THE EFFECT OF THE USE OF DIFFERENT TYPES AND LEVELS OF TAPIOCA FLOUR ON THE PHYSICAL QUALITY OF RABBIT MEATBALLS

Aris Sri Widati¹, Mustakim¹, Eny Sri Widyastuti¹, Herly Evanuarini¹, Dedes Amertaningtyas¹, Mulia Winirsya Apriliyani¹

¹Department of Animal Products Technology, Faculty of Animal Science, Universitas Brawijaya, Jl. Veteran, Kota Malang, East Java, Indonesia, 65145
*Corresponding email: ariswidfptub@ub.ac.id

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ABSTRACT

The purpose of this research was to determine the best type and level of tapioca flour in rabbit meatballs based on pH, WHC, cooking loss, and color. Rabbit meat and tapioca flour were used as research materials. The method used is a laboratory experiment using a completely randomized design with a factorial pattern. Factor A is the type of tapioca flour, namely dragon tapioca flour and special tapioca flour. Factor B is the level of use of tapioca flour, namely 25% and 50%. The pH value, WHC, cooking loss, and color used as the analyzed variable. Data analysis used Analysis of Variance and if there was a significant effect, it was continued with Duncan's Multiple Distance Test or DMRT. The results showed that the treatment using different types and levels of tapioca flour had a highly significant difference effect (P < 0.01) on WHC, cooking loss, L, a*, and b* and had no effect (P>0.05) on rabbit meatball pH. It can be concluded that tapioca special flour with level 25% gives the best results on characteristic of rabbit meatball.

Keywords: Rabbit meat; restructured meat; meatballs; tapioca flour
INTRODUCTION

Currently, rabbit meat consumption has not reached the target due to public perception that rabbits are favorite animals. Rabbit have advantages that is growth fast body weight, meat rabbit could made as ingredient alternative substitution beef and meat goats. The composition nutrition of rabbit meat namely 18.7% protein and 6.2% fat (Murti, et al., 2020). Meat the rabbit that doesn’t quick processed will result in happening change physical and chemical as well as influence results processed the resulting product.

Meatball is one type processed food that is popular nowadays. The raw ingredient of meatball generally use beef or chicken meat and tapioca flour. The meatball production with use 50% meat with addition flour starch or flour cereals (Montalalu, et al., 2013). One of the efforts made is to use rabbit meat as the main ingredient for making meatballs. The use of rabbit meat with more fat content low compared to with beef, hope can improve the quality of meatballs. Diversification product meatball rabbit will play a role in increase sales and attract the consumers (Hanif and Fafurida, 2018).

Tapioca flour is one of the ingredients for meatballs that functions as binding agent and filler according to Montalalu, et al. (2013) usage filler as ingredient filler will repair structure processed, improve water holding capacity, and increase elasticity product. Tapioca flour is a binder in the manufacture of meatballs. The use of tapioca flour will affect the elasticity of the meatballs. The advantages of tapioca flour with a carbohydrate content of 86.55%. Tapioca starch has two soluble fractions, namely amyllose and insoluble fraction, namely amylpectin so that when heated, tapioca feels sticky (Usmiati, 2009, and Winarno, 2002). In addition, the gel formation (gelatinization) produced by tapioca flour in meatball processing affects the thickness, density, stiffness, and texture of meatballs (Widati, et al). The purpose of this research was to determine the effect of the use of type flour tapioca and level tapioca flour to meatball rabbit.

MATERIALS AND METHODS

The Materials

The materials used in making the meatballs are rabbit meat, dragon tapioca flour, special tapioca flour, garlic, sugar, salt, pepper, egg whites, and ice cubes. The equipment used for the meatballs includes a meat grinder, analytical scale, stove, pot, basin, spoon, cutting board, knife, and slicer, pH meter, color reader.

The Methods

This study used a laboratory research method with a completely randomized design experimental method factorial pattern with 2 factors. In factor A, namely the type of tapioca treatment (used by partners and modified tapioca or special tapioca) and factor B, namely the percentage of tapioca (25 and 50% w/w).

