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Effect of Chicken Intestine Substitution on Chemical Quality of Nugget

Harapin Hafid, Nuraini, Dian Agustina, Fitrianingsih, Inderawati

[1]Program Study of Animal Science, Faculty of Animal Science, Halu Oleo University
Jl. HEA Mokodompit Kampus Baru Anduonohu Kendari 93232
***Corresponding author e-mail: harapinhafid14@gmail.com**

Abstract. This research was aimed to study the chemical quality of the chicken nuggets substituted chicken intestine. There are eight levels of chicken intestine with chicken intestine consisting of 0% chicken intestine and 100% chicken meat, A1 consisting of 15% chicken intestine and 85% chicken meat, A2 consisting of 25% chicken intestine and 75% chicken meat, A3 consisting of 40% chicken intestine and 60% chicken meat, A4 consisting of 50% chicken intestine and 50% chicken meat, A5 consisting of 65% chicken intestine and 35% chicken meat, A6 consisting of 75 % chicken intestine and 25% chicken meat, A7 consisting of 90% chicken intestine and 10% chicken meat, and A8 consisting of 100% chicken intestine and 0% chicken meat. Each treatment was repeated five times. The results showed that the water content and ash substituted chicken nuggets chicken intestines were not significantly different ($p > 0.05$). Intestine substitution into the chicken *nuggets* significant ($p < 0.05$) against the protein and fat content of chicken *nuggets,* where the highest protein content in treatment A8 (100% chicken intestine) was 24.9% and the lowest in treatment A0 (100% chicken meat) that is 11.33%. The greater increase in the *nugget* chicken intestinal, the higher the protein content. Meanwhile nugget fat content tends to decrease as the percentage of the addition of chicken intestinal. The more the addition of substitution intestinal produce low-fat *nugget.* It was concluded that chicken intestine substitution may increase protein and decrease the fat content of chicken nuggets.
Keywords: nuggets, chicken meat, chicken intestines, chemical quality.

Abstrak. Penelitian ini bertujuan untuk mempelajari kualitas kimia nugget ayam yang disubstitusi usus ayam. Perlakuan subtitusi daging ayam dengan usus ayam ada delapan taraf yaitu A0 yang terdiri dari 0% usus ayam dan 100% daging ayam, A1 yang terdiri dari 15% usus ayam dan 85% daging ayam, A2 yang terdiri dari 25% usus ayam dan 75% daging ayam, A3 yang terdiri dari 40% usus ayam dan 60% daging ayam, A4 yang terdiri dari 50% usus ayam dan 50% daging ayam, A5 yang terdiri dari 65% usus ayam dan 35% daging ayam, A6 yang terdiri dari 75% usus ayam dan 25% daging ayam, A7 yang terdiri dari 90% usus ayam dan 10% daging ayam, dan A8 yang terdiri dari 100% usus ayam dan 0% daging ayam. Masing-masing perlakuan diulang lima kali. Hasil penelitian menunjukkan bahwa kadar air dan abu nugget ayam yang disubtitusi usus ayam tidak berbeda nyata ($p > 0.05$), Kadar air *nugget* ayam pada penelitian ini adalah sebagai berikut A0 (99,8%), A1 (99,8%), A2 (99,8%), A3 (99,8%), A4 (99,8%), A5(99,9%), A6(99,9%), A7 (99,7%), dan A8 (99,8%). Kadar abu pada A0 (2,61%), A1 (1,61%), A2 (2,90%), A3 (1,80%), A4 (2,23%), A5 (2,84%), A6 (2,62%), A7 (2,39%), dan A8 (2,26%). Subtitusi usus ke dalam *nugget* ayam berpengaruh nyata ($p < 0,05$) terhadap kadar protein dan lemak *nugget* ayam, dimana kadar protein tertinggi pada perlakuan A8 (100% usus ayam) yaitu 24,9% dan terendah pada perlakuan A0 (100% daging ayam) yaitu 11,33%. Semakin besar penambahan usus ayam dalam *nugget*, kadar protein semakin tinggi. Sementara itu kadar lemak nugget cenderung menurun seiring besarnya persentase penambahan usus ayam. Semakin banyak penambahan subtitusi usus menghasilkan produk *nugget* yang rendah lemak. Dapat disimpulkan bahwa substitusi usus ayam dapat meningkatkan protein dan menurunkan kandungan lemak nugget ayam.
Kata kunci: nugget, daging ayam, usus ayam, kualitas kimia

Introduction

Producing quality livestock products with high nutritional value and low cost is the main goal of livestock processing. This requires considerable creativity by designing an economical material formulation (Hafid & Syam, 2007). The use of livestock waste or byproducts such as intestines in the manufacture of processed including the efforts that need to be considered.

