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Proportion optimization of honey pineapple juice on the custard organoleptic and chemical properties

Siti Susanti, Lutviana Tiaswuni, Ahmad Ni'matullah Al-Baarri, Yasmin Aulia Rachma
Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang, Indonesia

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ABSTRACT

Custard is categorized as a dairy product that has a sweet taste, soft, and thick texture. The addition of honey pineapple to custard making is an innovation to improve the organoleptic and chemical characteristics of custard. The purpose of this study is to know the effect of adding honey pineapple juice on the organoleptic and chemical properties of pineapple custard. The experimental design used 5 treatments and 4 replications. The study began with the process of making custard products according to the addition of honey pineapple juice treatments there are P0 (control), P1 (20%), P2 (40%), P3 (60%), and P4 (80%). The test method is done by organoleptic and proximate analysis tests. The results of the organoleptic test showed that the addition of honey pineapple juice affects the color, taste, aroma, and overall preference of pineapple custard. Proximate analysis showed that the addition of pineapple juice honey affected the water content, ash content, fat content, and carbohydrate content of pineapple custard. This study concludes that the difference in the proportion of pineapple honey affects the organoleptic and chemical characteristics of pineapple custard.

Corresponding Author:

Siti Susanti
Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University
Prof. Soedarto St., SH Tembalang-Semarang 50275, Indonesia
Email: sitisusanti@live.undip.ac.id

1. INTRODUCTION

Custard is a dairy product that has a soft and thick texture with a sweet taste. Custard can be categorized as a snack or dessert and can be consumed by various groups of people, from children, and adolescents, to adults. Its soft characteristics and thick consistency make custard a product that is often used as topping, filling, or decorating of various types of cakes. Custard is generally made from a mixture of egg yolks, cornstarch, sugar, and milk. The ingredients used have their respective roles so that they affect the result of the custard character. To add flavor, ingredients such as vanilla are often added to custard products. However, the development of a richer custard flavor has not done much. The addition of fruits will result in a custard with a new flavor. The addition of strawberries in the process of making custard affects the chemical and sensory characteristics of custard [1]. Meanwhile, until now pineapple has never been found as a flavor enhancer in custard.

Pineapple (*Ananas comosus (L) Mer*) is a tropical fruit that is easily found in Indonesia. The type of pineapple that grows in Indonesia is honey pineapple with a sweet taste, fragrant aroma, and reddish yellow skin color. Honey pineapple is also included as fruits that have quite complete bioactive compounds. Pineapple honey contains vitamin C, vitamin A, calcium, phosphorus, magnesium, iron, sodium, potassium, and sucrose [2]. Based on the results of proximate analysis, the nutritional content of fresh honey pineapple per 100 grams is 85.3% water; 8.29% carbohydrates; 0.54% protein; and 0.12% fat [3].

Honey pineapple has a yellow pulp with a sweet-sour taste. The yellow color of honey pineapple indicates that honey pineapple contains carotenoid pigments, such as beta-carotene which is a compound with high antioxidant activity [4]. The content of beta-carotene in fresh pineapple reaches 35 micrograms in every 100 grams of pineapple [5]. In addition, honey pineapple also contains 1.79 grams of glucose, 4.59 grams of sucrose, and 1.94 grams of fructose in every 100 grams of the fruit [6]. This makes honey pineapple have a sweeter taste than other types of pineapple. As a plant that can grow all year round, the number of honey pineapples in Indonesia is quite abundant. This is shown by the increase in pineapple production over the past five years from 1,396,153.00 tons in 2016 to 2,886, 417.00 tons in 2021. However, the high production of honey pineapple is not offset by high consumption rates. According to data from the *Survei Sosial Ekonomi Nasional* (SUSENAS) in 2017, the level of pineapple consumption per capita per year was 0.469 kg. The amount is relatively low compared to the consumption of other types of fruit such as oranges and apples. Pineapple is also a perishable fruit that can only survive for 2 to 3 days after picking the ripe fruit [7]. This causes many pineapples that are not used to end up being rotten.

