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The Effect of Adding Batak Onion Juice (*Allium chinense G. Don*) on the Physical and Organoleptic Quality of Chicken Nuggets

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ABSTRACT

Chicken nuggets are processed products that are easily contaminated if the processing and storage of the product are not good. Batak onions contain antioxidant compounds that can prevent oxidative damage to chicken nuggets. This study aims to determine the effect of using Batak onion juice on the physical quality and organoleptic quality of chicken nuggets. The study was conducted at the Technology Research Laboratory, Faculty of Agriculture and the Animal Production Laboratory, Faculty of Agriculture, University of North Sumatra in November 2023. The research design used was RAL (Completely Randomized Design) with 4 treatments, namely P0 = 0%, P1 = 5%, P2 = 10%, P3 = 15% and 5 replications. The parameters of this study were physical quality tests, namely pH, cooking loss, water holding capacity, and organoleptic tests of color, taste, aroma and texture. The results of this study indicate that Batak onion juice with a concentration of 5%, 10%, 15% has a significant effect (P <0.05) on the physical quality and organoleptic quality of taste and aroma in chicken nuggets but does not affect the color and texture.

Keywords: *Allium chinense G Don*, Chicken meat, Nugget, Organoleptic, Physical quality

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1. Introduction

One of the processed livestock products that is popular with the public is chicken nuggets. Chicken meat contains fatty acids (30-40%). The high fatty acid content in chicken nuggets makes nuggets more susceptible to oxidation, which has an impact on changes in taste and reduced nutrition. The nuggets industry has made several innovations to increase the nutritional content of chicken nuggets and seek alternative natural preservatives. The innovations made are related to replacing basic ingredients, reducing fat content, increasing fiber content and increasing nutrition so that the nutritional value of chicken nuggets is better. The addition of additional food ingredients improves the quality and quality of nuggets. The addition of Batak onions to chicken nuggets aims to improve the quality of chicken nuggets. The addition of Tiwai onions with concentrations of 5%, 10% and 15% can improve the physical quality of chicken nuggets [1].

Batak onions (*Allium chinense G. Don*) are plants that grow abundantly in North Sumatra, local people, especially the Batak tribe, use this spice as a seasoning in traditional dishes such as arsik. In the world of health, Batak onions have many benefits, namely for vitamin K, eye health, skin rejuvenation, improving

reproductive health, preventing gum, tongue and lip diseases, high mineral content, weight loss, antidote, balancing blood sugar, helping with digestive problems and preventing cancer [2]. Batak onions (*Allium chinense G. Don*) contain bioactive compounds such as flavonoids, saponins in stem onion extract which have benefits as antimicrobials [3]. Batak onions contain high antioxidants and can inhibit fungal growth [4,5]. Based on the description above, a study was conducted to determine the effect of adding Batak onion juice to chicken nuggets through physical tests including pH, water binding capacity, water content, and cooking loss as well as organoleptic tests..

2. Method

This research was conducted from October 2023 to November 2023. Organoleptic tests were conducted at the Production Laboratory, Animal Husbandry Study Program, and physical tests were conducted at the Research Laboratory of the Faculty of Agriculture, University of North Sumatra. The materials used were fresh chicken breast meat, garlic, pepper, tapioca flour, salt and aquadest Batak onion juice, filter paper, label paper, tissue, and buffer solution. The equipment used were containers, spoons, baking sheets, knives, cutting boards, thermometers, analytical scales, ovens, plastic clips, aluminum cups, measuring cups, caver presses, stopwatches, knives, glass plates, millimeter block paper, sensory test forms and stationery. The part used was fresh Batak onion bulbs. Batak onions were peeled and washed using running water. The washed Batak onions were then drained and weighed according to the treatment. Batak onion is put into a blender then water is added according to the treatment dose: 5% (5 g of Batak onion bulbs + 95 ml of water), 10% (10 g of Batak onion bulbs + 90 ml of water), 15% (15 g of Batak onion + 85 ml of water), then blended until smooth and then filtered to get juice [6].

