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Characteristics Apple Fruit Bar: Addition Green Tea, Moringa Leaves Tea, and Bay Leaves Tea

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A B S T R A C T

Because about 95% of polyphenols do not absorb in the small intestine and instead enter the large intestine, they can provide calming or anti-stress benefits. Therefore, we developed Fruit Bar products using phenol-rich food ingredients like green tea, dried moringa, and dried bay leaves. This study aims to determine the effect of adding different infusions and types of tea on the quality of Fruit bars. This study used a Completely Randomized Design (CRD) with two factors: the type of tea (green tea, moringa leaf tea, bay leaf tea) and the amount of infusion added (40%, 50%, 60%), and the results were analyzed using 5% ANOVA. The best result came from adding 60% green tea infusion, which led to a water content of 23.00%, a pH of 3.5, crude fiber of 0.93%, a polyphenol content of 25.83 mg GAE/g, and an antioxidant activity of 78%.

Contribution to Sustainable Development Goals (SDGs):
SDG 3: Good Health and Well-being
SDG 12: Responsible Consumption and Production

1. INTRODUCTION

1.1. Research Background

Fruit bars supplemented with food ingredients containing calming compounds can be developed to address the increasing problem of depression in Indonesia. Fruit bars are food products made by destroying the original fruit structure and adding sugar, acid, and pectin to produce attractively coloured products with a soft, chewy texture and sweet taste [1]. Fruit bars are generally only made from puree, either a single fruit or a combination of various fruits. However, in this study, fruit bars were made with green tea infusion, moringa leaf, and bay leaf tea to add value to the apple fruit bar product produced. The development of snack bar products with the addition of honey and kimpul starch to dried fruit and cereal snack bars produces snack bars rich in fiber nutrition, namely 5.76% and calories of 362.18 kcal. The fiber and calorie content is higher than commercial products [2]. Another study also developed a snack bar product from mackerel flour with jackfruit, durian, and cempedak seeds to reduce stunting. The best RUTF snack bar treatment was produced, a product made from 85% durian seed flour and 15% mackerel flour, with a water content of 2.89% and an ash content of 4.02%. Fat content 44.85%. Protein content 41.53%. And carbohydrate content is 6.71% [3].

In this study, food ingredients with calming benefits are green tea, moringa leaf tea, and bay leaf tea. Green tea was used in this study because green tea has a total phenol of 1.3708 ± 0.0049 (mgGAE / g) and flavonoids 0.1991 ± 0.011 mgQE / g. The second ingredient used is moringa leaf tea [4]. Moringa leaf tea was used in this study because Moringa leaves can reduce heat stress in rabbits [5]. Polyphenol content in Moringa leaves can provide calming benefits and can reduce anxiety. Dried Moringa leaves are a good source of polyphenols, ranging from 2,090–12,200 mg AEG/100g [10].

The third ingredient used is bay leaf tea. Bay leaves are good for health because they contain antioxidants. In addition, bay leaves also have benefits for reducing stress because bay leaf tea contains a total phenol of 240.29 ± 9.48 mgGAE/L and a total flavonoid of 61.61 ± 0.97 mg QE/L [6].

Based on the description above, this study manufactured fruit bars made from apple puree, adding green tea, moringa leaf tea, and bay leaf tea with different concentrations as alternative snacks high in polyphenols and antioxidants that can provide calming benefits. Apple fruit bar products will be tested for physical characteristics, proximate, antioxidant, and polyphenol content, and sensory tests to obtain the best formulation.

1.2. Literature Review

Fruit bar is a food product made by destroying the original fruit structure by smoothing and restructuring it in a gel of sugar, acid, and pectin which produces an attractively colored product, with a soft, chewy texture, and sweet taste. The beneficial role of Fruit bar production is the ease of preserving fruit to control post-harvest losses. Several types of Fruit bars have been developed using different fruits, either singly or in combination [1].

Green tea is processed without fermentation by steaming fresh leaves at high temperatures to maintain polyphenol content and inactivate enzymes that can oxidize [8]. reen tea has a total phenol of 1.3708 ± 0.0049 (mgGAE/g) and flavonoids of 0.1991 ± 0.011 mgQE/g [4].

