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Acceptability and Nutritional Composition of Dragon Fruit–Moringa–Roselle Velva as a Functional Snack for Stunted Children

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ABSTRACT

Introduction Stunting is a chronic form of undernutrition that occurs during the growth and development of children.
Purpose This study aims to identify acceptability and analyze protein and fiber content in Velva Dragon Fruit Moringa with Roselle Addition as an alternative snack for stunting children.
Methods This study used a post-test only control group design to evaluate the effect of the addition of rosela on the protein and fiber content of dragon-moringa fruit velva. Three formulations were tested with different levels of rosela (23.3 g; 21.67 g; 20 g). The hedonic test was conducted by 25 trained panelists and used informed consent, analyzed using the Kruskal-Wallis and Mann-Whitney tests with significantly different results ($p < 0.05$). Protein levels were analyzed by the Kjeldahl method and fibers by gravimetric method.
Results The KR03 formulation showed the highest sensory acceptance with a mean score of 3.85. Nutritional analysis showed that KR03 contained 6.89% protein and 0.51% fiber.
ConclusionThe KR03 formulation of velva dragon fruit-moringa with roselle addition demonstrated the highest acceptability among panelists, indicating its potential as a preferred alternative snack for children at risk of stunting. Its balance between taste and nutritional value supports its feasibility as a functional food intervention.

INTRODUCTION

Stunting or failure to grow is a condition of child growth disorders due to chronic malnutrition that occurs from the beginning of life, especially during the first 1,000 days of life (HPK). Stunting is characterized by a z-score of height by age (TB/U) of less than -2 standard deviations based on WHO standards[1]. Stunting is caused by insufficient protein and nutrient intake, recurrent infections, poor hygiene, and low maternal knowledge about child nutrition. This condition is exacerbated by weak immunity and lack of fiber intake, so that children are prone to illness and growth disorders[2,3].

Stunting is a condition of failure to grow in children due to chronic malnutrition that occurs from pregnancy to the age of two, which has an impact on stunted physical growth, impaired brain development, decreased immune system, and increases the risk of chronic diseases in adulthood such as obesity, diabetes, and heart disease; In addition, stunted children are also more prone to mental health disorders, visual impairments, low productivity and income as adults, and have the

potential to create cycles of malnutrition between generations, so stunting prevention is very important to ensure a better quality of life and children's future[4–7].

About 80% of stunting cases under five in the world come from 14 countries, and Indonesia ranks fifth highest. In 2017, the stunting rate in Indonesia reached 29.6%, exceeding the WHO threshold (20%). In 2018, the prevalence dropped to 30.8%, and again decreased to 28% in 2019[8,9]. Protein and dietary fiber are two important nutritional components that play a role in the growth and development process of children[10]. Protein is irreplaceable in the formation and repair of body cells, while fiber helps maintain the health of the digestive tract and immune system. This need can be met through local foods that are rich in nutrients[11].

Moringa leaves (*Moringa Oleifera*) and Roselle flowers (*Hibiscus Sabdariffa*) are potential sources of nutrients[12]. Moringa leaves contain high protein and fiber, while Roselle contains antioxidants and fiber that are beneficial in supporting cognitive and immune function, especially in pregnant women and children[13]. One of the food innovations developed is Velva, a fruit-based, low-fat, easy-to-make, and children-friendly frozen dessert product. The development of moringa and Roselle-based velva is expected to be a healthy snack alternative that can help address stunting problems in a practical and fun way.

MATERIALS AND METHODS

This study is an experimental study with a post-test only control group design that aims to evaluate the effect of the addition of rosela on the protein and fiber content of dragon-moringa fruit velva. Three formulations of velva were tested, with a fixed composition for dragon fruit (187.5 g) and moringa powder (10 g), as well as dried rosemary flower variations: Formulation 1 (23.3 g), Formulation 2 (21.67 g), and Formulation 3 (20 g). The manufacture of velva was carried out at the Nutrition Department of the Surabaya Polytechnic (October 2021 – July 2022) through the process of making dragon fruit purée, mixing with milk and additives (skim milk, cornstarch, salt, and CMC), and repeated cooling in the freezer to produce the desired velva texture. The hedonic test was conducted on 25 trained panelists who were selected based on their understanding of the hedonic test, rather than randomly and informed consent. The assessment included color, aroma, texture, and taste using a hedonic-scale questionnaire. The hedonic test data were analyzed using the Kruskal-Wallis test and continued with the Mann-Whitney; The results are said to be significantly different if the P value < 0.05. Protein content was analyzed using the Kjeldahl method, while fiber content used the gravimetric method.

