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THE EFFECT OF THE USE OF LOCAL MICROBIAL-BASED FERMENTATION MEAT WITH *LACTOBACILLUS PLANTARUM* ON PHYSICAL QUALITY OF FUNCTIONAL SAUSAGE

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Abstract

Sausages are a popular food product based on meat, are generally high in cholesterol which has a negative impact on health. One effort that can be done is to make functional sausages by adding cooked meat to the processed products. Bekasam is a traditional fermented product made from fish, but can be replaced with meat because it has a high enough protein of 16-22%. The starter used in making bekasam is Lactobacillus plantarum which is a homofermentative lactic acid bacteria. The role of lactic acid bacteria during the fermentation process can hydrolyze proteins and produce bioactive components in meat that function for health so it is expected to become functional food. The purpose of this study was to determine the effect of the comparison of the concentration of beef and bekasam meat on the physical quality of sausage products. The study was conducted experimentally, using a Completely Randomized Design (CRD) with 5 treatments comparing the concentration of beef and used meat as follows: P1 (100% beef), P2 (75% beef and 25% Bekasam meat), P3 (50% beef and 50% meat used), P4 (25% beef and 75% bekasam meat) and P5 (100% bekasam meat). The results showed that the giving of bekasam meat in making sausages had an influence on the water holding capacity, cooking losses, tenderness and pH of sausages.

Key words**:** *"Lactobacillus plantarum", water holding capacity, cooking losses, tenderness, pH, sausages*

INTRODUCTION

According to Indonesian Standard 3820-2015, sausages are products made from meat which is mashed with or without the addition of other food ingredients and food additives that are permitted and put into sausage casings with or without the cooking process. Characteristics of a good sausage has a chewy texture, does not contain preservatives, is free of harmful chemicals and does not contain synthetic dyes that can be dangerous if consumed. Meat-based sausages are generally high in cholesterol which has a negative impact on health (Rahardjo, 2003) [9]. One effort that can be done is to make functional sausages by adding cooked meat to the processed products.

Bekasam is a traditional fermentation product usually made from fish, mixing rice, and salt in a closed container and then anaerobic fermentation process is carried out so as to make this processed product has a distinctive taste. In addition to using fish, spices can be made using beef which has a high enough protein content of 16-22%. The starter is used in making the bekasam is Lactobacillus plantarum which is a homofermentative lactic acid bacterium, producing almost 90% lactic acid as its main product and producing antimicrobial compounds that can inhibit harmful bacteria and pathogenic bacteria in meat (Fardiaz, 1992) [4].

Lactobacillus plantarum produces bacteriocin or protein compounds that have a bactericidal effect against other microorganisms. The role of lactic acid bacteria, among others, improves the taste of fermented products, provides preserving properties and can increase the digestibility of nutrients. Lactic acid bacteria during the fermentation process also hydrolyze proteins and produce bioactive components in meat that function for health so that they are expected to become functional food.

This research uses traces taken from the bekasam to be used as sausages. Bekasam meat is pieces of meat separated from rice,

this is because rice serves as a carbohydrate so that it is no longer used in making sausages. The function of bekasam meat in sausage mixture is that it can break down meat protein due to the fermentation process of the meat which produces bioactive peptides so that it is expected to affect the physical quality of sausages. Bioactive peptide is a type of peptide that has a definite amino acid sequence by working very actively and has health effects on the human digestive tract, besides it functions as an antioxidant, anticholesterol, antimicrobial and antihypertensive (Olugbuyiro and Oseh, 2011). Therefore, the addition of bekasam meat in the production of sausages is expected to increase functional value and positively influence physical quality characteristics that are closely related to consumers' attractiveness of functional food products from meat.

MATERIALS AND METHODS

Research Materials

The main ingredients used are beef and bekasam meat. Spices for making sausages are garlic, pepper, nutmeg, granulated sugar, salt, tapioca flour, margarine, skim milk. The chemicals used are standard solutions (buffer pH 4 and 7). The starter used is *Lactobacillus plantarum.*

Observed variables

The variables are as follows:

Water holding capacity

The measurement of water holding capacity refers to using the centrifugation method using the formula:

$$\% \text{ WHC} = \frac{the\ volume\ of\ water\ absorbed\ (ml)}{\text{meat weight (g)}}$$

Cooking Losses

The calculation of cooking losses refers to Soeparno (2009) [11] as follows:

$$Cooking\ loss\ (\%) = \frac{w1 - w2}{w1}\ X\ 100\ \%$$

where:

w_1 = The weight before the sausages is smoked

w_2 = The weight after smoked sausages

Tenderness

Tenderness test refers to Combes *et al*., (2002) [2] using a mechanical device, Warner Blatzer by looking at the value of breaking the meat (g/sec).

Acidity (pH)

Acidity (pH) measurement in meat is done using a pH meter (Lukman *et al*., 2007) [6].