Moringa oleifera is a plant that has various health benefits [9]. Dried moringa leaves can provide calming benefits for mice experiencing heat stress. Moringa leaves have benefits that can calm anxiety in pregnant women because they contain polyphenol compounds [5]. Polyphenols in moringa leaves have the potential to be a drug in the field of mental health. The range of polyphenols in dried moringa leaves is 2,090–12,200 mg GAE/100g [10]. Bay leaves are a well-known culinary ingredient that is widely used in food. In addition, bay leaves are also used as medicine to treat various health diseases [6]. Consuming boiled bay leaves can lower systolic and diastolic blood pressure. This can happen because bay leaves contain flavonoid compounds that act as vasodilators of blood vessels [11]. Bay leaf tea contains total phenols of 240.29 ± 9.48 mgGAE/L and total flavonoids of 61.61 ± 0.97 mg QE/L [7].

1.3 Research Objective

To find out the effect of adding different brews and types of tea on the quality of the fruit bars produced.

2 MATERIALS AND METHODS

2.1 Materials

The raw materials for making Fruit bars consist of apples, moringa leaves, green tea, bay leaves, citric acid, and sugar obtained from the Pucuk District market, Lamongan Regency. Pectin was obtained from an online store in Surabaya. The analysis materials consist of Fruit bar samples; H_2SO_4 (Merck); NAOH (Merck); Aquades; methanol (Merck); ethanol (Merck), HCl (Merck), DPPH reagent (Sigma Aldrich), Folin-Ciocalteu reagent (Merck), Na_2CO_3 (Merck), Gallic acid (Merck), Quercetin (Sigma), $AlCl_3$ (Merck).

2.2 Research Procedure

This study used a Completely Randomized Design (CRD) factorial pattern with two factors, where factor I is the type of tea added consisting of three types of tea, namely green tea, moringa leaf tea, and bay leaf tea. Factor II is the amount of added tea infusion consisting of three levels, namely 40%, 50%, and 60%, each treatment was repeated twice so that 18 experimental units were obtained.

2.3 Making Fruit Bars

a. Apple puree is added with sugar (10%), citric acid (0.03%), and pectin (5%), then stirred until homogeneous.
b. Addition of different types of tea infusions according to the following treatments:
   - Addition of the amount of green tea infusion: 40%, 50%, and 60%
   - Addition of the amount of moringa leaf tea infusion: 40%, 50%, and 60%
   - Addition of the amount of bay leaf tea infusion: 40%, 50%, and 60%
c. Dough molding
d. Dough poured into a tray with a thickness of 0.3 cm.
e. Drying the dough
f. The dough in the pan is put into the oven at a temperature of 55oC for 3.5 hours.
g. Cutting

3 RESULT AND DISCUSSION

3.1 Moisture Content

Table 1 shows that apple fruit bar with the addition of 60% bay leaf tea infusion has the highest water content. Meanwhile, the sample with the lowest water content is the addition of 40% green tea infusion. The analysis results in Table 1 show that the higher the percentage of tea infusion added to each treatment of different types of tea, the higher the water content of the apple fruit bar. This can happen because the water content of the apple fruit bar is influenced by the type and percentage of the amount of tea infusion added. One factor affecting the water content in apple fruit bar products in this study is the pH value. Water content of fruit bars from a mixture of bananas (*Musa sapientum*) and cashews (*Anacardium accidentally*) has an inverse relationship with the pH value, namely the higher the pH value, the lower the water content of the fruit bar [13].