Although it has various advantages and benefits, honey pineapple processing has not been done optimally. Utilization of honey pineapple as a food product is still limited to products with relatively simple processing. Based on its nutritional content and characteristics, honey pineapple has great potential to be developed into custard products. Making custard with the addition of honey pineapple is one of the innovations to diversify custard products. Previous research by Ali [8] added dates, red beetroot, golden berries, and whole prickly pear to make custard which showed that the addition of these various fruits significantly increased antioxidant activity, minerals, and the level of panelist acceptance. Research by Hamad *et al.* [9] states that the addition of pineapple to the manufacture of probiotic drinks increases the acid and mineral levels of the product. The absence of research related to the use of honey pineapple in custard has encouraged researchers to examine the organoleptic and chemical characteristics of optimizing the addition of honey pineapple juice.

Honey pineapple is added in the form of juice because of its properties easier to process and digest, more durable, and have the same quality as the original fruit [10]. This study was conducted to determine the optimization of the proportion of honey pineapple juice in pineapple custard products. The benefit of this study is to increase the diversification of custard products and create custard products that have better organoleptic and chemical characteristics.

2. RESEARCH METHOD

2.1. Making honey pineapple juice

The process of making honey pineapple juice begins with stripping ripe honey pineapple that has a yellowish skin color obtained from Superindo followed by washing the pulp of the fruit. Then the cutting of the fruit pulp into small sizes (1×1×1 cm) to facilitate the smoothing process. Refinement is carried out with a tools blender (Cosmos) with a ratio of pineapple honey and water 8:1. The refining process is done until the honey pineapple becomes puree. Puree of honey pineapple then filtered with a filter cloth so that the result of honey pineapple juice is soft.

2.2. Making pineapple custard

Custard preparation is carried out according to [11] procedure with some modifications. The production process begins with mixing egg yolks (35 g) and sugar (60 g) with a whisk until evenly marked with a dough that does not spill when the container is turned over. Add cornstarch (25 g) and stir again with whisk until evenly distributed and no lumps. Brew milk powder (30 g) with lukewarm boiled water to a volume of 200 ml. Wait for the milk to cool, then add the honey pineapple juice according to the treatment 0, 20, 40, 60, and 80% (as seen in Table 1). Heat the milk and honey pineapple juice mixture using a saucepan over low heat until it boils. After boiling, turn off the stove and add the mixture of milk and honey pineapple juice to the mixture of egg yolks, sugar, and cornstarch little by little while stirring until the mixture is evenly mixed. Next, put the mixed dough back into the pan and heat it over low heat until it thickens.

Table 1. Composition of pineapple juice custard

Materials	Treatment material (%)				
	0	20	40	60	80
*Honey pineapple juice	0	40	80	120	160
Powdered milk solution (ml)	200	200	200	200	200
Egg yolks (g)	35	35	35	35	35
Granulated sugar (g)	60	60	60	60	60
Cornstarch (g)	25	25	25	25	25

*) is % of powdered milk solution

2.3. Parameter analysis

2.3.1. Organoleptic test

The organoleptic tests are carried out using the scoring method. The test was conducted with 25 panelists who were instructed to assess the parameters of color, pineapple aroma, viscosity, pineapple flavor, and preferences. Panelists were asked to provide a sensory score (numerical scale 1-4) for each sample based on the parameters in Table 2 to determine the sample's sensory characteristics.

Table 2. Numerical scale of organoleptic test parameters

Numerical scale	Parameters				
	Color parameter	Pineapple aroma	Viscosity	Pineapple flavor	Preferences
1	Not yellow	Does not smell	Not thick	Does not feel	Not like
2	Rather yellow	Rather smells	Rather thick	Rather feels	Rather like
3	Enough yellow	Enough smells	Quite thick	Enough feels	Quite like
4	Yellow	Smells	Thick	Feels	Like

2.3.2. Chemical characteristic test

Chemical analysis of pineapple custard is done by proximate analysis method. Chemical parameters tested include water, ash, protein, fat, and carbohydrate content. The analysis methods were done by measuring the water content by the thermogravimetric method [12], ash content by the furnace method [13], protein content by the Kjeldahl method [14], fat content by the Soxhlet method [15], and carbohydrate content by difference method [16]. Each test was carried out with 3 repetitions.