Meatball Preparation

The material used is rabbit meatballs using different types and levels of use of tapioca flour. The first step in making meatballs is to remove the fat contained in the rabbit meat and then ground the meat using a grinding machine together with salt and some ice cubes for 1 (one) min.

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*Corresponding author: Aris Sri Widati Email: ariswidfptub@ub.ac.id Department of Animal Products Technology, Faculty of Animal Science, Universitas Brawijaya, Jl. Veteran, Kota Malang, East Java, Indonesia, 65145
add other ingredients, namely garlic, shallots, sugar, salt, pepper, egg white, and ice cubes for 1 (one) min. Added tapioca flour according to the treatment for 1 (one) min and mixed evenly. The dough is put into a bowl container and then formed into balls using hands and a spoon of the same size and then put and cooked in water at a temperature of 70°C until it floats. Transfer the meatballs that have been floating in boiling water at 100°C for 10 min. The cooked meatballs were drained and cooled at room temperature before being analyzed.

**Procedure Test**

**pH**

The pH of rabbit meatballs was measured using a pH meter (AOAC, 2005). The pH meter was calibrated with buffer solutions 4 and 7. The sample of meatballs used was 1 (one) gram and then crushed using mortar and pestle. Added distilled water and stirred for 5 (five) min. The sample is transferred into a measuring cup, then the pH is measured by immersing the pH meter electrode approximately 2-4 cm into the solution containing the sample until the instrument shows the measured pH. The pH value is obtained based on the scale indicated by the pH meter. The electrodes were then rinsed using distilled water and used for further pH measurements.

**WHC**

WHC (water holding capacity) was measured using filter paper (Hamm, 1986). Sample as much as 0.3g and placed on filter paper Wathman No. 42. Paper and samples are placed between 2 (two) glass plates which are loaded with 35kg for 5 (five) min. The paper and the sample were taken and then the wet area and the area of the meatball sample were drawn on the transparent mica.

The area of the circle of the sample is measured and calculated, as is the area of the outer circle formed by the water. Thus the area of the circle formed by free moisture is the subtraction of the area of the outer circle with the area of the inner circle. WHC measurement can be calculated using the formula:

\[
\text{Amount of free water} = \frac{(\text{Wet area area (cm}^2) - 8)}{0.0948}
\]

\[
\% \text{ Wet area content} = \frac{(\text{Amount of free water})/(\text{sample weight}) \times 100}\%
\]

\[
\text{WHC} (\%) = \text{Moisture content of the sample} (\%) - \text{wet area content} (\%)
\]

**Cooking Loss**

Cooking loss was determined based on the difference in the weight of the meatball sample before and after being cooked at 80°C for 1 h, and was expressed as a percentage (%) (Seoparno, 2011). The 50g sample used was then put in a plastic bag and tightly closed so that during the boiling process the water did not enter the bag. The sample was boiled in a water bath at 80°C for 1 h. The sample was removed from the plastic bag and cooled at room temperature and then dried. The boiled sample was weighed to determine the final weight of the sample. Cooking loss measurements can be calculated using the formula:

\[
\text{cooking loss} (\%) = \frac{(A-B)}{A} \times 100\%
\]

Information:  
A: weight before cooking  
B: weight after cooking

**Warna LAB**

The color of rabbit meatballs was measured using a color reader (AOAC, 2005). The petri dish is lined with clear plastic, then a color reader is attached to the surface of the rabbit meatball. Turn on the color reader and measure the color reader by pressing the start button. The values of L, a*, and b* were obtained and then repeated 3 times in each treatment. The color values...
taken are the values of L, a*, and b* as a unit. The L value, representing the level of brightness, starts from 0 for black and 100 for white. A* values represent red for 0 to 100, and green for values 0 to -80. The value of b* represents the color yellow for the value 0.

**Statistic Analysis**

Data that can be analyzed using analysis of variance (ANOVA). If the results of the analysis show significant or highly significant differences, then further analysis is carried out using Duncan's Multiple Range Test (DMRT).