RESULT

This research included sensory and laboratory testing to determine the protein and fiber content of Velva products made from dragon fruit and moringa with the addition of rosela flowers (Hibiscus sabdariffa). Sensory testing is carried out through a hedonic test that includes four main parameters, namely taste, color, aroma, and texture. The main focus of this study is to evaluate the

differences in hedonic characteristics that arise due to variations in the composition of rosela in Velva products, with the aim of identifying the best formulations received by the panelists. The differences in these characteristics are then analyzed and presented in Table 1.

Table 1 Characteristics of Moringa Dragon Fruit Velva Formulation with the Addition of Rosela

	Formulasi		
Indicator	KR01	KR02	KR03
Color	Dark brown	Slightly pink brown	Pink
Aroma	Acidic and flavorful moringa powder	Sour and aromatic of moringa	Sour and slightly flavored moringa powder
Texture	Soft	Soft	Soft
Taste	Taste of moringa and sour	Tastes moringa and slightly sour	Tastes moringa and slightly sour

The results of organoleptic tests on three formulations of Velva based on dragon fruit, moringa, and rosemay (KR01, KR02, and KR03) showed variations in color, aroma, texture, and taste attributes. The color of KR01 tends to be dark brown, KR02 is reddish-brown, and KR03 is pink, indicating that the higher the concentration of rosela, the more intense the color of the product. The aroma of the three is predominantly sour and typical of moringa. The third texture of the uniform formulation, which is soft, indicates the consistency of the manufacturing process. In terms of taste, KR01 tastes sour with a predominance of moringa flavors, while KR02 and KR03 have moringa flavors with a lighter acidity, indicating that rosela can provide a balance of flavors that are more acceptable to the panelists.

Table 2 Average Distribution of Moringa Dragon Fruit Velva Formulation with the Addition of Rosella

Indicator	**Formulasi Velva**		
	KR01	KR02	KR03
Color	3,16	3,64	4,24
Aroma	2,6	2,92	3,24
Texture	2,96	3,04	3,92
Taste	2,4	3,08	4
Average	**2,78**	**3,17**	**3,85**

Based on the results of the hedonic test, the KR03 formulation obtained the highest score on all assessment indicators, namely color (4.24), aroma (3.24), texture (3.92), and taste (4.00), with an

overall average of 3.85, indicating the highest acceptance rate compared to KR02 (3.17) and KR01 (2.78). The increase in value from KR01 to KR03 suggests that a decrease in the amount of rosela in the formulation may increase the acceptability of the product, likely due to a more balanced color intensity or flavor of rosela.

Table 3 Protein and Fiber Content Test Results Per 100 g Moringa Dragon Fruit Velva with the Addition of Rosela

	Formulasi Velva		
	KR01	KR02	KR03
Protein Content Test Results Per 100 grams (%)	7,10%	7,11%	6,89%
Fiber Content Test Results Per 100 grams (%)	0,99%	0,57%	0,51%

Based on Table 3, it is known that the highest protein content per 100 grams of dragon-moringa velva with the addition of rosela is found in the formulation KR02 (7.11%), followed by KR01 (7.10%) and KR03 (6.89%). This difference in protein content is relatively small, but suggests that too little amount of rosela (as in KR03) tends to lower protein levels, likely due to the lower protein contribution of rosela material.

For fiber content, the KR01 formulation showed the highest yield of 0.99%, followed by KR02 at 0.57%, and KR03 at 0.51%. This shows that the more rosela is added, the more fiber content in the product increases. Thus, although KR03 has the best hedonic acceptance, KR01 is superior in fiber content, while KR02 excels in protein content. Therefore, the selection of the best formulation needs to consider the balance between acceptability and nutritional content.