The chicken meat is cut and ground, then mixed with Batak onion juice according to the treatment and other ingredients until homogeneous. The dough is put into a container with a thickness of 1 cm. The dough is steamed for 20 - 30 minutes at a temperature of 50-60o C. The dough is cut into 2 x 5 cm pieces. The dough is coated with eggs and breadcrumbs

2.1 Data Analysis

This study was conducted experimentally using the Completely Randomized Design (CRD) method with 4 treatments and 5 replications. Randomization in the study as one way to ensure that the chances of each treatment are the same for the experimental unit, randomization was carried out using the simple random sampling method. Data analysis was carried out using the excel and SPSS programs for analysis of variance, namely Analysis of Variant (ANOVA) and Kruskall-Waliss, if the data results obtained were significantly different between treatments, they were further tested using the Duncan's Multiple Range Test (DMRT) and White-Mann.

2.2 pH Test

A 10 g chicken nugget sample was cut into small pieces and ground until smooth. The sample was put into a beaker glass plus 20 ml of distilled water, stirred until homogeneous. The pH was measured using a pH meter that had been calibrated with a buffer solution to obtain accurate results. The pH value was measured five times and then the average was calculated [7].

2.3 Cooking Loss

Prepared nugget samples of 10 g/treatment then weighed, then put in plastic clips and boiled in water at a temperature of 75°C (45 minutes). The sample was dried with tissue, then the sample was weighed.

2.4 Water Holding Capacity

Water binding capacity was measured using the pressing method from Hamm, measurement using the Carver press tool [8]. Chicken nugget samples (±0.3 g/treatment) were placed on filter paper, clamped between two glasses and pressed for five minutes. The wetted area is the wetted area obtained from the difference in the area of the circle measured with millimeter paper [9].

2.5 Organoleptic

The samples to be tested were given a code and then placed in a container. The panelists were directed to observe the color of the chicken nugget sample with the addition of Batak onion juice. The taste of the chicken nugget was tested by the panelists' sense of taste. The sample was prepared with a marked code, each subsequent sample change was directed to drink water first to neutralize the sense of taste. The panelists tasted the chicken nugget sample, then wrote the value on the test format sheet [10]. The testing procedure for the aroma of chicken nugget with the addition of Batak onion juice was that the panelists inhaled the aroma of the chicken nugget sample with the addition of Batak onion juice, each test in each treatment, the panelists

neutralized the sense of smell by inhaling the aroma of coffee powder, then filled out the organoleptic test form sheet [10]. The test procedure for texture began with the panelists assessing the texture of the nugget by touching the surface, pressing, and biting the sample, then filling out the organoleptic texture test form sheet [11].

3. Discussion

3.1 pH Test

The results of the study of the addition of Batak onion juice as an additional ingredient to the pH value of chicken nuggets can be seen in Table 1. The highest average pH of chicken nuggets was in the P0 treatment with a value of 6.63 and the lowest average was in the P3 treatment with a value of 5.69. Further DMRT tests on four treatments of chicken nuggets with the addition of Batak onion juice showed that P0 was not significantly different from P1, P1 was not significantly different from P2, P2 was not significantly different from P3. However, P0 was significantly different from P2 and P3, P1 was significantly different from P3 at a significance level of 5%.

Table 1 Average pH value of the addition of Batak onion juice as an additional ingredient in chicken nuggets

Treatment	Replicate					Average±SD
	U1	U2	U3	U4	U5	
P0 (0%)	6,85	6,43	6,59	6,76	6,50	6,63 ± 0,17^{c}
P1 (5%)	6,65	6,64	6,92	5,62	5,65	6,30 ± 0,62^{bc}
P2 (10%)	6,50	6,41	5,86	5,57	5,51	5,97 ± 0,46^{ab}
P3 (15%)	6,18	5,48	5,55	5,56	5,69	5,69 ± 0,28^{a}

Note: Different superscripts in the same column indicate a significant difference (P<0.05).

The results of this study indicate that the addition of Batak onion juice up to 15% can reduce the pH value of chicken nuggets. The results of this study are in line with previous studies that the addition of Batak onion has an effect on reducing the pH of lamb rendang in the control of 6.4 with the provision of Batak onion worth 6.2 [12]. The degree of acidity (pH) is a criterion for assessing the degree or level of acidity and alkalinity in fresh meat or processed meat products [13]. One of the factors that reduces the pH of the product is caused by the pH value of the raw materials used, which causes variations in the pH value of the nuggets. Changes in the pH value in the study were caused by the addition of Batak onion juice which had an effect on the hydrogen balance of the nuggets. Mixing the ingredients produces a new hydrogen balance point in the nuggets [14].

