AgriHealth
Journal of Agri-food, Nutrition and Public Health
ISSN 2722-0656 (Print) 2722-0648 (Online)

AgriHealth: Journal of Agri-food, Nutrition and Public Health. 4(1), 23-32, 2023
URL: https://jurnal.uns.ac.id/agrihealth/article/view/70515
DOI: http://dx.doi.org/10.20961/agrihealth.v4i1.70515

The Evaluation of Physicochemical and Sensory Properties of Sehati Yogurt Drink Flavors with a Combination of Spice Extract

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Received: January 17, 2023; **Accepted**: March 9, 2023

Abstract

Yogurt is a popular functional drink that can be flavored and enhanced with a variety of spice extracts. Variants of flavors with a combination of spice extracts increase their uniqueness and practical value because of their bioactive components. However, it is necessary to study the physicochemical characteristics and sensory acceptance after adding the flavor variants of the spice extract combinations produced. This study aimed to determine the physicochemical and sensory attributes of the small and medium enterprise of Sehati yogurt drink, which added the flavor combination of ginger, lemongrass and galangal spice extracts in the *kunir asem*, *wedang uwuh* and *wedang telang* flavor variants. The variations were 5% v/v *kunir asem*, 5% v/v *wedang uwuh* and *wedang telang* 5% v/v and 0% for the control used a completely randomized design (CRD) with five replications. Based on the results, the Sehati yogurt drink with 5% *kunir asem* flavor variant had the highest viscosity, fat content and carbohydrates with 53.4 cP; 3.15%; and 14.61% respectively. The *wedang uwuh* flavor variant had the most elevated moisture and ash content with 0.3% and 81.27% respectively while the *wedang telang* flavor variant had the highest protein content value of 1.74%. Moreover, the highest score in terms of taste (sour), aroma, color, thickness and level of preference (sensory attributes) was the *wedang telang* flavor variant. This research will contribute to further developing functional drinks combined with traditional spices.

Keywords: galangal; ginger; lemongrass; physicochemical characteristics; yogurt

INTRODUCTION

Yogurt is a popular fermented milk product that contains probiotic bacteria. It has numerous advantages, including maintaining the digestive system in the body, preventing various diseases (allergies, diarrhea and constipation) (Rangkuti, 2017). The content of lactic acid bacteria (LAB) in yogurt products can also benefit health by maintaining the balance of microflora in the intestine (Astuty et al., 2021). According to Rizal et al. (2016), probiotics in yogurt products were active cultures that were intentionally added to fresh cow's milk ingredients. It has been scientifically proven that yogurt contains good nutrition and positively impacts human health.

Along with the development of technology, yogurt has a variety of variants and innovations

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Cite this as: Latifasari, N., Naufalin, R., Supriyanti, R., Nuraeni, I., & Hartono, E. F. (2023). The Evaluation of Physicochemical and Sensory Properties of Sehati Yogurt Drink Flavors with a Combination of Spice Extract. *AgriHealth: Journal of Agri-food, Nutrition and Public Health*, *4*(1), 23-32. doi: http://dx.doi.org/10.20961/agrihealth.v4i1.70515

to meet market demand. Many fruit flavor variants and combinations of fruit and vegetable flavors have been developed to meet product variations. Thus, consumers did not feel bored and could increase their daily yogurt consumption (Pertiwi et al., 2022). Research conducted by Kumalasari et al. (2013) and Jannah et al. (2014), also led the development of a yogurt drink with flavors of starfruit extract and longan extract. However, no research and commercial product has combined yogurt drinks with various spices and flavors, such as ginger, lemongrass and galangal. This flavor variant with a combination of herbs will increase its uniqueness and functional value because it contains bioactive components such as flavonoids, polyphenols, zingiberin, shogaol and gingerol (Sari et al., 2015).

According to Sari et al. (2015), lemongrass contains geraniol, citronellal, citronellol, limonene and polyphenolic compounds. Ginger has gingerol, shogaol and zingiberence (Sari et al., 2015). Galangal contains alkaloids, terpenoids, saponins, flavonoids, phenolics and steroids (Untoro et al., 2016). Yuliningtyas et al. (2019), also suggested that the two combinations of ginger (*Zingiber officinale* var. *rubrum*) and lemongrass (*Cymbopogon nardus* L. Rendle) in drinks were shown to contain various bioactive compounds such as flavonoids, alkaloids and saponins. This research developed an innovative flavor variant of a combination of spice extracts added inside a yogurt drink produced by Sehati small and medium enterprises (SME). However, it is necessary to study the physicochemical characteristics and sensory acceptance after adding the flavor variants of the spice extract combinations. This study aims to determine the physicochemical and sensory attributes of the Sehati yogurt drink by adding a blend of ginger, lemongrass and galangal extract to the *kunir asem*, *wedang uwuh* and *wedang telang* flavor variants.

