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Antioxidant, Protein, and Fat of Chicken Nuggets with the Addition of Goat Gelatin

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Abstract

This study aims to determine the antioxidant, protein, and fat content of chicken nuggets through the addition of goat skin and bone gelatin which was previously pretreated with Lactobacillus plantarum 1UHCC and acetic acid. Data were processed using a completely randomized design (CRD) and tested further using Duncan's test with treatments including chicken nuggets with the addition of skin gelatin through Lactobacillus plantarum pretreatment (CGSP), chicken nuggets with the addition of skin gelatin through acetic acid pretreatment (CGSA), chicken nuggets with the addition of bone gelatin through Lactobacillus Plantarum pretreatment (CGBP), chicken nuggets with the addition of bone gelatin through acetic acid pretreatment (CGBA) and control (without adding gelatin), the treatment was repeated 4 times. The results of this study were the highest antioxidant in chicken nuggets, namely with the addition of L. plantarum pretreatment gelatin, which was 20.82%, while the protein content was 57.58%, while the highest fat content was in chicken nuggets with the administration of acetic acid pre-treated goat bone gelatin (CGBA) 3.41%. This study concluded that chicken nuggets with the addition of L. plantarum gelatin pretreatment contained higher antioxidants than the control.

Keywords: gelatin antioxidant, L. plantarum, chicken nuggets

A. Introduction

Chicken nuggets are one of the results of processing chicken meat which has a complex taste. The ingredients used in making the nuggets themselves are pieces of meat ground into smaller sizes and mixed with spices and flour (Ishak et al., 2014). The process of making gelatin from the start from pretreatment, and extraction to product application will affect the quality and safety of the product itself (Hasma, 2020). So that the gelatin from the best pretreatment results is used in the addition of chicken nuggets. The addition of gelatin to chicken nuggets can help improve the quality of processed meat products, because it has many uses, namely as a binder, adhesive, thickener, and emulsifier (Ahmed et al., 2020).

Gelatin is a hydrocolloid product derived from the extraction of animal collagen protein obtained from connective tissue, both skin, and bone, by soaking acids, bases, and enzymes (Hasma et al., 2020). Research by Hasma et al. (2019) showed that gelatin resulting from the hydrolysis of L. plantarum and acetic acid aged 1 year with a concentration of 5% showed optimal results. capable of forming soft bones. The reason is, among others, as stated by Hasma et al., (2022) that Gelatin with the acid method has a stable number of intermolecular cross-links. Soaking with acid will destroy the covalent cross-links in collagen so that during extraction the free α-chain is released

Chicken nuggets are a processed chicken meat product that is breaded, and has a high nutritional content but if stored for a long time will be easily damaged so the nutritional content will decrease including the antioxidant content (Sabikun et al., 2020). Currently, research on the antioxidant, protein, and fat content of chicken nuggets with the addition of gelatin which is processed through L. plantarum pretreatment and acetic acid is still lacking, so this research is optimized to improve the quality of chicken nuggets, because gelatin has antioxidant potential, as stated by Adriana et al. (2017) that the free amino acids in gelatin, namely arginine (Arg) and tyrosine (Tyr) were identified as free amino acids which function as antioxidants. This is reinforced by the statement of Ahmed, et al (2020) that extracted gelatin amino acids show a high glycine and proline content, so that if they are added to the chicken nuggets it will add to the nutritional value of the chicken nuggets.

Combining antioxidants from gelatin with antioxidants in chicken meat in making chicken nuggets is an effective way to inhibit fat oxidation, as a study by Bedrnicek et al. (2020) stated that adding other substances to meat products is an effective method for inhibiting or delaying lipid oxidation which can cause sensory changes and negative nutrition in meat products and can extend the shelf life of the product. Furthermore, Hasma et al. (2020) stated that the addition of gelatin to chicken nugget products is very important in the diversification of food ingredients because of its high nutritional value, especially the content of amino acids. The purpose of this study was to determine the antioxidant, protein, and fat content in chicken nuggets with the addition of gelatin which had been pretreated with L. plantarum and acetic acid.