Chicken intestine is a byproduct chicken cutting. Intestine has relatively low commercial value, but have a complex nutrient content. The protein content of chicken intestine was 22, 93%, fat 5,6%, and ash 3,44% (Baihaki et al.,

2010). So far the utilization of chicken intestines is still limited. Chicken intestines used as catfish feed and raw materials for chips satay intestine or bowel, particularly in Java. In Southeast Sulawesi, people are still foreign to processed foods made from the intestine. Most chicken intestines are discarded as waste that is not useful. If viewed from the nutritional content, chicken intestine is a potential food product of animal origin (Hafid et al., 2017)

Nugget is one of the food products of animal origin. *Nugget* is a form of spiced ground beef product, and then covered by gluten flour *(batter),* breadcrumbs giving *(breading)* and fried half-baked and then frozen to preserve quality during storage. Main raw material of *nuggets* comes from chicken*,* beef, mutton, and marine animals such as fish and shrimp (Tasse, et al*.,* 2015).

This research aims to study the chemical quality of the chicken nuggets substituted chicken intestine. Expected to be a reference utilization of slaughterhouse waste in the form of intestinal hardly worth the price and can be a source of environmental pollution form of stench to process them into nutritious food products.

Materials and Methods

The material used in this study were chicken *nuggets* with the main ingredient of meat and intestines of broilers obtained from the vendors in Anduonohu market at Kendari. Additional ingredients such as tapioca, breadfruit flour, and spices (garlic, pepper powder, salt, nutmeg flavoring powder, skim milk, flour crumb, and eggs).

Making the *nugget* follow the steps being taken by the Laksono et al. (2012) which has been modified. Chicken and chicken intestines (as per treatment formulation) are 300 g ground, then added ice and salt flakes, then added sugar, pepper, garlic, skim milk, corn oil and tapioca flour. All the ingredients are stirred into a homogeneous dough. The *nuggets* of dough in a baking dish molded aluminum, and covered by using plastic then steamed. Steaming dough made until the internal temperature reaches 60 to 70 ° C for approximately 30 minutes, after steaming, the dough *nuggets* that have cooled to room temperature and then inserted into the refrigerator for 30 minutes. The dough that has been dense is called half-baked dough. The dough is then cut into pieces of approximately 4 x 4 cm with a thickness of one cm, then dough smeared with eggs and smeared again with bread. The initial frying using oil was submerged for 30 seconds at 200 ° C. Nugget packed in plastic and stored in a freezer and then performed the final frying ie nuggets fried for four minutes at 200 ° C. Nugget making process shown in Figure 1

.

Table 1. Chicken *Nugget* Ingredients substituted with Chicken Intestine

Ingredients (%)	Treatment								
	A0	A1	A2	A3	A4	A5	A6	A7	A8
Chicken meat	100	85	75	60	50	35	25	10	0
Chicken intestine	0	15	25	40	50	65	75	90	100
Tapioca flour	10	10	10	10	10	10	10	10	10
Garlic	3	3	3	3	3	3	3	3	3
Pepper powder	2	2	2	2	2	2	2	2	2
Salt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Nutmeg powder	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flavoring	1	1	1	1	1	1	1	1	1
Sugar	1	1	1	1	1	1	1	1	1
Skimmed milk powder	5	5	5	5	5	5	5	5	5

Meat Quality Test

Water Content (KA) (AOAC, 2005)

First the empty bowl is dried in the oven at 105 ° C for 15 minutes and cooled in the desiccator, then weighed. A total of 10 g sample and inserted in the cup which had been weighed and then dried in the oven at 105 ^{0} C for 12 hours. The plate containing the dried sample is subsequently transferred into the desiccator, cooled and then weighed. Drying is done until a constant weight is obtained. Drying is done until a constant weight is obtained. The percentage of moisture content is calculated as follows:

$$\text{Water content (\%)} = \frac{\text{sample weight (start)} - \text{sample weight (end)}}{\text{sample weight (end)}} \times 100\%$$

Ash Content (AOAC, 2005)

Sample *nuggets* were used to test the water content is as much as 10 g inserted into the porcelain dish, then put into an electric furnace at a temperature of 400-600 ^{0} C. After the sample whitish sample is lifted then moved into a desiccator and cooled and weighed. Ash content can be calculated by the way. Ash content formula as follows:

$$\text{Ash content (\%)} = \frac{\text{weight of ash}}{\text{fresh weight}} \times 100\%$$

Protein (AOAC, 2005)

Measurement of protein levels was calculated using Kjeldahl with the work that is, used as a sample of 10 g put in a 100 ml Kjeldahl flask, then added 2 g of K_2SO_4, 20 ml of H_2SO_4 concentrated and boiling stones. After that for 30 minutes done distruction until obtained light green liquid (clear).

