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The Effect of the Addition of *Turmeric* and *Temulawak* on the Hedonic Value of Starfruit Syrup

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ABSTRACT
One of the efforts that can be made to prevent the spread of Covid-19 is to increase the body's immunity, especially for residents who are affected. The purpose of this study was to determine the results of the starfruit syrup made with the addition of the herbal ingredients of turmeric (*Curcuma longa*) and *temulawak* (*Curcuma xanthorhiza Roxb*). The experiment was carried out with four treatments, namely: starfruit syrup (A); starfruit syrup with the addition of turmeric (B); starfruit syrup with the addition of *temulawak* (C); and starfruit syrup with the addition of *temulawak* and turmeric (D). This study aims to determine the effect of variations in the addition of the two herbal ingredients on the hedonic quality of syrup. The data collection technique used the hedonic test with 30 respondents. The hedonic test was performed using the nonparametric test by SPSS 26 method to see the viscosity, color, taste, and aroma values and if they were significantly different then continued with Duncan's continued test. The results showed that there was an effect of variations in the addition of herbal ingredients on the hedonic quality of the syrup. The best product for processing starfruit syrup was treatment C with the addition of *temulawak* with color quality specifications (very liked), taste quality (very liked), viscosity level (very liked), and aroma quality (liked).

Keywords: *Syrup, Starfruit, Turmeric, Temulawak, Hedonic Value*

1. INTRODUCTION

Wuluh starfruit (*Averrhoa bilimbi L.*) is a plant that is commonly found in Indonesia, and the price is cheap. Starfruit is one type of plant that is often used as traditional medicine. This plant is widely used to treat various diseases such as coughs, diabetes, rheumatism, mouth sores, toothaches, bleeding gums, acne, diarrhea, and high blood pressure [1]. Besides, the research results [2] stated that starfruit can be used as an antibiofilm, namely increasing defense mechanisms for bacteria including defense against physical force, phagocytosis by immune system cells, and protecting against the penetration of toxic compounds like antibiotics. The potential of other starfruit was also stated by [3] which states that a plant that can grow to a height of 5 - 10 meters is useful as a cough medicine, rheumatism, canker sores, and toothache. The water in the fruit can also be used for making syrup [4]. In 100 grams of fruit contains 36 calories; water 92.9 g; vitamin C 35 mg; and phosphorus 13 mg [5], also contain vitamins A, B, and C [6].

Thus, starfruit has the potential to be developed as a processed food product. One of them is in the form of syrup. The syrup is a type of drink in the form of a thick solution with various flavors according to the raw material [7]. Fruit syrup is a syrup made from fruit raw materials.

This research developed an innovation in processing starfruit into syrup products. To increase its benefits, starfruit syrup is added with turmeric (*Curcuma longa L*) and *temulawak* (*Curcuma zanthorrhiza*). The benefits of turmeric and *temulawak* in single or combined use can increase body resistance as an immunomodulator [8]. Turmeric and *temulawak* contain natural metabolite compounds in the form of curcumin. Curcumin has various therapeutic potentials such as antibiotics, antivirals, antioxidants, anti-cancer, and treat Alzheimer's disease.

Various pharmacological studies have been carried out on curcumin. One of the concerns at this time is the effect of curcumin on healing Covid-19. This has been known since the SARS epidemic that occurred in 2003. The receptor that plays a role, namely SARS-CoV-2 is an

angiotensin-converting enzyme 2 (ACE2). ACE2 can be fixed to the cell and the soluble does not stick to the cell. Research on curcumin compounds as single or pure compounds reported increasing ACE2 in trial subjects [9].

Meanwhile, the processing of starfruit into syrup on a household and home industry scale can be done with simple tools and processes. Starfruit is easy to obtain, as are turmeric and *temulawak*.

The urgency of the research is based on the fact that starfruit grows well in tropical areas. Its abundant fruit is often left to rot on the tree or allowed to fall. Its sour taste causes people not to consume this fruit fresh. Therefore, the development of processed food products is based on starfruit in the form of packaged syrup drinks.

2. METHOD

2.1. Equipment and Materials

The equipment used for processing herbal starfruit syrup is plastic bowl, stainless steel knives, scales, juicers, boiling pans, and gas stoves. While the materials used in this research are starfruit, sugar, turmeric, and *temulawak*. The sugar used is liquid.

