

STUDY OF ADDITION OF PURPLE SWEET POTATO FLOUR (*IPOMOEA BATATAS* L.) ON ANTIOXIDANT ACTIVITY AND QUALITY CHEMISTRY OF CHICKEN NUGGETS AS FUNCTIONAL FOOD

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Abstract

*This study aims to examine the effect of adding purple sweet potato flour (*Ipomoea batatas* L) on antioxidant activity and chemical quality of chicken nuggets as a functional food. The research was carried out in 3 stages, namely (1) making purple sweet potato flour, (2) making chicken nuggets with the addition of purple sweet potato flour, (3) testing chicken nuggets including antioxidant activity tests, and chemical quality consisting of water content tests, content tests. protein, fat content test and dietary fiber test. This research was carried out experimentally using a completely randomized design with 4 additional treatments of purple sweet potato flour, namely P1 = 10 g, P2 = 20 g, P3 = 30 g and P4 = 40 g, with 4 replications. The results showed that the addition of purple sweet potato flour had a very significant effect ($P < 0.01$) on the antioxidant variables and the chemical quality of chicken nuggets. In conclusion, the addition of purple sweet potato flour up to 30 g resulted in antioxidant activity and good chemical quality of chicken nuggets as a functional food.*

Key words: antioxidant, chemical quality, chicken nuggets, purple sweet potato.

INTRODUCTION

Consumers' interest in foodstuffs, not only those that have complete nutritional content and good taste, but also must have certain physiological benefits for the body.

Nugget is one of the practical fast food products and is currently well known by the public.

The fat content of broiler chicken is quite high as the main ingredient for processing nuggets. Consumption of nugget products containing fat must be balanced with the presence of dietary fiber in purple sweet potato flour. Another advantage is the high anthocyanin content in purple sweet potato flour. Anthocyanins have a high ability as an antioxidant because of their ability to scavenge free radicals and inhibit lipid peroxidation, the main cause of damage to cells associated with aging and degenerative diseases (Cevallos-Casals & Cisneros-Zevallos (2002) in Suda et al., 2003).

Generally, the flour used as a binder in the manufacture of chicken nuggets is starchy material such as tapioca flour, rice flour, maezena flour, sago flour and wheat flour. On the other hand, staple food for the community

should ideally be sourced from local raw materials so that costs can be reduced.

Purple sweet potato has a nutritional content that is rich in vitamins (B1, B2, C and E), minerals (Ca, Mg, K and Zn), dietary fiber and carbohydrates (Antarlina & Utomo, 1999). Due to its high water binding ability, purple sweet potato flour can be used as a binder in the manufacture of processed food products. In addition, purple sweet potatoes have a fairly dense purple color due to the purple pigment anthocyanin which functions as an antioxidant and contains dietary fiber (Darmadji, 2005).

The advantages that can be taken through substitution and addition of biological materials include improving nutrition, as health food and increasing the preference value of these processed products. Research on the addition of purple sweet potato flour up to 30 g in chicken nuggets resulted in the physical properties and sensory quality of chicken nuggets that were favored by panelists (Ratulangi & Rimbing, 2021). The study of the use of vegetable products with purple sweet potato flour added to processed meat products such as nuggets is an interesting side to study. It is hoped that the

addition of purple sweet potato flour will produce nugget products that contain dietary fiber and antioxidants, so that this product can be used as a source of functional food.

MATERIALS AND METHODS

The ingredients used in this study were 1200 g of fresh chicken breast and 100 g of purple sweet potato flour, milk powder, butter, egg yolk, tapioca flour, breadcrumbs, garlic, onion, pepper, flavoring, DPPH Himmedia 50 mg, methanol proanalysis, vitamin C, hexane, potassium sulfate, sulfuric acid, NaOH-Na₂S₂O₃, boric acid, HCl, acetone, mannanase enzyme, phosphate buffer & acetate buffer, coomassie brilliant blue G250, BSA.

Data was collected by measuring variables through proximate analysis and antioxidant activity. The tabulated data is then analyzed by analysis of diversity. If there are differences between treatments, it is continued with Duncan's Multiple Region Test (Setyaningsih et al., 2010).

RESULTS AND DISCUSSIONS

The results of the analysis of antioxidant activity, water content, fat content, protein content and dietary fiber content of chicken nuggets added with purple sweet potato flour are as shown in Table 1 below:

Table 1. Average antioxidant activity, water content, fat content, protein content and dietary fiber content of chicken nuggets added with purple sweet potato flour

| Variable | Treatment | | | |
|------------------------------|----------------------|----------------------|----------------------|----------------------|
| | P1 | P2 | P3 | P4 |
| Antioxidant activity (µg/ml) | 3356.99 ^a | 3108.10 ^b | 2578.90 ^c | 2398.30 ^d |
| Water content (%) | 58.36 ^a | 58.35 ^a | 56.60 ^b | 56.79 ^c |
| Fat content (%) | 7.35 ^a | 7.81 ^b | 8.01 ^{bc} | 7.43 ^{ab} |
| Protein content (%) | 14.17 ^a | 14.75 ^b | 14.81 ^{bc} | 14.21 ^a |
| Dietary fiber content (%) | 0.66 ^a | 0.53 ^b | 0.84 ^c | 0.92 ^d |

Note: Different superscripts on the same line show significantly different (P<0.05).

