Antioxidant Activity, Organoleptic Quality of Dangke Nuggets with the Addition of Corn Flour (Zea mays L.)

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Abstract. This study aimed to analyze the effect of substituting wheat flour with corn flour on antioxidant activity and organoleptic of dangke nuggets with different storage durations. This study used a completely randomized design (CRD) factorial pattern with three replications and three treatments. The first factor was 0%, 5%, and 10% corn flour; the second was 0, 14, and 28 days of storage in the freezer. Antioxidant measurement using the DPPH method and organoleptic includes testing color, aroma, taste, texture, and preference of dangke nuggets. The results showed no correlation between the treatment level of corn flour addition and the storage duration, which had no significant effect (P > 0.05) on the antioxidant content of dangke nuggets. For organoleptic parameters in terms of color, aroma, taste, texture, and liking, there was no correlation between the treatment level of corn flour addition and storage duration, which had no significant effect (P > 0.05).

From this study, it can be concluded that the treatment of a 5% corn flour addition level in the formulation can increase antioxidant activity and organoleptic quality in terms of aroma and texture of nuggets, and the addition of 10% corn flour also improves the quality of color and liking of nuggets. Meanwhile, the more extended storage, the more antioxidant and organoleptic quality of dangke nuggets will decrease.

1 Introduction

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Corn flour has the advantage of containing carotenoids such as β-carotene, α-carotene, and lutein, which are antioxidants that can reduce free radicals. The many health functions of carotenoids provide several health functions for the body. In general, carotenoids can cause carcinogenic cell damage. Corn flour is made from corn that has been ground until smooth. Another filler that can be used in making nuggets is corn that has been puffing. Corn contains 97% starch, 10% protein, and 3% fat. Corn flour is sticky and chewy when cooked, has viscosity, and can form a chewy gel during cooking. Corn flour contains protein in the form of gluten. Products made from corn flour are perfect for emulsion products because it has high amylopectin content and low amylose content.

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2 Materials and Methods

1.1 Preparation of corn flour

The procedure for making corn flour referred to the modified method of Suarni [16], which was by preparing sticky corn samples, which were first shaken and then soaked for 8 hours. Then, the corn was dried and ground using a machine until smooth, followed by a sieving process to produce corn flour with the desired level of fineness; then, the flour was dried again to reduce the moisture content of the flour. The dried corn flour was put into plastic and tested for antioxidant content.

1.2 Preparation of Dangke nuggets

The procedure for making dangke nuggets refers to the modified method by Arham [19]: weighing the ingredients to be used. Dangke, egg yolk, ice cubes, and salt were put into a food processor and ground for 2 minutes (until mixed). Other ingredients such as wheat flour, corn flour, onions, pepper, and flavoring were added and ground again until all ingredients were mixed. The prepared dough was put into a baking tray and steamed for 30 minutes. The cooked dough was then cooled and cut into square pieces. Pieces of dangke nuggets were coated with a solution of wheat flour and coated with breadcrumbs and then put into plastic, and then stored in a freezer for 15-30 minutes for the 0-day storage treatment so that the breadcrumbs were more attached to the nuggets and for other treatments stored in the freezer for 14 and 28 days and antioxidant testing was carried out. Nuggets stored in a refrigerator were ready to be fried in hot oil until they produced a golden yellow color and then drained; organoleptic testing was carried out.

3 Measured variable

The variables measured were the antioxidant activity and organoleptic quality of dangke nuggets with the addition of corn flour.
3.1 Antioxidant activity

Antioxidant testing was carried out based on Prasetyo et al. [20]; DPPH powder weighed as much as 0.007 g, dissolved with 50 mL of ethanol, and vortexed until dissolved. The DPPH solution was taken to 1 mL, then added ethanol to 5 mL and allowed to stand for 30 minutes. Crushed nugget samples were then homogenized. The sample was weighed, 1 gram was put in a measuring cup, 0.0019 DPPH was added, and 50 ml of 100% methanol and vortexed until the sample was dissolved. Centrifuged at 3,000 rpm for 15 minutes and then filtered. Incubated for 30 minutes at room temperature, then re-added the absorbance using a spectrophotometer with a wavelength of 517 nm. Samples were made as many as 3 with three repetitions. Antioxidant levels can be measured using the following formula:

\[
\text{Antioxidant level} = \frac{\text{Control absorbance} - \text{Sample absorbance}}{\text{Control absorbance}} \times 100\%
\]

3.2 Organoleptic quality


4 Results and Discussion

4.1 Antioxidant Activity of Dangke Nuggets
dangke nuggets. The treatment with the highest antioxidant content of dangke nuggets was obtained with a 5% addition of corn flour.