Table 1. Results of analysis of water content, pH, and crude fiber

Treatment		Water Content	pH
Tea	**Infuse**		
Green tea	40%	21.63±0.78^{a}	3.96±0.02^{f}
	50%	21.88±0.46^{ab}	3.81±0.01^{e}
	60%	22.62±0.58^{abc}	3.54±0.01^{b}
Moringa leaf tea	40%	22.37±0.73^{ab}	3.70±0.01^{d}
	50%	24.07±0.62^{c}	3.58±0.03^{bc}
	60%	26.83±0.72^{de}	3.48±0.01^{a}
Bay leaf tea	40%	21.87±0.69^{a}	3.77±0.03^{e}
	50%	26.31±0.81^{d}	3.60±0.02^{c}
	60%	28.46±0.63^{e}	3.45±0.03^{a}

Note: The average value followed by different letter notations is a significant difference

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3.2 pH

Table 1 shows that apple fruit bar with the addition of 40% green tea infusion has the highest water content. Meanwhile, the sample with the lowest pH is the addition of 60% bay leaf tea infusion. The results of the analysis showed that the pH value of each treatment of different types of tea decreased along with the increasing percentage of tea infusion added. The decrease in pH of each sample occurred gradually along with the increasing percentage of the amount of tea infusion added. This can happen because the pH value of the apple fruit bar is influenced by the pH of the raw materials. The lower the pH of the raw materials, the lower the pH value of the apple fruit bar product. Analysis of raw materials showed that the pH values of green tea infusion, moringa leaf tea, and bay leaf tea were 5.80, 5.76, and 5.64, respectively. These results are in line with the statement that the pH of the sample decreased with an increasing concentration of acidic cashew fruit puree [13].

Table 2. Results of analysis of antioxidant activity and polyphenol levels of apple fruit bar

Treatment		Polyphenols (mg GAE/g)	Antioxidant activity (%)
Tea	Infuse		
Green tea	40%	14.42 ± 0.28^{d}	69.83 ± 0.38d
	50%	17.35 ± 0.14^{e}	73.62 ± 0.84e
	60%	25.83 ± 0.55^{g}	78.01 ± 0.92f
Moringa leaf tea	40%	11.96 ± 0.52^{c}	58.07 ± 0.61b
	50%	13.86 ± 0.31^{d}	65.33 ± 0.31c
	60%	23.27 ± 0.45^{f}	69.99 ± 0.61d
Bay leaf tea	40%	4.44 ± 0.17^{a}	45.56 ± 0.08a
	50%	10.96 ± 0.41^{b}	45.88 ± 0.23a
	60%	12.03 ± 0.41^{c}	46.32 ± 0.23a

3.3. Polyphenols

Table 2 shows that the lowest polyphenol content of apple fruit bar is 40% bay leaf tea infusion, while the highest polyphenol content of apple fruit bar is found in the 60% green tea infusion treatment. This can occur because the polyphenol content in each type of tea is different. Based on testing the raw materials' polyphenol content, green tea's polyphenol content is higher than that of moringa leaf tea and bay leaf tea. The polyphenol content of green tea, moringa leaf tea, and bay leaf tea based on the results of raw material analysis are respectively 39.35 mg GAE/mL; 13.62 mg GAE/mL; and 2.51 mg GAE/mL. This is in line with the literature stating that green tea contains polyphenols of 30 mg GAE/mL [16], moringa leaf tea 1550 mg GAE/100mL [15], and bay leaf tea 240.29 ± 9.48 mg GAE/L [7].

3.4 Antioxidant Activity

Table 2 shows that the lowest antioxidant activity of apple fruit bar is in the treatment of adding 40% bay leaf tea infusion, while the highest antioxidant activity of the apple fruit bar is in the treatment of adding 60% green tea infusion. This can occur because the antioxidant activity in each tea type is different. Based on testing the antioxidant activity content of raw materials, green tea's antioxidant activity is higher than moringa leaf tea and bay leaf tea. The antioxidant activity of green tea infusion, moringa leaf tea, and bay leaf tea based on the results of raw material testing, were respectively 90.92%; 80.55%; and 58.18%. The antioxidant activity of green tea is 90.54% [16]. This is complemented by the statement that green tea has a high antioxidant content due to its high catechin content. In addition, the polyphenol content influences the sample is antioxidant activity. Antioxidant activity has a direct relationship with the polyphenol content. The higher the polyphenol content, the higher the antioxidant activity [17].

CONCLUSION

The phenol content and antioxidant activity of green tea infusion were higher than moringa and bay leaf tea. The best treatment was adding 60% green tea infusion which resulted in a water content of 22.62%; pH 3.5; polyphenol content of 25.83 mg GAE/g; and antioxidant activity of 78%.

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