Antioxidant activity

The results of the observation of the antioxidant activity of chicken nuggets with the addition of purple sweet potato flour ranged from 3356.99

to 2398.30 µg/ml. The more the addition of sweet potato flour to chicken nuggets, the lower the antioxidant activity value, which means the better.

The results of analysis of variance, the addition of purple sweet potato flour 10-40 g to chicken nuggets gave a very significant difference (P<0.01) on the value of antioxidant activity. Based on the DMRT further test, it was shown that treatment P1 was significantly different (P<0.05) with treatment P2, P3 & P4. Treatment P2 was significantly different (P<0.05) with treatment P3 & P4, as well as treatment P3 was significantly different (P<0.05) with treatment P4. The difference in the value of antioxidant activity in the treatment of adding purple sweet potato flour to chicken nuggets was due to the presence of anthocyanins as natural antioxidants contained in purple sweet potato flour. The higher the treatment with the addition of purple sweet potato flour, the higher the anthocyanin content causes the value of antioxidant activity to increase as measured by the Inhibiting Concentration (IC50) (Tritantini et al., 2016). The antioxidant activity contained in purple sweet potato flour which was used as a treatment in this study was based on the results of the examination of the Medical Laboratory of the Health Polytechnic of the Ministry of Health of Manado (2021) of 46.9 µg/ml. Anthocyanins are a type of natural antioxidant. The natural antioxidants contained in purple sweet potatoes can stop the chain reaction of free radical formation in the body which is believed to be the mastermind behind premature aging and various accompanying diseases such as cancer, heart disease, high blood pressure, and cataracts. Anthocyanins isolated from purple sweet potato have strong antioxidant activity (Pokorny et al., 2001).

Water content

The results of observations of the water content of chicken nuggets with the addition of purple sweet potato flour at different levels ranged from 56.60 to 58.36%. The more the addition of sweet potato flour to the chicken nuggets, the lower the water content.

The results of analysis of variance, the addition of purple sweet potato flour 10-40 g to chicken nuggets gave a very significant difference (P<0.01) on the percentage of water content. Based on the DMRT further test, it was shown

that treatment P1 was not significantly different ($P>0.05$) with treatment P2, but significantly different from treatment P3 & P4. Treatment P2 was significantly different ($P<0.05$) with treatment P3 & P4, as well as treatment P3 was significantly different ($P<0.05$) with treatment P4. The difference in water content values in the results of this study was due to the addition of purple sweet potato flour to chicken nuggets, causing differences in the water content of each treatment. The higher the addition of purple sweet potato flour to chicken meat nuggets, the water content decreases. The value of the water content in this study was about 56.60% to 58.36% lower than the recommended water content of SNI 6683:2014, which is a maximum of 60% specifically for combination chicken nuggets.

Water content is one of the most important characteristics of foodstuffs, because water can affect the appearance, texture, and taste of foodstuffs. The water content in foodstuffs determines the freshness and durability of these foodstuffs, high water content makes it easy for bacteria, molds, and yeasts to breed, so that changes will occur in foodstuffs, the lower the water content, the slower the growth of microorganisms to breed, so that the decay process will take place more slowly, the limit of the water content of microbes that can still grow is 14-15% (Winarno (2004) in Rijal et al., 2019).

Fat level

The results showed that the average fat content of chicken nuggets with the addition of purple sweet potato flour ranged from 7.35% to 8.01%. The results of analysis of variance showed that the addition of purple sweet potato flour 10-40 g to chicken nuggets had a very significant effect ($P<0.01$) on the percentage of fat content. Based on the DMRT further test, it was shown that treatment P1 was significantly different ($P<0.05$) with treatment P2 & P3 but not significantly different from treatment P4. Treatment P2 was not significantly different ($P>0.05$) with treatment P3 & P4, as well as treatment P3 was not significantly different ($P>0.05$) with treatment P4. The difference in the fat content value from the results of this study was caused by the addition of purple sweet potato flour to chicken nuggets, causing differences in the fat content of each treatment. The higher the addition of purple sweet potato

flour in chicken nuggets, the fat content decreases. The fat content value in this study was about 7.35% to 8.01% lower than the recommended fat content of SNI 6683:2014 with a maximum quality requirement of 20% both chicken nuggets and combinations. This chicken nugget product with the addition of purple sweet potato flour can be a reference for consumers who want chicken nugget products with low fat content. Consumption of excess fat can harm consumers, where fat is stored in the body so that it can cause various diseases such as stroke, heart, coronary, obesity and so on. Winarno (2002) in Rijal et al. (2019) states that fats and oils are found in almost all types of food with different contents. The fat content in foodstuffs is crude fat and is the total lipid content in actual amounts. Fats and oils are food substances that are important for maintaining the health of the human body. In addition, fats and oils are also a more effective source of energy than carbohydrates and proteins.

