



Assessment of Nutritional Quality, Organoleptic Attributes, and Acceptability of Red Bean and Moringa Chicken Nuggets as a Potential Dietary Alternative for Stunting Prevention

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ABSTRACT

This study delves into the development and evaluation of red bean moringa chicken nuggets as a potential dietary solution, particularly for stunted children. The investigation encompassed comprehensive assessments, including organoleptic tests, nutritional value analyses, and product acceptability evaluations. The formulation of the red bean moringa chicken nuggets incorporated various compositions, with moringa leaves and red beans serving as key ingredients. Trained panellists underwent organoleptic assessments, with the resulting data revealing nuanced preferences in terms of colour, aroma, taste, and texture. The nutritional value was scrutinised against established standards, indicating alignment with prescribed guidelines, albeit with a minor deviation in carbohydrate content due to the inclusion of red beans. Furthermore, the product's acceptability among the community was evaluated, demonstrating positive feedback across taste, shape, aroma, and texture parameters. The product's nutritional value, coupled with its appealing sensory attributes, position it as a suitable option for children, particularly those affected by stunting. The study underscores the potential of these red bean moringa chicken nuggets as a palatable and nutritious alternative catering to the needs of young consumers. The suggestion from this research is that red bean and moringa nuggets can be consumed by stunted children or to prevent stunting because they have high nutritional value, especially protein.

Keywords: *red bean moringa chicken nuggets, stunting prevention, organoleptic assessment, nutritional value, dietary alternative*

1. INTRODUCTION

According to the WHO [1], children who are stunted or have short stature for their age are those whose height or body length is less than -2 standard deviations. Usually occurring within the first 1000 days of life (HPK), stunting, also known as linear growth delay, is presently a global and Indonesian public health concern. In Indonesia, 1 in 3 children, or 30.8% of toddlers, suffer from stunting Kemenkes RI [2], a rate still greater than the Asian average of 21.8% Global Nutrition Report [3]. The SSGI (2021) reports that the prevalence of stunting in toddlers in Indonesia is 24.4% [4], which is still greater than the threshold that raises public health concerns and puts the country in the high group (20 - <30) De Onis [5].

The first 1000 days of a child's life, from conception to their second birthday, are considered the golden age of human existence. Stunting frequently starts in utero, during foetal development, and in many cases, it is even predetermined during pregnancy Martorell R [6]. Stunting risk factors begin throughout pregnancy and persist after supplemental foods are offered in addition to breastfeeding. During this time, the quantity and quality of nutrients consumed can provide the groundwork for a child's or adult's healthy growth and development. Stunting or linear growth delay can have negative short- and long-term effects and is linked to higher rates of child morbidity and mortality, impaired cognitive, motor, and socioemotional development, poorer academic performance and learning capacity, lower levels of work capacity and productivity, and shorter adult mothers, as well as a higher chance of non-communicable illnesses Black RE [7]. Childhood and adolescent growth failure is frequently irreversible and uncorrectable Martorell R & Victoria CG [8, 9].

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Chicken nuggets contain processed poultry products produced through a combination of chicken meat along with optional incorporation of various other food constituents. These products may include approved food additives and can undergo processes such as shaping (through steaming or freezing), coating, and optional frying followed by freezing [10]. Reverberating across diverse age demographics, chicken nuggets represent a favoured source of animal-derived protein. This preference is particularly pronounced among children, a demographic for whom the primary component of these nuggets, namely fresh chicken meat, remains consistently accessible within the market. Beyond their protein content, fresh chicken imparts vital fatty acids and B vitamins, pivotal for fostering the growth and maturation of children Rahmi Y [11]. Endeavours to refine chicken nugget offerings have yielded varied innovations, among them the incorporation of moringa leaves and red beans. Fresh moringa leaves, renowned for their nutritional richness, manifest a protein content of 5.1 grams per 100 grams, accompanied by 0.6 grams of zinc and 6 milligrams per 100 grams Direktorat Jenderal Kesehatan Masyarakat [12]. Additionally, red beans, aside from their vegetable protein content, emerge as a notable fibre source, bolstering digestive processes Kementerian Desa [13].