The antioxidant content in the Batak onion used causes the pH value to decrease [12]. The antioxidant content (phenol) can affect the pH value because it has acidic properties. The heating factor in the nugget steaming process is also one of the factors that affects the pH of the nugget, where the process uses high temperature heating [15]. Temperature and cooking time play a role in influencing the final pH value [16].

3.2 Cooking Loss

The effect of adding Batak onion juice as an additional ingredient on the cooking loss of chicken nuggets can be seen in Table 2. The highest average cooking loss of chicken nuggets was in treatment P0, with a value of 7.94% and the lowest average was in treatment P3 with a value of 4.19%. Treatments P0, P1, and P2 had higher cooking losses compared to the lower P3 treatment. The results of the analysis of variance showed that the addition of Batak onion juice had a significant effect on the cooking loss of chicken nuggets. The results of the DMRT further test on four treatments of chicken nuggets with the addition of Batak onion juice showed that P0 was not significantly different from P1 and P2, P1 was not significantly different from P2 and P3, P2 was not significantly different from P3. However, P0 was significantly different from P3 at a significance level of 5%.

Table. 2 Average cooking loss value from the addition of Batak onion juice as an additional ingredient in chicken nuggets (%)

Treatment	Replicate					Average±SD
	U1	U2	U3	U4	U5	
P0 (0%)	7,14	11,11	7,14	7,14	7,14	7,94± 1,77^{b}
P1 (5%)	7,14	7,14	7,14	7,14	3,45	6,40± 1,65^{ab}
P2 (10%)	3,45	7,14	7,14	3,45	7,14	5,67± 2,02^{ab}

P3 (15%)	7,14	3,45	3,45	3,45	3,45	4,19± 1,65[a]

Note: Different superscripts in the same column indicate a significant difference (P<0.05).

The results of this study are in line with the results of previous studies on the physical quality of lamb meat affected by the concentration and duration of soaking of Batak onion extract, the cooking loss value decreased due to the increase in the concentration of onion extract used [12]. Cooking loss is the loss of fluid and nutrients during the processing or cooking process, thereby reducing the weight of the sample [17]. In contrast, the water holding capacity in this study was influenced by pH, which was also significantly different up to the treatment of 15% Batak onion juice (Table 1). The pH value is directly proportional to the water content, the water content in the nuggets decreased because Batak onions are acidic so that the pH value decreased [12]. Low water content increases water holding capacity, water holding capacity is inversely proportional to cooking loss, where if the water holding capacity is high, it causes low cooking loss

3.3 Water Holding Capacity

The effect of adding Batak onion juice as an additional ingredient on the water binding capacity of chicken nuggets can be seen in Table 3. The highest average water binding capacity of chicken nuggets was in treatment P3, with a value of 47.66% and the lowest average was in treatment P0 with a value of 43.34%. The results of the analysis of variance showed that the addition of Batak onion juice had a significant effect on the water binding capacity of chicken nuggets. Further results of DMRT on four treatments of chicken nuggets with the addition of Batak onion juice showed that P0 was not significantly different from P1, P1 was not significantly different from P2 and P3, P2 was not significantly different from P3. However, P0 was significantly different from P2 and P3 at a significance level of 5%. The water binding capacity in this study was significantly different, influenced by pH, which was also significantly different up to the 15% Batak onion juice treatment (Table 1). Water binding capacity is also influenced by cooking losses. The cooking losses produced by adding Batak onion juice also gave significantly different results (Table 2).

Table. 3 Average value of water binding capacity of the addition of Batak onion juice as an additional ingredient in chicken nuggets (%)

Treatment	Replicate					Average±SD
	U1	U2	U3	U4	U5	
P0 (0%)	46,80	41,10	41,90	45,90	41,00	43,34± 2,79[a]
P1 (5%)	45,70	41,50	45,70	45,70	44,20	44,56± 1,83[ab]
P2 (10%)	47,50	46,70	46,30	46,80	47,60	46,98± 0,55[b]
P3 (15%)	47,40	53,40	46,60	47,00	43,90	47,66± 3,49[b]

Note: Different superscripts in the same column indicate a significant difference (P<0.05).

The results of the study of the addition of Batak onion juice to the P3 treatment (15% Batak onion juice) showed an increase in water binding capacity. This is in line with the income [18] which states that water binding capacity is closely related to cooking loss value. Low water holding capacity is related to increased cooking loss value, and greater cooking loss will reduce the nutritional content of nuggets, thereby reducing the quality of nuggets. Water binding capacity is in line with the level of protein content in meat [19]. Protein contained in meat or meat products is useful as a chemical water binding material in the emulsion process and as a water binder [8]. Increasing the amount of flour used in the dough affects the protein content of the nuggets, causing the water binding capacity of the meat protein to decrease [8]. The concentration of protein in Batak onion juice contributes to the ability of nuggets to maintain water content. The higher the protein content of a dough, the better the dough binds water [18].