Distruction results plus distilled water 10 ml, then shaken until homogeneous, then 20 ml of the solution was added NaOH concentrated 20 ml and indicators pp 3 drops then distilled by holding erlenmeyer flask 125 ml containing H_3BO_3 3% of 20 ml, and *metal* indicator *red* and *blue* *metal* each 2 drops. After distillation with 0.1 N HCl until it changes color to light purple. For blank solution done in the same way but without using the sample. Measurement of protein content was done by using kjeldalh method of nitrogen content calculated by the formula:

$$\text{Nitrogen (\%)} = \frac{(\text{HCL} - \text{blanko}) \text{x N HCL x } 14.007}{\text{mg sample}} \text{ x } 100\%$$

Fat Levels (AOAC, 2005)

The method used for fat content is the soxlet method. The sample is weighed as much as 1 g later weighed wrapped with fat-free dry paper and put in the oven with a temperature of 150 ^{0} C for one night. The dried samples taken were weighed in a still warm state, then incorporated into a soxhlet extraction tool. The reservoir was filled with chlorophyroid and methanol with a 2: 1 ratio of half the contents of the reservoir. The soxhlet extraction tool also filled the same solution up to half the volume. After that it was extracted for about 8 hours, then the sample was taken and dried in the oven for 24 hours. After dry the sample is weighed in the heat. The method used for fat content is the soxlet method. Percentage of fat content is calculated as follows:

$$\text{Fat content (\%)} = \frac{\text{sample weight (start)} - \text{sample weight (end)}}{\text{sample weight (end)}} \times 100\%$$

Results and Discussions

Chemical quality showed that the moisture content and ash throughout each treatment showed no significant difference ($p > 0.05$), while the crude protein and fat indicates significantly different ($P<0.05$). Chemical quality chicken nuggets with chicken intestines substitution during the study are presented in Table 2.

