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The Characteristics and Organoleptic Qualities of *Moringa oleifera* Jelly Candy Post Kelor Leave Puree Supplementation

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Abstract. *Kelor* leaves are local food that can be used as food products because of the fairly complete nutritional content. This study aimed to determine the effect of moringa leaf puree on Moringa jelly candies' organoleptic properties and get the best formulation based on the result. This research employed an experimental study using CRD with three formulas and two repetitions. Data were tested using Analysis of Variance (ANOVA) and continued with Duncan's test. The determination of the best formulation was then calculated using the effectiveness index method. The results showed that the highest average organoleptic properties which is sensory evaluation and consumer acceptability were obtained by Moringa jelly candy with 20% moringa leaves puree. The best formulation was obtained by Moringa jelly candy with 20% moringa leaf puree with a product value of 0.84. Hence, the fortification of jelly candy ingredients by adding Moringa leaves powder (MOLP) offers an alternative model for the future development of nutritional candy and healthy food.

INTRODUCTION

Moringa oleifera or known as *kelor* is one of the local plants that have many usages for human survival, almost all parts of its plant can be used, be it the roots, stems, leaves, and seeds [1]. One aspect of Moringa, which is widely used is the leaves. Moringa leaves can be used as vegetables and dried as additives for food [2–4]. Moringa leaves are known to be an ingredient that contains high nutritional contents and is easy to digest [5]. The nutrients contained include protein, fiber, vitamin A, B group, C, and K [2]. Moringa leaves also contain calcium, potassium, magnesium, iron, manganese, and copper [6]. Having such high nutritional contents, moringa leaves can be used as an ingredient to add nutritional value to products that are malnourished like white bread [2]. Moringa leaves can use to combat micronutrient deficiencies [7].

Jelly candies are more preferred by children than other kin of candies because they are easy to swallow and have a delicious taste [8]. The various type of jelly candy and their attractive colors are the main attraction for children. Generally, jelly candy's main ingredients are water, flavor, and thickening agents such as gelatin, so it has a chewy texture and a transparent color. The highest content of conventional jelly candy is sugar while lacking in other nutrients, such as vitamins and minerals. The addition of vegetables such as moringa leaves in a jelly candy mixture is yet to be found. Meanwhile, the use of vegetables as additives provide a better nutritional content of the product[8,9]. It can be the basis for new product development by using green vegetables in moringa leaves to make jelly candy. Besides adding color to jelly candy, the use of green vegetables also augments nutritional values. It also affects the organoleptic properties of the products produced. Organoleptic properties are the assessment of food products by the

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senses possessed by a human. Sensory attributes play an important role in determining the acceptability of a product [10]. Organoleptic assessment is essential to measure the acceptance rate and product evaluation. This study aims to determine the effect of different moringa leaf puree percentage on moringa jelly candies' organoleptic properties included sensory evaluation and consumer acceptability, then determine the best formulation based on the results.

EXPERIMENTAL DETAILS

Materials

The ingredients used in the making of moringa jelly candy are moringa leaves obtained in the District of Sawojajar, Malang, and other ingredients comprised of sugar, gelatin, glucose syrup, and citric acid, and candy dryers obtained in a cake shop in Malang. The tools used in making moringa jelly candy include a digital scale, measuring cup, blender, filter cloth, small glass bowl, stainless pan, spoon, spatula, thermometer, timer, and mold.

Method

The study was conducted using experimental research with randomized design (CRD). Prior to being processed into jelly candy, moringa leaves were grinded into a puree after blanched. The treatment used in this study was a formulation using different percentages of moringa leaf puree, namely F1 = 20% moringa leaf puree, F2 = 30% moringa leaf puree, and F3 = 30% moringa leaf puree with two repetitions. The process was followed by two organoleptic test in the form of a sensory evaluation test and a consumer acceptability test in terms of color, taste, aroma, and texture. Sixty students of the industrial engineering study program were involved for the sensory evaluation test and 60 children with a range of 8 - 12 years were involved for the consumer acceptability test. Organoleptic tests were carried out by giving product samples alternately with plain water as a flavor enhancer. The assessment of organoleptic properties used an assessment sheet for the sensory evaluation test and the consumer acceptability test covering taste, color, aroma, and texture with a score range of 1 - 5. The range of values on the sensory evaluation test is different for each trait provided; a score of 1 is given to the worst property, and a score of 5 represents the best property. The score range on the consumer acceptability test, which includes taste, color, aroma, and texture, has a score of 1 given to the unpreferred property and a score of 5 on the preferred property. The data were collected in the forms of sensory evaluation and consumer acceptability assessments in terms of taste, color, aroma, and texture of Moringa jelly candy.