2.2. Research Procedure

The processing of starfruit syrup includes the following stages: fruit sorting, fruit extraction, filtering, boiling, and bottling. The selected fruit is of good quality and is ripe enough [10]. The stages in making fruit juice are sorting, washing, removing unused parts (defective/rotten), cutting, blanching, extracting fruit juice, and filtering [11]. The washing process should be carried out with running water so that contaminants can be minimized [12]. The following is a flow chart of the starfruit syrup making process.

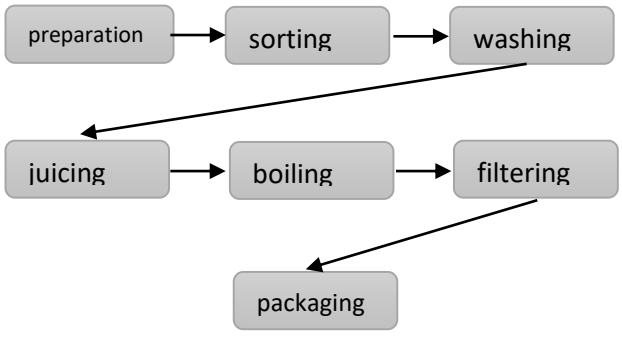

Figure 1 Flow chart of the syrup manufacturing process

The product consists of four variations, namely: starfruit syrup (A); starfruit syrup with variations in the addition of turmeric (B); starfruit syrup with variations in the addition of *temulawak* (C); and starfruit syrup with variations in the addition of turmeric and *temulawak* (D).

2.3. Data Collection and Analysis Techniques

Hedonic organoleptic testing was applied in this study using a score sheet on the google form application and distributed using the WhatsApp link. Panelists consist of trained and untrained panels totaling 30 people. The elements to be assessed in the syrup product including color, aroma, and viscosity. Meanwhile, the assessment of the diluted syrup includes color, aroma, viscosity, taste, and preferences. The scale used consists of 4 scales (1-4), namely: 1 = Dislike; 2 = rather like; 3 = Like; 4 = Really like. The specific treatment design can be seen in the following table.

Table 1. Design of starfruit syrup treatment

Treatment	Descriptions
A	Starfruit syrup without the addition
B	Starfruit syrup with the addition of turmeric (*Curcuma longa*)
C	Wuluh starfruit syrup with the addition of *temulawak* (*Curcuma xanthorhiza Roxb*)
D	Starfruit syrup with the addition of turmeric (*Curcuma longa*) and *temulawak* (*Curcuma xanthorhiza Roxb*)

The results of the hedonic test of starfruit syrup were analyzed using SPSS 26 nonparametric statistics, with a significance level of 95%. Determination of selected products using the Bayes method.

3. RESULTS AND DISCUSSION

3.1. Color

The results of the hedonic test of starfruit syrup showed the standard deviation value of the hedonic test for the color of starfruit syrup as shown in Figure 2 showing that the panelist acceptance rate for the highest color parameter was obtained by syrup B for the like criteria. Syrup C received the highest response among the three other syrup ratings. Meanwhile, panelists considered syrup A to be the least preferred syrup among the three other syrups. The type of syrup that has the lowest score has a less attractive, less clean, and slightly dull note. Meanwhile, the best rating for syrup B got an assessment that showed the criteria were bright yellow. Panelists assessed that the color criteria for each syrup had no contrasting differences. This assessment is based on records which state that the ingredients used in syrup, both curcuma and curcumin, have the same color substance. In addition, the panelists rated syrup A as having a pale color and contrasting with other syrup

colors. This is what causes the syrup to be rated with the highest dislike criteria.

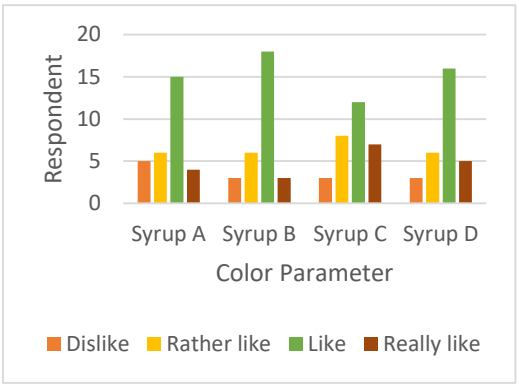

Figure 2 The average value of the hedonic test color parameters

The results of the nonparametric analysis of the hedonic test for color showed that the effect of adding turmeric and *temulawak* did not show no significant difference in syrup color (P >0.05).