Stunting is a condition where a toddler's height is shorter than that of toddlers of the same age Hamidiyah A [14]. In Banyuurip Ujung Pangkah Gresik Village, the number of children under five with stunted growth is 24 children. One of the potential local ingredients in Banyuurip Village is Moringa leaves, which are easily found in residents' yards, along with red beans that are widely sold in Traditional Markets in the Banyuurip Village area. The functional food that will be developed is Moringa red bean chicken nuggets, where the resulting product has a high protein content sourced from both animal protein derived from chicken and vegetable protein from Moringa leaves and red beans. Furthermore, this study also aims to develop and test the acceptability of additional food for toddlers, namely, red bean moringa chicken nuggets, to prevent stunting. This research activity will implement practices for handling and accelerating the reduction of stunting at the regional level by providing education and counselling to the community through a family-oriented approach. This collaboration between Brawijaya University and Ujungpangkah Health Center has led to the conception and execution of this research initiative.

2. METHODS

This study falls under the category of true experimental research, comprising four distinct research stages. The initial stage encompassed the formulation of the red bean moringa nugget recipe. In the subsequent stage, trained panellists conducted organoleptic tests. The third stage entailed evaluating the nutritional composition of the most promising treatment formulation based on the outcomes of the organoleptic evaluation. Finally, the fourth stage involved assessing the acceptability of the product.

2.1. Formulation of Recipes

The primary constituents employed in this study comprised fresh chicken, moringa leaves, moringa flour, and red beans. The formulation of the red bean moringa chicken nugget recipe involved creating three distinct recipe compositions. Composition P1 integrated fresh chicken, moringa leaves, and red beans in a ratio of 9:2:1. Composition P2 combined fresh chicken, moringa flour, and red beans in a ratio of 9:0.5:1. Composition P3 featured fresh chicken, moringa leaves, and red beans in a ratio of 8:2:2. The manufacturing of red bean moringa chicken nuggets transpired within the Dietetic and Culinary Laboratory at the Faculty of Health Sciences, Brawijaya University. The production process encompassed various stages, including ingredient blending, moulding, steaming, breading, double frying, and packaging.

2.2. Organoleptic Evaluation

The evaluation of organoleptic attributes was conducted within the Dietetic and Culinary Laboratory at the Faculty of Health Sciences, Brawijaya University, employing a panel of trained assessors comprising five members. This evaluation aimed to discern the formulation exhibiting the most optimal composition in terms of taste, colour, aroma, and texture. The outcomes of this assessment will undergo statistical analysis utilising ANOVA at a confidence level of 95% and a significance threshold (p-value) below 0.05. Subsequently, the preferred treatment will undergo further scrutiny through the DeGarmo test. Following this, the formulation with the optimal composition will undergo subsequent examination to assess its nutritional content, including proximate analysis, as well as measurements of Zinc and Iron parameters.

2.3. Nutritional Value Assessment

Subsequently, the most optimal composition of red bean moringa chicken nuggets underwent comprehensive testing for proximate components (including water content, ash content, protein, fat, and carbohydrates), as well as Fe and zinc content.

2.4. Acceptance Evaluation

The assessment of acceptability took place within Banyuurip Village, Ujungpangkah, Gresik Regency. The participants for this evaluation were mothers of children under the age of five, who evaluated attributes such as taste, aroma, appearance, and texture of the red bean moringa chicken nuggets.

3. RESULTS AND DISCUSSION

3.1. Recipe Formulation Results

The outcomes of the red bean moringa chicken nugget recipe formulation are depicted in Figure 3.1 below. Notably, P1 exhibits a more vibrant hue compared to P2 and P3, with P2 displaying the most pronounced greenish tint. This divergence in coloration can be attributed to the introduction of moringa in the form of flour in P2, whereas in P3, the proportion of moringa leaves added surpasses that of P1.



Figure 3.1 Red bean moringa chicken nuggets

3.2. Organoleptic Evaluation Results

The outcomes of the organoleptic evaluation conducted by trained panellists yielded the subsequent findings:

Table 3.2. Organoleptic Evaluation Results

Parameter	P1	P2	P3	p-value
Colour	4,4	3,6	4,2	0,089
Aroma	4,2	3,4	4,2	0,244
Taste	4,4	3,6	4,2	0,123
Texture	4,4	3,8	4	0,262

Analysing the results of the organoleptic test in terms of indicators encompassing colour, aroma, taste, and texture, it becomes evident that the nugget group with higher percentages of added fresh moringa leaves and red beans exhibits lower organoleptic test values. Additionally, the inclusion of moringa leaves in the form of flour garnered less favour from the panellists, consequently leading to reduced respondent acceptance. Similarly, the outcomes of the organoleptic test, assessed through average values, generally align with the order of individual organoleptic averages per indicator.