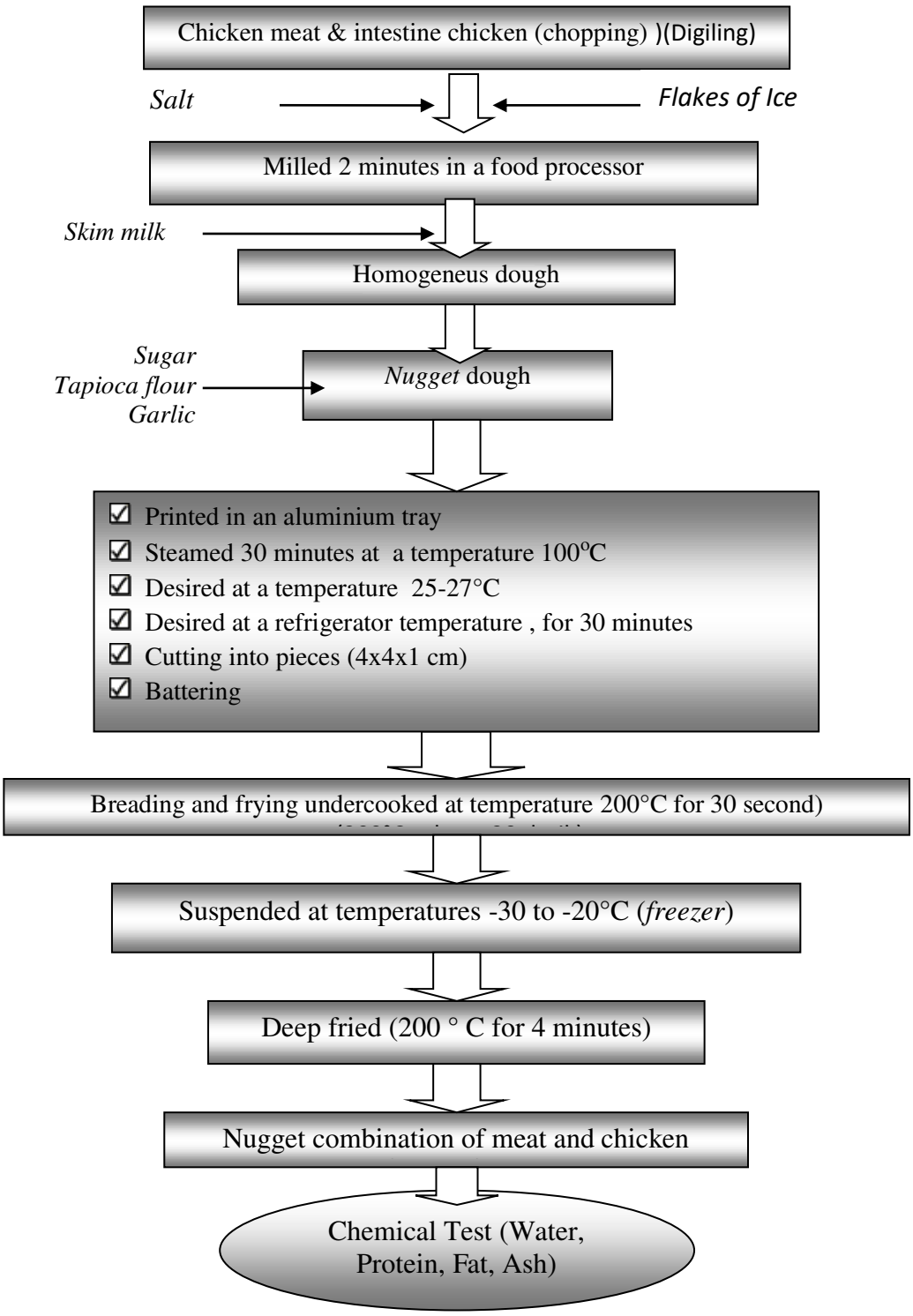

Figure 1. Nugget Processing Scheme

Table 2. Quality Chicken *nuggets* with chicken intestine substitution

Quality Chemistry	Treatment								
	A0	A1	A2	A3	A4	A5	A6	A7	A8
Water (%)	99.8[a]	99.8[a]	99.8[a]	99.8[a]	99.8[a]	99.9[a]	99.9[a]	99.7[a]	99.8[a]
Crude protein (%)	11.33[a]	13.75[b]	14.58[b]	15.75[c]	17.58[d]	18.58[d]	19.83[e]	22.83[f]	24.95[g]
Fat (%)	23.93[g]	21.85[f]	20.56[f]	19.09[e]	18,14[de]	17.03[cd]	15.69[c]	14.11[b]	11.00[a]
Ash (%)	2.61 [a]	1.84 [a]	2.90 [a]	1.80 [a]	2:23 [a]	2.84 [a]	2.62 [a]	2:39 [a]	2:26 [a]

Information: The numbers followed by different letters on the same line show a marked difference (P <0.05).
A0 = 0% chicken intestine + 100% chicken meat
A1 = 15% chicken intestine + 85% chicken meat
A2 = 25% chicken intestine + 75% chicken meat
A3 = 40% chicken intestine + 60% chicken meat
A4 = 50% chicken intestine + 50% chicken meat
A5 = 65% chicken intestine + 35% chicken meat
A6 = 75% chicken intestine + 25% chicken meat
A7 = 90% chicken intestine + 10% chicken meat
A8 = 100% chicken intestine + 0% chicken meat

Water content

The water content is a very important parameter in determining the quality of *the nugget,* Table 2 it can be seen that the substitution of chicken intestine with different percentages are not significantly different (p> 0.05) on the water content. Water content of chicken nuggets in this study is very high. According to the National Standard of Indonesia, nuggets maximum water content is 60% (BSN, 2002; Laksono et al., 2012).

The high possibility is caused by a long enough intestinal griding process in which the elastic and tough intestines must first be chopped and then milled using ice cubes. The composition of the nugget is expected to affect water levels nugget produced. Setaningrum (2013) obtain seaweed nuggets water content ranging from 73,10% - 77,72%. Meanwhile, according to Abubakar (2013) commercial nugget content water is 51,82%. The main factor of water content of the product is the main raw material, water added during cooking and water liberation during cooking, other factor influencing the water content is frying process (Winarno, 1997). Meanwhile, by Soeparno (2009) high water levels can be used as an indication of good water-binding power.

Protein levels

The results showed intestinal waste substitution of chicken in the chicken *nuggets* significant (p <0, 05) the protein content of chicken *nuggets.* The highest protein content in treatment A8 (100% chicken intestine) is 24.9% and the lowest in treatment A0 (100% chicken), i.e. 11.33%. The larger the addition of chicken intestinal waste into *nuggets,* protein content tends to be higher.

