

Effect on carrot substitution on nutrition facts, Beta-Carotene, and hedonic characteristic of rabbit meat nugget

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Abstract. *Background and aim:* The use of rabbit meat nuggets offers several health benefits since rabbit meat has more protein than chicken meat and less fat, making it suitable for consumption by those with cardiovascular disease. Nevertheless, rabbit meat nuggets are somewhat expensive compared to chicken meat. Thus, additional ingredients are required as a substitute for rabbit meat nuggets without changing the taste or compromising the nutritional content of rabbit meat nuggets. Carrots will be used as a substitute for rabbit meat nuggets in this study due to their high fiber content and beta-carotene, which will increase the nutritional value of rabbit meat nuggets. *Methods:* The experimental design used in this study used a single factor of 3 treatments with 3 repetitions, namely differences in carrot substitution (0%, 20%, and 40%) in rabbit meat nuggets. The data from the chemical and physical analysis were analyzed using SPSS for windows 26.0. *Results:* The results showed that rabbit meat nuggets with carrot substitution were high in beta-carotene and fiber ($p < 0.05$). The substitution of carrots up to 40% is still at the panelists' preferred level. *Conclusions:* The substitution of carrots to rabbit meat nuggets improved the nutritional benefits, raising fiber and beta-carotene levels in the nuggets.

Key words: Carrot, nugget, rabbit meat, substitution

1. Introduction

Carrots are known for their high fiber and beta-carotene content. Insoluble fiber is essential for avoiding digestive system dysfunction. Considering the benefits and potentials of the fundamental ingredients of nuggets, these elements may be employed in the production of nuggets with good nutritional content for health and positive public acceptance. Furthermore, the use of carrots as a replacement is projected to lower the selling price of rabbit meat nuggets, allowing them to be enjoyed by people of all ages. Nevertheless, this is not the case. Carrots are not a popular food, especially

among youngsters, despite the fact that they are high in beta-carotene, which is beneficial to both children and adults. As a result, precooked food items are created as a kind of product development innovation in order to boost customer appeal and the product's selling value. Fast food was established in this day and age to make it simpler for customers to process it, however it should be noted that fast food is generally high in macronutrients but seldom high in micronutrients that are also important for the body, such as beta-carotene and fiber.

Nugget is one type of processed meat that is often found in the market and is liked by the public,

especially children. Nuggets are one of the ready-to-eat frozen food products that are processed by heating until they are half cooked (precooked). Nuggets are made from ground beef that has been seasoned and steamed, then sliced. The utilization of rabbit meat nuggets has many health benefits, because rabbit meat has a higher protein content than chicken meat and has low-fat content, making it suitable for consumption by those with cardiovascular disease (1).

Rabbit meat has better nutritional content than other livestock meat. Every 100 g of meat contains a protein content of 20.1% higher than 18.6% chicken protein and 16.3% beef. The fat content of rabbit meat is 5.5% lower than chicken 15.6% and beef 24.1%. Rabbit meat cholesterol levels are also lower, which is 53 lower than chicken 70% and beef 58% (2).

Nowadays, there is still a limitation on the study of the application of rabbit meat, especially in the nugget. Thus, this study aims to give health benefits and increase the selling power of healthy rabbit meat nuggets with the substitution of carrots.

2. Materials and methods

2.1. Materials

The tools used in this study were a baking sheet and a steamer. The ingredients used in this study were rabbit meat (Department of Livestock and Animal Health of Central Java Province, Indonesia), carrots (Superindo Market, Indonesia), tapioca flour, skim milk, garlic, onions, ground pepper, salt, sugar, and flavoring that were purchased from the nearby grocery market.

2.2. Methods

The experiment was performed in a completely randomized design with a single factor of three treatments which each treatment was repeated seven times (21 trial units). The research method will be to conduct training on how to make rabbit meat nuggets with carrot substitutions, followed by a chemical analysis of the nutritional facts and beta-carotene values of rabbit nuggets with 0%, 20%, and 40% (w/w) carrot substitutions to determine the proportion of

carrots that are consumed optimally as a substitute material in the production of rabbit nuggets.

2.2.1. PREPARATION OF MAKING RABBIT MEAT NUGGET WITH CARROT SUBSTITUTIONS

The rabbit meat nuggets with carrot substitutes were prepared in three stages: meat grinding, steaming, and frying. The rabbit meat is first pounded until smooth, then combined with additional components such as tapioca flour, skim milk, garlic, onions, ground pepper, salt, sugar, and seasoning. Then, for each treatment, a proportion of carrot substitution was introduced, specifically 20% and 40%, as well as a control treatment without carrots. The nugget dough is then cooked for around 45 minutes before being removed and sliced into square shapes. The steamed nuggets are then coated with breadcrumbs and fried.