2.4. Data analysis

Organoleptic test data obtained from this study will be analyzed using the Kruskal-Wallis test with a significance level of 5%. When the results of the Kruskal-Wallis test show the effect of the treatment, that will be carried out further tests with the Mann-Whitney test. Meanwhile, data from the proximate analysis will be analyzed by the analysis of variance (ANOVA) test using a significance level of 5%. If the results of the analysis of ANOVA show the effect of the treatment, that will be carried out further tests with Duncan's multiple range test (DMRT) to determine the differences between treatments. Data analysis was performed using the SPSS 26.0 application for Windows.

3. RESULTS AND DISCUSSION

From this research, we found that the concentration of honey pineapple juice added in making custard correlates with the organoleptic and chemical characteristics of custard. The results of the organoleptic assessment by panelists of pineapple custard products can be seen in Table 3. Our findings show the addition of honey pineapple juice significantly affects the characteristics of organoleptic custard viewed from the parameters of color, aroma, flavor, and preferences, but no significant effect on the viscosity of the custard. These results are related to [11], which stated that the addition of some tropical fruits such as tamarind, soursop, and lime affects the sensory characteristics of custard. This influences the color, aroma, consistency, taste, and overall acceptance of the panelists. The more honey pineapple juice is added, the more yellow the custard color is produced. This also applies to the parameters of aroma and flavor where the more honey pineapple juice is added, the result of pineapple aroma and flavor are getting stronger. We also found that the more honey pineapple juice is added, the higher the panelist's assessment of the custard color. The flesh of honey pineapple fruit is yellow derived from carotenoid pigments called beta-carotene and xanthophyll [17]. Both color pigments are commonly used as food coloring. Beta-carotene is one of the pigments that contribute yellow, orange, and red colors [18]. This causes the more proportion of honey pineapple juice added, the color of the custard product will be more yellow. Color is the first characteristic assessed by consumers. Color becomes an important attribute that influences consumer decisions in buying or consuming products [2].

Table 3. Organoleptic characteristics of pineapple custard

Parameters	Honey pineapple juice additions (%)				
	0	20	40	60	80
Color	1.84 ± 0.62^{a}	2.62 ± 0.65^{b}	3.24 ± 0.52^{c}	3.48 ± 0.59^{c}	$3.96\pm0,2^{d}$
Pineapple aroma	1.2 ± 0.58^{a}	1.92 ± 0.86^{b}	2.84 ± 0.69^{c}	3.04 ± 0.84^{c}	3.64 ± 0.76^{d}
Viscosity	3.32 ± 0.9	3.2 ± 0.76	3.08 ± 0.64	3.36 ± 0.76	2.96 ± 0.89
Pineapple flavor	1.2 ± 0.5^{a}	2.4 ± 0.87^{b}	$2.76\pm0.72b^{c}$	2.96 ± 0.84^{c}	3.6 ± 0.76^{d}
Preferences	2.32 ± 0.9^{a}	2.52 ± 0.59^{a}	2.96 ± 0.89^{b}	3.12 ± 0.73^{b}	3.24 ± 1.13^{b}

Remarks of Table 3: the values in the table represent the mean (average) ③ standard deviation. The values that are followed by different letters on the same line show a real difference ($p<0.05$) based on the Kruskal-Wallis test followed by the Mann-Whitney test.

Aroma is one of the sensory attributes measured by the sense of smell [19]. Aroma is caused by volatile compounds that are in food ingredients in an amount of less than 100 ppm [20]. Consumers tend to like the specific aroma of products. The more honey pineapple juice is added, the panelist's assessment of the pineapple aroma in the custard is higher. This is due to the fragrant and characteristic aroma that honey pineapple has. The distinctive aroma of honey pineapple comes from volatile substances in the methyl ester and ethyl ester groups such as methyl butyrate, ethyl butyrate, and ethyl hexanoate Honey pineapple fruit used in this research is the ripe one so that the aroma is more fragrant [21]. There is an increase in the number of volatile compounds in the ripe pineapples.

