International Journal of Integrative Research (IJIR)
Vol. 4, No. 7, 2026: 507-516

Use of Yellow Cornstarch (Zea Mays L.) Against the Quality of Broiler Nuggets

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A R T I C L E I N F O

Keywords: Corn, Chemical and Organoleptic Physical Properties

Received : 3 May
Revised : 25 June
Accepted: 26 July

A B S T R A C T

The Use of Manado Yellow Corn Flour (Zea Mays L) Against the Quality of Broiler Nuggets. The study aims to determine the physical and organoleptic physical properties chicken nugget products that use yellow corn flour. The material used in this study consists of meat chicken, yellow corn flour, and other ingredients. Study done by using a completely randomized design (CRD) consisting of 4 treatments and 4 replications and for organoleptic using 30 panelists as a test. Treatment namely P1 10% = chicken meat 500 g + yellow corn flour 50 g, P2 20% = chicken meat 500 g + yellow corn flour 100 g , P3 30% = chicken meat 500 g + yellow corn flour 150 g P4 40% = chicken meat 500 g + yellow corn flour 200 g . The observed variable were pH, water holding capacity, and cooked shrinkage. The organoleptic properties (flavors, aroma, texture, color). The results of the Anova test this study showed that the chicken nugget using yellow corn flour has a significantly different from pH, cooked shrinkage and for organoleptic gave a very different influence on the aroma, color, taste, texture. Based on the results of data analysis and discussion it is concluded that nuggets chickens that use yellow corn flour havenot caused changes to pH, conditions, water- binding power, cooked shrinkage and organoleptic properties in color variables, aroma, taste, and texture

INTRODUCTION

Nuggets are a form of processed meat products made from ground meat that is molded in the form of square pieces and coated with battered and braded flour (Maghfiroh, 2000). Nuggets are made from ground meat that is seasoned, mixed with binding agents, then molded into a certain shape, steamed, cut and greased with batter and covered with breading. (Permadi et al., 2012). (Gumilar et al. (2011) explained that the manufacture of nuggets requires a filler that is able to bind water but has a small influence on emulsification. Nuggets are fried half-cooked and frozen to maintain their quality during storage (Astawan, 2007). Nuggets are a form of ready-to-eat frozen food products, namely products that have been heated until half-cooked (precooked), then frozen (Afrisanti, 2010). This ready-to-eat frozen product only requires 1 minute of frying time at a temperature of 150^{o} C. Nuggets are consumed after the deep fat frying process (Saleh et al, 2002).

One of the fillers and binders used in making nuggets is cornstarch to improve the stability of the emulsion, reduce shrinkage due to cooking, give it a bright color, increase elasticity, form a dense and attractive texture. Corn flour is very good for emulsion products because it is able to bind water and retain the water during cooking (Permadi et al., 2012). Gumilar et al. (2011) explained that the manufacture of nuggets requires fillers that are able to bind water but have little influence on emulsification. (Abubakar, T. (2011), (Suarni (2009), explained that the size of corn starch granules is large enough to show great resistance to heat and water. Corn flour is very good for emulsion products because it is able to bind water and retain the water during cooking (Wellyalina and Aisman, 2013). Cornmeal too is a functional food that contains high protein, vitamin A and protein content of 9.2%. so that it does not require other substitution ingredients in its application, besides this, corn flour also contains dietary fiber, beta-carotene and Fe.

METHODOLOGY

Research Time and Duration

This research has been carried out at the Laboratory of Animal Product Technology (ENT) of the Faculty of Animal Husbandry, Unsrat Manado, North Sulawesi, which took place from May 17 to June 18, 2022.

Research Materials

The ingredients used in making nuggets are chicken meat, salt, ice cubes, milk powder, seasonings, eggs, garlic, yellow cornstarch, bread flour.

The tools used in this study are as follows:

Basin, scale, boiler, Baking sheet, spoon, gloves, knife, plastic clip, scissors, Millimeter block paper, weight 35 kg, measuring cup, pH meter HM 7J TOA, mica plastic, organoleptic test, (stationery, paper, questionnaire).

Research Methods

The experimental design used in this study was the Complete Random Design (RAL) with 4 treatments and 4 replicas (Steel and Turrie, 1994) and for organoleptics 30 panelists were used as replicates

The treatment used is as follows:

P1 10% = Chicken meat 500 g + yellow cornstarch 50 g

P2 20% = Chicken meat 500 g + yellow cornstarch 100 g
P3 30% = Chicken meat 500 g + yellow cornstarch150 g
P4 40% = Chicken meat 500 g + yellow cornstarch 200 g.