The color of the starfruit syrup looked the same for all treatments and there was no significant color change. The addition of turmeric and ginger caused the panelists' acceptance of the colors to tend to decrease. The mixture of sugar and starfruit juice contained in the starfruit syrup is thought to cause the color of the syrup to be dominated by brownish color. In the treatment of starfruit syrup which has been added with turmeric and temulawak, the color of the syrup turns dark brown. The panelists' preference for starfruit syrup was highest in treatment A (without the addition of turmeric and *temulawak*) because the color of the syrup produced tended to be light brown. Meanwhile, if it is in the form of a drink, the highest color score is owned by treatment C (adding *temulawak*).

Following the research conducted by [14], which states that the high concentration of acid in the starfruit syrup processing and the addition of ingredients containing curcumin will cause the syrup to turn brown. Also added by Rahmani, et al. [15] that the higher the sugar concentration and the heating time the more crystalline granules in the starfruit syrup.

In the process of giving sugar to food, followed by heating, browning often occurs due to caramelization of the syrup, thereby reducing the value of panelists' acceptance of the color. Research result [16] states that sugar has properties that can cause a browning reaction so that a solution of sucrose is evaporated so that its concentration will increase, as well as the boiling point. In line with research [17] which states that the oxygen molecules in contact with the product will immediately enter the reaction chain and cause the oxidation of the pigment acid to oxidize, resulting in a color change in the starfruit syrup.

3.2. Flavor

Panelists' assessment of aroma parameters can be seen in Figure 3 below. It is clear that there is a significant difference in syrup D. As many as 20 panelists expressed their preference for the aroma of the combination of curcuma and turmeric. Followed by syrup C with a total of 14 panelists. Meanwhile, syrup A and B did not show significant differences in this aroma criteria. Evidenced by the criteria given (like). However, in terms of aroma, syrup A received the most evaluation from the panelists for the very like criteria. The reason is that there is an unfamiliar aroma, and there is an additional aroma. Meanwhile, treatment A had the highest value (really liked), because according to the panelists, the syrup had a fresh aroma. The results of the nonparametric analysis stated that the concentrations of turmeric and temulawak showed significant differences in the aroma parameters of the starfruit syrup (P < 0.05).

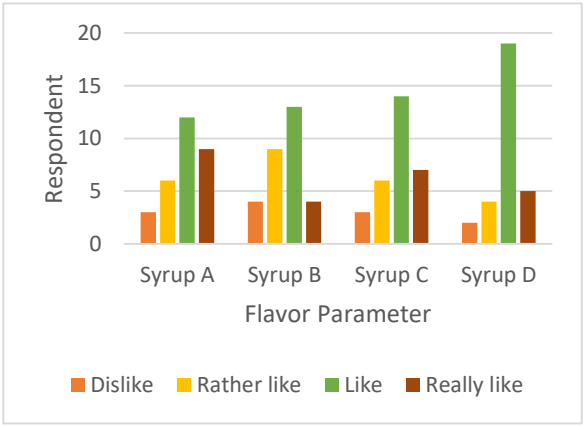

Figure 3 The average value of the hedonic aroma test parameters

According to [18], although caramelization can cause discoloration, if the process continues, it will produce an aroma that consumers prefer depending on the type of additives provided. Also added by [19], freshly processed starfruit syrup tends to be preferred by consumers because there is no physical deviation such as odor. Research result [19] states that changes in the cell structure contained in curcumin can affect the smell and taste of certain ingredients, especially during the heating process, so that cell damage can reduce nutritional value and cause odor and taste irregularities.

3.3. Viscosity

Based on the average value of the hedonic test in Figure 4, the viscosity parameter of starfruit syrup shows that not much different from the aroma assessment parameters. Panelists considered that D syrup was liked by its consistency level with like criteria. Meanwhile, for

the same criteria, syrup C and D were followed. Meanwhile, the panelists rated syrup as the most preferred for syrup A. Meanwhile, syrup D also received the most responses for the least like criteria.