Taste attributes can be measured by the sense of taste in the form of the tongue. Taste includes flavor components are a combination of aroma and stimulation on the tongue [22]. The more honey pineapple juice is added, the panelist's assessment of the pineapple flavor in the custard is higher. Honey pineapple has a sugar content of 8.29% so it has a fairly sweet taste. Honey pineapple also has a distinctive taste caused by the content of acid compounds in the form of citric acid and malic acid [23]. This causes the more the addition of honey pineapple juice, the pineapple flavor in the custard will be stronger.

Consumer preference for a product is closely related to the level of acceptance. Food products are acceptable if factors such as color, aroma, texture, and taste meet consumer expectations [24]. The level of liking for a product is a combination of visual assessment, sense of taste, and sense of smell. Analysis of the data in Table 3 shows that the difference in the proportion of honey pineapple juice has a significant effect on the level of preference for custard produced. Data from the assessment of panelists showed that the panelists liked the custard with the addition of honey pineapple juice. This is because the addition of honey pineapple juice can improve the color, aroma, and flavor attributes of the custard.

Table 4 shows the finding that the addition of honey pineapple juice significantly affects the chemical characteristics of pineapple custard viewed from the parameters of water content, ash content, fat content, and carbohydrate content but has no significant effect on the protein content of custard. This research shows that the more honey pineapple juice is added, the water content of the custard is increasing. This also applies to the ash content parameters. Meanwhile, the addition of honey pineapple juice lowers the fat and carbohydrate levels of the custard.

Table 4. Chemical characteristics of pineapple custard

Parameters	Honey pineapple juice additions (%)				
	0	20	40	60	80
Water content	60.22 ± 1.70^{a}	63.00 ± 1.09^{b}	63.99 ± 1.90^{b}	68.23 ± 1.09^{c}	71.80 ± 0.45^{d}
Ash content	0.48 ± 0.07^{a}	0.53 ± 0.001^{a}	0.59 ± 0.03^{b}	0.62 ± 0.01^{bc}	0.64 ± 0.02^{c}
Fat content	3.37 ± 0.35^{b}	$3.36.65\pm0.43^{b}$	3.35 ± 0.19^{b}	2.91 ± 0.45^{ab}	2.61 ± 0.13^{a}
Protein content	2.29 ± 1.25	2.60 ± 0.49	3.43 ± 1.03	3.44 ± 0.83	3.45 ± 1.52
Carbohydrates content	33.64 ± 2.62^{d}	30.51 ± 2.01^{cd}	28.64 ± 2.92^{c}	24.80 ± 0.83^{b}	21.50 ± 1.78^{a}

Remarks of Table 4: the values in the table represent the mean (average) ③ standard deviation. The values followed by different letters on the same line show a real difference ($p<0.05$) based on the ANOVA test followed by Duncan's test.

The addition of honey pineapple juice with different proportions significantly affects the water content. It increases with the increasing number of honey pineapple juice added. Honey pineapple juice has a high-water content, so the increase in the proportion of honey pineapple juice added also increases the water content of the product. In addition, water content is also influenced by the pectin content in honey pineapple. Pectin can form a gel through hydrogen bonding of water with free carboxyl groups and hydroxyl groups in pectin which makes the bound water difficult to release [25]. The concentration of pectin in honey pineapple fruit is 2.3% by dry weight with a pH of about 4-5. The content of pectin and the acidity level in the pulp of honey pineapple is quite capable of forming a gel that can confine water to the tissue material.

The Ash content test is done by using the furnace method with a temperature of 600 ºC to obtain perfect ash. The addition of honey pineapple juice with different proportions significantly affects the ash content. The more proportion of honey pineapple juice is added, the ash content of the custard is increased. The ash content is influenced by the mineral content of a substance. Honey pineapple has an ash content of 1.80% with a mineral content of 0.28 mg of Iron; 12 mg of Magnesium; 16 mg of Calcium; 150 mg of Potassium; and 0.10 mg of Zinc in every 100 g of the material [26]. This causes the addition of honey pineapple juice in custard can increase the ash content. This result is in agreement with [8] states that the

addition of natural sources such as dates, red beetroot, golden berries, and whole prickly pear significantly increases the ash content of custard.