3.4 Organoleptic

3.4.1 Color

The effect of adding Batak onion juice as an additional ingredient on the organoleptic value of the color of chicken nuggets can be seen in Table 4. The results of the Kruskall-Wallis's test of Batak onion juice added to chicken nuggets did not have a significant effect (P>0.05) on the organoleptic value of the color. The results

of the panelist's assessment of the color of the four treatments ranged from 3.17 to 3.50, this shows that the average color of each treatment has a neutral color with the characteristics of a color that is not too dark and not too light. The highest average is at P3 (3.50) while the lowest treatment is at P0 and P1 (3.17).

Table 4 Average color test value of adding Batak onion juice as an additional ingredient to chicken nuggets

Treatment	Score					Average±SD
	1	2	3	4	5	
P0 (0%)	2	9	8	4	7	3,17 ±1,29[a]
P1 (5%)	3	2	16	5	4	3,17 ±1,09[a]
P2 (10%)	0	1	17	11	1	3,40 ±0,62[a]
P3 (15%)	0	5	11	8	6	3,50 ±1,01[a]

Description: The same subscript in the same column indicates no significant difference (P>0.05). The organoleptic color characteristic assessment score: 5 = Light/white, 4 = Fairly white, 3 = Neutral, 2 = Fairly dark, and 1 = Dark/black

This result is caused by the content in the Batak onion juice not affecting the appearance of the nugget color. The absence of significant color differences is also influenced by the color of the Batak onion juice which is white according to the color of the Batak onion bulbs used. Batak onions are white bulb plants that grow in clusters with a diameter of 1-1.5 cm [20].

3.4.2 Taste

The effect of adding Batak onion juice as an additional ingredient on the organoleptic value of chicken nuggets can be seen in Table 7. The results of the hedonic quality organoleptic test showed that the highest nuggets taste value was P3 with a score of 4.03 while the lowest taste value was P0 with a score of 3.07, this shows that the taste of P0 has a lower savory taste characteristic, because there is no addition of Batak onion juice while P3 has a higher savory characteristic. Based on the results of the Kruskall-Wallis test, it shows that the addition of Batak onion juice has a significant effect (P <0.05) on the organoleptic value of taste. The Mann-Whitney follow-up test showed that the organoleptic taste was not significantly different (P> 0.05) at P0 and P1. However, P0 was significantly different from P2 and P3, P2 was significantly different from P3 at a significance level of 5%. The addition of Tiwai onions to chicken nuggets had a significant effect on the taste value [1].

Table 5 Average value of taste test of adding Batak onion juice as an additional ingredient in chicken nuggets

Treatment	Score					Average±SD
	1	2	3	4	5	
P0 (0%)	1	7	11	11	0	3,07±0,87[a]
P1 (5%)	0	0	20	10	0	3,33±0,48[a]
P2 (10%)	0	0	12	16	2	3,67±0,61[b]
P3 (15%)	0	0	6	17	7	4,03±0,67[c]

Description: Different subscripts in the same column indicate a significant difference (P<0.05). Organoleptic taste characteristic assessment scores: 5 = Very tasty, 4 = quite tasty, 3 = tasty, 2 = quite bland, and 1 = Bland.

Taste is related to the aroma and texture of the processed product to be assessed. The taste of food can have different variations because the tongue has red papillae that function to absorb taste. Factors that affect taste are chemical compounds, temperature and the combination of cooking ingredients used [21]. The results of the study that were significantly different were due to the protein content of Batak onions which affected the taste, resulting in differences in the resulting values. The protein content is hydrolyzed into amino acids, such as glutamic acid, thus providing a distinctive savory taste. The savory taste of food is influenced by the amino acid content [22].

