CHARACTERISTICS OF TAMARILLO JELLY DRINK USING VARIOUS SUGAR CONCENTRATION AND THE PROPORTION OF PAPAYAS AS A HEALTHY DRINK FOR SCHOOL CHILDREN

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Abstract

Jelly drinks are popular drinks for school children. As a healthy alternative for school children, the tamarillo jelly is made from natural ingredients which contains as like as vitamin C. This study aimed to determine the best formula between proportion of papayas, sugar concentration, physicocemical and vitamin C every serving size based on Recommended Daily Allowance (RDA). This study used Randomized Block Design (RBD) with 2 factors were examined that consist of proportion tamarillo: papaya (A) of 70%:30% (A1); 60%:40% (A2); 50%:50% (A3), and the sugar concentration (B) at 10% (B1); 15% (B2); 20% (B3). Six combinations of treatments were repeated for two times producing 18 experimental units. The organoleptic variable analyzed by Friedman test, if there were significant different continued by Comparative Test Dual 5% and the best product used Effectiveness Index Test. Treatment was done by combining tamarillos and papayas in certain proportions. It resulted in different effects on the organoleptic variables comprising of color, aroma, texture, taste and preference.

The treatment that produces the best jelly drink contain a 50% proportion of papaya and a 15% the concentration of sugar (A3B2) with organoleptic properties such as yellowish red color; chewy texture; sweetness; and tend to preference with physicochemical properties pH 4; sugar reduction of 2.87% and viscosity of 1520 cP. This product provided a vitamin C contribution of 63.6-70.7% RDA with a serving size of 140-157 ml.

Keywords: School children, jelly drink, tamarillo, papaya, vitamin C

Introduction

Consuming street snacks and being food selective have become a lifestyle and habit of school children. They often ignore nutritional content as a preference factor. It influences their nutritional dietary is closely related to their growth (Proverawati et al., 2008). This habit should be a concern for all parties in order to avoid nutritional deficiency-related diseases (Saputri et al., 2012). Colored beverages or syrups, iced drinks, jelly or agar, and meatball soup have been categorized as unhealthy food for years (Kemenkes RI, 2015). In addition, 90 percent of the population over 10 years old in central Java are indicated to consume vegetables and fruits at a low quantity (Riskesdas, 2013). The low quantity consumption of vegetables and fruits than required by school children might cause vitamin deficiency especially vitamin C which is commonly found in vegetables and fruits. Vitamin C is a kind of vitamin that is water-soluble (Guyton & Hall, 2007). Therefore, it can be an appealing concept to produce food and beverages by utilizing the nature of this vitamin. One potential product for this concept is jelly drink (Nuraini, 2007). Jelly drink is a gel-textured drink consistently composed by thick liquid which can be easily sucked and contains a high concentration of water. Gel composition relies on hydrocolloid substances. Using tamarillos as the main ingredient, it is necessary to add thickener or hydrocolloid as they contain a low composition of Pectin (Cahyana, 2005). This pectin can be found in papayas. Another essential ingredient is sugar which provides sweetness and serves as the thickener which binds free water molecules to increase viscosity (Anggraini, 2008). Jelly drink in the current market contains artificial sweeteners such as natrium siklamat, aspartame, natrium benzoat, cloudifier, and food colorings. Thus, it is suggested to provide a healthier alternative for child consumption. One prominent option is to use tamarillos as the main ingredient due to their appealing aroma (Kumalaningsih dan Suprayogi, 2006). The production of tamarillos is steadily increasing from 482.305 tons in 2010 to 518.448 tons in 2012 (BPS, 2013). Despite its less optimal use, this fruit contains various
nutritional contents. It contains 29.8 mg of vitamin C per 100 grams of tamarillos (Sivakumaram and Huffman, 2017). Based on this finding, this study is conducted to produce a new variant of the jelly drink using tamarillos as the main ingredient. It is expected that this product can be a healthy alternative for child consumption and fulfill the need of vitamin C for school children.

Methods

This study is an experimental study using a Randomized Group Design (RBD) method. with 2 factors, the proportion of tamarillo: papaya (A) by 70%: 30% (A1); 60%: 40% (A2); 50%: 50% (A3), sugar concentration (B) of 10% (B1); 15% (B2); 20% (B3). The sample in this study was 18 experimental units. The independent variables in this study are the proportion of papaya and the concentration of sugar. The dependent variable in this study is organoleptic nature (color, flavor, taste, texture and preference).