Chicken *nuggets* with the addition of a variety of different types of materials, tend to produce different protein levels. Chicken *nuggets* with the addition of 25% suweg flour as *filler* has a protein content of 18.61% (Gumilar *et al.,* 2011). Meanwhile rabbit nuggets plus soybean flour has a protein content between 17, 43% to 19.93% (Afrisanti, 2010).

According SNI 01-6683-2002 about chicken *nuggets, nugget* protein content requirement of at least 12% (National Standardization Agency, 2002). The protein content in the product *nuggets* are affected by the type and protein content of raw materials and supplies used. The use of substitute materials such as chicken intestinal waste is believed to be able

to contribute to elevated levels of protein in the product *nuggets.* As is known that chicken intestine contains a high enough protein. Chicken intestinal protein content reaches 22, 93 (Baihaki, *et al.,* 2010).

It could be argued that the substitution of chicken intestinal waste have a positive influence on the protein content of the product *nuggets.* Protein is a nutrient that is essential for the body because it serves as a fuel, a substance the body builders and regulators (Winarno, 1997).

Fat level

Fats, proteins and carbohydrates are the building blocks of living cell structures and their derivatives. In food, the fat is used as the medium of heat in the frying process (Chen and Chen, 2003), in addition to the fat also acts as a flavoring savory as well as improve the texture and taste of food.

Low levels of nugget fat caused by the intestinal material used have a low-fat content than chicken meat results of the study (Table 2). Nugget fat content tends to decrease as the percentage of the addition of chicken intestinal waste. Nugget fat content ranging from 11.00 to 23.93. Fat content nugget in this study is much lower when compared to the commercial nugget that is 34, 48% (% db) (Abubakar et al., 2013).

The type and nutrient content of raw material in the manufacture of influencing fat nugget nuggets produced products. According to the United States Department of Agriculture (2011), the total fat content of chicken meat is 11%, while the fat content in the intestine only 5, 60% (Baihaki et al, 2010). So the more the percentage of substitution of the intestine in *the nugget,* which is followed by the least percentage of chicken meat, will produce low-fat *nugget.*

Meat and cooking methods also affect the fat content of the final product. The meat portion used in this study is breastless meat and thighs without skin, so it tends to produce a low-fat nuggets product. Coupled with the substitution of the poor chicken intestinal waste fat content, so the higher the percentage of waste substitution intestine, fat content tend to show a significant decline. *Nugget* is a food product that is passed through the frying process. Fryers generally will increase the fat content of a food product. However, in this study tend not affect the frying fat *nugget.* It is caused by a short frying time of 30 seconds with a high temperature (200 ˚ C).

Ash content

In addition to organic matter and water, chicken *nuggets* also contain inorganic (mineral). In Table 2. it can be seen that with the substitution of chicken intestine with different percentages, show the results of which were not significantly different ($p > 0.05$) on the ash content of chicken nuggets. The ash content ranging from 1, 61 -2,84%. The ash content of products nugget in this study was lower than the ash content of duck meat nuggets that ranged from 3, 47 to 4.12% (Abubakar et al., 2013). While the ash content nugget in this study do not differ much with rabbit nuggets ash content with the addition of soybean flour ranged between 2 16 -2.14% (Afrisanti, 2010). Rabbit nuggets without the addition of soybean flour contains a higher ash content, namely 6, 39% up to 5.38% (Nurcahyanti, 2009).

In addition to coming from primary raw, ash content in chicken nuggets can also be derived from binders, fillers and flavorings (Nutrition Directorate of the MOH, 1995), the ash content of a product also has a relationship with the mineral content results in the material. The main raw material in this study were chicken meat and chicken intestinal waste. The ash content of chicken intestine is 3, 44%(Baihaki *et al.* , 2010), while the mineral content of chicken meat is 0.72%

(Soeparno, 2009). In addition to coming from the raw materials, the ash content of a product is also influenced by the treatment process. Sundari *et al.* (2015) states that food that is experiencing the cooking process can be decreased and the increase ash content from fresh material. Substitution of chicken intestinal waste into *nuggets* does not affect the ash content in the product *nuggets.*

Conclusions

It can be concluded that chicken intestine substitution can increase protein and decrease the fat content of chicken nuggets. Nugget product with composition 50% chicken intestine and 50% chicken meat (A4) has water content 99,8%, 17,58%, protein, 18,14% fat and ash.2.23% preferred by panelists.

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