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Nutritional Knowledge and Acceptance of Red Bean–Moringa Chicken Nuggets among Mothers with Toddlers in Gresik, East Java, Indonesia

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Abstract

The problem of stunting in Indonesia has long-term impacts on the nation's future. Stunting causes low productivity, low intellectual capacity, and the risk of chronic disease. In order to support the government's program through proper nutrition, this study aims to assess the utilization of functional food products with high protein content, specifically red bean–moringa chicken nuggets. The study uses a questionnaire to assess the acceptability of red bean–moringa chicken nuggets and determine the level of knowledge and eating habits. The research was conducted at Ujungpangkah Public Health Center, Gresik Regency. The study subjects were 31 mothers of toddlers aged 1-5 years. The results show that most mothers of toddlers have good nutritional knowledge (87.7%). The average score for eating habits was moderate (53.8%); with six toddlers (19.4%) having good eating habits, while 25 toddlers (80.6%) had poor eating habits. Pearson's analysis showed no significant correlation among nutritional knowledge, eating habits, and food acceptance. Based on the acceptability test results, the red bean-moringa chicken and nuggets were liked by the respondents and have the potential to be an alternative plant-based dietary nutrition. To meet the nutritional needs of toddlers and to reduce the rates of stunting, future programs will include training in the preparation of red bean-moringa nuggets and conducting economic feasibility analysis in Gresik Regency, which is located in East Java Province, Indonesia.

Keywords: Acceptance, Dietary Alternative, Knowledge, Stunting Prevention, Red Bean-Moringa Chicken Nuggets.

Introduction

Stunting is a worldwide health issue that results in impaired growth and development in children as a consequence of malnutrition. This issue affects the quality of life and may result in premature mortality (1). Stunting among children is a pervasive global health challenge that reflects a significant form of chronic malnutrition. Defined as a height-for-age z-score (HAZ score) less than -2 or below the World Health Organization's growth standards, stunting indicates not only suboptimal growth but also various long-term developmental repercussions, including impaired cognitive abilities and increased susceptibility to infections and non-communicable diseases (2, 3). As per estimates from leading health organizations like UNICEF, WHO, and the World Bank, approximately 149 million children under five were stunted globally as of 2020, with particularly high prevalence rates reported in Asia, where over half of the world's stunted children reside (3, 4). This problem is compounded in lower-resource settings, where factors such as food insecurity, inadequate healthcare, and insufficient maternal education contribute significantly to the prevalence of stunting (5, 6). In 2019, the World Health Organization (WHO) reported that Southeast Asia (31.9%) exhibited the highest prevalence of stunting, following Africa (33.1%), with Indonesia ranking sixth after Bhutan, Timor Leste, the Maldives, Bangladesh, and India (7). In Indonesia, the situation regarding child stunting is dire, with the country ranked fifth globally for the highest prevalence of stunting (8, 9). Data indicate that the prevalence of stunting among Indonesian children has stagnated at levels around 37% in recent years (6, 10). The stunting situation translates to an alarming number of children affected, highlighting a public health emergency that warrants urgent attention and intervention. Factors contributing to stunting in Indonesia are multifaceted, including socioeconomic disparities, inadequate maternal nutrition during pregnancy,

