



# Physicochemical Characteristics and Acceptance Test of Chicken Nuggets Using Bitter Gourd Fruit (*Momordica Charantia L*) as One of the Halal Food Sources

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**Abstract.** The use of bitter melon in nugget products with the treatment of the ratio of bitter melon and chicken meat is made with the aim of being one of the innovations in the use of bitter melon as an effort to diversify local food-based food to increase the quality value and nutritional content of nuggets. Then to determine the effect of using bitter melon in nugget products, especially chicken nuggets on physicochemical properties and hedonic tests. The research conducted was experimental research and used a completely randomized design (CRD) with a ratio of bitter melon and chicken meat of 40%: 60%, 50%: 50%, and 60%: 40% with two repetitions. The parameters observed were proximate content (water, fat, carbohydrate and crude fiber), physical properties (texture) and hedonic test or taste test (taste, aroma and texture). Data in this study were analyzed using ANOVA and Duncan's Multiple Range Test (DMRT). The results of the analysis stated that there was a significant effect of using bitter melon in nugget products with a ratio of bitter melon and chicken meat on proximate content, physical properties and hedonic test. The use of bitter melon with the ratio of bitter melon and chicken meat in nugget products can contribute to the fiber content that is not possessed in the nutritional content of chicken nuggets and the average results of the level of liking in nugget products with the most preferred bitter melon and chicken meat ratio treatment is at a ratio of 50%: 50%.

**Keywords:** Bitter melon, Chicken Meat, Nugget.

## 1 Introduction

Bitter melon is known as a source of vitamins and minerals and high levels of dietary fiber [1]. Bitter melon contains macro nutrients such as fat, carbohydrates, and protein and contains micro nutrients such as vitamins and minerals that are needed by the human body [2]. However, the utilization of bitter melon as culinary preparations is still less varied. People generally only use bitter melon as food processed into vegetables [3]. Processing of bitter melon in Indonesia can apply several kinds of processing techniques, for example in Bali bitter melon is processed as a stir-fried vegetable for the

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dinner menu, because it is believed to warm the body and can be cooked in various processing such as steamed made dumplings, sautéed for example sautéed shrimp bitter melon, sautéed anchovies, sautéed balado spices. Bitter melon besides being processed as a dish can also be used for medicine [4]. Bitter melon has a bitter taste, especially in the leaves and fruit, so some people are less appealed in consuming bitter melon [3], this is due to the phytochemical content in bitter melon, namely diosgenin compounds. They are generally known for their less favorable bitter properties [5]. Besides having a bitter taste, bitter melon also comprises a fairly high water content. One way to reduce the bitter taste and high water content in bitter melon can be done preliminary treatment with salting. Pretreatment with salt in the process of processing bitter melon with packaging techniques makes some water come out and eliminates the bitterness in bitter melon [6].

One of the innovations in the utilization of bitter melon as a healthy food with diverse nutritional content and a fast serving process and also favored by various groups of people is processed into nuggets. The National Standardization Agency (BSN) (2014) in SNI 01-6683-2014 defines nuggets as processed meat products mixed with or without other ingredients and permitted food additives, then molded by steaming or freezing techniques, assigned coating materials, with or without frying and freezing. So far, nuggets are generally created from chicken meat and other food additives.

Chicken meat is one of the main ingredients that are crucial in making nuggets. In preparing the ingredients in making nuggets, the selection and quality of chicken meat plays a very important role so that it must be considered properly [7]. The composition of chicken meat consists of 73.7% water, 20.6% protein, 4.7% fat, 1% ash, and 4% minerals [8]. This study deals to analyze the effect of using bitter melon on proximate levels (water, fat, carbohydrates and crude fiber), physical properties (texture) and hedonic test or test the level of liking (taste, aroma and texture) of nuggets of bitter melon and chicken meat ratio. The ratios used were 40%:60%, 50%:50% and 60%:40%.

## 2 Materials and Methods

This study used a complete randomized design (CRD) consisting of a factor of the ratio of bitter melon and chicken meat with treatment (K1) 40%: 60%, (K2) 50%: 50%, (K3) 60%: 40%, with two repetitions. The main ingredients used in this study are bitter melon and chicken meat. Other ingredients include medium protein wheat flour, ice cubes, salt, pepper, garlic, eggs, batter ingredients (eggs), and breading ingredients (bread flour). The tools used in the process of making this research product such as digital scales, knives, basins, baking sheets, blenders, steaming pans, spoons, stoves, frying pans, spatulas, temperature thermometers, rulers. Chemical analysis tools and physical properties are Oven, desiccator, cup, analytical scales. Scales, extraction tube, erlenmeyer, counter cooler, filter paper, litmus paper, spatula, crucible, desiccator, Fiberbag, glass spacer, oven, platinum dish, balance, furnace. Texture Analyzer and Hedonic test questionnaire.