RESULTS AND DISCUSSION

Organoleptic Properties

Organoleptic testing was carried out through sensory assessment, namely by tasting the taste, observing color, aroma, and the texture of the product. The discussion of organoleptic properties was divided into two groups, group one is the sensory evaluation which explained the evaluation of the product by the panelists', then group two is the consumer acceptability which explained the acceptance of the product.

Sensory Evaluation

The result of the moringa jelly candy sensory evaluation test can be seen in Figure 1. The score range used was 1-5, with the parameters assessed comprised taste, color, aroma, and texture of Moringa jelly candy. The sensory evaluation in terms of Moringa jelly candy's sweetness using different percentages of moringa leaf puree is slightly sweet enough indicates with a score range of 4.15 – 4.40. The result of ANOVA analysis shows a significance of 0.043, followed by Duncan’s test showing that the jelly candy formulation with a percentage of 20% moringa leaf puree was significantly different from other formulations. The decrease in the level of the sweet flavor of Moringa jelly candy is caused by citric acid, which can dissimulate sweet flavor, especially in products using less moringa leaf puree portion [11]. The use of citric acid and glucose syrup can enhance the taste of jelly candy so that the sour taste appears more and reduces the sweetness value in the formulation of 20% moringa leaf puree. The addition of citric acid can spur taste on products, thus giving more value to the taste [12].

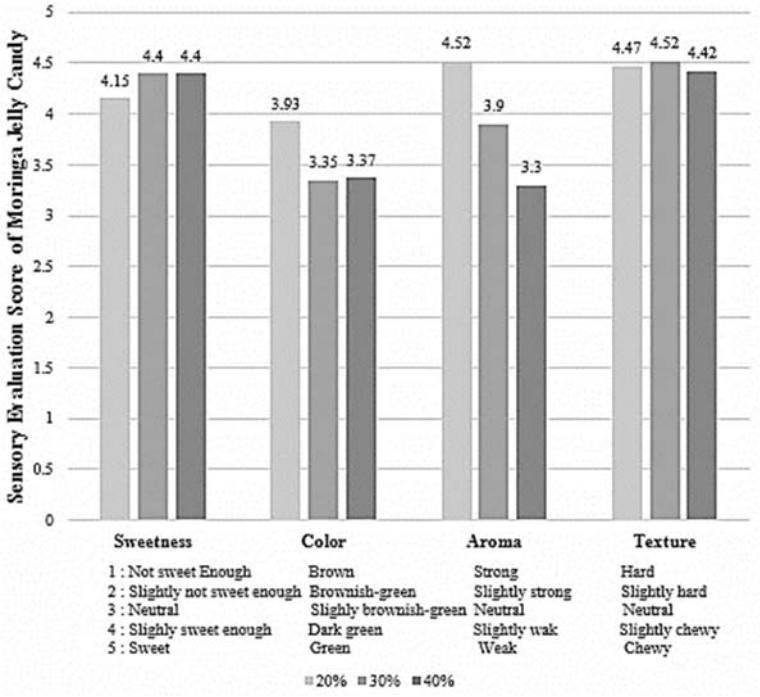

FIGURE 1. Result of Sensory Evaluation Test on Moringa Jelly Candy

The sensory evaluation in terms of Moringa jelly candy's color using a different percentage of moringa leaf puree is slightly brownish-green with a score range of 3.35 – 3.93. The result of ANOVA analysis shows a significance of 0.001, followed by Duncan's test showing that the jelly candy formulation with a percentage of 20% moringa leaf puree was significantly different from other formulations. Color is an essential characteristic in a product, especially a jelly candy product [8]. The blanching process carried out in the making of moringa leaf puree changes the leaves' green color into brown. The chlorophyll content in moringa leaves is oxidized and becomes pheophytin at high temperatures[13,14]. The addition of citric acid in the making of Moringa jelly candy causes an acidic atmosphere during the process, so that the color of the jelly candy turns brown. Adding more portions of moringa leaf puree will create a darker color that makes it less attractive [14]. The green color that arises on bread from the chlorophyll content in Moringa leaf flour is less liked by panelists [2].

The sensory evaluation in terms of Moringa jelly candy's aroma shows that the jelly candy with different percentages of moringa leaf puree produces an odor ranging from neutral to slightly weak odor with a score range of 3.30 – 4.52. Based on the result of ANOVA analysis, it shows a significance of 0.000, followed by Duncan's test showing that Moringa jelly candy's aroma has a significant difference in each formulation. The good and bad impression of a product can be seen from the aroma it has. Aroma arises due to a mixture of various food ingredients, which creates a distinctive odor [15]. The higher the percentage of moringa leaf puree used in jelly candy, the more unpleasant the odor of the product. Blanching as an effort to reduce the unpleasant aroma of Moringa jelly candy remains less effective. The unpleasant aroma produced by Moringa jelly candy is caused by the content of lipoxidase enzymes and essential oils in moringa leaves. Lipoxidase enzymes and oils have volatile properties, producing a distinctive aroma that is less preferred [16]. The volatile substances are well kept in the gelatin [8].