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lack of exclusive breastfeeding for the first six months, and limited access to diverse and nutritious foods (3, 6, 8). The long-term implications of stunting in Indonesia threaten individual health and development and jeopardize the nation's economic growth and human capital, necessitating comprehensive strategies to combat this pressing public health issue (11, 12). According to the Indonesian Nutritional Status Survey conducted in 2022, stunting in Indonesia was 21.6%. East Nusa Tenggara exhibited the highest rate at 35.3%, followed by West Sulawesi at 35%, Papua at 34.6%, West Nusa Tenggara at 32.7%, and Aceh at 31.2% (13). The incidence of stunting remains elevated in East Java, located on the island of Java (14). Twenty districts and cities are documented as exhibiting a stunting prevalence in children under five that exceeds the provincial average (15). Gresik Regency exhibits a prevalence rate of stunting by 23%, nearly aligning with the East Java figures of 23.5%. The high percentage of stunting cases demonstrates that issues of underweight and stunting persist in Gresik Regency, as indicated by a rise in prevalence compared to previous years. The Gresik Regency Government is prioritizing 10 sub-districts for stunting reduction: Dukun, Ujungpangkah, Sidayu, Kebomas, Driyorejo, Wringinanom, Kedamean, Menganti, Cerme, and Duduk Sampeyan (16). Ujungpangkah is an area within Gresik Regency, encompassing 9 million hectares, bordered to the north by the Java Sea, to the south by Sidayu District, and to the west by Panceng District. In 2023, this region's population was 1,304,203, including 192.059 women aged 15 to 24 (17). Based on that ratio, several individuals have been diagnosed with stunting, as identified through the screening service program at the Ujungpangkah Community Health Center.

Stunting is caused by various factors, including socioeconomic conditions, maternal nutritional status during pregnancy, infant illnesses, and inadequate nutritional intake for infants (18). Over time, stunting can adversely affect the cognitive capabilities of those impacted, elevating the likelihood of obesity, diabetes, hypertension, cancer, and various physical developmental disorders. In the short term, stunting results in a diminished quality of life for affected individuals due to limited access to superior education, employment prospects, and income (13). Addressing the stunting crisis in Indonesia requires a holistic approach that incorporates nutritional interventions, education on childcare practices, improvement of socioeconomic conditions, and enhanced access to healthcare services. Interventions must be tailored to the specific regional contexts while promoting awareness about proper maternal and child nutrition (19).

The research team discovered through the analysis of issues and patient histories of individuals diagnosed with stunting at the Ujungpangkah Public Health Center that parents, especially pregnant women, remain uncertain about the implications of stunting, methods for its mitigation and prevention, and strategies for ensuring optimal family nutrition. Researchers discovered that processed meat consumption in Indonesia is increasing significantly, as it serves as a viable alternative food option for households, particularly in the frozen food category (20). This study seeks to address the issue of stunting in Ujungpangkah District, Gresik Regency, and lower the rate through the utilization of processed functional foods. This present study was implemented using the Theory of Planned Behavior (TPB) (21) approach, concentrating on enhancing positive attitudes, utilizing social norms, and reinforcing perceived behavioural control via education and supportive interventions. Participants can considerably contribute to decreasing the rate of stunting among toddlers. The framework is illustrated in Figure 1.

This study aims to develop a functional food: chicken nuggets incorporating moringa leaves and red beans, resulting in a product with elevated protein derived from animal protein in chicken and plant-based protein from moringa leaves and red beans. To mitigate stunting, develop and evaluate the acceptability of complementary foods for toddlers, specifically chicken nuggets incorporating moringa leaves and red beans.

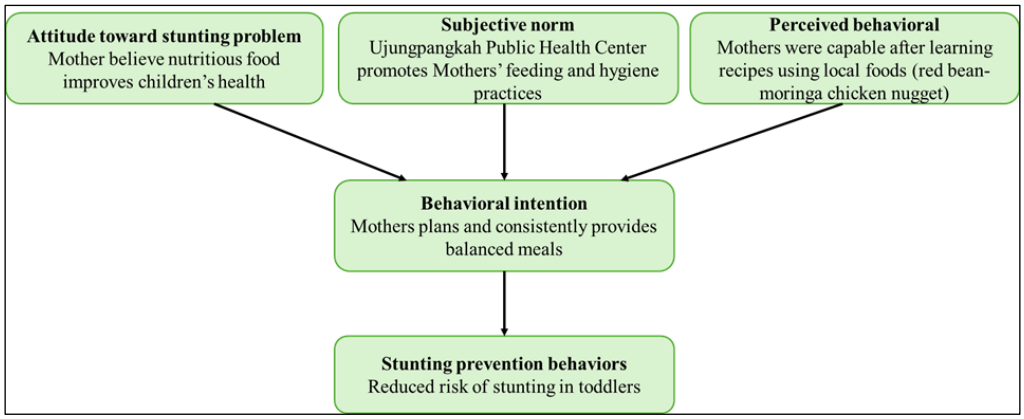

Figure 1: Diagram of the Study Framework, Adapting the Theory of Planned Behavior (TPB) to Prevent Stunting in Ujungpangkah District, Gresik Regency, and East Java, Indonesia