3.4.3 Aroma

The effect of adding Batak onion juice as an additional ingredient on the organoleptic value of chicken nugget aroma can be seen in Table 6. The statistical results show that P3 is the treatment with the highest value, namely 3.17, while P0 (control) is the treatment with the lowest value with a score of 1.07, while treatments P1, P2, and P3 have higher scores than P0. The addition of Batak onion juice to nuggets gives the aroma of

Batak onion to chicken nuggets. The results of the Kruskall-Wallis test on the organoleptic aroma of the addition of Batak onion juice gave a significant effect (P <0.05). Further white-mann tests on four treatments of chicken nuggets with the addition of Batak onion juice showed significant differences (P <0.05) between P0 and P1, P2 and P3; P1 with P2 and P3, and P2 with P3. These results can be shown that the addition of Batak onion juice up to 15% can increase the aroma value of chicken nuggets. The higher the concentration of Tiwai onion as an additional ingredient in nuggets, the thicker the aroma of Tiwai onion [1].

Table 6 Average value of aroma test from the addition of Batak onion juice as an additional ingredient in chicken nuggets

Treatment	Score					Average±SD
	1	2	3	4	5	
P0 (0%)	28	2	0	0	0	1,07 ±0,25[a]
P1 (5%)	13	15	2	0	0	1,63 ±0,61[b]
P2 (10%)	3	16	7	4	0	2,40 ±0,86[c]
P3 (15%)	0	7	13	8	2	3,17 ±0,87[d]

Description: Different subscripts in the same column indicate a significant difference (P<0.05). Organoleptic aroma characteristic assessment scores: 5 = Very aromatic Batak onion, 4 = Aromatic Batak onion, 3 = Quite aromatic Batak onion, 2 = Slightly aromatic Batak onion, and 1 = No aroma Batak onion

The aroma of chicken nuggets is related to the protein content that is denatured into certain amino acids such as glutamic acid in chicken meat and spices. The spices added to the nuggets, such as garlic, shallots, and other ingredients also contribute to the aroma of the nuggets [23]. Batak onions contain sulfur compounds, which are compounds that provide a distinctive pungent aroma like that caused by the aroma of shallots [24]. Batak onion bulbs have a very strong onion aroma [25].

3.4.4 Texture

The effect of adding Batak onion juice as an additional ingredient on the organoleptic value of chicken nugget texture can be seen in Table 7. The results of statistical analysis showed that the texture of each treatment had different values. The highest texture value was P3 (3.27) while the lowest value was P0 (3.03). Based on the Kruskal-Wallis test, it showed that the addition of different concentrations of Batak onion juice had no significant effect (P>0.05) on the texture of chicken nugget.

Table 7. Average texture test value of adding Batak onion juice as an additional ingredient to chicken nuggets.

Treatment	Score					Average±SD
	1	2	3	4	5	
P0 (0%)	0	5	19	6	0	3,03±0,61[a]
P1 (5%)	0	3	21	6	0	3,10±0,55[a]
P2 (10%)	0	3	19	8	0	3,17±0,59[a]
P3 (15%)	0	0	22	8	0	3,27±0,45[a]

Description: The same subscript in the same column indicates no significant difference (P>0.05). The organoleptic texture characteristic assessment score: 5 = Very smooth, 4 = smooth, 3 = rather smooth, 2 = Hard, and 1 = Very hard.

Texture can be seen and felt directly using the sense of sight and touch [26]. The addition of Batak onion juice to chicken nuggets does not have a significant effect on the texture value because the addition of additional ingredients in liquid form (Batak onion juice) does not change the texture of the nuggets. This is due to the use of onion juice with different concentrations, the same amount of water, the same amount of chicken meat and additional spices used produce a similar texture, previous research that the water content and texture of the additional ingredients added affect the texture of the nuggets [27]. Food texture is closely related to the physical structure and mechanical properties and directly affects the acceptance and repurchase of a food product by consumers, consumers have different expectations of texture for different types of food.

4. Conclusion

The results of the study showed that the higher the dose of the addition of Batak onion juice, the lower the pH value and cooking loss produced, but the higher the water binding capacity of chicken nuggets. Based on the results of the organoleptic test, the preferred color is nuggets with the addition of 5% Batak onion (nuggets

with white meat on the inside of the nuggets), the preferred taste is nuggets with the addition of 5% Batak onion juice (with the characteristic of a savory nugget taste), the most preferred aroma is nuggets with the addition of 0% Batak onion juice (nuggets do not have a Batak onion aroma) and the most preferred texture is nuggets with the addition of 15% Batak onion juice (nuggets with a slightly smooth texture). The results of the analysis showed that Batak onion juice had a significant effect on the organoleptic quality of taste and aroma, but did not have a significant effect on the quality of color and texture.

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