B. Methodology

1. Materials and Design of Research

The research used 300 g chicken meat, L. planratum pretreatment gelatin, and acetic acid at a concentration of 2% (Hasma et al., 2016), and seasonings such as garlic, pepper, salt, and tapioca flour mixed into a dough, then ground in a food processor for 15 seconds. Administration of gelatin including CGSP, CGSA, CGBP, CGBA, and control as treatment. The same thing was done for each treatment. The dough formed is put into a mold with a thickness of 1 cm and then steamed in a steam pan at 50°C for 30 minutes. Chicken nugget products were analyzed for antioxidants using the DPPH method, fat content, protein content, and antioxidants using the DPPH method.

a) Antioxidant activity was determined using diphenyl picrylhydrazyl (DPPH). Each sample was added 1 mL of DPPH, 1 mL of sample concentration series, and the control volume was supplemented with 5 mL of methanol, and incubated for 30 minutes in a dark room. each sample was made at a concentration of 200-3200 µg/mL then the sample was measured at the maximum wavelength (515 nm) using a 20D+ spectron. (Molyneux, 2004).
   The antioxidant formula uses the DPPH method.
   The antioxidant content is obtained from the formula:

$$\text{Antioksidant} = \frac{\text{Ec} - \text{Es}}{\text{Ec}} \text{x } 100\%$$

Note:
Ec = absorbance control
Ice = absorbance of the sample

b) Fat

As much as 5 g of chicken nuggets was extracted, using petroleum ether and methanol solvents, the extraction process was carried out continuously for at least 20 times the fat solvent in petroleum ether and methanol was separated by distillation. The flask containing fat was dried at 105oC to constant weight. Calculation of fat content is calculated based on the weight of fat divided by the weight of the sample multiplied by one hundred percent (AOAC, 1995).

Gelatin fat content formula

Fat content is calculated by the following formula:

$$\text{Fat Level} = \frac{P(b-a)}{W} x \frac{100}{\text{Dry Weight}}$$

Description:
W = Sample weight (g)
P = Dilution Factor (10/5)
a = Initial weight of cup (g)
b = Weight of cup after drying process (g)

c) Protein

A total of 1 g of sample was put into a Kjeldahl tube containing 2 catalyst tablets, 3 ml of hydrogen peroxide and 15 ml of acid H2SO4 then left in an acid chamber for 10 minutes until it was extruded for ± 2 hours at 410oC or until the solution was clear. The digested samples were allowed to stand until they reached room temperature and then 50-75 ml of distilled water was added.125 ml Erlenmeyer flask containing 25 ml of 4% boric acid (H3BO3). Distillation is carried out by adding 10 ml of NaOH to the distillation apparatus to produce a green color. The resulting distillate was then titrated with 0.1 N HCl until a pink color changed. The blank standard was also analyzed using the same steps as the sample analysis (AOAC, 1995).

Protein content formula

Protein levels are calculated using the formula:

$$\text{Protein levels (\%)} = \frac{Va - Vb \text{ x N HCl x } 14{,}007 \text{ x } 6{,}25}{W} \text{ x } 100\%$$

Description:
Va = ml HCL for sample titration
Vb = ml HCl for blank titration
N = Normality of HCl used
14.007 = Atomic weight of nitrogen
6.25 = Nitrogen Conversion Factor
W = Sample Weight (g).

2. Sample of Research

A total of 20 samples with 5 treatments and 4 repetitions included chicken nuggets with the addition of skin gelatin through Lactobacillus plantarum (CGSP) pretreatment, chicken nuggets with the addition of skin gelatin through acetic acid pretreatment (CGSA), chicken nuggets with the addition of bone gelatin through Lactobacillus plantarum pretreatment (CGBP), chicken nuggets with the addition of bone gelatin through acetic acid pretreatment (CGBA) and control (without the addition of gelatin), repeated treatments for 4 times.

3. Technique of Data Collection

The data were obtained through experiments in the laboratory by observing the antioxidants, protein, and chicken nuggets fat which were given the addition of gelatin which had been pretreated with lactobacillus plantarum and acetic acid so that 5 treatments were obtained and repeated 4 times.

4. Parameters of Research

The parameters observed in this study were technical aspects and non-technical aspects. Technical aspects include respondent characteristics, rearing systems and patterns, reproductive potential (mating system, service per conception, and calving interval), feed potential (type and source of feed), disease management and control, human resource aspects (livestock officers), institutional aspects, and capital sources while non- technical aspects include supporting facilities and infrastructure such as public pinch cages, animal posts, Artificial Insemination posts, BPP, abattoir, road conditions, telecommunications, electricity, and water sources.