MATERIALS AND METHOD

Material

The materials used in this study were plain yogurt produced by Sehati SME, Purwokerto, spices purchased from the Manis market in Purwokerto, and additional ingredients such as granulated sugar bought from supermarkets. The chemicals used for analysis with pro-analysis specifications (Sigma-Aldrich and Merck) were obtained from suppliers in Purwokerto, such as pH buffer, distilled water, NaOH, HCl, 95% ethanol, silica gel and acetic acid. Knives, stoves, blenders, shakers, pH meters, viscometers, vortices, ash furnaces, spectrophotometers, desiccators, analytical balances, porcelain cups, test tubes, thermometers and sensory test questionnaires are utilized.

Experimental design

This study used a completely randomized design (CRD) with four treatments and five replications. The factors in this study were the addition of flavor variants of the combination of ginger, lemongrass and galangal spice extracts to the control 0% (v/v), 5% *kunir asem* (v/v) flavor variants, 5% *wedang uwuh* (v/v) and 5% *wedang telang* (v/v) in yogurt drinks. The observed variables included pH value (AOAC, 2005), viscosity, ash content, water content (AOAC, 2005), protein content, fat content, carbohydrate content (Husni et al., 2015) and sensory attributes (Hedonic test) which included aroma, taste, color, texture (thickness) and level of preference.

Sensory evaluation of the three flavor variants of the yogurt drink products was conducted using the scoring test method. In this test, panelists were asked to state the magnitude of the impression obtained based on a numerical scale (1 to 4) determined by the examiner (Ares et al., 2014). There are five criteria to be assessed: taste, aroma, color, thickness and preference. The sensory test scores for these five parameters ranged from 1 to 4 with categories for taste (from not sour to sour), aroma (from not typical of yogurt to typical of yogurt), color (from unattractive to attractive), thickness (from not thick to thick) and preference (from dislike to like).

Making plain yogurt

The main ingredients used to make yogurt are fresh cow's milk, skim milk and yogurt starter. The process for making plain yogurt produced by Sehati SME is made by heating (pasteurizing) fresh cow's milk which has been added to 15% skim milk at a temperature of 70 to 80 ºC for 15 minutes. Then the milk is cooled until it reaches a temperature of 40 to 45 ºC before adding 5% yogurt starter. After that, incubation was carried out for 8 to 12 hours in a closed container to produce a sour taste and a thick

form and then stored at 5 °C, so that plain yogurt was obtained (Harismah et al., 2017, with modification).

Making a combination of flavors of spice extracts

They are making a combination of spice extract flavor variants using three main types of spices, namely ginger, lemongrass and galangal with a composition of 30 g ginger, 10 g lemongrass and 1 g galangal. In addition to the three types of spices, other ingredients are added to make up the flavors of *kunir asem*, *wedang uwuh* and *wedang telang*. The best composition used to make the *kunir asem* flavored spice extract is 5 g turmeric, 30 g ginger, 10 g lemongrass, 1 g galangal, 2 cinnamon sticks, 2 cardamoms, 3 cloves and 200 ml of water added. In making the spice extract for the *wedang uwuh* flavor variant, 30 g ginger, 10 g lemongrass, 1 g galangal, 1 cinnamon stick, 2 cardamoms, 5 cloves, 1.5 g secang wood, 200 ml water are needed. Then to make the spice extract for the *wedang telang* flavor, 30 g ginger, 10 g lemongrass, 1 g galangal, water for soaking butterfly pea flowers (7 flowers per 20 ml) and 200 ml water. Each sample of the spice flavor variants was produced by boiling and filtering the spices before being added to the yogurt drink (Sari et al., 2015, with modification).