The findings of the organoleptic testing reveal no substantial discrepancies across colour, aroma, taste, and texture parameters among formulations P1, P2, and P3. However, the test results do indicate that P2 yields the lowest value in comparison to P1 and P3. This implies that the incorporation of moringa leaf powder into the production of red bean moringa nuggets was met with disfavour by the panellists. Notably, notable shifts in organoleptic attributes due to Moringa powder fortification are attributed to the absorption of Moringa powder

by the nuggets, along with the tendency of Moringa properties to dominate, thus significantly influencing colour, aroma, taste, and texture, De Onis [5].

Subsequently, the DeGarmo test was conducted to identify the optimal treatment. The outcomes of the DeGarmo test revealed that P1 achieved a weight of 1, signifying that among the three formulations, P1 emerged as the superior treatment option.

3.3. Nutritional Value Assessment

The outcomes of the nutritional value assessment are presented in the subsequent results:

Table 3.3. Test Results for Red Bean Moringa Chicken Nuggets per 100 grams

Parameter	Test Results	SNI 6683:2014 – Chicken Nuggets
Water (%)	39,63	Max. 60
Ash (%)	1,69	
Proteins (%)	14,16	Min. 9
Fat (%)	17,85	Max. 20
Carbs (%)	26,67	Max. 25
Zn (mg)	0,97	
Fe (mg)	2,12	

Based on the aforementioned test results, it is evident that the red bean moringa chicken nugget aligns with the specifications outlined in SNI 6683:2014 Martorell R [6], despite a slight deviation in carbohydrate content beyond the SNI standard threshold. This discrepancy could be attributed to the inclusion of red beans in the nugget formulation. Kidney beans inherently possess a carbohydrate content of 28 grams per 100 grams and a fibre content of 2.1 grams per 100 grams, factors that might contribute to the surpassing of the stipulated carbohydrate levels in the SNI standard.

3.4. Product Acceptance Evaluation

The outcomes of the community-based product acceptance evaluation are presented in the subsequent table:

Table 3.4. Average Results of the Product Acceptance Evaluation

Product	Taste	Shape	Aroma	Texture
Red Bean Moringa Chicken Nuggets	4,9	4,4	4,6	4,5

Based on the outcomes of the acceptability test, it is evident that the moringa red bean chicken nugget product received favourable reception from the panellists across taste, shape, aroma, and texture parameters, attaining an average rating exceeding 4. This indicates that the panellists' evaluations spanned from 'liking' to 'really liking' the product. As per the panellists' assessments, the red bean moringa chicken nugget appears suitable for consumption by children, attributed to its delightful taste, appealing appearance, typical aroma akin to conventional nuggets, and tender texture. Although certain panellists suggested introducing greater variation in shapes to enhance the product's allure and entice children towards consuming this moringa red bean chicken nugget offering.

4. CONCLUSION

The red bean moringa chicken nuggets align with the nutritional benchmarks established by the SNI 6683:2014 for chicken nuggets. This makes them a suitable dietary option for children, particularly those experiencing stunting. These nuggets boast a delectable flavour, a familiar aroma akin to standard nuggets, an appealing shape, and a tender texture, all of which contribute to their potential as a favourable choice for this demographic. The suggestion from this research is that red bean and moringa nuggets can be consumed by stunted children or to prevent stunting because they have high nutritional value, especially protein

5. AUTHOR CONTRIBUTIONS

HRW has contributed as head of research and recipient of research grants from professors from the UB Faculty of Veterinary Medicine. He has the role of leading the research and providing direction so that the research can be completed on time. EJM has contributed to carrying out research, drafting research journals, and oral presentations of research results. TSK has contributed to making nugget formulas, testing and making nuggets in the laboratory, drafting research journals, and oral presentations of research results.

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