2.2.2. ANALYSIS OF NUTRITIONAL FACTS OF RABBIT MEAT NUGGET WITH CARROT SUBSTITUTIONS

Parameter testing of nutritional facts on rabbit meat nuggets included testing for moisture content, ash content, carbohydrates, protein content, fat content, and crude fiber. The test was carried out based on the proximate test method according to the AOAC method (2005).

The percentage of water content in the rabbit nugget was calculated using the method with a dry oven base, the percentage of protein content was calculated using the method with the Kjeldahl method by multiplying the 6.25 conversion factor, the percentage of fat and crude fibre content were calculated using soxhlet method, the percentage of ash content was calculated with the furnace method, the percentage of the carbohydrate was calculated using by difference method, which is to reduce the total number of components (100%) with moisture, protein, fat, crude fibre and ash.

2.2.3. ANALYSIS OF BETA-CAROTENE OF RABBIT MEAT NUGGET WITH CARROT SUBSTITUTIONS

Identification of beta-carotene was carried out by the thin-layer chromatography method, the Carr-Price method. Besides that, thin layer chromatography was

carried out with silica gel F254 in the stationary phase, mobile phase, hexane:acetone:ethanol (1:1:4 v/v), direction of elution up, and UV spot detector 254.

2.2.4. HEDONIC TESTS OF RABBIT MEAT NUGGET WITH CARROT SUBSTITUTIONS

Hedonic tests of rabbit meat nugget were determined using 25 semi-trained panelists. Panelist preferences were assessed for hedonic qualities such as taste, flavor, texture, color, and overall satisfaction. Each panelist sampled three different types of rabbit meat nuggets, each with a three-digit code. They graded the hedonic test form using the scoring procedure that was provided. The ratings were assigned as 1, 2, 3, and 4, corresponding to "liked," "quite liked," "slightly liked," and "disliked."

2.2.5. STATISTICAL ANALYSIS

The parametric analysis of variance (ANOVA) test was used to analyze data from chemical and physical analyses. At a significance level of 0.05, parametric testing was performed using the SPSS 26.0 program. If the treatment has an impact, the test is repeated with the Duncan Multiple Range Test (DMRT) to determine the mean value of the difference. The non-parametric Kruskal-Wallis test was used to analyze data from the hedonic test, followed by the Mann-Whitney test. Meanwhile, in beta carotene testing, analysis was carried out using descriptive methods.

3. Results and discussions

Several tests, including nutritional facts, beta-carotene levels, and hedonic tests, were performed in this study to acquire analytical findings of the effect of carrot substitution on rabbit nuggets.

3.1. Nutritional facts of rabbit nuggets with carrot substitutions

The results of the nutritional facts of rabbit nuggets with carrot substitutions are shown in Table 1 below.

Based on the research that has been done, it is known that the substitution of carrots in rabbit meat nuggets has a significant effect on carbohydrates and crude fiber ($p > 0.05$) while for water, ash, protein, and fat content there is no significant difference ($p > 0.05$). The moisture content of rabbit meat nuggets has almost the same value but tends to be higher in the treatment with carrot substitution. This is because carrots have a high water content, which is around 86-93% (3). The highest carbohydrate content in rabbit meat nuggets was in the T₀ treatment, namely the treatment without carrot substitution. The value of carbohydrates in nuggets is influenced by the presence of other nutritional levels such as water content, protein content, fat content, crude fiber content, and ash content. This is because the calculation of the carbohydrate value is determined based on the by difference method, namely the calculation based on the total component number

Table 1. Nutritional Facts Rabbit Nugget with Carrot.

Parameters (%)	Treatments		
	T ₀	T ₁	T ₂
Water content	53.66±1.82	53.92±2.48	54.85±0.23
Ash content	2.85±0.12	2.76±0.19	2.80±0.17
Carbohydrates	21.44±1.15 ^a	17.87±0.59 ^b	19.25±0.30 ^b
Protein	13.73±0.66	13.03±1.10	12.93±0.49
Fats	6.67±0.46	6.68±0.43	7.04±0.13
Crude Fibre	13.23±0.35 ^a	14.23±0.32 ^b	15.17±0.10 ^c

Values above are mean ± standard deviation. Values followed by different letters in the same row showed significant differences ($p < 0.05$) based on the ANOVA test followed by Duncan's test. T₀-T₂ each treatment 0% ; 20% and 40% carrot substitution on rabbit nuggets.

(100%) minus the total value of water content, protein, fat, crude fiber, and ash (4).

The substitution of carrots increased the crude fiber content, and the water and fat content in the nuggets tended to be high, thereby reducing the carbohydrate content in the nuggets. Meanwhile, the substitution of carrots increased the percentage of fiber in the nuggets ($p < 0.05$). This is because carrots are rich in fiber consisting of pectic polysaccharides, hemicellulose, and cellulose (5). Therefore, the more carrots added, the higher the fiber content in the nuggets. The crude fiber in carrots is 7.18-8.87% (6).

3.2. Beta-carotene values

The results of Beta-carotene value in rabbit meat nuggets with carrot substitutions are shown in Figure 1.