Making yogurt drinks

Yogurt drink was made by mixing plain yogurt previously produced with added sugar water in a ratio of 1:1 (v/v), so that it becomes a yogurt drink (Kumalasari et al., 2013 with modification). Furthermore, the resulting yogurt drink was added with a combination of flavor variants of 5% (v/v) spice extracts each, namely the flavors of *kunir asem*, *wedang uwuh* and *wedang telang*, while as a comparison yogurt drink control was used without the addition of 0% spices flavor variant.

Data analysis

The data obtained were analyzed using the one-way ANOVA method followed by DMRT if there were differences at the significance level $\alpha = 5\%$. While the sensory test was analyzed with ANOVA $\alpha = 5\%$ if the data is normally distributed, then if the data is not normally distributed, it will be tested with non-parametric Kruskal-Wallis.

RESULTS AND DISCUSSION

pH value

Including the spice combination variant did not substantially change the pH value ($P > 0.05$) of the final spiced yogurt drink, as determined by an analysis of variance. The yogurt beverage with the spice extract taste combination of *kunir asem*, *wedang uwuh* and *wedang telang* had a pH value between 4.34 and 4.38. The pH of the control yogurt drink, in contrast, was 4.28. The average pH of the spice extract combination flavor variation treatment is depicted in Figure 1.

Figure 1 shows the pH value in the control treatment was lower than the yogurt drink with the spice combination flavor variant. This can be caused by the high activity of LAB in forming lactic acid in the yogurt fermentation process. Ibrahim et al. (2019), also stated that the milk sugar (lactose) contained in cow's milk would split into lactic acid and acetaldehyde compounds. The more lactic acid that forms inside the yogurt, the higher the acidity level. However, the addition of the spice flavor variant did not affect the pH value of the resulting yogurt drink product. This is also confirmed by the research conducted by Kumalasari et al. (2013).

Viscosity value

The treatment of variant flavors of the combination of ginger, lemongrass and galangal spice extracts showed a significant effect on the viscosity of the resulting yogurt drink ($P < 0.05$). The average viscosity value of yogurt drinks in the treatment of adding flavor variants with a combination of spice extracts can be seen in Figure 2. Including the flavor variant of the combination of *kunir asem* spice extract increased the viscosity of the yogurt drink product by 53.4 cP compared to 48.54 cP and 49.92 cP for the *wedang uwuh* and *wedang telang* flavor variants, respectively, and 49.34 cP for the control. One of the factors that can increase the viscosity of yogurt drinks is the low pH (acidic) conditions. The increase in viscosity is also closely related to the pH value. According to Suprihana (2012), a pH value below 5.3 causes a decrease in the solubility of casein, whereas at a pH of 4.8 to 4.7 casein will precipitate ultimately, resulting in the structure and consistency of the yogurt becoming thicker.