The sensory evaluation in terms of Moringa jelly candy's texture with different percentages of moringa leaf puree was slightly chewy with a score range of 4.42 – 4.52. Based on the ANOVA test result, the use of different moringa leaf puree does not have a significant texture with a p value of 0.593. The texture is one of the organoleptic attributes related to taste, namely the mouth and the sense of touch as detectors of properties such as crunchy, soft, coarse, smooth, fibrous, and chewy. The use of moringa leaf puree does not affect the texture of Moringa jelly candy. The texture of jelly candy is mainly obtained from gelatin, which has reversible properties. The main texture of jelly candy made with gelatin is affected by its concentration and pH [8]. Gelatin gives a characteristic chewy texture b suitable hardness, and appropriate transparency [17].

Consumer Acceptability

The result of the moringa jelly candy consumer acceptability test can be seen in Figure 2. The result of the consumer acceptability test (preference) for the overall Moringa jelly candy shows that the jelly candy formulation with 20% moringa leaf puree is superior to other formulations. The consumer acceptability taste of the Moringa jelly candy shows a score range of 3.57 – 4.57. The result of ANOVA analysis shows a significance of 0.000, followed by Duncan's test showing that the jelly candy formulation with a percentage of 20% moringa leaf puree was significantly different from other formulations. The decreased consumer acceptability scores can occur due to a bitter taste, since moringa leaves contain tannin [18]. Tannin will produce a bitter taste in the mouth, which affects the preference of panelists [19]. In addition, the increasing number of moringa leaf puree added will strengthen the unpleasant taste and aroma of moringa leaves. The addition of 15% dry moringa leaves gives an unpleasant after-taste and bitter taste in making cookies. The difference between the sensory evaluation score and the consumer acceptabilityscore shows that the panelists prefer the taste of Moringa jelly candy being moderate sweetness and the taste of moringa leaves to be dissimulated [20].

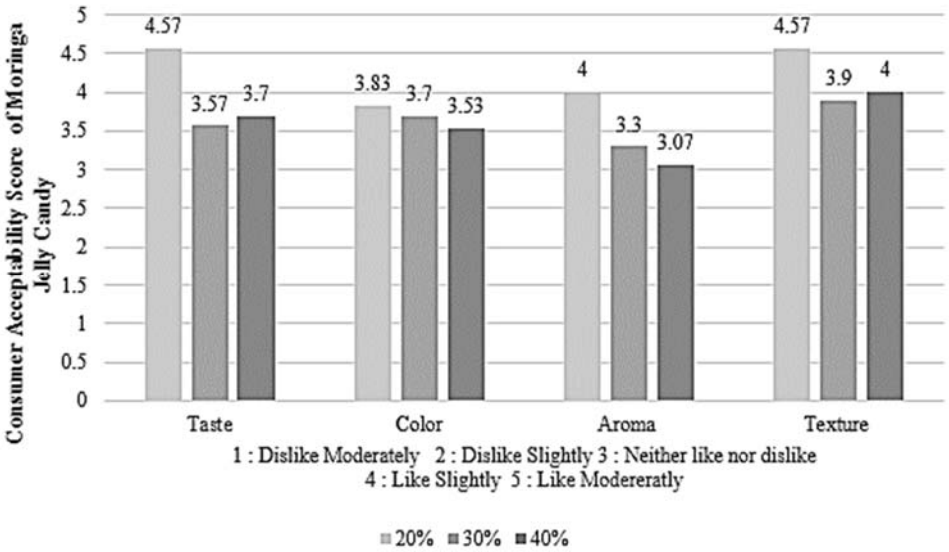

FIGURE 2. Result of Consumer Acceptability Test on Moringa Jelly Candy

The consumer acceptability property in terms of Moringa jelly candy's color shows a score range of 3.53 – 3.83. Based on the result of ANOVA analysis, it shows a significance of 0.113. The use of different moringa leaf puree in the making of jelly candy does not make a significant difference. When seen in terms of color, the 20% moringa leaf puree has the highest score in the two organoleptic tests than the other two formulations. The sensory evaluation of Moringa jelly candy is directly proportional to the level of preference of the panelists. The green color on bread from the chlorophyll content in moringa leaf flour is less by consumers [2]. It is supported by [21] state that the higher the amount of moringa leaf powder added in the making of cookies, it will produce dark brownish green cookies less preferred by panelists who tend to prefer light brownish green colored cookies. The making of crispy moringa noodles showed the highest addition of moringa puree gave a better rating from the panelists than the formulation with more moringa leaf puree [22].