The fat content test was done by the Soxhlet method, called extraction using n-hexane solvent [27]. Fats are non-polar organic compounds, so they can be dissolved in n-hexane which is an organic solvent and nonpolar. The addition of honey pineapple juice in different proportions significantly affects the fat content of custard. The more proportion of honey pineapple juice is added, the fat content of the custard decreases. Pineapple contains the bromelain enzyme, which belongs to proteolytic enzymes. Proteolytic enzymes can break down proteins into free amino acids. Fat in food is covered by protein. When the protein is denatured by proteolytic enzymes, the fat in the food tissue will come out [28]. During the cooking process, the fat will be degraded so that the fat content decreases with the addition of honey pineapple juice. The decrease in fat content is also due to the content of active substances such as saponins, vitamin C, flavonoids, and tannins in pineapple which can reduce fat accumulation [29]. This result is in agreement with [9] that the addition of pineapple juice to the probiotic beverage did not show a significant increase or even a decrease because the fat content in honey pineapple is very small and is often damaged during the processing process.

The carbohydrate content test is done through the by-difference method which is 100% reduced by the percentage of total water content, ash content, fat content, and protein content. The addition of honey pineapple juice with different proportions significantly affects the carbohydrate content of the custard. The greater the proportion of honey pineapple juice added, the ash content of the custard decreases. Pineapple honey has a fairly high carbohydrate content of 13.7%. The decline in the carbohydrate content of the custard occurs due to the method difference depending on the results of other proximate analyses of water content, ash content, fat content, and protein content [30]. With the higher content of other nutrients than carbohydrates, the carbohydrate content by difference is getting downhill. The decrease in carbohydrate content is also influenced by the heating process. The heating causes hydrolysis which makes the ability to bind the water material decrease, so the constituent of the simple carbohydrates is clumping [31]. This study has investigated comprehensive research about the organoleptic and chemical characteristics of custard on the optimation of honey pineapple addition proportion. However, additional in-depth research may be required to know its physical and shelf-life characteristics.

4. CONCLUSION

Our research shows that the additional proportion of honey pineapple juice in custard making affects the characteristics of color, flavor, and aroma as well as water, ash, fat, and carbohydrate content. The addition of honey pineapple juice from P2 to P4 can increase the value of the panelist's preference for custard products. The best formulation of custard preferred by the panelists is the addition of honey pineapple juice with P4 treatment (the addition of honey pineapple juice as much as 80%).

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BIOGRAPHIES OF AUTHORS

Siti Susanti has a Ph.D. degree in Agricultural Sciences majoring in Bioscience Molecular from Kagoshima University, Japan in 2013, Veterinarian (Faculty of Veterinary Medicine) (Gadjah Mada University, Indonesia). Currently, she is a Lecturer at the Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Indonesia. Her research interest includes in vitro and preclinical tests on various functional food potential product development. She can be contacted at email: sitisusanti@live.undip.ac.id.

Lutviana Tiaswuni is a final-year student at the Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Indonesia. She interned at several food companies to learn the quality control of food products. She also participated in several community service programs related to food such as the development of livestock farming community groups, women, and elderly related to SDG. She can be contacted at email: lutvianatiaswuni@students.undip.ac.id.

Ahmad Ni'matullah Al-Baarri is a Ph.D. in Food Science from Kagawa University, Japan in 2010, Magister Science (MSc) (Agricultural Sciences) (Gadjah Mada University, Indonesia), BSc (Dairy Science) (Gadjah Mada University, Indonesia). Currently, he is a Lecturer at the Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Indonesia. His research on food enzymes and immobilization has been published in national and international journals. And also active in various organizations such as PATPI Semarang and the Indonesian Food Technologist Community. He can be contacted at email: albari@lecturer.undip.ac.id.

Yasmin Aulia Rachma is a Master in Food Science and Technology from Gadjah Mada University, Indonesia, in 2021 and Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, in 2018. Her research interests include functional food development and processing technology, especially physiological processing techniques, namely germination. She can be contacted at email: yasminar1906@gmail.com.