Methodology

Study Area and Study Design

This research is part of community service activities that target the issue of stunting in the community, especially in Ujungpangkah sub-district, Gresik Regency, East Java, Indonesia, with a geographic location at 6°55′9.50992″S 112°32′47.35280″E. A cross-sectional study was conducted from May to November 2023 to assess the nutritional knowledge of mothers with toddlers, their children's eating habits, and acceptance of red bean–moringa chicken nuggets, a community-based product developed previously (22).

Study Preparation

During the preparation phase, coordination was carried out with the Ujungpangkah Public Health Center to identify the problems in the Ujungpangkah Public Health Center's working area. The field enumerators will prepare the questionnaires to be used in the study. Before data collection, the researchers explained the study and obtained informed consent from the respondents.

Implementation

The subjects in this study were 31 respondents. The selected subjects are mothers of children aged 1-5 years. The research objectives of selected respondents will be explained to them, and the field enumerator will provide an informed consent form. After approval, data were collected through interviews using a recently developed questionnaire on nutritional knowledge and eating habits. Next, respondents will be given red bean moringa nugget products to try.

The respondents will assess the taste, shape, aroma, and texture of the red bean-moringa chicken nugget product in the table provided along with the questionnaire. There were 10 closed-ended questions about nutritional knowledge, and six questions regarding eating habits. The questionnaire related to nutritional knowledge contains 10 questions, including the definition of nutritious food; the benefits of food for the body; food nutrients; examples of energy-rich food sources; examples of dishes containing energy-rich nutrients; the function of nutrients in food; examples of plant-based protein sources; examples of high-protein food ingredients; examples of high-nutrient vegetables and fruits; the requirements for a well-balanced meal composition. The food acceptability assessment used a 5-point hedonic scale comprised of "dislike extremely" to "Like extremely", with "Neither like nor dislike" in the middle.

Data Analysis

The respondents' answers were analyzed according to right or wrong, frequency, and percentage values. The data was cleaned and analyzed using Microsoft Excel®. The correlation between variables was analyzed using Pearson's correlation test with a 95% confidence interval. Statistical analyses were performed using JASP Version 0.18.3 (23).

Results and Discussion

Nutritional Knowledge

This research activity implements practices for handling and accelerating stunting reduction at the regional level by providing education and counselling to the community through a family approach, resulting from collaboration between Brawijaya University and the Ujungpangkah Community Health Center. Table 1 depicts the

respondents' knowledge level about general nutritional information. The study results showed that most mothers of toddlers had good nutritional knowledge. Lack of knowledge includes knowledge about the function of daily nutrition (poor) and plant-based protein sources (moderate).

Table 1: The Perception of the Respondents Regarding Nutrition (n=31)

Questions Item	Correct Answer		Knowledge Level
	n	%	
The definition of nutritious food	31	100	good
The benefits of food for the body	29	93.5	good
Nutritional composition of our food	29	93.5	good
Energy source nutrients in food	29	93.5	good
Energy source nutrients are found in daily dishes	30	96.7	good
The function of daily food nutrients	15	48.4	poor
The examples of plant-based protein sources	23	74.2	moderate
Foods with high protein ingredients	28	90.3	good
Examples of high-nutrient vegetables and fruits	29	93.5	good
The requirements for a well-balanced meal composition	29	93.5	good
Average	27.2	87.7	good

Knowledge score <50% = poor knowledge, 50–75% score = moderate knowledge, >75% score = good knowledge.