Table 1. The average antioxidant value of dangke nuggets with corn flour (Zea mays L.) addition with different storage durations.

<table>
<thead>
<tr>
<th>Addition Level (%)</th>
<th>Storage Duration (Days)</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>47.06±0.55</td>
<td>47.23±0.56</td>
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<tr>
<td>0</td>
<td>48.07±0.78</td>
<td>49.02±0.44</td>
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<tr>
<td>10</td>
<td>41.38±0.46</td>
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</tr>
<tr>
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<td></td>
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Notes: Different superscript in the same row indicate significantly different treatments (P<0.05).

4.2 Organoleptic Quality of Dangke Nuggets

4.2.1 Colour

The average value of the flour addition level to the nugget colour organoleptic was the highest in the treatment of 10% corn flour addition with a value of 4.20, and the lowest is in the addition of 0% corn flour with a value of 3.73, which means the nugget criteria are slightly bright yellow. The results of the analysis of variance for the treatment of flour addition level to the colour of nuggets showed results that had a significant effect (P<0.05), which means that there was an effect of the corn flour addition level in the making of dangke nuggets on the colour aspect. Making nuggets through the steaming process produces changes in the colour of the nuggets. According to [23], browning reactions occur due to the Maillard reaction, which is a reaction between carbohydrates, significantly reducing sugars and amino acids in the presence of heating. This reaction produces a yellow-to-brown color, highly desirable in food processing. According to Winarno [24], the color of nuggets most preferred by consumers is golden yellow.
The results of the average value of the flour addition level to the aroma of nuggets showed no significant effect (P>0.05), which means that there is no significant effect (P>0.05) of the storage duration on the organoleptic aroma of dangke nuggets were obtained.

The average value of the treatment of storage duration on the aroma of nuggets showed no significant effect (P>0.05) on the organoleptic is 14 days with a value of 3.22 which means the criteria for nuggets aroma are somewhat milky. The results of the analysis of variance for the treatment of flour addition of 10% corn flour with a value of 3.00, which means that the criteria for nuggets aroma are somewhat milky.

4.2.2 Aroma

The concentration of flour used so it only contributes a little different concentrations does not affect the aroma of the nuggets produced. The results of the analysis of variance for the interaction between the treatment level of various types of flour with the addition to the organoleptic value and preference for dangke nuggets with the addition of corn flour are somewhat milky.

4.2.3 Taste

The average value of the treatment of nugget storage duration on the highest aroma level is 4.26±1.02 with a value of 3.66±0.73 which means the criteria for nuggets aroma are somewhat milky.

Table 2. Average organoleptic value and preference for dangke nuggets with the addition of corn flour.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Addition Level (%)</th>
<th>Storage Duration (Days)</th>
<th>Average</th>
<th>0</th>
<th>14</th>
<th>28</th>
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</thead>
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<td>Colour</td>
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<td>3.57±1.35</td>
<td>3.57±1.35</td>
<td>3.73±1.34&lt;sup&gt;a&lt;/sup&gt;</td>
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<td>4.00±1.07</td>
<td>3.90±1.12</td>
<td>4.10±1.15</td>
<td>4.00±1.09&lt;sup&gt;ab&lt;/sup&gt;</td>
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<td>4.27±0.69</td>
<td>4.17±0.74</td>
<td>4.17±1.05</td>
<td>4.20±0.83&lt;sup&gt;b&lt;/sup&gt;</td>
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</tr>
<tr>
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<td>3.92±1.22</td>
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<tr>
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<td>4.31±1.00&lt;sup&gt;ab&lt;/sup&gt;</td>
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<tr>
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<td>10</td>
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<td>3.87±0.73</td>
<td>3.63±0.66</td>
<td>4.06±0.92&lt;sup&gt;c&lt;/sup&gt;</td>
<td></td>
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<tr>
<td></td>
<td>Avarage</td>
<td>4.26±1.02&lt;sup&gt;a&lt;/sup&gt;</td>
<td>3.66±0.73&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.48±0.76&lt;sup&gt;b&lt;/sup&gt;</td>
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</tr>
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</table>
means the criteria for nuggets with a very savory taste and the lowest in the addition of 10% corn flour with a value of 4.06 which means the requirements for nuggets with a savory taste. The results of the analysis of variance for the treatment of flour level addition to the taste of nuggets showed a very significant effect (P <0.01), which means that there is an effect of the corn flour addition level in the making of dangke nuggets on the taste of nuggets. This is because there are differences in the use of flour, and the percentage of flour used is different so that it can affect the taste of nuggets. According to Winarno [27], the taste is usually influenced by several things, such as chemical compounds, temperature, the combination of food with additives, and the length of the cooking process; the taste is more influenced by the formation of ingredients than the food processing.