**RESULTS AND DISCUSSION**

**The Effect of Using Different Types and Levels of Tapioca Flour on pH, WHC, and Cooking Loss of Rabbit Meatballs**

The results of the analysis of variance showed that the treatment using different types and levels of tapioca flour had a highly significant effect (P<0.01) on WHC and cooking loss and didn’t gave significant effect (P>0.05) on the pH of rabbit meatballs as shown in Table 1.

**Table 1.** The average pH value, WHC, and Cooking Loss of Rabbit Meatballs with the Use of Different Types and Levels of Tapioca Flour.

<table>
<thead>
<tr>
<th>Type Tapioca</th>
<th>Level (%)</th>
<th>pH</th>
<th>WHC (%)</th>
<th>Cooking Loss (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapioca Dragon</td>
<td>25</td>
<td>6.61 ± 0.02</td>
<td>64.67 ± 0.80</td>
<td>1.90ac ± 0.11</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>6.64 ± 0.02</td>
<td>59.71b ± 0.97</td>
<td>0.79b ± 0.18</td>
</tr>
<tr>
<td>Tapioca Special</td>
<td>25</td>
<td>6.59 ± 0.02</td>
<td>65.49a ± 0.33</td>
<td>1.16ad ± 0.13</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>6.63 ± 0.05</td>
<td>59.78b ± 0.56</td>
<td>0.86b ± 0.11</td>
</tr>
</tbody>
</table>

Description: a,b,c,d Different superscripts in the same column showed a highly significant effect (P<0.01)

**pH Value**

The results of the statistical analysis of the pH of rabbit meatballs in Table 1 showed that the use of the type and level of tapioca flour didt gave significant effect (P>0.05) on the pH of rabbit meatballs. The average pH value of rabbit meatballs ranged from 6.59-6.64. The results showed that the pH values were not different. This is because the source of dietary fiber can affect the pH of meatballs (Mehta, et al., 2013). The results of research Nuhriawangsa, et al. (2021) showed that chevon meatballs with the addition of 10% taro flour could increase the pH of the meatballs in the presence of amylopectin and amylose content.

**WHC**

The results of the statistical analysis of the WHC rabbit meatballs in Table 1 show that the use of the type and level of tapioca flour gave highly significant effect (P<0.01) on the WHC of rabbit meatballs. Water holding capacity is the ability of meat to retain moisture during cutting, heating, grinding and processing (Soeparno, 2005). The average value of WHC rabbit meatballs ranged from 59.71-65.49%. The highest average WHC value is 65.49% with the use of special tapioca flour by 25% and the lowest WHC average value is 59.71% with the use of dragon tapioca flour as much as 50%. The results of research Nuhriawangsa, et al. (2021) showed that there was a decrease in meatballs with an increase in the concentration of using taro flour 7.5%. The use of tapioca flour as much as 50% in the rabbit meatballs production greatly affects the water holding capacity of the product.

**Cooking Loss**

The results of statistical analysis of cooking loss of rabbit meatballs in Table 1 show that the use of types and levels of tapioca flour has a very significant effect (P <0.01) on cooking loss of rabbit meatballs. The average cooking loss of rabbit
meatballs ranged from 0.79-1.90. The highest average cooking loss was 1.90% with the use of dragon tapioca flour by 25% and the lowest average cooking loss was 0.79% with the use of 50% dragon tapioca flour. The increasing use of flour in the manufacture of meatballs causes a decrease in cooking loss with the release of water by meat proteins that can stick to starch during cooking (Dincer, et al., 2018). Cooking in the manufacture of meatballs will affect the shrinkage of protein, so that the water denatured protein is released. Cooking can also cause changes in the dimensions of meatballs with the loss of water and fat (Serdaroglu, et al., 2005). Cooking loss is the result of changes in the two main structural protein systems in meat, namely actomyosin and collagen (Garcia-Segovia et al., 2007).

The Effect of Using Different Types and Levels of Tapioca Flour on the color of L, a*, and b* Rabbit Meatballs

The results of the analysis of variance showed that the treatment using different types and levels of tapioca flour had a very significant effect (P<0.01) on the color of L, a*, and b* rabbit meatballs as shown in Table 2.