Statistical Analysis

The study was carried out experimentally in a laboratory using a Completely Randomized Design (CRD) with 5 treatments comparing the concentration of beef and bekasam meat as follows: P1 (100% beef), P2 (75% beef and 25% bekasam meat), P3 (50 % beef and 50% bekasam meat), P4 (25% beef and 75% bekasam meat) and P5 (100% bekasam meat). All data obtained were analyzed using analysis of variance (ANOVA) and differences between treatments were analyzed by Duncan's test.

RESULTS AND DISCUSSIONS

The quality of sausage products can be assessed from the physical, chemical, and acceptability qualities of sausages. The physical quality of sausages can be done by observing values: water holding capacity (WHC), cooking losses, tenderness and pH. The results of the physical quality of sausages in various treatments are presented in Table 1.

Water holding capacity

The water holding capacity is the ability of meat to bind water (Soeparno, 2009) [11]. Sausage water holding value from various comparisons of beef and bekasam meat shows that the highest yield was obtained at P3 (62.56%) while the lowest was at P1 (53.26%). Furthermore, to find out to what extent the binding capacity of sausage water was affected by the addition of bekasam meat, a statistical analysis was performed with variance, showing that the giving of bekasam meat had a significant effect ($P < 0.05$) on the strength of sausage water. The treatment of P1 without added of bekasam meat is

significantly different from sausages added with meat because the meat has undergone a fermentation process which causes the meat texture to become soft so that the ability of the muscles to bind water is mainly caused by actomiosin, the main component of myofibril in the ability of the meat to bind water can be retained (Prinyawiwatkul *et al*., 1997) [8].

Table 1. The Average Physical Quality of Sausages in Various Treatment

Variables	**Treatment**				
	P_1	P_2	P_3	P_4	P_5
Physical quality					
WHC (%)	53.26[a]	62.41[b]	62.56[b]	59.98[b]	60.49[b]
Cooking Loss (%)	7.75[a]	5.75[b]	5.75[b]	5.25[b]	5.25[b]
Tenderness (g/sec)	0.35[a]	0.52[ab]	0.46[ab]	0.57[b]	0.92[b]
pH	4.8[a]	4.4[b]	4.3[b]	4.2[b]	4.2[b]

Notes: The letters that are different horizontally in the treatment column show significantly different.
Source: Own results in the laboratory.

Cooking Loss

Cooking losses are the weight of meat lost during cooking. Cooking losses is influenced by temperature and cooking time (Soeparno, 2009) [11]. Sausage cooking loss values from various treatments showed that the highest yield was obtained at P1 (7.75%), while the lowest yield was equal at P4 and P5 (5.25%). The statistical analysis was then performed with variance to determine the extent to which sausage cooking losses were affected by the giving of bekasam meat, showing that adding of bekasam meat had a significant effect (P <0.05) on sausage cooking losses. The treatment of P1 (7.75%) was significantly different from sausages added with meat. This is proportional to the binding capacity of the sausage water produced, in addition, because the formulations used in sausage dough are different. This is in accordance with the opinion of Huda *et al.*, (2010) [5], Essien (2003) [3] that the cooking losses of cooked sausage has been influenced by several factors such as grinding temperature, cooking method and time, water holding capacity, water content, fat content and type of formulation used.

Tenderness

The sausage tenderness value from various treatments showed that the highest yield was obtained at P5 (0.92), while the lowest yield was at P1 (0.35). Furthermore, statistical analysis was performed to determine the extent to which sausage tenderness was affected by adding of bekasam meat, showing that the giving of bekasam meat had a significant effect (P <0.05) on sausage tenderness. P1 treatment was significantly different from P4 and P5, whereas P5 was significantly different from P1, P2, P3 and P4. This is due to the higher concentration of bekasam meat showing the tendency of tenderness also increased. The cooking process can also increase tenderness, depending on the time and temperature used (Soeparno, 2009) [11].

pH

pH is the acidity or alkalinity (Ahmed, 2012) [1]. The pH value of sausages from various treatments showed that the highest yield was obtained at P1 (4.8), while the lowest yield was equal at P4 and P5 (4.2).

Furthermore, statistical analysis was carried out to determine the extent to which the sausage pH was influenced by adding of bekasam meat, showing that adding of bekasam meat had a significant effect (P <0.05) on sausage pH. The treatment of P1 (4.8) was significantly different from sausages that were added to the fermented meat from the meat due to the fermentation process which caused a decrease in pH in sausages (Setiadi, 2001) [10].

CONCLUSIONS

The addition of bekasam meat in making sausages has an effect on the water holding

capacity, cooking losses, tenderness and pH of sausages.

Further testing is needed regarding the use of local microbial-based meat (*Lactobacillus plantarum*) based on sausage quality.

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