Application of Chicken Sausage Using Psyllium Husk Flour as a Natural Antioxidant

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Abstract. The use of psyllium husk flour which is rich in fiber and bioactive compounds, can increase the nutritional value of chicken sausages. This study aims to develop chicken sausages using Psyllium Husk Flour (PHF) as a source of natural antioxidants. PHF is known to have high fiber and bioactive compound content that can function as natural antioxidants. The method used is a laboratory experiment using a Completely Randomized Design (CRD) ANOVA with 4 treatments and 5 replications, if different results are obtained between treatments, further Duncan's Multiple Range Test (DMRT) will be carried out. The treatment of adding psyllium husk flour to chicken sausages is without addition (T0), 5% (T1), 10% (T2) and 15% (T3). The results of adding PHF showed a decrease in moisture content and cooking loss, as well as an increase in water holding capacity (WHC), yield and antioxidants, while increasing organoleptic quality, including color, texture, taste, and aroma that are preferred by panelists. It can be concluded that the best chicken sausage is produced with the addition of 15% PHF based on the physicochemical properties.

1 Introduction

Sausage is a popular processed meat product, made from ground beef or chicken mixed with spices and then stuffed into casings [1]. In Indonesia, sausage is one type of food that is often consumed, with consumption reaching around 43.9% [2]. Sausages generally have a chewy texture. Chicken sausage has a weakness, namely that it is easily rancid. Several studies have been conducted, one of which was on chicken sausages using tomato paste as a natural antioxidant to reduce the use of synthetic antioxidants [3]. Efforts to improve the quality of sausages are carried out by adding ingredients that function as natural antioxidants, namely psyllium husk flour, which is expected to extend the shelf life of chicken sausages.

Psyllium Husk Flour (PHF) is a flour with a natural and concentrated source of soluble fiber derived from the husk of psyllium plant seeds and introduced as a medicinal plant by Indian Muslims [4]. PHF is used in the manufacture of several food products such as bread, pasta and other foods. Psyllium husk flour contains 12.08% protein, 0.09% fat, and 3.83% fiber. PHF also contains minerals such as phosphorus 1.4 mg, magnesium 1.6 mg, potassium 85 mg and calcium 16 mg [5]. PHF is used in the manufacture of several food products. Psyllium seeds are often used as a food ingredient in the form of breakfast cereals that are produced to contribute to a healthy lifestyle because of their content as a diet or replacing fat.

Based on the introduction, it is important to conduct research on the study of the use of psyllium husk flour as a antioxidants derived from nature in chicken sausages to repair the quality of chicken sausages.

2 Materials and Method

2.1 Material

This study used the following materials boneless breast and thigh boiler meat, PHF, tapioca flour, eggs, vegetable oil, garlic, ice cubes, salt, pepper and cellulose casings. The tools used in making sausage samples included Neozen brand chopper, basin, spoon, knife, gloves, cutting board, stove, sausage stuffer, analytical scales Mettler Toledo AB204-S.

2.1.1 Preparation of Chicken Sausage with the Addition of PHF

Procedure for making chicken sausage using modified PHF. Fresh chicken meat is washed thoroughly and cut into cubes then ground using a meat grinder. Salt and ice cubes are added during the grinding process. The ground meat is mixed with ingredients according to treatment such as tapioca flour (control), PHF, eggs, garlic, salt, pepper and oil. The dough is put into a plastic sleeve and steamed for ± 25 minutes at a temperature of 80° C in a pan of waters. The cooked sausage is drained then drained and put into cold water for 10 minutes, then analyzed.

Water content analysis was conducted using the oven method [7]. WHC analysis was conducted using centrifugation [7]. Cooking loss analysis used the cooking and weighing method [7]. Yield analysis used weighing [7]. Antioxidant analysis used DPPH [8]. Organoleptic quality analysis was conducted by 5 semi-trained panelists using hedonic scale scooring [9].