The consumer acceptability property in terms of the aroma of Moringa jelly candy shows a score range of 3.07 – 4.00. The result of ANOVA analysis shows a significance of 0.000, followed by Duncan's test showing that the jelly candy formulation with a percentage of 20% moringa leaf puree is significantly different from other formulations. The panelists' level of preference to the aroma of Moringa jelly candy is directly proportional to the sensory evaluation of Moringa jelly candy, where the product formulations containing more moringa leaf puree produce a stronger unpleasant aroma, thus decreased preference. The decrease in the score that occurs is due to the unpleasant aroma of moringa leaves, which becomes stronger with the more percentage of moringa leaf puree added. Previous studies show that the addition of moringa leaves juice on the candy products will give a rotten smell of the product [12]. The

production of crispy noodles gets the highest panelist acceptance value in the formulation of moringa puree with the least amount of 10% [22].

The texture of the Moringa jelly candy has an average of 3.9 to 4.57. Based on the ANOVA analysis, it shows a significance of 0.000, followed by Duncan's test showing that the jelly candy formulation with a percentage of 20% moringa leaf puree is significantly different from other formulations. The texture is an index of food quality that can be assessed by the fingers, tongue, and palate. Moringa jelly candy formulation with the most preferred texture is the jelly candy with a percentage of 20% moringa leaf puree. The texture of the jelly candy highly depends on the amount of gelatin used [8]. Moringa jelly candy formulation with the most preferred texture is jelly candy with a percentage of 20% moringa leaf puree. However, the sensory evaluation result shows that the jelly moringa candy's texture does not differ as the texture of the jelly candy is mainly derived from the amount of gelatin used [11]. The significant level of preference is due to the fact that the texture of the jelly candy with 20% moringa leaf puree is the closest to the texture of jelly candy in general. Moreover, the different result obtained on the two sensory tests may be caused by the selection of different panelists. The panelists for the sensory evaluation test were semi-trained so that the results obtained were more neutral, while the children selected for the consumer acceptability (preference) test tended to be more sensitive to food textures. Several study findings state that children are not interested in products that look healthy and less attractive. Children tend to choose snacks that are familiar and prefer their tastes [23].

Best Formula

The calculation in terms of the effectiveness index of Moringa jelly candy can be seen in Table 1. The calculation of the effectiveness index of Moringa jelly candy with the best formulation based on the assessment of its organoleptic properties is the jelly candy formulation using 20% moringa leaf puree with the highest product value (NP) of 0.84. The results obtained are based on the calculation of all the organoleptic values of each formulation. The jelly candy formulation with moringa leaf puree of 20% had a favorable acceptance value for each parameter so that it received a high product value compared to other formulation. Moringa jelly candy with the best formulation has organoleptic properties like slightly sweet enough, slightly brownish-green color, slightly weak odor aroma, and have a slightly chewy texture.

TABLE 1. Effectiveness index of Moringa jelly candy

Effectiveness index of Moringa jelly candy								
Variables	**BV**	**BN**	**20%**		**30%**		**40%**	
			NE	**NP**	**NE**	**NP**	**NE**	**NP**
Sensory evaluation of taste	0.5	0.09	0	0	1	0.09	1	0.09
Sensory evaluation of color	0.6	0.11	1	0.11	0	0	0.034	0.00374
Sensory evaluation of aroma	0.8	0.14	1	0.14	0.49	0.0686	0	0
Sensory evaluation of texture	0.75	0.14	0.5	0.07	1	0.14	0	0
Consumer acceptability of taste	0.5	0.09	1	0.09	0	0	0.13	0.0117
Consumer acceptability of color	0.6	0.11	1	0.11	0.57	0.0627	0	0
Consumer acceptability of aroma	0.8	0.14	1	0.14	0.25	0.035	0	0
Consumer acceptability of texture	1	0.18	1	0.18	0.15	0.027	0	0
Total NP			*0.84			0.4233		0.10544

Notes: BV : Variable weight; BN : Weighted value; NE : Effectiveness value; NP : Product value;
*: The best formulation

SUMMARY

This study finds that the use of different percentages (20%, 30% and 40%) of moringa leaf puree affects the organoleptic properties of Moringa jelly candy. The sensory evaluation in terms of the sweetness of Moringa jelly candy is slightly sweet. The sensory evaluation in terms of the color of Moringa jelly candy is slightly brownish-green. The best formulation of Moringa jelly candy is obtained from the product with 20% moringa leaf puree, of which product value (NP) of 0.84. Further research on nutritional analysis and packaging of Moringa jelly candy is required to become a functional food.

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