The analysis applied in this study is the analysis of proximate content including moisture content using the Oven method [9], fat content using the Soxhlet method [10], carbohydrate content using the by difference method [11], crude fiber content using the Acid Alkali Digestion method [12], physical properties, namely texture using the Texture Analyzer method [13], sensory tests including taste, aroma and texture (hedonic

test and scoring test) and overall acceptance (hedonic test) [14]. In this study, the data taken from the analysis of proximate levels, physical properties and hedonic tests were tested using the one-way ANOVA method with a significance level of 5%. If there is a real difference (significant) then continue the Duncan's Multiple Range Test (DMRT) test to determine the level of difference in each treatment.

### 3 Results and Discussion

#### 3.1 Proximate content

The average results of the analysis of the proximate content of nuggets with the treatment of the ratio of bitter melon and chicken meat 40%:60%, 50%:50%, and 60%:40% can be seen in Table 1.

**Table 1.** Mean Results of Proximate Content Analysis of Nugget with Bitter Gourd Fruit and Chicken Meat Ratio Treatment

Formulas (BP:DA)	Proximate Content			
	Water content (%)	Fat content (%)	Carbohydrate content (%)	Crude fiber content (%)
40%:60%	30,044	22,178	29,518	1,194
50%:50%	34,179	20,031	29,643	1,581
60%:40%	35,959	17,908	31,189	2,034

Notes: BP = Bitter melon, DA = Chicken Meat

#### 3.2 Water Content

Based on the average results of water content analysis in Table 1, ANOVA and DMRT tests were done. The ANOVA test results on water content showed that there was a significant difference in the nuggets with the treatment of bitter melon and chicken meat ratio (Significance (P) <0.05) which is 0.000, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences of the three nuggets and the results of the DMRT test. The results showed that the increasing percentage of bitter melon fruit increased the water content. The study showed that nuggets with the treatment of bitter melon and chicken meat ratio of 60%: 40% had the highest average water content of 35.959%.

Bitter melon has a higher water content than chicken meat. The water content in bitter melon is 94.03 grams/100 grams [15], while the water content in chicken meat is 55.90 grams/100 grams [16]. The main factors of product water content are the water content of the main raw materials, as well as water added during cooking and water liberation during cooking [17]. The water content of nuggets is not only affected by the raw materials but can also be influenced during the processing process [18]. Increased moisture content can be influenced by the reduced effectiveness of protein in binding water. This is influenced by the interaction between starch derived from additional ingredients in the manufacture of nuggets, namely wheat flour with protein contained in chicken meat so that water can no longer be bound perfectly by protein because the protein that should bind water is used to bind starch [20]. The protein content

in this study is higher in chicken meat compared to the protein in bitter melon, with the more addition of bitter melon and the less addition of chicken meat, the amount of protein will decrease and cause the water content to increase. The water content in this study ranged from 30.044% - 35.959% and complied with SNI 6683: 2014 standard, because it is still below the quality requirements for combined chicken nuggets with a maximum water content of 50% [21].

### 3.3 Fat content

Based on the average results of fat content analysis in Table 1, ANOVA and DMRT tests were conducted. ANOVA test results on fat content showed that there was a significant difference in the nuggets with the treatment of bitter melon and chicken meat ratio (Significance (P) <0.05) which is 0.000, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences of the three nuggets and the results of the DMRT test. The results showed that as the percentage of bitter melon increased, the fat content decreased. The study showed that nuggets with the treatment of bitter melon and chicken meat ratio of 60%: 40% had the lowest average fat content of 17.908%.

Bitter melon has a lower fat content than chicken meat. The total fat content in bitter melon is 0.017 grams/100 grams [15], while the fat content in chicken meat is 25.00 grams/100 grams [16]. Chicken meat has a fat content of 4.7% of the total content of other nutrients [8] so that the fat content in chicken meat will be much higher than the fat content in bitter melon. In addition, bitter melon consists of fiber content, fiber can reduce fat content by binding fatty acids in food ingredients (Septiono, et al., 2019). Based on the quality requirements of combined chicken nuggets, the fat content in the nuggets of the ratio of bitter melon and chicken meat 60%: 40% complied with SNI standards because it was below the maximum limit of 20%.