In this study, most respondents were aware of nutrition and the role of adequate nutrition for child development. The lack of knowledge regarding daily nutrient functions and plant-based protein sources deserves attention and improvement. The reliance on locally available food sources, often limited to rice, vegetables, and minimal animal protein, can result in monotonous diets devoid of essential macro and micronutrients required for optimal health (24). In Indonesia, maternal awareness and knowledge regarding nutrition play a crucial role in ensuring the healthy growth and development of infants and toddlers. Those that can be grown in their local environments. Numerous studies suggest that enhancing maternal nutritional knowledge through targeted educational programs can improve dietary diversity and feeding practices (25, 26). Such interventions help mothers understand the significance of plant-based protein sources, enabling them to make informed decisions that improve nutritional fulfilment for their children.

Children Eating Habit

Eating habits, behaviours, attitudes, beliefs, and choices regarding the food consumed were assessed based on the mothers of toddlers answering six questions; a score above 5 indicates good eating habits, while a score below 5 indicates poor eating habits. Based on interviews with mothers regarding their children's eating habits, six toddlers (19.4%) had good eating habits, while 25 other toddlers (80.6%) had poor eating habits.

Table 2: Respondents' Scores on Eating Habits (n=31)

Items	Correct Answer		Level of Eating
	n	%	Habits
Children's meal time per day	28	90.3	Good
Children always eat complete meals daily	9	29.0	Poor
The order of daily dishes: Rice, meat/fish side dish, vegetable side dish, fruit, milk	10	32.3	Poor
Children eat rice with side dishes every day	26	83.8	Good
Children eat vegetables every day	13	41.9	Poor
Children eat fruit every day	14	45.2	Poor
Average	16.6	53.8	

Score <50% = poor habit, 50–75% score = moderate habit, >75% score = good habit

The respondents' characteristics based on the question items are presented in Table 2. The results show good eating habits scores on the items children eat daily (90.3%), and the use of side

dishes for meals daily (83.8%). Research indicates that mothers in rural communities often lack awareness of balanced nutritional needs, leading to excessive consumption of carbohydrates while neglecting the intake of essential proteins and a diverse array of food options. This pattern can contribute to adverse health outcomes, including stunting (27). The tendency to prioritize easily accessible, less nutritious foods further complicates efforts to ensure adequate nutrition for toddlers. Consequently, this lack of dietary diversity is strongly associated with inadequate growth and development among toddlers, as reflected in increased stunting rates (28).

The eating habits of toddlers in rural Indonesia are strongly linked to their nutritional status, with a lack of diversified diets contributing to malnutrition. Maternal knowledge directly impacts feeding practices such as complementary feeding (the introduction of solid foods alongside breastfeeding). Mothers who are well-informed about nutritional needs are better equipped to select appropriate complementary foods that align with their child's developmental stage (29). Conversely, insufficient knowledge or misinformation can lead to inadequate dietary diversity, exposing children to the risks of malnutrition and stunting (3). According to study findings, early alterations in dietary practices, particularly in childhood, may enhance health outcomes and reduce the likelihood of disease manifestation in later stages of life (30). The imbalanced diet can be attributed to insufficient knowledge about healthy food diversity and safety, which can hinder improving eating habits and adopting healthy eating patterns. Therefore, motivation is needed for mothers with toddlers to consider healthy eating habits. Addressing this issue requires comprehensive strategies that improve maternal knowledge about nutrition, enhance access to diverse food sources, and promote the inclusion of animal and plant proteins to ensure children's healthy growth and development.