The substitution of carrots to rabbit nuggets increased the beta-carotene content of the nuggets. This is because carrots are rich in beta-carotene content (7). Beta-carotene is a carotenoid with strong antioxidant activity that has been widely used and attracted the attention of consumers (8).

In addition to the fact that carrots are good for the eyes, the carotenoids, polyphenols, and vitamins in carrots function as antioxidants, anticarcinogens, and immune enhancers. Anti-diabetic, cholesterol-lowering, and cardiovascular disease, antihypertensive, hepatoprotective, renoprotective, and wound healing

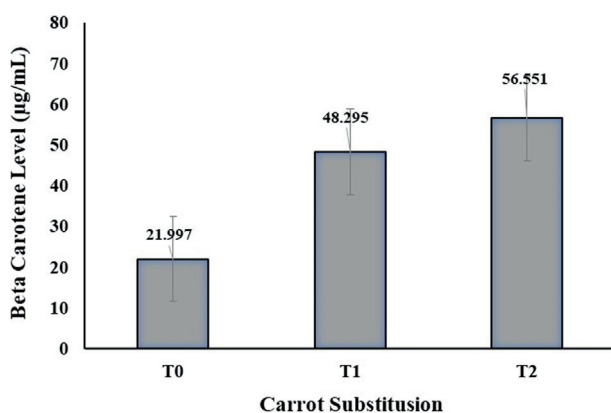


Figure 1. Beta-carotene level of rabbit nugget with carrot substitutions of T₁, T₂, and T₃ (0, 20, and 40% respectively). Data was expressed as a mean of µg/mL unit ± SD of triplicate analysis.

benefits of carrots have also been investigated in previous studies (9).

3.3. Hedonic values

Based on the research that has been done, it shows that the substitution of carrots with different percentages affects the hedonic values of the nuggets ($p < 0.05$). The results of the nuggets can be seen in Table 2.

Based on the results of hedonic testing that has been carried out, there are significant differences ($p < 0.05$) in the texture, taste, and overall preference of rabbit meat nuggets with the substitution of carrots. Aroma is a very subjective taste and smell and is difficult to measure because everyone has sensitivity and preference. The aroma of rabbit meat nuggets was not significantly different ($p > 0.05$) because the nuggets were wrapped in breaded flour, then fried. The existence of a frying process causes the aroma of the nuggets to be biased so that it is difficult to detect the difference in scale. The texture of rabbit meat nuggets with 40% substitution (T₂) was the least preferred texture by the panelists, while for T₀ and T₁ treatment nuggets there was no difference. The higher the concentration of carrot substitution in rabbit meat nuggets, the lower the panelists' preference level. This is presumably because, the higher the substitution of carrots, the texture of the nuggets becomes mushy so that the panelists are less likely to like it. Carrots have a fairly high water content of 88%, this large water content causes when grated and mixed in the nugget dough, the carrots produced have a mushy texture and are not liked.

Table 2. Hedonic values of Rabbit Meat Nugget With Carrot Substitutions.

Parameters	Treatments		
	T ₀	T ₁	T ₂
Aroma	3.04 ± 0.73	3.00 ± 0.57	2.76 ± 0.66
Texture	3.20 ± 0.76 ^a	2.92 ± 0.70 ^a	2.28 ± 0.67 ^b
Taste	3.24 ± 0.88 ^a	2.97 ± 0.84 ^b	2.64 ± 0.90 ^b
Overall	3.40 ± 0.64 ^a	2.96 ± 0.67 ^b	2.52 ± 0.65 ^c

All values above are mean ± standard deviation. Values followed by different letters in the same row showed significant differences ($p < 0.05$) based on the ANOVA test followed by Duncan's test. T₀-T₂ = Carrot substitution concentration respectively 0% ; 20% ; 40%. Likeness scale: 1 (disliked), 2 (quite liked), 3 (liked), and 4 (very liked).

The most preferred taste of rabbit meat nuggets with carrot substitution was the T_0 treatment. The higher the concentration of carrot substitution in rabbit meat nuggets, the lower the panelists' preference in terms of taste. The treatment gave the impression of a specific taste because the three nuggets had a different taste with the substitution of carrots. The higher the use of carrots gives the impression of a distinctive sweet carrot taste and can cover the taste of rabbit meat. Overall, the panelist's most preferred level of preference was T_0 and the least preferred was T_2 . The overall assessment by the panelists was seen from the aspect of taste and texture of the nuggets. However, carrot substitutions until 40% are still at the level of being quite favored by the panelists. But indeed, there is a need for developing the product to create rabbit meat nuggets with the substitution of carrots that have a texture and taste that are suitable for consumers at large.

Conclusion

The substitution of carrots to rabbit meat nuggets gave a better nutritional effect, namely increasing fiber and beta-carotene levels in the nuggets. The substitution of carrots up to 40% caused a change in the texture and taste of the nuggets but it was still at a level that was quite liked by the panelists.

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