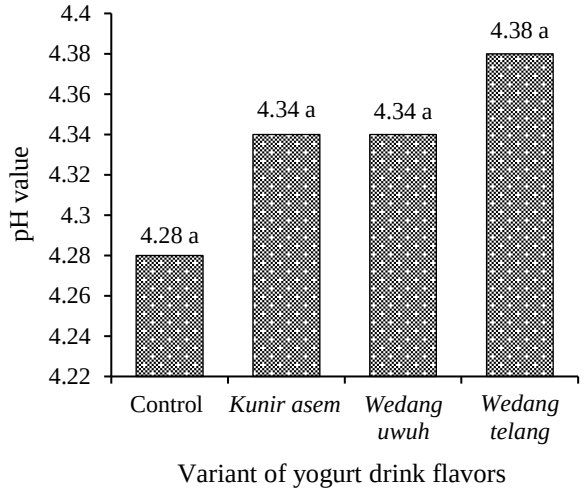

Figure 1. pH value of flavors variant of yogurt drink

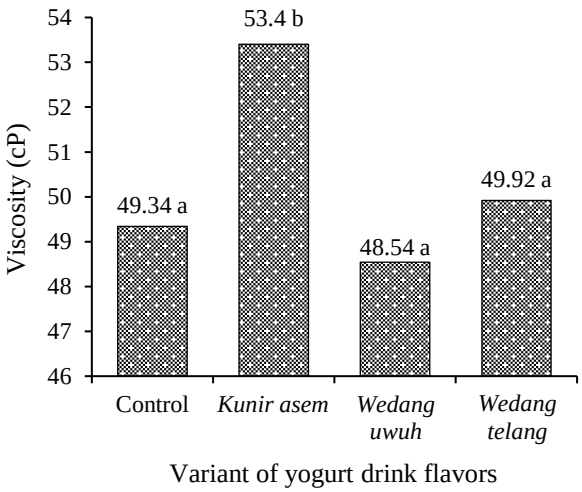

Figure 2. Viscosity value of flavors variant of yogurt drink

Increasing the viscosity of the yogurt produced will be directly proportional to the increase in the resulting viscosity value. In the *kunir asem* flavor variant, the significant increase in density can also be caused by the composition of the spices making up the *kunir asem* flavor, namely the addition of tamarind. The addition of tamarind in the manufacture of the *kunir asem* flavor variant will cause the total acid to increase, so the degree of acidity of the yogurt will increase, affecting the coagulation of milk protein. Wahyudi and Samsundari (2008) also stated that an increase in total acid would cause milk casein to coagulate, resulting in a gel consistency. The formation of a gel causes the texture to turn into a semi-solid so that the viscosity increases.

Ash content

The ash content of the yogurt drink with a combination of the spice extracts of *kunir asem*, *wedang uwuh* and *wedang telang* flavors obtained results of 0.26% to 0.30%. The average ash content in the spice extracts flavored yogurt drink can be seen in Figure 3. Based on the results of the analysis from the treatment of the flavor variant combination of spice extracts, it showed that there was no significant effect on the ash content of the yogurt drink in each of the resulting treatments ($P > 0.05$). It is conceivable that these results were affected by adding spice extract ingredients to each type of yogurt drink flavor was not considerably different and the amount applied was virtually the same. According to Syaputra et al. (2015), it was stated that ash content could also be affected by the use of raw materials and other additives in the processing process. Kumalaningsih et al. (2016), also stated that the mineral content in yogurt could be seen from the ash content produced. The higher the ash content contained, the higher the content of minerals. In addition, the components in minerals are also influenced by several things, such as plant species, geographical conditions, physiology and the type of material used (Kusumawati et al., 2020). However, all the yogurt drink produced still meets the Indonesian National Standard (SNI) 01.2981-2009 for yogurt products maximum ash content limit was 1% (Destiana et al., 2021).

Moisture content

The moisture content in the yogurt drink variant of the *kunir asem*, *wedang uwuh* and *wedang telang* flavor variants obtained 79.20% to 81.30%. The results of moisture content data for the spice extract flavored yogurt drink can be seen in Figure 4. There was a significant difference in the moisture content of yogurt drinks with the addition of a flavor variant of a combination of spice extracts ($P < 0.05$). Yogurt drink with the variants of *kunir asem* and *wedang uwuh* flavors has an average moisture content that was not much different, namely 81.2% and 81.27%, respectively. In comparison, the moisture content in the yogurt drink variant of the *wedang telang* flavor has a value of 80.45% which is not much different compared to the control yogurt drink