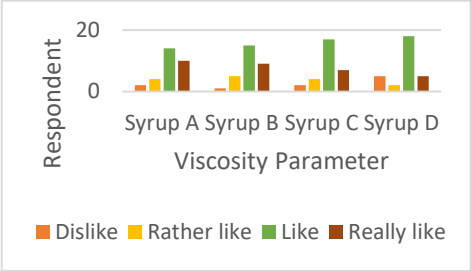

Figure 4 The average value of the hedonic test viscosity parameter

The results of nonparametric analysis showed that the effect of sugar concentration and the addition of turmeric and *temulawak* was not significantly different on the viscosity level of the starfruit syrup. (P > 0.05). The average value of panelist acceptance on the hedonic test shows that the panelists' assessment is almost the same and the value range is not too far away for each treatment. However, the panelists' ratings tended to increase with the addition of ginger. The lower water content occurs due to the increase in sugar concentration and heating time so that the syrup texture becomes thicker and more compact and affects the panelists' acceptance rate of the viscosity of starfruit syrup.

Table 2. Test Statistics[a,b]

	Color	Flavor	Viscosity
Kruskal-Wallis H	8.912	8.871	4.096
df	3	3	3
Asymp. Sig.	.030	.031	.251

a. Kruskal Wallis Test

b. Grouping Variable: Treatment

Starfruit syrup viscosity level tends to be high with increasing sugar concentration and heating time. This treatment causes the syrup to look thicker due to the low water content. In line with research results [20], which states that the use of hygroscopic sugar in starfruit syrup causes the syrup's thickness to become compact.

3.4. Taste

The average value of the hedonic test (Figure 5) for the taste of starfruit syrup shows that the lowest value of the panelist's preference is in treatment A (rather like it), and the highest value is based on the panelist's preference in treatment C (like) with very good taste criteria.

The results of analysis test (P<0.05) for the taste hedonic test of starfruit syrup showed a significant difference between the combination of turmeric and ginger treatments on the taste of the starfruit syrup. The results of Duncan's continued test stated that treatment D showed a significant difference in all treatments.

Based on the average value in the hedonic test, it can be seen that the more types of ingredients are added, the lower the value of panelists' acceptance of the taste of starfruit syrup. The concentration of turmeric and *temulawak* is thought to cause the consistency of the liquid starfruit syrup to be higher. Also, the subjectivity of the panelists might affect the taste assessment of starfruit syrup, namely that some like products with a high concentration of turmeric and some do not like it.

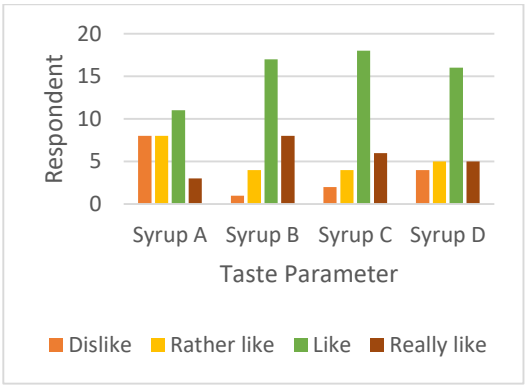

Figure 5 The average value of the hedonic test taste parameter

[21] stated that the level of preference for the panelists towards starfruit syrup tended to decrease with the increase in other additives provided. It is because the content of curcumin that seeps into the syrup is getting more and more, causing my taste. Added by [2], that the high concentration of turmeric and *temulawak* causes the taste of the starfruit syrup product sometimes not liked by consumers. According to [21], the amount of sugar used will determine the level of taste and aroma that the syrup produces. It is also added that the amount of addition of other ingredients in the ideal syrup ranges from 15% - 25% by weight of the main ingredients.

3.4.1 Selected product quality characteristics

The Bayes method is a technique that can be used to perform analysis in making the best decisions from several alternatives to produce optimal results. Before being analyzed using the Bayes method, several observed parameters were ranked based on the importance index of the expert's opinion (Table 3).