Research Variables

The variables that will be observed in this study are: pH, Water Binding Ability, Ripe Shrinkage, and Organoleptic Test (hedonic) including: Color, aroma, texture, taste pH Measurement, pH measurement was carried out with a pH meter according to Bloom's (1988) instructions. The principle of pH measurement is to determine the conditions of acids and bases. pH testing using an electronic pH meter.

The method used is to turn on ON/OFF, previously clean the indicator cathode with aquades so that it is neutral (at pH 7). Then clean with a tissue. Prepare corn nuggets that have been mixed with aquades in a 1:1 ratio in a cup cup. Dip the indicator cathode but previously it should be at the zero position, so it will get the actual pH value of the corn nugget.

Water-Binding Capacity

Water-binding capacity was tested using the Hamm method, following the procedure described by Hartono et al. (2013). A 0.3 g sample of meat was pressed under a 35 kg load for five minutes. Next, the area covered by the meat sample and the area of the wet zone surrounding it were marked and measured. The wet area was determined by subtracting the area of the inner circle from the area of the outer circle using a planimeter, yielding a value in mgH_2O that could be measured.

Cooking Loss

Cooking loss in this study was determined according to the method described by Suradi (2006) by placing the nuggets in boiling water for 30 minutes. The samples were then removed, wiped with a paper towel, and weighed using a digital scale to determine the cooking loss value.

Organoleptic Test

Organoleptic testing is one method used to determine a product's acceptability and to assess the quality of a food ingredient; organoleptic research involves evaluation by stimulating the body's sensory organs (Soekarto, 1985). Organoleptic testing uses hedonic quality testing—a more specific type of hedonic test that typically aims to determine panelists' responses to general organoleptic quality attributes, such as texture, odor/flavor, and color. Meanwhile, a preference test is a type of acceptability test (Rahayu, 1998).

Research Procedures

In this study, several procedures will be carried out, including: Grinding

The chicken nugget production experiment began by grinding the chicken meat for 2 minutes, with the addition of ice cubes, salt, eggs, garlic, pepper, and yellow cornstarch.

Steaming

Steaming in nugget production serves to inactivate enzymes that would cause undesirable changes in color, flavor, or nutritional value during storage. The main purpose of steaming is to reduce the moisture content in the raw materials so that the texture becomes compact.

Cutting

After steaming, the steamed product is cooled and then cut into 2-cm-thick pieces. Cutting the steamed chicken nuggets reduces their size to make frying easier.

Dipping

Dipping the cut nugget mixture in egg white. This step involves dipping the cut nuggets in egg white so that the breadcrumbs will adhere to the nuggets.

Coating

Coating with breadcrumbs is the most important step in the nugget-making process. Coating with breadcrumbs makes the product crispy, tasty, and delicious. And just like that, the chicken nuggets are ready to be fried.