### 3.4 Carbohydrate content

Based on the average results of carbohydrate content analysis in Table 1, ANOVA and DMRT tests were conducted. The ANOVA test results on carbohydrate content showed that there was a significant difference in the nuggets with the treatment of the ratio of bitter melon and chicken meat (Significance (P) <0.05), namely 0.002, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences between the three nuggets and the results of the DMRT test. The results showed that the increasing percentage of bitter melon fruit increased the carbohydrate content. The study showed that nuggets with the treatment of bitter melon and chicken meat ratio of 60%: 40% had the highest average carbohydrate content of 31.189%. The increase in carbohydrate content is thought that bitter melon has a carbohydrate content of 3.7 grams/100 grams [15], so that the higher the percentage of bitter melon addition, the resulting carbohydrate content will increase. Carbohydrate is a constituent component in food fiber which is part of plants that can be consumed [22]. Bitter melon itself has a high fiber content and this also affects the content of carbohydrate content in the bitter melon itself, so the addition of bitter melon in nuggets produce the results of carbohydrate content in it tends to be high. In addition, the effect of high carbohydrate content in this

study can also be caused by the addition of additional ingredients in making nuggets, one of which is wheat flour. Wheat flour has a fairly high carbohydrate content of 77.3% [19]. The carbohydrate content of the nuggets with the treatment of the ratio of bitter melon and chicken meat has not met the standard quality requirements for combined chicken nuggets based on the SNI 6683: 2014 standard which is set at a maximum of 25%.

### 3.5 Crude Fiber content

Based on the average results of crude fiber content analysis in Table 1, ANOVA and DMRT tests were conducted. The ANOVA test results on crude fiber content showed that there was a significant difference in the nuggets with the treatment of the ratio of bitter melon and chicken meat (Significance (P) <0.05), namely 0.000, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences between the three nuggets and the results of the DMRT test. The results showed that the increasing percentage of bitter melon fruit increased the crude fiber content. The study showed that nuggets with the treatment of bitter melon and chicken meat ratio of 60%: 40% had the highest average crude fiber content of 2.034%. The increase in fiber content is thought that bitter melon has a fiber content of 2.8 grams/100 grams [15], so the higher the percentage of bitter melon addition, causing fiber content will increase. Bitter melon is known as a source of vitamins and minerals as well as high levels of dietary fiber [1]. In this study, the use of bitter melon with the ratio of bitter melon and chicken meat in nugget products can contribute to crude fiber content and water-soluble vitamins that are not contained in chicken nuggets.

**Table 2.** Mean Results of Analysis of Physical Properties of Nugget with Treatment of Bitter Gourd Fruit and Chicken Meat Ratio

Formulas (BP:DA)	Physical Properties Texture (N)
40%:60%	4,332
50%:50%	3,658
60%:40%	3,174

Notes: BP = Bitter melon, DA = Chicken Meat

### 3.6 Physical Properties

The average results of the analysis of the physical properties of nuggets with the treatment of the ratio of bitter melon and chicken meat 40%:60%, 50%:50%, and 60%:40% can be seen in Table 2.

### 3.7 Texture

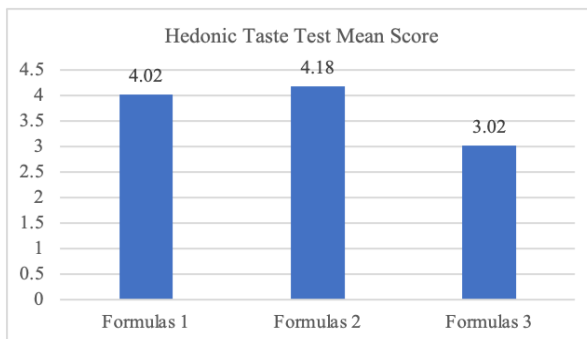
The results of the ANOVA test of texture in Table 2 show that there is a significant difference in the nuggets with the treatment of the ratio of bitter melon and chicken meat (Significance (P) <0.05) which is 0.000, so it is continued in the DMRT (Duncan's

Multiple Range Test) test to see the differences of the three nuggets and the results of the DMRT test. The results showed that the increasing percentage of bitter melon and the decreasing percentage of chicken meat, the texture value decreased.