Table 2. Average brightness L, redness a*, and yellowness b* Rabbit Meatballs with the Use of Different Types and Levels of Tapioca Flour.

<table>
<thead>
<tr>
<th>Type Tapioca</th>
<th>Level (%)</th>
<th>Variable</th>
<th>L</th>
<th>a*</th>
<th>b*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tapioca Dragon</td>
<td>25</td>
<td></td>
<td>65.99 ±0.70</td>
<td>1.63 ±0.30</td>
<td>12.91 ±0.97</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td></td>
<td>69.22 ±0.90</td>
<td>2.20 ±0.25</td>
<td>13.34 ±0.63</td>
</tr>
<tr>
<td>Tapioca Special</td>
<td>25</td>
<td></td>
<td>67.14 ±0.98</td>
<td>1.07 ±0.17</td>
<td>12.58 ±0.61</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td></td>
<td>70.66 ±0.96</td>
<td>2.49 ±0.40</td>
<td>12.48 ±1.48</td>
</tr>
</tbody>
</table>

Description: a,b,c,d Different superscripts in the same column showed a highly significant effect (P<0.01)

Brightness L

The results of statistical analysis of the brightness of L rabbit meatballs in Table 2 show that the use of types and levels of tapioca flour has a highly significant effect (P<0.01) on the brightness of L rabbit meatballs. The average value of L brightness ranges from 65.99-70.66. The highest average L brightness value was 70.66 using 50% special tapioca flour, while the lowest L brightness average was 65.99 using 25% dragon tapioca flour. The results showed that the use of special tapioca flour affects the brightness of the rabbit meatball L because the color of the flour tends to be lighter. This is in accordance with the results of research by Husniati and Adi (2018) that the color of tapioca flour is white and has low fiber and lignin values and can produce good viscosity. Efriilia, et al. (2016) stated that the myoglobin content in oxidized meat can affect the color of the meatballs formed.

Redness a*

The results of statistical analysis of the redness of a* rabbit meatballs in Table 2 show that the use of types and levels of tapioca flour has a highly significant effect (P<0.01) on the redness of a* rabbit meatballs. The average value of redness a* ranged from 1.07 to 2.49. The highest average a* redness value was 2.49 using 50% special tapioca flour, while the lowest a* redness average was 1.07 using 25% special tapioca flour. The results showed that 50% special tapioca flour could increase the redness of a* in rabbit meatballs. The color of the meatballs is influenced by the use of the type and amount of meat, the type and amount of flour, and other added ingredients (Aslinah, et al., 2018).

The increased redness of a* in rabbit meatballs was supported by the presence of flavonoids in tapioca flour. Tarigan, et al. (2020) stated that tapioca flour contains...
flavonoids with shown free radical scavenging activity. In addition, the denaturation of myoglobin (the pigment most responsible for the red color) begins between 55 C and 65 C so that the color changes in the meat during cooking (King and Whyte, 2006).

Yellowish b*

The results of statistical analysis of yellowish b* rabbit meatballs in Table 2 show that the use of types and levels of tapioca flour had a highly significant effect (P<0.01) on the yellowness of b* rabbit meatballs. The mean value of yellowish b* ranged from 12.48–13.34. The highest average yellowish b* value was 13.34 using 50% dragon tapioca flour, while the lowest b* yellowness average was 12.48 using 50% dragon tapioca flour.

The yellowish color of b* increased due to the presence of carotenoids in tapioca flour used in making meatballs. Cassava plants contain carotenoids in the form of beta-carotene (Ni'matusyukriyah and Swasono, 2020). Research results Aukkanit, et al. (2015) showed that the use of corn flour in meatballs can produce a yellowish color in the presence of carotenoids in corn.

CONCLUSION

The use of different types and levels of tapioca flour affects the physical quality of rabbit meatballs. It can be concluded that tapioca special flour with level 25% gives the best results on characteristic of rabbit meatball.

REFERENCES