The process of making yellow corn flour (Zea Mays L) can be seen in Figure

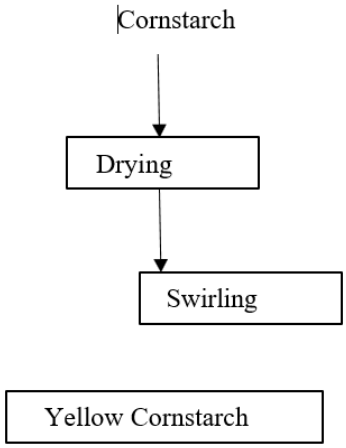

Figure 1. Yellow Corn Setup Flowchart

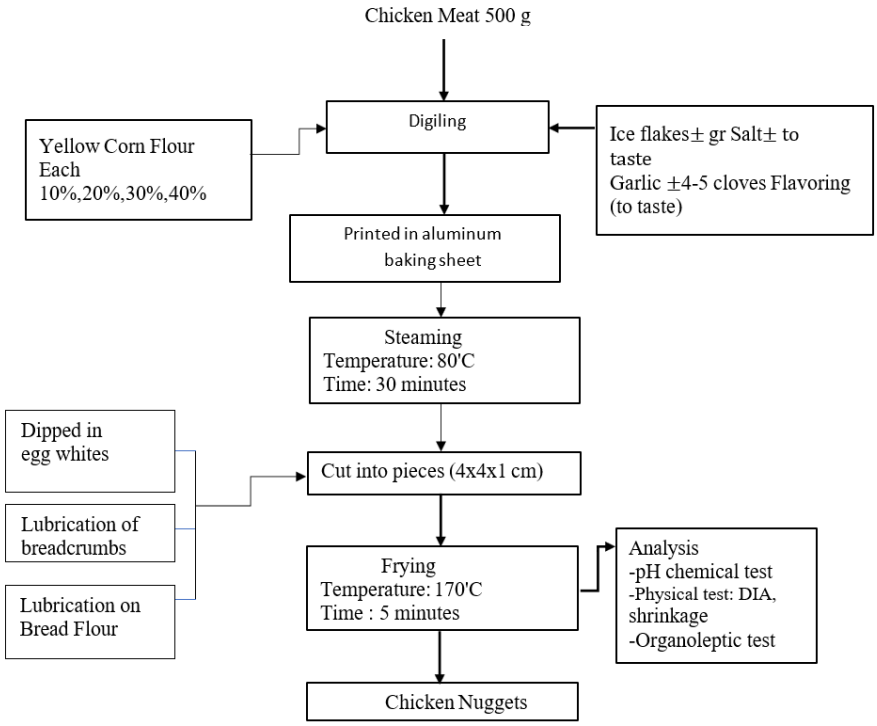

Figure 2. Chicken Nugget Making Flow Chart

RESULTS AND DISCUSSION

The average data on the use of yellow corn flour for the chemical physical test of chicken nuggets is presented in Table 2 below

Table 2. The Average Use of Yellow Corn Flour on the Chemical Physical Test of Chicken Nuggets

Variabel	Treatment			
	P1	P2	P3	P4
pH	6, 15	6, 17	6, 15	6.32
Water Bonding Power	13,53a	12,65b	45, 00c	48, 60c
Cooking Shrinkage	1, 53	1, 06	1, 38	1, 41

Ket : Different Superscripts on the Same Line Mean Very Real Differences (P<0.05)

Effect of Treatment on pH the data from the observations on the effect of treatment on the pH value of chicken meat are listed in Table 2. The observed pH values of broiler chicken nuggets to which yellow corn flour was added ranged from 6.17 to 6.15. The highest value was observed in the 20% treatment, at 6.17, and the lowest value was observed in the 10%, 30%, and 40% treatments, at 6.15. The results of the analysis of variance (ANOVA) indicate that the treatment with yellow corn flour had no statistically significant effect (P > 0.05) on the pH values of the chicken nuggets. This is because the meat used in the study was taken from the same source and the same part of the carcass. In addition to the meat used, the level of corn flour used also did not affect the pH value of the chicken nuggets or cause a change in the pH of the resulting nuggets. According to Aswar (2005), the pH value of the base ingredients can cause changes in the pH value of the nuggets. This occurs due to changes in the hydrogen balance within the nuggets as a result of the pH value of the base ingredients used in their production.

Effect of Treatment on Water-Holding Capacity

The research results for water-binding capacity in Table 2 show that the highest mean value was found in treatment P4 with a mean of 48.60, followed by P3 with a mean of 45.00, then P2 with a mean of 32.65, and P1 with a mean of 13.53; the lowest value was found in P1 with a mean of 13.53.

The results of the analysis of variance (Appendix 2) indicate that the addition of corn flour to the chicken nuggets had a statistically significant effect (P < 0.05) on water-binding capacity. Furthermore, the results of the BNJ post-hoc test showed that treatment P1 differed significantly (P < 0.05) from P2, and P2 differed significantly (P < 0.05) from P3 and P4. Meanwhile, P3 was the same as P4. The addition of yellow corn as a treatment in chicken nuggets resulted in differences in water-binding capacity. The higher the proportion of corn used in chicken nugget production, the higher the percentage of water-binding capacity.

The water-binding capacity of meat is influenced by the state of the meat proteins, although less than 5% of the water is directly bound to the hydrophilic groups of the meat proteins (Bintoro, 2008). According to Soeparno (2005), the water-binding capacity of meat plays a very significant role in the production of nuggets—for example, during heating, grinding, ingredient mixing, or the emulsification process that forms the nuggets. The water-binding capacity of the nuggets is influenced by their moisture content. The distinct differences in moisture content between corn flour and chicken meat result in significant differences in the percentage of water-binding capacity. This is supported by the analysis of the variance in moisture content between chicken nuggets containing broccoli and plain chicken nuggets, which showed significant differences.

Teruel et al. (2015) noted that the higher the protein content in a material, it will have greater water-binding capacity. Cornstarch contains nearly 90% water, 7% carbohydrates, 3% protein, and almost no fat; the average moisture content in chicken ranges from 70–75%. Moisture content is related to drip loss; the higher the moisture content, the easier it is for water to be lost from the meat, which also leads to a reduction in the meat's nutrient content. (Maliluan et al. (2013) reported that in the production of chicken nuggets using a 40 g substitution of wheat flour and rice flour as fillers, the water-binding capacity ranged from 30.59–38.89%, while.