The results of the average value for storage duration treatment on the nuggets organoleptic taste is the highest at 0 days with a value of 4.39 and the lowest at 28 days with a value of 4.20, which means the criteria for nuggets with a savory taste. The results of the analysis of variance for the storage duration treatment on the taste of nuggets showed no significant effect (P>0.05).

The results of the analysis of variance for the interaction between the treatment level of corn flour addition and storage duration on the organoleptic taste of dangke nuggets were found to have no significant effect (P>0.05), which means that there is no interaction between the factors of corn flour addition level and storage duration of nuggets.

4.2.4 Texture

The results of the average value for the treatment of flour addition levels on the organoleptic texture of nuggets were obtained the highest in the treatment of 5% flour addition with a value of 4.88, which means the criteria for nuggets with a beautiful texture and the lowest in the addition of 0% corn flour with a value of 4.31 which means the requirements for nuggets with a fine texture. The results of the analysis of variance for the treatment of flour addition level to the texture of the nuggets showed a very significant effect (P<0.01), which means that there is an effect of the corn flour addition level in the making of dangke nuggets on the texture of the nuggets. This is due to the difference in flour and flour use presentation levels. The most preferred criteria by the panelists were those that used a combination of wheat flour and corn flour. According to Balitbantan [28], white corn flour has a fluffy or chewy texture and has high water absorption compared to other corn types. Adding wheat flour to crab nuggets produces a slightly stiff texture.

The results of the average value for storage duration treatment on the nugget's organoleptic texture was the highest in 0 days with a value of 4.71 and the lowest in the 28-day with a value of 4.52, which means the criteria for nuggets with a very smooth texture. The results of the analysis of variance for the treatment of storage duration on the texture of nuggets showed no significant effect (P>0.05).

The results of the analysis of variance for the interaction between the corn flour addition level and storage duration on the dangke nuggets organoleptic texture were found to have no significant effect (P>0.05), which means that there is no interaction between the factors of corn flour addition level and storage duration of nuggets.

4.2.5 Preference

The results of the average value of the flour addition level to the organoleptic preference of nuggets were obtained the highest in the treatment of 10% addition of flour with a value of 4.06 and the lowest in the addition of 0% corn flour with a value of 3.51, which means the criteria for nuggets preference was in Like criteria. The results of the analysis of variance for
the flour addition level treatment to the liking of nuggets showed results that were very significantly influenced (P < 0.01), which means that there is an effect of the corn flour addition level in the dangke nuggets making on the level of nugget preference. Overall, the results obtained by the panelists had a response of Like to the nuggets both with and without corn flour. The results obtained are the same as the results of the organoleptic test conducted[16]; the level of liking for corn flour in native chicken nuggets received a like response from the panelists.

The results of the average value of the storage duration treatment on the liking organoleptic was the highest in 0 days with a value of 4.26 and the criteria of Like and the lowest in the 28-day treatment with a value of 3.48 and the criteria was somewhat like. The results of the analysis of variance for the treatment of storage duration and the texture of the nuggets showed a very significant effect (P < 0.01), which means that there is an effect of the dangke nuggets' storage duration on the level of nugget liking. The longer the storage duration of nuggets, the more the response of panelists from Like to Somewhat Like decreased.

The results of the analysis of variance for the interaction between the treatment of the corn flour addition level and the storage duration on the Liking organoleptic of dangke nuggets were found to have no significant effect (P>0.05), which means that there is no interaction between the factors of the corn flour addition level and the nuggets storage duration.

5 Conclusion

The treatment of a 5% corn flour addition level in the formulation can increase antioxidant activity and organoleptic quality in terms of aroma and texture of nuggets, and the addition of 10% corn flour also improves the quality of color and liking of nuggets. Meanwhile, the longer the storage duration, the lower the antioxidant and organoleptic quality of dangke nuggets.

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