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Effect Addition of Potato Flour to Physical Characteristic of Beef Meatballs

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ABSTRACT

Meat is a food ingredient that is currently being modified into a food that is popular with consumer. This study aims to evaluate the effect of adding potato starch on the physical and organoleptic quality of beef meatballs. A completely randomized design (CRD) with 5 treatments and 5 replications was used in the study. The treatments were 5% potato starch (P1), 10% potato starch (P2), 15% potato starch (P3), 20% potato starch (P4) and 25% potato starch (P5). The parameters observed were physical quality including the degree of acidity (pH), cooking loss, water holding capacity, and rendement. The results of the study showed that the physical quality of beef meatballs with the addition of potato starch had a significant effect on water holding capacity, but there was no significant effect (P>0.05) on the degree of acidity (pH), cooking loss and rendement.

Keywords: Meatballs, Beef, Physical Quality, Potato Flour, Water holding capacity

1. Introduction

Beef is a food that has nutritional value in the form of protein which contains a complete composition of amino acids [1]. With its high nutritional content, especially protein with a balanced amino acid composition, meat is a reliable food ingredient for fulfilling people's nutrition [2].

Meatballs are a food whose main ingredient is meat and additional ingredients in the form of flour and spices which are ground, then shaped into balls and boiled until cooked [3]. The meat usually used in making meatballs is beef, chicken and fish. Apart from meat, which is the main ingredient in making meatballs, you also need additional ingredients such as flour and spices.

Potato starch has the ability to bind large amounts of water which makes the granule size expand (swelling power) larger [4]. Potato flour has the characteristics of high absorption capacity, smooth texture, slightly sweet taste, with a characteristic fragrant aroma of potato flour and other nutritional substances or which allows it to be used as a wheat flour composite [5]. Based on the background above, it is necessary to

conduct research on adding potato flour to beef meatball dough to see the effect of the physical properties of beef meatballs with the addition of potato flour.

2. Research Methods

2.1. Time and Place of Research

This research was carried out at the Animal Products Technology Unit Laboratory, Faculty of Animal Husbandry, Halu Oleo University, Kendari, Southeast Sulawesi.

2.2. Research Materials

1. Material

The materials used in this research consist of main materials and supporting materials. The main materials consist of the outermost part of the beef hamstrings and potato flour (*Solanum tuberosum*), and the supporting ingredients consist of tapioca flour, garlic, salt, ground pepper and ice cubes.

2. Tools

The tools used in this research were copper (meat grinder), digital scales, pans, basins, spoons, pH meters, analytical scales, gas stoves, pestles, label paper, stationery and cameras.

2.3. Research Design

The experimental design used for this research was a Completely Randomized Design (CRD) using 5 treatments and 5 replications.

P1 : Potato flour 5%
P2 : Potato flour 10%
P3 : Potato flour 15%
P4 : Potato flour 20%
P5 : Potato flour 25%

2.4. Research variable

This research variable consists of physical quality tests with sub-parameters of physical quality including cooking loss, yield, water holding capacity (DIA) and Degree of Acidity (pH).

The formula model used for this research design is as follows:

1. Cooking loss is obtained using the formula:

$$\text{Cooking loss}(\%) = \frac{BA - BP}{BA} X\ 100\%$$

Information:

BA = Weight of meatball dough (g)

BP = Weight of product (meatballs) after cooking (g)

2. The meatball yield value can be calculated using the following formula:

$$\text{Rendement}\ (\%) \frac{\text{Meatball Weight}}{\text{dough}} \text{ x } 100\ \%$$

3. Water holding capacity (WHC) was measured using the Hamm method, namely by weighing a sample of 0.3 g. The sample was pressed for 5 minutes using a 35 kg load, then the area covered by the meatball sample and the area of

the wet area around it were marked and measured with a planimeter to obtain the mgH2O value. The mgH2O value is used to calculate the free water content, and the water holding capacity value is obtained from the difference between the total water content and the free water content.

$$mg\mathrm{H^2O} = \frac{\text{Wet are } (\mathrm{cm^2})}{0{,}0948} - 8{,}0$$

Information :

MgH ^{2} O: Milligrams of free water

$$\text{Water content (\%bb)} = \frac{W3}{W1} x\ 100$$

$$\text{WHC} = \%\ \text{Water content} - \frac{\mathrm{mgH^2O}}{300}\ x\ 100$$

Information :

W3= Weight loss

W1= Sample weight

4. The pH value of the meatballs to be analyzed is weighed at 5 grams and mixed with 50 ml of distilled water, crushed using a pestle and mortar. After the mixture is homogeneous, measurements are carried out. pH measurements are carried out by immersing the pH-meter electrode in the solution containing the sample until the instrument shows the measured pH value, the electrode is then rinsed with distilled water, dried and used for subsequent pH measurements .