2.2 Methods

The method in this study used laboratory experiments using a Completely Randomized Design (CRD) and the data was analyzed using ANOVA with 4 treatments and 5 replications. If the results are obtained between treatments, then it is continued with the Duncan Multiple Range Test (DMRT).

T0: Without addition
T1: Addition of psyllium husk flour as much as 5%.
T2: Addition of psyllium husk flour as much as 10%.
T3: Addition of psyllium husk flour as much as 15%.

3 Result and Discussions

3.1 Moisture Content

The average value moisture content of chicken sausage with PHF can be seen in Table 1. Based on Table 1, the higher percentage of PHF added, the lower moisture content of chicken sausage. The addition of dietary fiber causes a decrease in water content in the meat emulsion system. High moisture content can enlarge the pores of the sample, thereby shortening the shelf life of the product. The moisture content of sausages sold on the market contains water content ranging from 59.5% - 73.9% [10]. SNI 3820 : 2015, the maximum moisture content of chicken sausage is 67%.

Table 1. Average value of moisture content

Treatment	Moisture Content (%) ± SD
T_0	46.07 ± 0.92^a
T_1	45.70 ± 0.90^b
T_2	44.04 ± 0.71^c
T_3	42.71 ± 0.72^c

Description: Distinct letters in the columns signify a significant statistical difference (P<0.01).

3.2 Water Holding Capacity (WHC)

The average value WHC chicken sausage with the addition of PHF can be seen in Table 2. Based on Table 2, the higher percentage of PHF added, the higher WHC of chicken sausage. This is because psyllium husk has a very high absorption capacity for water, so that when added to the sausage dough it will absorb most of the available water and cause an increase. PHF is able to increase the WHC of sausages thanks to its ability to absorb and bind moisture. This can prevent the product from drying out after cooking. Chicken sausage with various additions levels of salt and NaCl produced WHC values of 67.88% to 81.37% [11]. Beef sausage using carrageenan has a WHC value of 58.68% to 60.72% [12]. WHC in chicken sausage decreases with increasing percentage of tomato paste. This decrease is due to the high water content in tomato paste [13].

Table 2. Average value of WHC

Treatment	WHC (%) ± SD
T_0	91.80 ± 0.52^a
T_1	93.61 ± 0.64^b
T_2	93.20 ± 070^{bc}
T_3	95.26 ± 0.72^c

Description: Distinct letters in the columns signify a significant statistical difference (P<0.01).

3.3 Cooking Loss

The average value cooking loss of chicken sausage with PHF can be seen in Table 3. Based on Table 3, the higher percentage of psyllium husk flour added, the lower the level of loss during the process of cooking chicken sausages. This is due to the minimal loss of nutrients and food weight during the cooking process. The higher the value of cooking losses, the greater the amount of nutrients and food weight that are reduced during the process [14]. The amount of cooking loss in chicken sausages with added coconut flour ranged from 2.17% to 4.25% [15]. Sausages using chicken with the use of soursop powder extract ranging from 2.78% - 5.07% [16].

Table 3. Average value of cooking loss

Treatment	Cooking Loss (%) ± SD
T_0	4.24 ± 0.53[a]
T_1	4.13 ± 0.32[a]
T_2	3.52 ± 0.35[b]
T_3	3.01 ± 0.14[b]

Description: Distinct letters in the columns signify a significant statistical difference (P<0.01).

3.4 Yield

The average value yield chicken sausage with the addition of PHF can be seen in Table 4. Based on Table 4, the higher percentage of PHF added, the higher chicken sausage yield value. The increase in yield value in each treatment indicates that the cooking process is more effective and efficient. To achieve high yield values, it is necessary to look at the product emulsion and minimize water and fat losses by using efficient binders [17]. The chicken sausage yield differs greatly between treatments, ranging from 61.88% to 86.36% [18]. The yield results from the use of soy protein emulsion increased in each treatment, which was 71.5% - 75.0% [17].