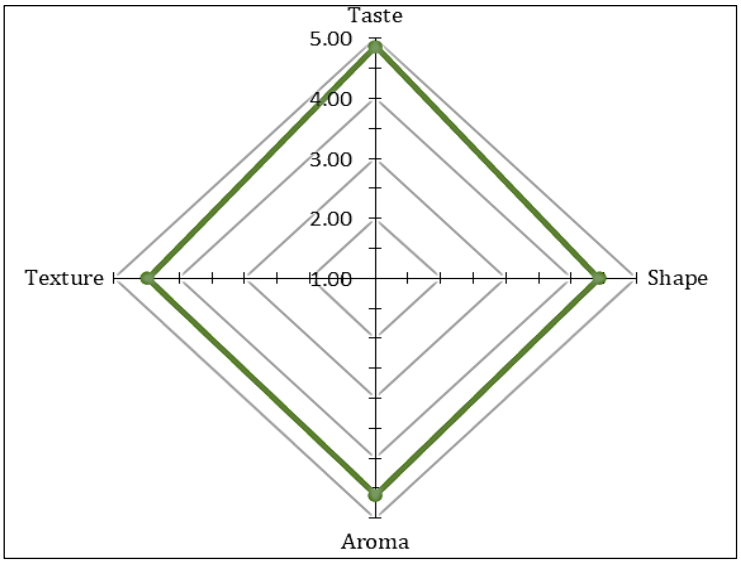

Figure 2: Respondent's Acceptability Scores on a 5-Point Hedonic Scale (N=31) of Red Bean-Moringa Chicken Nuggets

Red Bean-Maringa Chicken Nuggets Acceptance

The functional food used in this study was red bean-moringa chicken nuggets. This product is high in protein because it contains animal protein from chicken and vegetable protein from moringa leaves and red beans. Product acceptance is assessed through a preference test, with parameters including taste, shape, aroma, and texture. The results of the acceptability test show the average score in Figure 2. The result indicates that the panelists' acceptability score averages were >4, in the product's evaluation range between "like" to "like extremely". Based on the panelists' assessment, the red bean-moringa chicken nuggets appeared suitable for children due to their delicious taste, attractive appearance, distinctive aroma similar to conventional nuggets, and soft texture. However, some panelists suggested introducing a wider variety of shapes to increase the product's appeal and entice children

to consume these moringa red bean chicken nuggets.

The introduction of Red bean-moringa chicken nuggets represents a promising innovation for increasing nutritional intake and supporting stunting prevention efforts in Indonesia. Combining red beans (*Phaseolus vulgaris*) with moringa leaves (*Moringa oleifera*) provides a nutrient-dense food source rich in protein, iron, calcium, and vitamins, which are essential for child growth and cognitive development (31, 32). However, several obstacles may hinder the widespread market adoption of such functional foods, including price sensitivity, taste preferences, and cultural perceptions. The use of moringa and red bean ingredients may increase production costs compared to conventional chicken nuggets. Low-income families, who are often the target beneficiaries of stunting prevention programs, may find these products less accessible. Strengthening local agriculture through community farming cooperatives and government-backed agro-processing infrastructure can ensure sustainability and generate economic benefits for the rural region.

Correlation of Nutritional Knowledge, Eating Habits, And Food Acceptance

Correlation analysis was conducted to explore the relationship between the variables of knowledge, eating habits, and food acceptance, with the results shown in Figure 3. According to the scatter plot (Figure 3A), there is an insignificant negative correlation between nutritional knowledge and eating habits *(r*=-0.162, *p*=0.383). In contrast to this finding, some studies demonstrated a positive association between higher levels of nutritional knowledge and healthier eating habits (33, 34); meanwhile, some research suggests only a weak association between nutrition knowledge and dietary intake (35), implying that knowledge alone does not guarantee healthy eating behaviours.