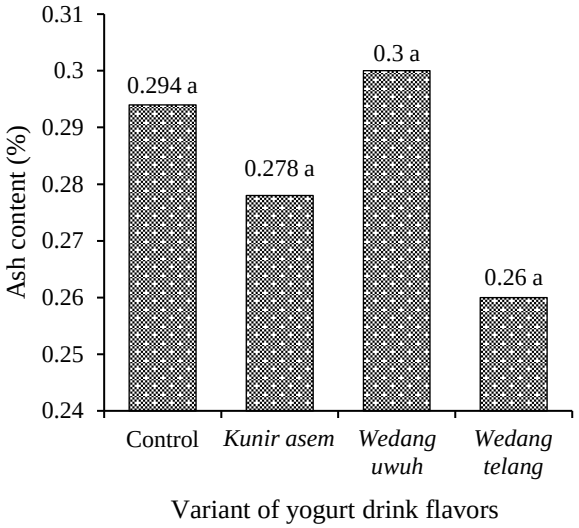

Figure 3. Ash content of flavors variant of yogurt drink

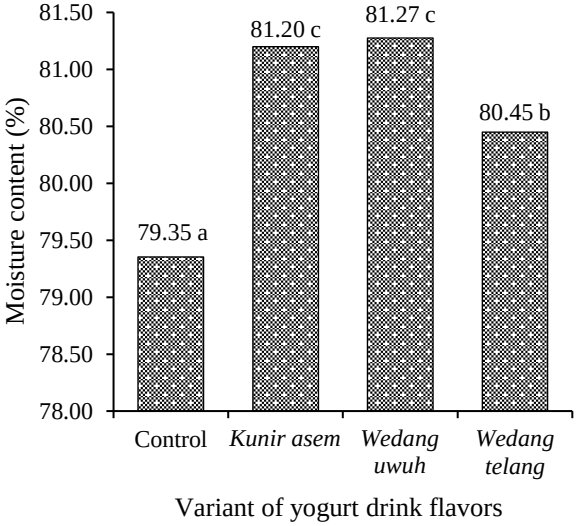

Figure 4. Moisture content of flavors variant of yogurt drink

with a moisture content of 79.35%. The quality standard for moisture content in yogurt drinks is generally 86% to 89%, so compared to all of these treatments, it does not meet the quality standards for the minimum moisture content in yogurt drink products. The average value of moisture content is between 86% to 89% in yogurt drink products that have the consistency and appearance of a liquid to semi-solid product. Thus, the yogurt drink still has a reasonably thick texture from the three flavor variants. The higher the moisture content value, the higher the water contained in the yogurt, so its physical appearance will be more liquid and can cause yogurt drinks to be easily damaged (Celik et al., 2006) and vice versa.

Protein content

There was a significant effect on the protein content parameter ($P < 0.05$) with the addition of the yogurt drink with spice flavor variant. The average protein content in the resulting spice yogurt drink ranged from 0.97% to 1.74%. The protein content of the Sehati yogurt drink with the addition of flavors of *kunir asem*, *wedang uwuh* and *wedang telang* are presented in Figure 5.

Figure 5 shows that the highest protein content was obtained in the *wedang telang* flavor variant at 1.74%. In contrast, the lowest protein content was obtained in the *kunir asem* flavor variant at 0.97%. According to SNI Yogurt 01.2981-2009, the protein content that meets the quality requirements for yogurt products is at least 2.7%. Thus, the protein content of the three flavors of yogurt drink with spices and the control did not meet the minimum standard for protein content due to the addition of water and a combination of spice extracts. The results also changed the consistency of the yogurt to semi-thick to liquid, affecting the dissolved protein content of the final product. Kumalaningsih et al. (2016), also stated that the protein content of yogurt is determined by the quality and concentration of the ingredients base so the protein contained within yogurt is the total protein ingredients yogurt and LAB protein. The protein content of yogurt was also determined by the ingredients' quality, such as the quality of the cow's milk used. According to Ibrahim et al. (2021), the nutritional content of cow's milk will be significantly influenced by internal and external factors, such as type of animal, age, farm location, weather and feed. The higher the initial protein content of the ingredients from quality cow's milk, the greater the protein content in the yogurt produced. In addition, the protein content can also be affected by the processing by heating treatment. This is because proteins are easily denatured by heat, which causes the chains of bonds between amino acids to be broken (Destiana et al., 2021).