Effect of Treatment on Cooking Loss

The research results for cooking loss in Table 2 show that the highest average value was found in treatment P1 with an average of 1.53, followed by P4 with an average of 1.41, then P3 with an average of 1.38, and P2 with an average of 1.06; the lowest value was found in treatment P2 with an average of 1.06.

The results of the analysis of variance (Appendix 3) show that the treatment involving the addition of cornstarch did not result in a statistically significant difference ($P < 0.05$) in the cooking shrinkage of chicken nuggets. The addition of corn flour as a treatment for chicken nuggets did not result in any difference in cooking loss. This means that treatments P1, P2, P3, and P4 are considered equivalent because they did not cause any difference in the cooking loss of the chicken nuggets.

High cooking loss will cause the nutrient content in the nuggets to decrease, thereby reducing the quality of the nuggets. This is consistent with Soeparno's (2005) view that meat with lower cooking loss has relatively better quality than meat with higher cooking loss, because nutrient loss during cooking is minimal.

Cooking loss is defined as the percentage of weight lost compared to the weight of the nuggets before cooking. In other words, it is the weight loss that occurs during cooking. Soeparno (2005) states that cooking loss is an indicator of

the meat's nutritional value and is related to the amount of water bound within the cells between muscle fibers. Cooking loss is influenced by cooking temperature and duration; the higher the cooking temperature, the greater the amount of meat moisture lost (Shanks et al., 2002).

Effect of Treatment on Organoleptic Properties Average data on the use of yellow corn flour on organoleptic properties.

Table 3. The Average Effects of Yellow Corn Flour on the Organoleptic Properties of Chicken Nuggets are Presented in the Table Below

Variabel	Treatment			
	P1	P2	P3	P4
Aroma	5, 48	5, 37	5, 45	5, 40
Color	5, 60	5, 42	5, 51	5, 55
Tekstur	5, 48	5, 34	5, 17	5, 28
Zithera	5, 82	5, 42	5, 60	5, 62

Aroma of Broiler Chicken Nuggets

The highest average aroma scores for chicken nuggets made with yellow corn flour were found in treatments P1 (average score of 5.48) through P3 (average score of 5.45), followed by P4 (average score of 5.40), while the lowest score was found in P2 (average score of 5.37). The results of the analysis of variance (ANOVA) on the treatment of adding yellow corn flour showed no significant difference ($P > 0.05$) in the aroma of the chicken nuggets, meaning that the addition of yellow corn flour during chicken nugget production had no effect on the organoleptic properties of the aroma. The aroma profile of a product is determined by the raw material—chicken meat—and is influenced by the addition of yellow corn flour. Abubakar (2011) and Suarni (2009) explain that corn has a relatively large particle size. The aroma emitted by food is a very strong attraction and can stimulate the sense of smell, thereby stimulating the appetite (Hakim et al., 2013). The effect of adding yellow corn flour on the aroma of chicken nuggets is such that the higher the proportion of corn added during production, the stronger the aroma of the nuggets becomes, leading to a decrease in the panelists' ratings of the chicken nuggets' aroma.

The organoleptic test in this study was conducted according to the method described by Soekarto (1985), in which panelists evaluated a product's texture, aroma, color, and acceptability. The organoleptic test was included to identify the characteristics or factors influencing flavor and the acceptability of the food. Aroma is one of the parameters in sensory (organoleptic) testing using the sense of smell. An aroma is considered acceptable if the resulting product has a specific aroma (Soekarto, 1985). (general acceptance) of chicken nuggets conducted by Polizer et al. (2015), Verma et al. (2015), and Sharma et al. (2018) fell into the "like"

category. Furthermore, aroma is a subjective sensation produced by the sense of smell.

Color of Broiler Chicken Nuggets

The highest mean color value for chicken nuggets made with yellow corn flour was found in treatment P1 (mean 5.60), followed by P4 (mean 5.55), then P3 (mean 5.51), and the lowest value was in P24 (mean 5.42). The results of the analysis of variance for the treatment involving the addition of yellow corn flour showed no significant difference ($P > 0.05$) in the color of the chicken nuggets, meaning that the addition of yellow corn flour during chicken nugget production had an effect on the organoleptic property of color.