Results and discussions

The result of the analysis revealed that vitamin c content of tamarillos is 140.8 mg per 100 grams. It means that tamarillos can be harnessed as the main ingredient of a jelly drink which contains high content of vitamin c for school children. Papayas can be used as a natural pectin source which also contains vitamin C at 20 mg per 100 grams. The daily nutritional adequacy of vitamin c for children at the age of 4-6 years old and 7-9 years old is 45 mg and 50 mg for 10-12 years old. Based on the daily adequacy of vitamin c for school children, tamarillos and papayas used in this study can meet the daily supply of 281.6-312.9% and 40-44.4% of vitamin C.

A. Organoleptic variable

The analysis of organoleptic variables (textures, colors, aromas, sweetness, and preferences) showed that the treatment of combining tamarillos and papayas on a certain proportion coupled with sugar concentration (AxB) significantly influenced textures, colors, aromas, sweetness and preferences.

1. Color

The highest average score for color was found in the formula A2B2 which contained a 60% : 40% proportion of tamarillos to papayas and a 15% sugar concentration at 3.92 (red). The lowest score was found in the formula A3B3 which contained a 50% : 50% proportion of tamarillos to papayas and a 20% sugar concentration at 2.82 (yellowish-red). It shows that the higher proportion of tamarillos resulted in more red color of the jelly drink. It was caused by the anthocyanin compound which provided purplish-red on the skin and flesh of tamarillos (Diniyah et al., 2010). It can be seen on Figure 1.

![Figure 1. Average value of Jelly drink color in a combination of the proportion of Tamarillo porridge: Papaya porridge: sugar concentration (AxB)](image)

A study by Pandiangan et al. (2017) showed that panelist evaluation on the color of jelly made from tamarillos and papayas tend to increase based on the rise of the proportion of tamarillos and the decrease of the proportion of papayas. The color was from the fruits’ pigments. Papayas contain a yellowish pigment while tamarillos contain a red pigment.
2. Flavor

The highest average score for flavor was found in the formula A1B2 which contained a 70% : 30% proportion of tamarillos to papayas and a 15% sugar concentration at 2.58 (strong). The lowest score was found in the formula A3B1 which contained a 50% : 50% proportion of tamarillos to papayas and a 10% sugar concentration at 2 (slightly strong). The higher proportion of tamarillos resulted in a stronger aroma of the jelly drink. It shows that the aroma of tamarillos for this treatment could be differentiated by the panelists. It can be seen in Figure 2.

![Figure 2: Average value of Jelly drink aroma in the combination of the proportion of Tamarillo Porridge: Papaya porridge:sugar concentration (AxB)](image)

In line with a study of tamarillos jam production, the higher volume of tamarillos resulted in the stronger aroma of this fruit (Megawati et al., 2017). The aroma of a product could be detected as volatile substances of that product entered nasal passage and were received by the olfactory system. The volume of volatile substances was influenced by temperature and the nature of constructing substances of the product (Dewi, 2011). Winarno (2008) asserted that aroma-constructing components of fruits comprise ester compounds which are vaporable or volatile.

3. Texture

The highest average score for texture was found in the formula A3B3 which contained a 50% : 50% proportion of tamarillos to papayas and a 20% sugar concentration at 2.56 (chewy). The lowest score was found in the formula A1B1 which contained a 70% : 30% proportion of tamarillos to papayas and a 20% sugar concentration at 1.48 (not chewy). It can be seen on Figure 3.

![Figure 3: Average Value of Jelly Drink Texture in the Combination of Dutch Eggplant Porridge Proportion: Papaya Porridge:Sugar Concentration (AxB)](image)
The texture is defined as the nature of an ingredient which can be observed by eyes, skin, and muscles of the mouth. It is a description about ingredient attributes resulted from a combination of physical and chemical characteristics extensively received through skin contact, sights, and hearing (Lewis, 2000). It can be concluded that the higher proportion of papayas resulted in the higher rate of chewiness of the jelly drink texture. As Vania et al. (2017) asserted, the construction of the jelly drink gel becomes more solid indicating a higher rate of chewiness as the concentration of pectin increases. Papayas contain a high concentration of pectin which can be used as a natural pectin source to produce jelly drinks. The higher concentration of pectin resulted in a chewier texture as the free water content in jelly drinks was bound by molecules resulted by pectin hydrophilic groups. It caused the formation of the gel. The higher concentration of pectin resulted in a higher volume of absorbed and bound free water producing denser jelly (Sugiarso dan Nisa, 2015). Dealing with the effect of sugar concentration on jelly drink, it is shown that the increase of sugar concentration led to an increase of chewiness rate. Sinaga et al. (2008) suggested that the increase of sugar content in the tamarillos jelly resulted in a higher rate of chewiness. Sugar serves not only as a sweetener, but it also forms the texture. The balance existence of pectin in the liquid mixture and water on the surface of pectin will be affected by sugar concentration (Gardjito et al., 2005). The ability to bind water increased which led to higher sugar concentration and a more solid texture.