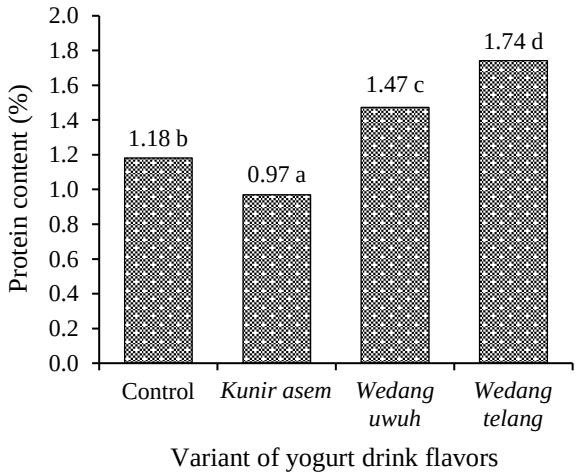

Figure 5. Protein content of flavors variant of yogurt drink

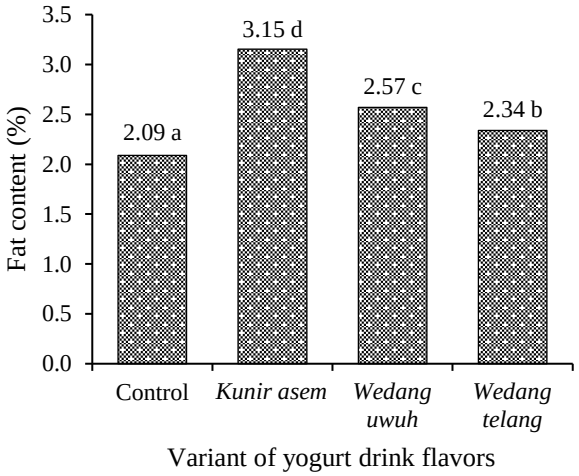

Figure 6. Fat content of flavors variant of yogurt drink

Fat content

The treatment of variant flavors of the combination of spice extracts of ginger, lemongrass and galangal showed a significant effect on the fat content of the resulting yogurt drink ($P < 0.05$). The average fat content in the control yogurt drink and *kunir asem*, *wedang uwuh* and *wedang telang* flavors ranged from 2% to 3.15%. The fat content in the control yogurt drink and the three flavor variants of the combination of ginger, lemongrass and galangal spice extracts can be seen in Figure 6.

The highest fat content of yogurt drink was obtained in the *kunir asem* flavor variant at 3.15%, while the lowest fat content was found in the control treatment at 2.09%. According to SNI Yogurt 01.2981-2009, the quality standard for fat content in yogurt products is a maximum of 3.8%. Based on these data, the yogurt drink product with the *kunir asem*, *wedang uwuh* and *wedang telang* flavor variants meets the SNI quality standards (Destiana et al., 2021). The high-fat content in the *kunir asem* flavor variant can be influenced by the composition of the ingredients for the yogurt drink flavor variant. Several spices, such as ginger, turmeric, lemongrass and galangal, have a reasonably high lipid content. Compounds in these spices can increase the total fat content of the ingredients because they contain a lot of essential oils, one of the lipid group compounds (Apriky et al., 2022).

Carbohydrate content

Carbohydrate level testing in the Sehati yogurt drink product used the reduction method (by difference) (Husni et al., 2015). Based on the test results, the carbohydrate content in the control yogurt drink and the resulting flavor variants ranged from 14.21% to 17.41%. The treatment of variant flavors of the combination of ginger, lemongrass and galangal spice extracts also showed a significant effect on the carbohydrate content of the yogurt drink produced ($P < 0.05$). The carbohydrate content in the Sehati yogurt drink with flavor variants of the *kunir asem*, *wedang uwuh* and *wedang telang* flavors is presented in Figure 7.

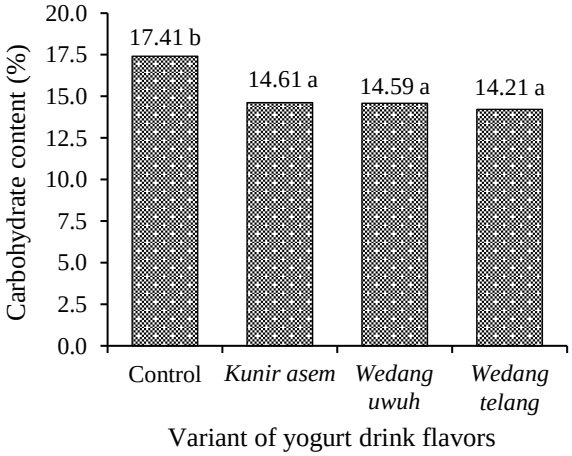

Figure 7. Carbohydrate content of flavors variant of yogurt drink

Figure 7 shows the carbohydrate content of the Sehati yogurt drink from highest to lowest, namely 17.41% (control), 14.61% (*kunir asem*), 14.59% (*wedang uwuh*) and 14.21% (*wedang telang*). The carbohydrate content in the resulting yogurt drink can come from the composition of the raw materials used, such as cow's milk as the primary raw material and other additional ingredients (Ibrahim et al., 2021). The control yogurt drink treatment had a higher carbohydrate content than the flavored variant yogurt drink. This could be due to the addition of spice extracts and water to the three variants of *kunir asem*, *wedang uwuh* and *wedang telang* which caused a decrease in the viscosity of the yogurt (Celik et al., 2006). The more liquid a solution will also impact the amount of nutrient content that will decrease.

Sensory evaluation

The average sensory evaluation of taste parameters to preferences for yogurt drinks with the addition of flavor variants with combinations of spice extracts can be seen in Table 1.