KR01, KR02, KR03

(3 formulasi velva)

The following is a hasil formulation product of dragon fruit velva moringa with the addition of rosela. There are 3 formulations of mung beans: moringa powder, namely: formulation 1 (Code KR 01) of 23.3 : 187.5 : 10, Formulation 2 (Code KR 02) of 21.67 : 187.5 : 10, and formulation 3 (Code KR

03) of 20 : 187.5 : 10. The final weight of the product is 450 g, which will be used in hedonic tests as well as laboratory tests for fiber and protein content.

DISCUSSION

Discussion of Characteristics and Hedonic Test of Moringa Dragon Fruit Velva Formulation with the Addition of Rosela

Each sample of moringa dragon fruit velva with rosella was examined in this study to determine its color, taste, aroma, and texture. In this study, the hedonic test carried out on the sample included 4 indicators, namely the texture, taste, aroma, and color of each formulation of mung bean velva with the addition of moringa powder.

a) Color

Color is the first thing seen by the panelists because the quality of the food depends on the existing color, from the existing color can give an impression to the panelists to judge[14]. Of the average values that have been obtained from 3 formulations, the formulation that received the highest average value is found in formulation 3 (KR03) with an average value of 4.24. Formulation 2 (KR02) got an average score of 3.64 and for formulation 1 (KR01) got an average score of 3.16.

This is because the composition contained in formula 1 (KR01) contains rosela higher than the two formulations, therefore the color produced is darker or dark brown because the red color in rosela mixes with the green color of moringa powder. The bright pink color produced by KR03 is most likely derived from the anthocyanin content in the dominant rosela, as conveyed by research conducted by[15] that anthocyanins not only improve the visual appearance of food products, but also provide functional value as an antioxidant.

b) Aroma

Aroma is an important tool for panelists to evaluate velva products. Aroma also determines the delicacy of the ingredients contained in an item to determine the delicacy of the food being tested[16]. The average highest aroma indicator was found in Formulation 3 (KR03) when observed based on sensory tests which was 3.24 and the lowest value for Formulation 1 (KR01) was 2.6. The findings from Agustina et al, show that the smell. Everyone has different scents, although they may recognize different scents/smells and have different feelings for liking different scents/smells.

c) Texture

Texture is one of the parameters that determine consumer acceptance. The use of many additives in the manufacture of velva can affect the visibility of velva, additional stabilizers such as CMC[18]. The use of stabilizers can reduce the size of the ice cubes as the dough freezes, making the velva softer7. Based on the average value of the hedonic test formulation 3 (KR03) of 3.92 for the formulation received the highest average value, and formulation 1 (KR01) received an average value of 2.96 for the lowest formulation. To get around this, liquid fresh milk, rosella

juice, and dragon fruit puree are thickened with CMC (*Carboxymethyl Cellulose*). Velva has a slightly softer texture due to the addition of CMC[19].

d) Taste

Taste significantly affects the level of preference of panelists, which can be used to assess the acceptability of a product12. It can be seen from the data obtained, there is a difference in the taste of each sample. The formulation with the highest average value has an average of 4 on formulation 3 (KR03). The resulting taste of velva is not sweet so granulated sugar is added to neutralize it. This study is supported by the findings of Rini et al, stating that this may be due to the combination of dragon fruit, moringa, rosella, sugar and other additives. The result of velva is not very sweet and from the taste produced by rosella which is too sour so that the result of velva obtained is slightly sour and sweet[17].

In the nutritional aspect, the KR02 formulation shows the highest protein content of 7.11% per 100 grams. This is an important finding because protein is the main nutrient in the growth of cells and tissues of children. Based on the 2019 Nutritional Adequacy Figures (AKG), the protein needs of children aged 1-3 years are 20 grams per day[20]. Adequate protein intake is essential in preventing stunting, as protein deficiency correlates with impaired linear growth and muscle mass[21].