2.5. Data analysis

The data obtained were analyzed using variance with a completely randomized design (CRD). Furthermore, if the treatment shows a real effect, it is continued with the Duncan Test (DMRT). Data processing was carried out using SPSS IBM 16.

3. Results and Discussion

Table 1. Average results of physical quality test measurements of beef meatballs with the addition of potato starch.

Parameter	Treatment					
	P0	P1	P2	P3	P4	P5
Degree of Acidity (pH)	5.74 ± 0.08	5.84 ± 0.06	5.78 ± 0.09	5.79 ± 0.10	5.78 ± 0.05	5.77 ± 0.09
Cooking Loss	3.40 ± 1.02	4.28 ± 1.06	4.00±1.02	3.85 ± 1.05	2.84 ± 1.06	4.20 ± 1.05
Water Holding Capacity (WHC)	37.34 ^{c} ±0.61	24.35 ^{a} ±0.59	23.59 ^{a} ±0.58	34.18 ^{b} ±0.61	36.31 ^{c} ±0.63	35.20 ^{b} ±0.58
Rendement	95.89±1.24	95.60±1.22	95.88±1.24	96.04 ± 1.23	96.81±1.23	95.80±1.26

Notes: 1. Different superscripts on the same line show significant differences (P<0.05).
2. P0 = No treatment, P1 = 5 % potato starch, P2 = 10% potato starch, P3 = 15% potato starch, P4 = 20% potato starch, P5 = 25% potato starch.

3.1. Degree of Acidity (pH)

The degree of acidity (pH) is an important indicator of meat quality by paying attention to the quality of technology and the influence of the quality of fresh meat. Observing pH is important because changes in pH affect the quality of the meatballs produced [6]. The average pH measurement for meatballs with the addition of potato starch is presented in Table 1.

The results of analysis of variance showed that making beef meatballs with the addition of potato starch did not have a significant effect (P> 0.05) on the pH of beef meatballs. This is thought to be because the pH of tapioca flour is not much different from the pH of potato starch so that the pH in each treatment is not much different. The pH of the meatballs is influenced by the raw materials, namely beef and the fillers and spices added to the meatball dough. The pH value of meat and meat products generally ranges between 4.6 - 7, and potato starch has a pH of 5.4 - 5.6 [7, 8].

3.2. Cooking Loss

Cooking loss is an indicator of the nutritional value of meat which is related to the meat juice content, namely the amount of water bound in and between muscle fibers. The average measurement of meatball cooking loss is presented in Table 1.

The results of analysis of variance showed that making beef meatballs with the addition of potato starch had no significant effect (P> 0.05) on the cooking loss value of meatballs. This is thought to be because the ability of tapioca flour and potato starch are the same in terms of binding and absorbing water so that the water lost during cooking shows no difference. The ability to absorb and retain water is a result of the starch content in each flour. [9] mentioned that potatoes have quite large water holding properties. This is because the parts that play the most role in water absorption from biomass are the amylose and amylopectin content, both of which are starch components.

3.3. Water Holding Capacity (WHC)

Water holding capacity is the ability of meat to maintain (free) water content when external pressure is applied (such as heating, grinding or pressing [10]. The average measurement of the water holding capacity of beef meatballs with the addition of potato starch is presented in Table 1.

The results of the analysis of variance showed that the addition of potato starch to beef meatballs had a significant effect (P<0.05) on the water holding capacity value of the meatballs. The water holding capacity of the addition of 5% (P1) and 10% (P2) potato starch showed the lowest water holding capacity, namely 24.43 and 23.59%, while the highest water holding capacity was the control water holding capacity (P0) and addition of 20% potato starch (P4). [11] and [12] found that potato starch with high viscosity and water binding ability has good gel strengthening ability in the surimi-starch system. Potato flour contains high levels of phosphorus when compared to other tubers.

3.4. Rendement

The rendement test is determined by calculating the ratio of the final weight to the initial weight expressed in percent, the difference between the weight after and before undergoing the cooking process which is influenced by temperature, filler material and cooking time. The average measurement of the rendement of beef meatballs with the addition of potato starch is presented in Table 1.

The results of the analysis of variance showed that making beef meatballs with the addition of potato starch had no significant effect (P> 0.05) on the rendement variable for beef meatballs. The addition of potato starch to each treatment did not affect the rendement value of the meatballs, where the rendement value of each meatball was not much different for each treatment. The average rendement value for beef meatballs is around 95.60 - 96.81%. This is influenced by the ability of potato starch and tapioca starch to bind water. [13] mentioned that rendement is influenced by the starch content in the flour used. The amylopectin content of tapioca flour is around 83% and the amylopectin content is 17%. [14] said that potato flour contains 78.96% amylopectin with an amylose content of 21.04% .

Conclusion

From the results and discussion, it can be concluded that the addition of potato starch has a significant effect on the physical quality of the meatballs, especially on the variable water holding capacity, and has no significant effect on pH, cooking loss and rendement.

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