The determination of the best product is seen based on the highest total value of the treatments tested. From the test results with the Bayes method (Table 3), it was found that the selected product was treatment C with a total of 12 panelists really liked syrup C based on the given criteria, it was slightly different from syrup B of 11

panelists. The lowest preference rating was obtained by syrup A, which only 3 people liked it, while for syrup D there were 4 panelists who liked it. Based on the analysis, there was no significant difference in the color and taste parameters. This is relevant to the results of the hedonic test that has been carried out which states that in terms of aroma, color and taste are not significantly different, but there are differences in respondents' acceptance of the viscosity parameter. While the lowest acceptance was in treatment D. This is thought to occur based on the aroma and taste parameters provided that both parameters result in an overly strong aroma assessment that eliminates the aroma of starfruit. Meanwhile, the overly dominant taste becomes a note for the taste parameter.

Table 3. Index of the importance of starfruit syrup based on sensory parameters

No	Parameter	Basic consideration	Index of Interest
1.	Taste	Taste is a major factor in determining whether a product is good or not based on consumer ratings. Consumer acceptance of the taste of starfruit syrup is influenced by individual subjectivity, the levels of turmeric and *temulawak* which are not too dominant are preferred by consumers (Rahmani, et al. 2007).	5
2.	Color	The color of the syrup is due to the breakdown of sucrose into glucose and fructose (inversion), as well as the combination of yellow in turmeric and *temulawak* produced from curcumin and oleoresin compounds (Jaruga et al., 1998 and Pan et al., 1999)	4
3.	Viscosity	Viscosity is closely related to the moisture content in food ingredients. In syrup, the viscosity is influenced by the ratio of water and sugar content, low water content and high sugar content make the consistency of the syrup better (Reo, 2012).	3
4.	Aroma	The aroma of the syrup is influenced by the caramelization process of sugar and turmeric and ginger essential oils that occur during the heating process.	2

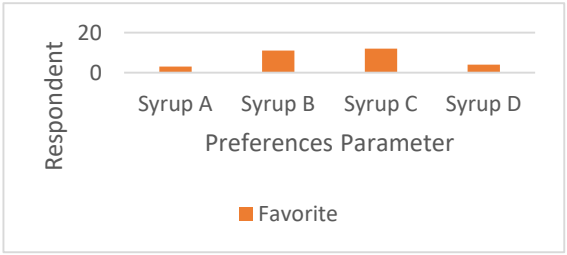

Figure 5 The preferences parameter

4. CONCLUSION

The addition of turmeric and *temulawak* herbal ingredients had a significant effect on the respondents' assessment of the quality of starfruit syrup. Based on the treatment that has been tested, it shows that product C, namely the addition of curcuma to starfruit syrup, is the most preferred syrup product for respondents, while product B scores not much different from the syrup product which has the highest score. Suggestions for further research are to add variations in ingredients, especially those that can improve respondents' assessment of the quality of starfruit syrup.

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REFERENCES

[1] Y. Fahrimal, S. Prawitasari, and B. Hasibuan, "larvasida alami belimbing wuluh," vol. 5, no. 2, pp. 179–184, 2019.

[2] R. A. Putri, "Pengaruh Proporsi Gula Pasir Terhadap Sifat Organoleptik Sirup Belimbing Wuluh Retno Andita Putri," *e-journal Boga*, vol. 5, no. 3, pp. 73–82, 2016.

[3] D. A. Purwanto, "Pengembangan Industri Kreatif Sirup Jamu Sehat Untuk Pemberdayaan Posdaya Di Kabupaten Sidoarjo Development Of Indonesian Herbal Medicine (Jamu)," vol. 1, no. 1, pp. 1–9, 2017.

[4] R. Gaffar, L. Lahming, and M. Rais, "Pengaruh Konsentrasi Gula Terhadap Mutu Selai Kulit Jeruk Bali (Citrus maxima)," *J. Pendidik. Teknol. Pertan.*, vol. 3, p. 117, 2018, doi: 10.26858/jptp.v3i0.5472.

[5] A. Aning Nur Fitriani, "Pengaruh Proporsi Tepung Jagung Dan Mocaf Terhadap Kualitas 'Jamof Rice' Instan Ditinjau Dari Sifat Organoleptik," *J. Tata Boga*, vol. 2, no. 3, pp. 34–43, 2013.