Table 4. Average value of yield

Treatment	Yield (%) ± SD
T_0	70.10 ± 0,58[a]
T_1	71.57 ± 0,74[b]
T_2	75.51 ± 0,81[c]
T_3	85.41 ± 0,87[d]

Description: Distinct letters in the columns signify a significant statistical difference (P<0.01).

3.5 Antioxidant

The average value antioxidant content chicken sausage with the addition of PHF can be seen in Table 5. Based on Table 5. the higher percentage of psyllium husk flour added, the higher antioxidant value of chicken sausage. The increase in antioxidant value is because psyllium husk can reduce the formation of free radicals from oxidized fat, thereby increasing the antioxidant capacity in sausage products. Chicken sausage with the addition of broccoli flour of 0.5% - 1.5% obtained an antioxidant value of 5.96% to 8.56% [19].

Table 5. Average value of antioxidant

Treatment	Antioxidant (%) ± SD
T_0	5.14 ± 0.09[a]
T_1	6.21 ± 0.21[b]
T_2	6.91 ± 0.14[b]
T_3	7.23 ± 0.16[c]

Description: Distinct letters in the columns signify a significant statistical difference (P<0.01).

3.6 Sensory Evaluation

All organoleptic parameters were assessed with a score of 1 - 5 from dislike very much to like very much [9]. The panelists involved were 5 people selected based on their experience and ability in evaluating food products or semi-trained. The selected panelists have insight into meat products or processed products. The panelists have an age range of 30 - 55 years and are male and female. The results of organoleptic tests of chicken sausage using PHF can be seen in Table 6.

Table 6. Average value of organoleptic

Treatment	**Texture (%) ± SD**	**Taste (%) ± SD**	**Aroma (%) ± SD**	**Color (%) ± SD**
T_0	4.44 ± 0.51^a	4.64 ± 0.57^a	4.56 ± 0.51^a	4.56 ± 0.51^a
T_1	4.44 ± 0.51^a	4.60 ± 0.58^a	4.32 ± 0.69^a	4.44 ± 0.51^a
T_2	4.36 ± 0.76^a	4.36 ± 0.81^a	4.20 ± 0.58^a	4.24 ± 0.78^a
T_3	4.48 ± 0.59^a	4.72 ± 0.46^b	4.60 ± 0.50^a	4.32 ± 0.85^b

Description: Distinct letters in the columns signify a significant statistical difference ($P<0.01$).

Based on Table 5, chicken sausage with the addition of 15% PHF has the highest texture acceptance score. This is due to the nature of psyllium husk flour which is able to absorb water and form a gel, which contributes directly to changes in the structure of the sausage and the consistency of the final product. Chicken sausage with added sorghum has hardness, elasticity and chewiness values that create a soft texture, making it chew and easier to bite , with values ranging from 3.03 - 3.93. [20].

Chicken sausage with the addition of 15% PHF had the highest taste acceptance score. This can happen because of its ability to modify texture and enhance sensory experience. The addition of 15% psyllium husk flour had the highest aroma acceptance score. This can happen because the husk flour can absorb water and form a gel that can trap volatile compounds and reduce the release of aroma during the cooking process.

Based on Table 5, chicken sausage without the addition of psyllium husk flour has the highest results. This can happen because psyllium husk gel can affect chemical reactions during cooking, such as the Maillard reaction which usually gives a brown color to the meat so that it is less preferred by panelists because of its pale color. The addition of psyllium husk had a negative impact on the functional properties and on the dough of wheat bread, resulting in wheat bread that was rated with unsatisfactory color and texture. [21].

4 Conclusion

In this study, it was concluded that psyllium husk can be used as a natural antioxidant in chicken sausage. Psyllium husk flour has very strong water absorption properties so that it produces the best water content. The best WHC, cooking loss, yield, antioxidants and organoleptic quality are also found in the addition of 15% psyllium husk flour. Further studies are needed to evaluate PHF as a natural antioxidant in various food product.

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