Taste

Sensory evaluation of the taste parameter showed a significant effect with adding a combination of spice extract flavor variants ($P < 0.05$). The addition of combination spice extract flavor variants significantly affected the taste, especially the sour taste of the yogurt drink. Based on the scoring test, the highest assessment score of the sour taste parameter was obtained in the yogurt drink sample by adding the *wedang telang* flavor variant with a score of 3.11 (a little bit of sour taste). This is related to the results of the pH and acidity produced. This sour taste is influenced by lactose fermentation which is converted into lactic acid by LAB. During fermentation, acetaldehyde is delivered, a compound that forms a distinctive flavor in yogurt (Jannah et al., 2014).

Aroma

Sensory evaluation of aroma parameters showed no significant effect ($P > 0.05$). The analysis showed that adding a combination of spice extract to the yogurt drink Sehati product had no significant impact on the aroma of the yogurt drink. Based on the scoring test, the average score of the panelists for the *kunir asem* flavor variant is 3.34 (quite typical of yogurt), *wedang uwuh* is 3.29 (quite familiar of yogurt) and *wedang telang* is 3.36 (quite familiar of yogurt). According to Jannah et al. (2014), a typical aroma of yogurt is obtained from forming lactic acid, acetaldehyde, acetic acid and diacetyl. LAB produce these compounds due to the yogurt fermentation process. Thus, this component of volatiles gives the characteristic acid and typical aroma of yogurt.

Color

Color is one of the visual profiles that gives the first impression of consumers, because it can affect consumers' acceptance of good products. Although a product of high nutritional value, good taste, and good texture, the product is less interesting if the color is less attractive (Mussayadah et al., 2020). Sensory evaluation of the color parameters of yogurt drink products with a combination of spice extract flavor variants did not significantly affect the color assessment of yogurt drinks ($P > 0.05$). Based on the scoring test, the average score of the panelists in color assessment for the *kunir asem* flavor variant is 3.82 (attractive), *wedang uwuh* is 3.71 (attractive) and *wedang telang* is 3.68 (attractive).

Thickness

The thickness of the yogurt drink product with a combination of spice extract flavor variants did not significantly affect the thickness assessment of the yogurt drink ($P > 0.05$). Based on the scoring test, the average score of the panelists for the *kunir asem* flavor variant is 2.54 (a little bit thick), *wedang uwuh* is 2.39 (a little bit thick) and *wedang telang* is 2.29 (a little bit thick).

Preference

Sensory evaluation of the preference parameter showed a significant effect with

Table 1. The average sensory evaluation of taste parameters to preferences for yogurt drinks

Parameters	Taste	Aroma^{ns}	Color^{ns}	Thickness^{ns}	Preference
Kunir asem	2.68^{a}	3.43	3.82	2.54	2.86^{a}
Wedang uwuh	2.86^{ab}	3.29	3.71	2.39	2.93^{ab}
Wedang telang	3.11^{b}	3.36	3.68	2.29	3.25^{b}

Note: Different superscripts show significant differences ($P < 0.05$); ns shows the presence of non-significant ($P > 0.05$)

adding a combination of spice extract flavor variants ($P < 0.05$). Combined with spice extract, flavor variants significantly affected the yogurt drink's preference. Based on the scoring test, the highest assessment score of the preference parameter was obtained in the yogurt drink sample with the addition of the *wedang telang* flavor variant with a score of 3.25 (like). According to Nursalim and Razali (2007), a panelist's preference for a product is influenced by several factors, including (1) color, taste and attractive appearance (sensory); (2) high nutritional value and (3) beneficial for the consumer's body. Thus, the level of consumer preference was determined from several sensory parameters.

CONCLUSIONS

Adding ginger, lemongrass and galangal substantially improves the Sehati yogurt drink. The 5% *kunir asem* taste variety was determined to have the maximum viscosity, fat content and carbohydrate content, with respective values of 53.4 cP, 3.15 % and 14.61 %. The *wedang uwuh* taste variety contains the most moisture and ash, at 0.3% and 81.27%, respectively. The *wedang telang* flavor variant received the highest ratings for taste (sour), aroma, color and preference level. Soon, additional research can be undertaken on the association between the stability of the spice yogurt drink product during storage and its shelf life.

ACKNOWLEDGEMENT

The authors thank the LPDP Ministry of Finance for funding this research with the 2022 LPDP Scientific Grants scheme.

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