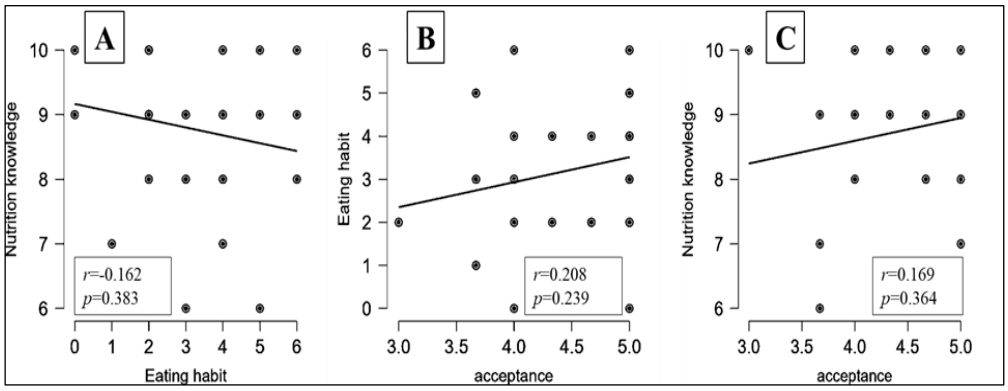

Figure 3: Scatter Plots Showing Pearson Correlation among Respondents' Nutritional Knowledge, Eating Habits, and Acceptance of Red Bean-Moringa Chicken Nuggets

The relationship between nutritional knowledge and eating habits toward food acceptance shows no significant correlation (Figure 3B, 3C). A study by Okoro *et al*., illustrates that a better understanding of nutrition, especially the health implications involved in consuming certain foods, correlates with increased acceptance and intake of core foods (36). Regarding eating habits, Strączek *et al*., emphasize the role of parental influence on the nutritional behaviors of children, demonstrating that children adopt food preferences based on what their parents consume, thereby leading to either positive or negative eating habits (37). Health programs promoting nutritional awareness, maternal education, and access to diverse food sources are essential strategies for addressing the persistent issue of stunting among Indonesian children (19). The importance of maternal empowerment through knowledge and resources cannot be overlooked, as it significantly impacts children's health outcomes and long-term development.

The red bean-moringa chicken nugget represents an innovative formulation and a contextually relevant solution that utilizes Indonesia's agricultural biodiversity to enhance public health. This product incorporates animal and plant proteins in a culturally acceptable manner, combining traditional nutritional sources with modern dietary trends. Inadequate nutrition in pregnant women and children, especially in the Gresik district, needs to be addressed by food diversification interventions. Strengthened community involvement and governmental

support can represent innovative, sustainable, locally-driven strategies for stunting prevention in Indonesia.

Study Limitation

The limitation of this study is that it only focused on the participants of mothers with children aged 1-5 years in the Ujungpangkah Community Health Center work area. This study did not include demographic data such as education, occupation, and parents' income. Future programs include producing the red bean-moringa chicken nugget and prioritizing cost-effectiveness and economic analysis of the red bean–moringa chicken nugget intervention to determine its financial feasibility and long-term sustainability for large-scale implementation in Gresik, East Java, Indonesia.

Conclusion

This study concluded that most mothers of toddlers have good nutritional knowledge (87.7%). The average score for eating habits was moderate (53.8%), with six toddlers (19.4%) having good eating habits, and 25 toddlers (80.6%) having poor eating habits. Based on the acceptability test, respondents generally liked the red bean moringa nugget product (score >4, of 5). Pearson analysis showed no significant correlation among nutritional knowledge, eating habits, and food acceptance. Future programs include training in making red bean-moringa nuggets and conducting economic analysis to determine the feasibility of red bean-moringa nuggets in Gresik Regency, East Java Province, Indonesia.

Abbreviations

HAZ score: height-for-age z-score, JASP: Jeffrey's Amazing Statistics Program, TPB: Theory of Planned Behaviour, UNICEF: United Nations Children's Fund, WHO: World Health Organization.

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Author Contributions

Herawati: designed the research, methodology, Esti Junining: executing the research, collecting data, Titis Sari Kusuma: executing the research, collecting data, Ani Setianingrum: performed the data analysis.

Conflict of Interest

The authors declare no conflict of interest in writing this paper.

Declaration of Artificial Intelligence (AI) Assistance

The authors state that generative artificial intelligence (AI) and AI-assisted technologies were only used to improve language editing, grammar checking, and formatting. Such tools did not generate content, analyze data, interpret results, or draw scientific conclusions.

Ethics Approval

Ethical clearance was not applicable.

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