Meanwhile, the KR01 formulation shows the highest fiber content of 0.99% per 100 grams. Dietary fiber has an important role in maintaining digestive health, improving gut microbiota function, and strengthening the child's immune system[22]. Fiber plays a role in supporting the absorption of macro and micro nutrients, as well as reducing the risk of indigestion such as diarrhea which can cause malabsorption and worsen stunting conditions[23]. Therefore, velva with a high fiber content can also contribute to the prevention of stunting indirectly through the improvement of the digestive system[24].

However, the high-fiber formulation of KR01 also contains a high intensity of moringa flavor, which the panelists did not like. This shows that there is a challenge in balancing nutritional value and product acceptability. Therefore, to increase acceptability without sacrificing nutritional value, it is necessary to make formulation modifications, such as reducing the proportion of moringa or adding natural flavors such as honey, vanilla, or cider[25].

Based on the results of the analysis, the formula (KR03) has a protein content of 6.89% and a fiber content of 0.51% per 100 grams. Referring to the 2019 Nutritional Adequacy Rate (AKG)[20], the protein requirement per day is 25 grams, while the fiber requirement is 20 grams. Snacks are given 2x a day so that snacks account for about 20% of the total daily needs. To meet the protein needs of snacks, toddlers need to consume about 73 grams of KR03 formula per day. Thus, KR03 formula has the potential to be an alternative snack that supports stunting prevention, especially in its contribution to meeting daily protein needs.

This research has several limitations that need to be considered. First, organoleptic tests were only conducted by trained adult panelists, so the results did not represent the preferences of toddlers as the main target of the product. Second, the study only measured protein and fiber content, without

including analysis of other important micronutrients such as iron, calcium, and zinc that also play a role in stunting prevention. Third, no product stability and shelf life tests were carried out, so the durability of product quality over a certain period of time is not yet known. Finally, the scope of research is still limited to the laboratory and has not been clinically tested on a population scale of toddlers to determine the impact of velva consumption on nutritional status or growth of children.

Potential bias in this study can occur at the organoleptic test stage because the assessment is subjective even though it is conducted by trained panelists. Taste, aroma, and texture preferences can be influenced by the panelists' personal experiences with ingredients such as moringa and rosemary, which have strong characteristics. In addition, bias may also arise from the inhomogeneity of manually produced velva samples, so consistency between formulations is not fully guaranteed. The use of laboratory tools and manual techniques in testing nutritional content also has the potential for variability of results that need to be anticipated with more test repeats.

CONCLUSION

Velva made from dragon fruit, moringa powder, and rosela shows potential as an alternative nutritious snack for stunted toddlers. The results of organoleptic tests showed that the formulation of KR03 (187.5 g dragon fruit: 10 g moringa : 20 g rosela) was the most preferred in terms of color, aroma, taste, and texture. Meanwhile, KR02 has the highest protein content (7.11%) and KR01 contains the highest fiber (0.99%). These findings show that the combination of local ingredients is able to produce products that are not only sensorially acceptable, but also contain essential nutrients that are important in supporting children's growth and development, especially in efforts to prevent stunting.

With these advantages, this velva has the potential to be further developed as a functional food in nutritional interventions for toddlers. Further research is recommended to include direct receptivity tests in children under five, analysis of micronutrient content such as iron, calcium, and zinc, and testing of product stability and shelf life. In addition, this product can also be directed to household-scale production or MSMEs with the support of community training and education. With a community-based approach and the use of local food, this velva can be one of the innovative solutions in the national program to accelerate stunting reduction. This research also enriched the literature related to local food innovation as a preventive nutrition intervention strategy in early childhood.

SUGGESTION

Dragon-moringa fruit velva with the addition of rosela has the potential to be developed as a nutritious snack for stunted toddlers. It is recommended to modify the formulation by lowering the content of moringa powder and adding natural flavors such as honey, vanilla, or fruit juice to increase acceptability. Follow-up research needs to include direct receptivity tests in toddlers, analysis of important micronutrients (iron, zinc, and calcium), and product stability and shelf life tests. This product is also feasible to be developed through MSMEs and community nutrition intervention

programs such as Posyandu and schools, as a local food solution that supports the acceleration of national stunting reduction.

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