Protein level

The results of the observation of the protein content of chicken nuggets with the addition of purple sweet potato flour ranged from 14.17% to 14.81%.

The results of analysis of variance, the addition of purple sweet potato flour 10-40 g to chicken nuggets gave a very significant difference ($P<0.01$) on the percentage of protein content. Based on the DMRT follow-up test, it was shown that treatment P1 was significantly different ($P<0.05$) with treatment P2, P3 but not significantly different ($P>0.05$) with treatment P4. Treatment P2 was not significantly different ($P<0.05$) with treatment P3 but significantly different ($P<0.5$) with treatment P4, as well as treatment P3 was significantly different ($P<0.05$) with treatment P4. The addition of purple sweet potato flour to chicken nuggets resulted in different protein levels for each treatment. This difference in protein content values was caused by the addition of purple sweet potato flour in each treatment. The value of protein content in this study was 14.17% to 14.81% higher than the quality requirements set by SNI 6683:2014, a minimum of 12% for chicken meat nuggets and 9% for combination chicken nuggets. Thohari (2017) said that the additives used were very influential, the higher the protein content of the additives, the higher

the protein content of the nuggets. According to the Indonesian National Standard 6683-2014, the nutritional quality requirement for chicken nugget protein in 100g is 12% and with the addition of purple sweet potato flour, the protein content of chicken nuggets increases between 14.17% to 14.81%.

Protein is a food substance that is very important for the body, because this substance in addition to functioning as fuel in the body also functions as a building and regulatory substance. The main function of protein for the body is to form new tissue and maintain existing tissue (Winarno, 1997). The high protein value of meat is due to its complete and balanced content of essential amino acids. Essential amino acids are the building blocks of body proteins that must come from food (cannot be formed in the body) (Wijayanti et al., 2013).

Dietary fiber level

The results of observations of the fiber content of chicken nuggets with the addition of purple sweet potato flour ranged from 0.53% to 0.92%. The results of analysis of variance, the addition of purple sweet potato flour 10-40 g to chicken nuggets gave a very significant difference ($P<0.01$) on the percentage of dietary fiber content. Based on the DMRT further test showed that treatment P1 was significantly different ($P<0.05$) with treatment P2, P3 P4. Treatment P2 was significantly different ($P<0.05$) with treatment P3 & P4, as well as treatment P3 was significantly different ($P<0.05$) with treatment P4. The difference in dietary fiber content in the results of this study was due to the addition of purple sweet potato flour treatment. The higher the addition of purple sweet potato flour to chicken nuggets, the higher the dietary fiber content. The dietary fiber content of this study was about 0.53% to 0.92% higher than the water soluble dietary fiber content of Tutut snail nugget with 75% sweet potato flour substitution was 0.82% (bb) and 1.59% (wk), and higher than the water soluble dietary fiber content in mandalung duck nuggets with the addition of 20% carrots, which is 0.71% (bk) (Patriani (2010) in Nurhidayah, 2011).

Dietary fiber is a component of plant tissue that is resistant to hydrolysis by enzymes in the stomach and small intestine. Dietary fiber is divided into two groups, namely soluble fiber (soluble dietary fiber) and insoluble fiber

(insoluble dietary fiber). Soluble Dietary Fiber (SDF) is a pectin, gum, mukilase which is widely found in oatmeal, nuts, vegetables and fruits. Insoluble fiber such as cellulose, hemicellulose and lignin are found in cereals, legumes and vegetables (Winarno, 2008). Purple sweet potatoes contain high levels of dietary fiber, minerals, vitamins and antioxidants. Pectin, hemicellulose, and cellulose compounds which are dietary fiber are found in sweet potatoes and play a role in determining their nutritional value. Dietary fiber is a polysaccharide that cannot be digested and absorbed in the small intestine so that it will be fermented in the large intestine (Murtiningsih & Suyanti, 2011). According to Sarwono (2005), sweet potatoes contain a lot of carbohydrates ranging from 75-90%, consisting of 60-80% starch, 4-30% sugar, cellulose, hemicellulose, and pectin.

CONCLUSIONS

Based on the results and discussion, it can be concluded that the addition of purple sweet potato flour up to 30 g resulted in antioxidant activity and good chemical quality of chicken nuggets as a functional food.

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