The study showed that the nuggets with the treatment of bitter melon and chicken meat ratio of 60%: 40% had the lowest average texture value of 3.174, the more the ratio of bitter melon increased, the texture produced would be softer and less dense. This is due to the high water content in bitter melon so that it can affect the texture of the nuggets to be easily destroyed [5]. The grinding process also affects the texture of the nuggets, the texture of chicken meat that has been ground is different from the texture of whole chicken meat. This is because during the grinding process, it is suspected that muscle fibers are broken by the grinding tool. Grinding serves to expand the surface area of chicken meat, so that protein extraction can occur, protein extraction is very important because it can affect the texture of the resulting chicken nuggets [24]. With more addition of bitter melon and less addition of chicken meat, the protein contained in it becomes less, causing the resulting texture to be less dense or even not dense. In addition, what affects the texture is also caused by the steaming process in the nuggets [23].

### 3.8 Hedonic Test

Hedonic test of nugget products with bitter melon and chicken meat ratio treatment use 30 panelists with two repetitions. Hedonic test of nugget products with bitter melon and chicken meat ratio treatment is divided into three, namely taste, aroma, and texture tests.



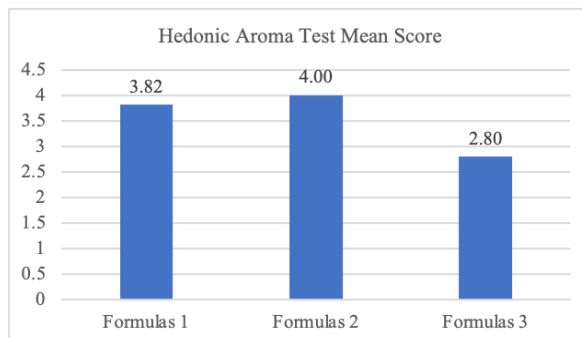
Descriptions: Formulas 1= Bitter Melon Fruit Ratio 40%: Chicken Meat 60%  
 Formulas 2= Bitter Melon Fruit Ratio 50%: Chicken Meat 50%  
 Formulas 3= Bitter Melon Fruit Ratio 60%: Chicken Meat 40%

**Fig. 1.** Mean Test Results of *Nugget* Flavor with Treatment of Bitter Gourd Fruit and Chicken Meat Ratio

**Taste.** The average results of the hedonic test analysis of the taste of nuggets with the ratio of bitter melon and chicken meat of 40%: 60%, 50%: 50%, and 60%: 40% can be seen in Figure 1. The results of the ANOVA test on taste showed that there was a significant difference in the nuggets with the treatment of the ratio of bitter melon and

chicken meat (Significance (P) <0.05), namely 0.000, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences between the three nuggets and the results of the DMRT test. The results showed that as the percentage of bitter melon increased and the percentage of chicken meat decreased, the flavor value decreased. The hedonic test showed that the nuggets with 50%:50% ratio of bitter melon and chicken meat had the highest average taste value of 4.18 (rather like) because it had the right balance of savory taste and the bitter taste of bitter melon was not too strong.

Taste sensation can be divided into four main tastes, namely salty, sweet, sour and bitter. Taste is also influenced by several factors, namely chemical compounds, temperature, concentration and interaction with other flavor components [25]. One of the factors that can affect the flavor of food is during the frying process, because there is a dissolution of food components such as proteins, carbohydrates, fats and minor components contained in these foods so as to form flavors in food [23]. The standardization of nugget flavor quality has a normal taste [21], this is in accordance with the results of the hedonic taste test on nuggets with the treatment of the ratio of bitter melon and chicken meat with the highest value of 4.18 (rather like) which can be interpreted as having a normal taste.



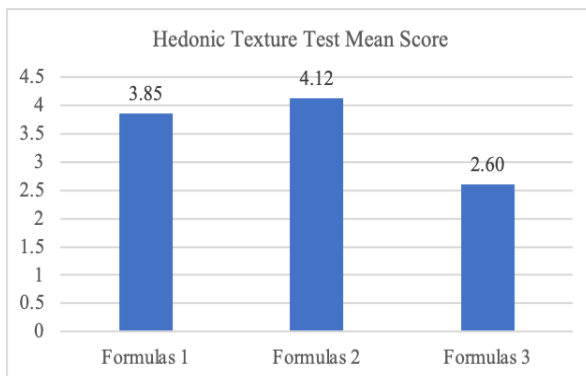
Descriptions: Formulas 1= Bitter Melon Fruit Ratio 40%: Chicken Meat 60%  
 Formulas 2= Bitter Melon Fruit Ratio 50%: Chicken Meat 50%  
 Formulas 3= Bitter Melon Fruit Ratio 60%: Chicken Meat 40%