4. Sweetness

The highest average score for sweetness was found in the formula A3B3 which contained a 50% : 50% proportion of tamarillos to papayas and a 20% sugar concentration at 4.6 (sweet). The lowest score was found in the formula A1B1 which contained a 70% : 30% proportion of tamarillos to papayas and a 10% sugar concentration at 3.74 (sour-sweet). The higher proportion of papayas resulted in slightly low sweetness of the jelly drink. It can be seen on Figure 4.

Figure 4. Average value of Jelly drink flavor in the combination of the proportion of Tamarillo Porridge: Papaya porridge with sugar concentration (AxB)

A similar study by Pandiangan et al. (2017) in an attempt to produce tamarillo and papaya-based jam asserted that a higher proportion of papayas resulted in a higher sweetness level. On the contrary, the higher proportion of tamarillos resulted in a higher sourness level of the jam. Papayas contain pure sugar comprising glucose and fructose. It means that the higher proportion of papayas results in the higher sweetness rate. Muchedin (2004) highlighted that sweetness rate is influenced by glucose and fructose composition of a product. A high proportion of papayas created jelly drink with a high rate of sweetness. Sugar concentration in jelly drink affected the sweetness. It is in line with a study conducted by Kurnia (2017) in an attempt to produce tamarillos based jam. It was found that the larger content of sugar increased the sweetness. The sweetness of a product is originated from the ingredients. The additional ingredients might affect the sweetness during the treatment and cooking process (Kumalaningsih, 2007).

5. Preference

The highest average score for preference was found in the formula A1B2 which contained a 70% : 30% proportion of tamarillos to papayas and a 15% sugar concentration at 2.58 (preferable). The lowest score was found in the formula A1B1 which contained a 70% : 30% proportion of tamarillos to papayas and a 10% sugar concentration at 1.98 (less preferable). Panelists’ preference was influenced by colors, aromas, textures, and sweetness of the jelly drink.
Based on the organoleptic test, the most preferable characteristic of the jelly drink possesses red color, strong aroma, chewy texture, and sweet sweetness. It is in line with Aksara et al. (2016) stating that panelists’ preference of the jelly drink is inclined towards sweet sweetness. Furthermore, Drewnowski et al. (2012) asserted that sweet sweetness can attract higher satisfaction as indicated in the area of esophagus and pancreas.

**B. The best treatment**

The result showed that the best treatment according to affectability index test of organoleptic variables was the jelly drink formula A3B2 which contained a 50% proportion of papayas and a 15% sugar concentration. Based on the vitamin C content of the best treatment of the jelly drink (A3B2), it was found that vitamin C content was as much as 31.8 mg/100 grams. The high concentration of pectin can form colloid dispersion (double helix structure) in a larger volume and stronger structure resulting in the prevention of vitamin C oxidation and thus sustaining a larger amount of vitamin C. The higher structure of double helix of pectin strongly suspended vitamin C content through its strong matrix. The denser structure of gel prevented oxygen and the cofactors from causing vitamin C oxidation (Agustin dan Widya, 2014). Jelly drink possessing pH 4 is on the category of acidic beverage with an acidic limit of consumable acidic drink possessed pH 3.5 (Desnilasari and Lestari, 2014). The best treatment was formula A3B2 containing a 50% : 50% proportion of tamarillos to papayas and 15% sugar concentration providing the 63.6-70.7% of daily supply of vitamin C for school children. It can be an alternative of vitamin supply for school children who tend to consume vegetables and fruit in a small quantity. This tendency might lead to nutritional deficiency of vitamin especially vitamin C. High deficiencies of vitamin C might lead to scurvy while low deficiencies might lead to exhaustion, anorexia, muscle pain, stress vulnerability and infection (Champe et al., 2010). Infection is an influencing factor of nutritional status (WHO, 2008). Children who suffer from nutritional deficiencies might seem pale and less energetic resulting in a decrease in their learning concentration and their learning achievement. Their learning capabilities will also decrease due to less optimal brain growth (Anindya, 2009) Therefore, students’ habit and behavior should be changed by providing the required guidance and education through pictorial stories. While for mothers, audiovisual media can be utilized (Purnamasari et al., 2017). Vitamin C is known as an antioxidant which neutralizes free radicals. It helps to construct collagen, healing sprue, increasing the healing rate of wounds as well as strengthening immunities against infection and stress (Sibagariang, 2010).

**Conclusions**

The best treatment of jelly drink was formula A3B2 containing a 50% : 50% proportion of tamarillos to papayas and 15% sugar concentration providing the 63.6-70.7% of daily supply of vitamin C for school children, that characterized by yellowish-red color, chewy texture, slightly strong aroma; high sweetness; and strongly preferable with pH 4, 2.87% sugar reduction, and viscosity of 1520 cP.

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References