[6] F. Y. Berhubungan, D. Kadar, and A. Urat, "The 2 nd University Research Coloquium 2015 The 2 nd University Research Coloquium 2015," pp. 95–100, 2015.

[7] A. Rosidi, A. Khomsan, B. Setiawan, and D. Briawan, "Potensi temulawak (c," no. 1995, 2004.

[8] A. Tumbelaka, A. S. Naiu, and F. A. Dali, "Pengaruh Konsentrasi Garam dan Lama Penggaraman terhadap Nilai Hedonik Ikan Bandeng (Chanos chanos) Asin Kering," *J. Ilm. Perikan. dan Kelaut.*, vol. 1, no. 1, pp. 48–54, 2013.

[9] L. Indriani, I. Y. Wiendarlina, and E. Rustiani,

"Pengembangan Herbal Cair Kombinasi Daun Salam [Syzygium Polyanthum (Wight) Walp.] Dan Kelopak Bunga RosellA (Hibiscus Sabdariffa L.) Dengan Berbagai Variasi Pemanis," *FITOFARMAKA J. Ilm. Farm.*, vol. 5, no. 2, pp. 48–58, 2015, doi: 10.33751/jf.v5i2.408.

[10] M. N. Amri, B. Susilo, and Y. Hendrawan, "Pengaruh Pengendalian Suhu Berbasis Logika Fuzzy Dan Kecepatan Pengadukan Pada Evaporator Vakum Double Jacket Terhadap Karakteristik Fisik Permen Susu The Influence of Fuzzy Logic Based Temperature Control and Mixing Speed to The Physical Characteristic o," vol. 3, no. 2, pp. 9–16, 2015.

[11] A. Rosidi, A. Khomsan, B. Setiawan, H. Riyadi, and D. Briawan, "Potensi Temulawak (Curcuma xanthorrhiza Roxb) Sebagai Antioksidan," *Pros. hasil-hasil Semin. Nas.*, 2014.

[12] P. A. Chintia, D. Pendit, E. Zubaidah, and F. H. Sriherfyna, "Karakteristik Fisik-Kimia Dan Aktivitas Antibakteri Ekstrak Daun Belimbing Wuluh (Averrhoa bilimbi L.) Physical-Chemistry Characteristics and Antibacterial Activity of Bilimbi (Averrhoa bilimbi L.) Leaves Extract," *J. Pangan dan Agroindustri*, 2016.

[13] J. W. Gooch, "Kruskal-Wallis Test," in *Encyclopedic Dictionary of Polymers*, 2011.

[14] F. Agustin and W. D. R. Putri, "Pembuatan Jelly Drink Averrhoa blimbi L. (Kajian Proporsi Belimbing Wuluh : Air dan Konsentrasi Karagenan)," *J. Pangan dan Agroindustri*, 2014.

[15] N. Aryanti, D. Kurniawati, A. Maharani, and D. H. Wardhani, "Karakteristik Dan Analisis Sensorik Produk Tahu dengan Koagulan Alami," *J. Ilm. Teknosains*, 2016, doi: 10.26877/jitek.v2i2/nov.1206.

[16] M. A. Arlita, S. Waluyo, and Warji, "Pengaruh Suhu dan Konsentrasi terhadap Penyerapan Larutan Gula pada Bengkuang (Pachyrrhizus erosus)," *J. Tek. Pertan. Lampung*, 2013.

[17] Hasyim, "Proses Pembentukan ATP Melalui Proses Aerobik," *Ilara*, 2010.

[18] W. F. E. Hanzen, U. S. Hastuti, and B. Lukiati, "Kualitas Yoghurt Dari Kulit Buah Naga Berdasarkan Variasi Spesies dan Macam Gula Ditinjau Dari Tekstur, Aroma, Rasa dan Kadar Asam Laktat," *Proceeding Biol. Educ. Conf.*, 2016.

[19] dkk. Fitri, "Konsentrasi Gula dan Sari Buah Terhadap Kualitas Sirup Belimbing Wuluh (Averrhoa bilimbi L.)," *JOM Faperta UR*, 2017.