2014. The high of water content of nugget was because of hygroscopic nature of the composite flour and processing condition. Winarno (2008) states that the water content in food ingredients also determines the freshness and durability of the food. The high quality affects the quality of the chicken nuggets produced and will make it easy for microbes to breed so that various changes will occur in the chicken nuggets product. The high amount in moisture content in the nuggets is possible due to the steaming process. During steaming, the cover of the steamer is not coated like a cloth so that it is exposed to moisture during steaming. The water vapor that rises is condensed on the surface so that the water content of the nuggets is high.

Decreasing the water content of nuggets can be done by processing such as steaming and frying. Harris and Karmas

(1989) said that the main purpose of steaming is to reduce the moisture content of the raw material so that the texture of the material becomes more dense. Harris and Karmas (1989) also stated that frying can evaporate the water content contained in the product, so that frying can reduce the water content of the product.

The results of the analysis of the fat content of the nuggets were 1.055%. According to the Indonesia National Standard (INS) No. 6683:2014 (2014), the standard for the nutritional content of chicken nuggets is a maximum fat content of 20%. Comparing to the ISN 6683:2014, this nugget has fulfilled the standard requirement although lower than standard. Suseno et al. (2007) stated that the higher the concentration of flour addition will cause decreasing the fat content of the products. The decrease in fat content is thought to be influenced by the nugget processing process like milling. In addition, the steaming process is also suspected to be the cause of the reduced value of the fat content of the nuggets. According to Lawrie (1995), fat content is strongly influenced by the cooking process, cooking temperature and cooking time of meat. High temperatures will melt the fat and tend to damage the texture left in the food product. The fat content of chicken nuggets in this study was low. Based on Yuliana et al. (2013), nugget made from chicken meat nuggets and chicken liver with the addition of tapioca have fat content ranging from $9.77 \pm 12.92\%$. So that the aroma of chicken nuggets as a result of this study does not have a sharp aroma. According to Murtidjo (2003) that the taste and aroma of chicken meat is closely related to fat.

The analysis of ash content in nuggets was 1.955% (Table 3). The ash content of chicken nuggets as a result of this study was higher than nuggets which only added by wheat flour. The ash content of nuggets made from chicken meat is 73% and the addition of 10% wheat flour is only 0.71% (Nugraha, 2019). The ash content roughly describes the mineral content of the

material, which usually consists of magnesium, calcium, iron and manganese. The function of minerals in the body is as a regulator and builder (Winarno, 2008). This shows that the minerals in nuggets made by composite flour are higher than those made from wheat flour. The high value of ash content in chicken nuggets is influenced by brown rice flour. The nutritional content in brown rice is minerals. Brown rice contains 86 mg of magnesium (of which 22% is the recommended daily intake) and 150 mg of phosphorus (of which 15% is the recommended daily intake). Comparing with the brown rice, white rice only contributes 24 mg of magnesium and 69 mg of phosphorus. In addition, the amount of salt and minerals contained in the product affect the value of the ash content in the nuggets (Prastia, et al., 2016).

The results of the analysis of protein content of nuggets showed a value of 29.195%. According to Indonesia National Standard (ISN) No 6683:2014 regarding chicken nuggets, the minimum protein content in a chicken nugget is 12%, which means that the protein content in the formulated nuggets has higher levels than ISN. The protein content of chicken nuggets made from composite flour was higher than nuggets made only from wheat flour. The high value of protein content was because the nuggets are made from chicken which is high in protein content and uses Isolated Soy Protein (ISP). ISP is refined soybean which contains 90% protein and can be used to increase protein content in food as a substitute for animal protein (Arifandy and Adi, 2016). The results of Nugraha's research (2019), the protein content of nuggets made from chicken meat is 73% with the addition of 10% wheat flour is 12.65%. The protein content in flour can trigger a perfect gelatinization process. The complete gelatinization process involves the binding of water by a network formed by a chain of protein molecules (Komariah et al, 2005). So, it will affect the texture of the nuggets.

Crude fiber is the residue of foodstuffs or agricultural products after being treated with boiling acid or alkali, and consists of cellulose, with a small amount of lignin and pentose. Fiber is very important for the process of facilitating digestion in the body so that the digestive process runs smoothly (peristalsis) (Hermayanti et al., 2006). Based on the results of this study, the crude fiber content of nugget were 16.064%. Crude fiber in nuggets comes from brown rice flour. According to Hernawan and Melyani (2016), the crude fiber content in brown rice is 3.97%. In addition, the fiber content of nuggets can be obtained from carrots and mocaf which are added to the dough. According to Abdillah (2006) chicken nuggets with the addition of carrots can increase product fiber because carrots contain high levels of insoluble dietary fiber. Based on Rahmah and Mustika (2018), vegetable nuggets added with 20% mocaf have 3.79% dietary fiber. Thus, the making of chicken nuggets with the substitution of brown rice flour and mocaf and the addition of carrots increased the fiber content of the nuggets.

CONCLUSION

The panelists preferred nugget B formulation than nugget A formulation. Panelists did not like formulation A because the taste of formulation A tends to be sour due to the large amount of mocaf added to the dough. Nugget had a water content of 57.553% higher than the Indonesian National Standard, which is a maximum of 50%, the fat content of 1.055% has fulfill the requirements, which was lower than standard with a maximum of 20%, the ash content was 1.955%, the protein was 29.195% higher than the standard recommendation, which is a minimum 20%, crude fiber was 16.064%, and carbohydrates other than fiber was 10.205% lower than the recommended INS, which is a maximum of 20%. By not using wheat flour as the main ingredient, these nuggets can be regarded as an alternative

food that is low in gluten and high in fiber because of the content in carrots, brown rice flour, and mocaf.

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