This indicates that broiler chicken is the dominant ingredient in chicken nuggets, which significantly influences the color of the light yellow corn flour and is also affected by the nugget frying process. The color of chicken nuggets is caused by the presence of anthocyanin pigments that are distributed from the skin to the meat. The high anthocyanin content in yellow corn flour exhibits greater stability compared to anthocyanins from other sources. That is why this crop is a healthier choice and a natural coloring alternative (Samber et al., 2013). Color is the first impression that arises and is evaluated by the panelists. According to Winarno (1997), an attractive color will entice panelists or consumers to taste the product.

Objective color assessment is important because it allows consumers to recognize and appreciate other product characteristics. Additionally, the range of color ratings for chicken nuggets depends on differences in each panelist's preference levels. The effect of adding yellow corn on the color of chicken nuggets is due to the fact that the frying temperature and breading method used for each nugget are consistent, thereby influencing the external color appearance of the chicken nuggets.

Taste of Chicken Nuggets

The highest average taste value of chicken nuggets using yellow corn flour was found at P1 with an average value of 5.82 to P4 with an average value of 5.62 then followed by P3 with an average value of 5.60 and P2 with an average value of 5.42 and the lowest value was found at P2 with an average value of 5.42. The results of the fingerprint analysis on the treatment of adding yellow corn flour did not have a very significant difference ($P>0.05$) on the taste of chicken nuggets, meaning that there was an effect of the addition of corn flour in the manufacture of chicken nuggets on the organoleptic properties of taste.

The taste of chicken nuggets is very related to the main ingredient, namely chicken meat and is influenced by the addition of yellow cornmeal. The savory taste produced by chicken nuggets comes from chicken meat. According to Rizki and Ardiani (2017), the savory taste in chicken nuggets arises due to the presence of amino acids in proteins and fats in chicken meat that are able to improve taste.

This is evidenced by the protein content of chicken meat of 18.2 g and fat of 25 g (Mahmud and Zulfianto, 2017). Jayasena et al. (2013). Taste is a multi-sensory perception produced through the integration of the senses of taste, smell, and the trigeminal nerve Then this is caused by the use of spices in making nuggets that are not different, so that the resulting flavor is almost the same. According to Ma'aruf W,. Rosyidi, D,. Radiati, L,E,.

Texture of Broiler Chicken Nuggets

The highest average texture scores for chicken nuggets made with yellow corn flour were found in P1 (average score of 5.48) and P2 (average score of 5.34), followed by P4 (average score of 5.28) and P3 (average score of 5.17); the lowest score was recorded in P3 (average score of 5.17).

The results of the analysis of variance (Appendix 7) showed that the treatment of adding yellow corn flour had no statistically significant effect ($P > 0.05$) on the texture of the chicken nuggets, meaning that the addition of yellow corn flour during chicken nugget production had no effect on the organoleptic properties of the texture. According to Fellows (2000), food texture is largely determined by the water content of the product. Many factors influence the texture of food ingredients, including the ratio of protein to fat content, processing temperature, moisture content, and water activity. Meat texture is one of the product characteristics that is important to consider because it is closely related to consumer acceptance (Melda et al., 2013).

The coating ingredients are egg whites and breadcrumbs. According to Owens (2001), the factor that influences the texture of the nuggets is the breadcrumbs during the breading process. Frying chicken nuggets at high temperatures will cause evaporation (2019), The complexity of a flavor is produced by the diversity of natural perceptions. Flavor is influenced by three factors: taste, and oral stimuli (heat and cold). The spices in these flavor enhancers serve to impart flavor to the nuggets. The addition of spices and flavor enhancers is primarily intended to enhance or improve the taste (Soeparno, 2005). some of the water in the food ingredients, so that the breadcrumbs on the outer layer of the chicken nuggets form a crispy texture. The effect of adding on the production of chicken nuggets regarding the organoleptic properties of texture, since the variation in the amount of yellow corn flour added across different treatment types was not significant enough to affect the texture of the resulting chicken nuggets. Texture is a sensory perception associated with touch. Sometimes texture is considered just as important as smell, taste, and aroma because it influences the perception of food.

The most commonly assessed characteristics are firmness, cohesiveness, and moisture content. Meat texture is one of the product properties that is important to consider because it is closely related to consumer acceptance (Melda et al., 2013). Texture testing of yellow corn flour chicken nuggets focused on chewability and biteability. Observing the texture of the nuggets is crucial, as the texture of the nugget coating can harden during frying.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and discussion, it can be concluded that the addition of 20% yellow corn flour (100 g) yields the best results in terms of pH, water-holding capacity, cooking shrinkage, and organoleptic properties—specifically color, aroma, flavor, and texture.

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