5. Data Analysis

The data were processed and analyzed with the help of a computer using SPSS Version 21. The data was displayed in the form of bar graphs. The analysis in this study used a 5x4 Completely Randomized Design. The significant value used is P<0.05. If the results of the ANOVA analysis show an effect, then continue with the Duncan test.

C. Result and Discussion

1. Antioxidant with DPPH in chicken nuggets

Antioxidant chicken nuggets with the addition of different gelatin can be seen in Figure 1.

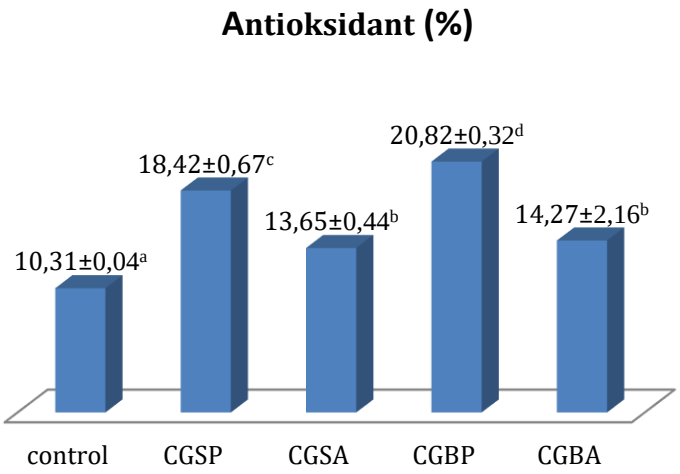

Figure 1. Antioxidant value with DPPH chicken nuggets with the addition of skin and bone gelatin of goats pre-treated L. plantarum and asthma acetate.

Information:
Different superscript abc showed a very significant difference (P<0.01)
Control = chicken nuggets without adding gelatin
CGSP = chicken nuggets with the addition of L. plantarum pretreatment goat skin gelatin
CGSA = chicken nuggets with the addition of pretreatment goat skin gelatin with acetic acid
CGBP = chicken nuggets with the addition of L. plantarum pretreatment goat bone gelatin
CGBA = chicken nuggets with the addition of pretreatment acetic acid goat bone gelatin

Analysis of variance showed that in the control treatment, CGSP, CGSA, CGBP, and CGBA had a very significant effect (P<0.01) on chicken nugget antioxidants. Chicken nuggets given pre-treatment L. plantarum (CGBP) goat bone gelatin had the highest antioxidant content compared to other treatments. This is because the chicken nuggets with the addition of goat bone gelatin have high arginine and tyrosine content compared to the others. As stated by Adriana et al., (2017) that the free amino acids in gelatin, namely arginine (Arg) and tyrosine (Tyr) were identified as free amino acids which function as antioxidants. Different types of gelatines can produce different responses to their ability to ward off free radicals (Rosmawati, 2018).

Gelatin amino acids and the presence of other nutritional additives in chicken nuggets have a role in inhibiting free radicals. Kittiphattanabawon et al., (2015) stated that gelatin can work as an antioxidant, although its effectiveness in counteracting free radicals is relatively low compared to hydrolyzed gelatin.

According to Jiang et al (2018), leucine is an amino acid with very strong antioxidant activity. Nikoo et al (2015) argue that the amino acid peptides that contribute to counteracting free radicals are glycine and proline, whereas according to Liu et al., (2016) tyrosine, tryptophan, and phenylalanine can be considered free radical scavengers. Lobo et al., (2010) assumed that

there are two principal mechanisms of antioxidant action, namely chain breakdown so that gelatin reactive amino acids donate electrons to free radicals, antioxidant action directs its effect by donating electrons, chelating metal ions, and acting as an antioxidant.

The content of saturated fat in broiler chicken meat ranges from 29.26% to 30.27% (Kartikasari et al., 2001), so when it is processed into chicken nuggets with the addition of gelatin even with a low antioxidant content in pretreated goat skin and bone gelatin L. plantarum and acetic acid will be able to inhibit the oxidation process in chicken nuggets. According to Saito et al (2003) in the oxidation process, where unsaturated fats occur active amino acids tend to donate electrons from saturated fats which will form many more reactive polymers.

Antioxidants are significant substances that inhibit the oxidation process at low concentrations. Antioxidants can work at different levels in the oxidation sequence. Antioxidants are chemical substances in low amounts that can prevent the oxidation of cellular organelles by minimizing cell damage (Adriana et al., 2017).