**Fig. 2.** Mean Test Results of *Nugget* Aroma with Treatment of Bitter Gourd Fruit and Chicken Meat Ratio

**Aroma.** The average results of the hedonic test analysis of the aroma of nuggets with the treatment of the ratio of bitter melon and chicken meat 40%: 60%, 50%: 50%, and 60%: 40% can be seen in Figure 2. The results of the ANOVA test on aroma show that there is a significant difference in nuggets with the treatment of the ratio of bitter melon and chicken meat (Significance (P) <0.05) which is 0.000, so it is continued in the DMRT (Duncan's Multiple Range Test) test to see the differences between the three nuggets and the results of the DMRT test. The results showed that the increasing percentage of bitter melon and the decreasing percentage of chicken meat, the aroma value decreased. The hedonic test of the panelists' level of liking showed that the nuggets with the treatment of bitter melon and chicken meat ratio of 50%: 50% had the highest average aroma value of 4.00 (rather like) on the grounds that it had a balance of the

distinctive aroma of the nuggets and the languorous aroma of bitter melon that did not dominate.

Aroma is a feeling produced by the senses of taste and smell. In the food industry, aroma or odor testing is considered to be important because it can quickly provide assessment results on the product about whether or not the product is acceptable [26]. The smell of food determines the delicacy of food ingredients [25]. The distinctive aroma of nuggets is very influential on consumer tastes related to the sense of smell, which comes from raw materials and spices [27]. The aroma of bitter melon tends to be languorous, the languorous aroma in bitter melon is thought to be caused by the enzyme lipoxidase which can be minimized by salting treatment. During the packaging process with the addition of salt in bitter melon, the water-soluble components will be reduced [28]. The quality standardization of nugget aroma has a normal taste [21], this is in accordance with the results of the hedonic taste test on the nugget ratio of bitter melon and chicken meat with the highest value of 4.00 (rather like) which can be interpreted as having a normal aroma.



Descriptions: Formulas 1= Bitter Melon Fruit Ratio 40%: Chicken Meat 60%  
 Formulas 2= Bitter Melon Fruit Ratio 50%: Chicken Meat 50%  
 Formulas 3= Bitter Melon Fruit Ratio 60%: Chicken Meat 40%

**Fig. 3.** Mean Test Results of *Nugget* Texture with Treatment of Bitter Gourd Fruit and Chicken Meat Ratio

**Texture.** The results of the ANOVA test on texture showed that there was a significant difference in the nuggets with the treatment of the ratio of bitter melon and chicken meat (Significance (P) <0.05), namely 0.000, so it was continued in the DMRT (Duncan's Multiple Range Test) test to see the differences between the three nuggets and the results of the DMRT test. The results showed that as the percentage of bitter melon increased and the percentage of chicken meat decreased, the texture value decreased. The hedonic test showed that the nuggets with the 50%:50% ratio of bitter melon and chicken meat had the highest mean texture value of 4.12 (somewhat liked) due to the dense texture but still juicy and chewy and not easily crushed. Texture is the feeling in the mouth when chewing and biting. Texture has an attraction to a product and affects product quality [25]. The texture and consistency of an ingredient will affect the flavor image generated by the food [25].



Texture is one of the main criteria used by consumers in assessing the quality and freshness of a product [29]. Texture parameters are an important factor in nugget products, because the typical texture of nuggets has juiciness and tenderness that can affect the appearance of the final product [27]. Juiciness or juicy impression of meat products is influenced by the amount of water that can be retained to remain in the meat after cooking and the production of saliva during chewing [30]. The standardization of texture quality of nuggets has a normal taste [21], this is in accordance with the results of the texture hedonic test on nuggets with the treatment of the ratio of bitter melon and chicken meat with the highest value of 4.12 (rather like) which can be interpreted as having a normal aroma.

## 4 Conclusions

Based on the results of the study, it can be concluded that there is a significant difference in the effect of the use of bitter melon on nuggets with the treatment of the ratio of bitter melon and chicken meat on proximate levels (water content, fat content, carbohydrate content and crude fiber content), physical properties (texture), and hedonic test (taste, aroma, and texture). While the results of the level of panelists' liking in the hedonic test of nuggets with the treatment of the ratio of bitter melon and chicken meat to taste, aroma and texture showed that nuggets with the treatment of the ratio of bitter melon and chicken meat of 50%: 50% were most favored by consumers both in terms of taste, aroma and texture of nuggets.

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