The above reactions underlie methods for determining antioxidant capacity or activity such as DPPH (2,2-diphenyl-1-picrylhidrazil), ABTS (2,2 azinobis 3-ethylbenzothiazoline-6-sulfonic acid), FRAP (Ferric reducing antioxidant power), TEAC (total equivalent antioxidant capacity), ORAC (oxygen radical absorbance capacity), TRAP (total radical trapping antioxidant parameter), TAC (total antioxidant capacity), TOSC (total oxygen scavenging capacity), FCR (follin calcaneal reagent), and cuppa. Antioxidant analysis methods based on the HAT reaction are ORAC, TRAF, TAC, FCR, and TOSC while those including ET are DPPH, ABTS, FRAP, TEAC, and Cupprac (Prior et al. 2005). An example of the DPPH radical scavenging mechanism by antioxidants can be seen in Figure 1.

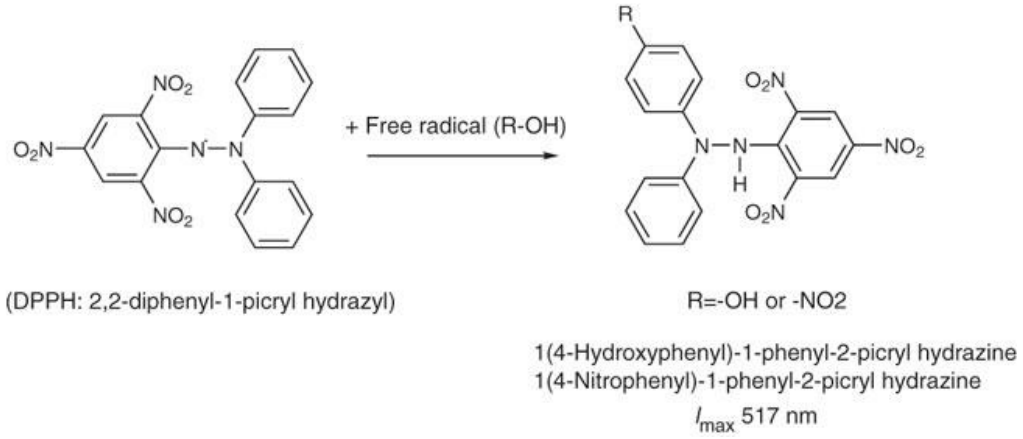

Figure 1. Mechanism of DPPH radical scavenging by antioxidants (Ebada et al., 2008).

2. Fat chicken nuggets

The fat content of chicken nuggets with the addition of different gelatin can be seen in Figure 2.

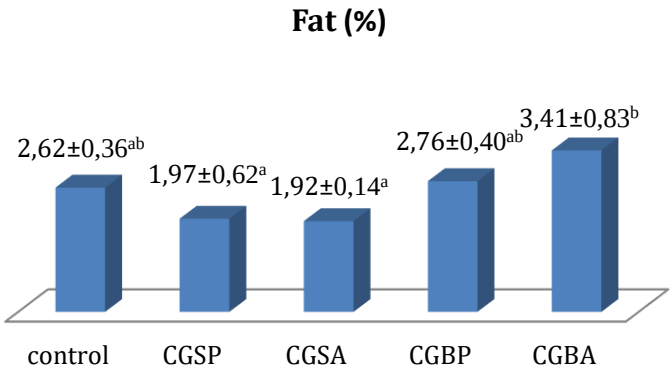

Figure 2. Fat value of chicken nuggets with the addition of skin and bone gelatin from goat pre-treatment L. plantarum and asthma acetate.

Information:
Different superscript abc showed a very significant difference (P<0.01)
Control = chicken nuggets without adding gelatin
CGSP = chicken nuggets with the addition of L. plantarum pretreatment goat skin gelatin
CGSA = chicken nuggets with the addition of pretreatment goat skin gelatin with acetic acid
CGBP = chicken nuggets with the addition of L. plantarum pretreatment goat bone gelatin
CGBA = chicken nuggets with the addition of pretreatment acetic acid goat bone gelatin

Analysis of variance in the treatment given the control, CGSP, CGSA, CGBP, and CGBA had a very significant effect (P<0.01) on the fat content of the chicken nuggets. The fat content of chicken nuggets with pretreatment L. plantarum skin gelatin and acetic acid tended to be lower than the control, but with the addition of L. plantarum and acetic acid pretreatment bone gelatin was higher. This is due to the skin, the ability to bind water being higher than bone so gelatin from skin-based ingredients with L. Plantarum pretreatment and acetic acid has a low-fat content so that gelatin is skin-based if mixed into chicken nuggets can also bind water and automatically reduced fat content. This study was supported by Aberle (2001) who stated that the higher the water content in the nuggets, the lower the fat content because the water content was negatively correlated with the fat content. Gelatin can bind water (Hasma et al., 2020) so the addition of gelatin as an additive can affect product characteristics, although this effect depends on the type of raw material used (Cofrades et al., 2000).

Fat is one of the groups included Lipids are organic compounds that have the special characteristic insoluble in water, but soluble in organic solvents such as ether, benzene, and chloroform (Pargianti, 2019). Fat is found in almost all types of food and each has several different content. Because it's a fat content analysis food is very important so that the calorie needs of an ingredient food can be calculated with good (Pargianti, 2019).

3. Protein Chicken Nuggets

The protein content of chicken nuggets with the addition of different gelatin can be seen in Figure 3.

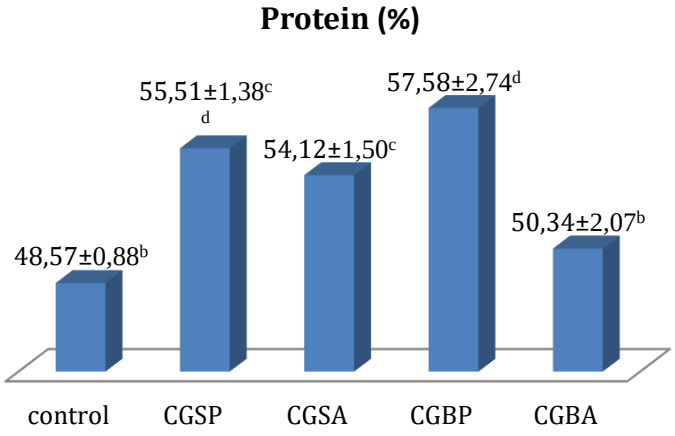

Figure 3. The protein value of chicken nuggets with the addition of skin and bone gelatin of goats pre-treated with L. plantarum and asthma acetate.

Information:
Different superscripts showed a very significant difference (P<0.01)
Control = chicken nuggets without adding gelatin
CGSP = chicken nuggets with the addition of L. plantarum pretreatment goat skin gelatin
CGSA = chicken nuggets with the addition of pretreatment goat skin gelatin with acetic acid
CGBP = chicken nuggets with the addition of L. plantarum pretreatment goat bone gelatin
CGBA = chicken nuggets with the addition of pretreatment acetic acid goat bone gelatin

Analysis of variance in the treatment given the control, CGSP, CGSA, CGBP, and CGBA had a very significant effect (P<0.01) on chicken nugget protein content. Chicken nuggets with the addition of pre-treated L. plantarum goat bone gelatin had the highest score while chicken nuggets without the addition of gelatin had the lowest score. This is according to Hasma et al (2020) gelatin is a polypeptide obtained from connective tissues such as skin and bones through soaking acids, bases, and enzymes. Increasing the amount of dissolved protein through acid treatment causes gelatin proteins, in this case, amino acids, to also increase.

The addition of gelatin to chicken nuggets can increase the protein content of chicken nuggets because the ingredients of chicken nuggets are like meat, flour is protein, so if you add the proteins it will further increase the protein content. Rasyid et al., (2020) stated that the more flour mixed in the dough, the greater the protein content. In addition, the addition of gelatin will get additional protein content. Chicken nuggets form compounds with other ingredients, for example between amino acids resulting from changes in protein (Ishak et al., 2014).

Pereira et al., (2016) stated that the factors that affect the protein content of gelatin are the type of gelatin and the source of the raw material, both bone and goat skin. In addition, the addition of flour also affects chicken nuggets. Protein is a substance that is very important for the body, because this substance has the main function, namely as a building agent in the body, and also functions as a regulatory substance. Soluble proteins vary depending on pH and the composition of amino acid residues and proteins in principle have maximum uptake due to the presence of peptide bonds (Hasma et al., 2021).

D. Conclusion

The conclusion that can be obtained from the results of this research is that chicken nuggets with the addition of L. plantarum gelatin pretreatment are a better pretreatment because it contains the highest antioxidants and protein and low fat compared to acetic acid treatment and control.

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