AGROLAND: The Agricultural Sciences Journal
Vol. 12, No. 1 June (2025), 66 - 78
P-ISSN : 2407- 7585 & E-ISSN : 2407- 7593, Published by Tadulako University

Original Research **Open Access**

FORMULATION OF "*ZILLICUM TEA*" FROM GINGER (*Zingiber officinale* var. amarum), STAR ANISE (*Illicium verum*), AND LEMONGRASS (*Cymbopogon citratus*) TOWARD ANTIOXIDANT ACTIVITIES AND HEDONIC ACCEPTABILITY

Nancy Felicia Manao[1), Yoga Aji Handoko[1)

[1)Agrotechnology Study Program, Faculty of Agriculture and Business,
Kristen Satya Wacana University, Salatiga
Email: yoga.handoko@uksw.edu

Submit: 21 April 2025, Revised: 25 September 2025, Accepted: September 2025
DOI : https://doi.org/10.22487/agroland.v12i1.2504

ABSTRACT

Zillicum tea is an innovations herbal tea product formulated from combination of three plants: ginger, lemongrass, and star anise. These three plants were selected for their functional value, particularly their antioxidant compounds. The purpose of this research was to determine the effect of antioxidant activity and hedonic acceptability properties of the three combinations of *Zillicum tea* formulation, and to identify the best of formulation based on these parameters. This research used a Completely Randomized Design (CRD) with four treatments(the combination of ginger, star anise, and lemongrass), specifically F1, F2, F3, F4 with five replications. Antioxidant activity and organoleptic properties are the primary parameters, while moisture content and total plate count test are supporting parameters. The result F4 formulations exhibited antioxidant activity of 54.41% inhibition ($p < 0.05$), which was significantly higher than that of F1 (33.20%), F2 (39.86%), and F3 (43.00%). Furthermore, the organoleptic taste score of F4 (5.28 ± 1.27) was also significantly greater comparased to the other formulations.

Keywords: Herbal Tea, Antioxidan Activity, Organoleptic, *Zillicum Tea.*

INTRODUCTION

Tea is a popular beverage among the public due to its health benefits. Nowadays, tea has expanded beyond traditional tea leaves (*Camellia sinensis* L. Kunze) to include infusions made from other plants.. Herbal tea is a product that not derived from *Camellia sinensis* and *Camellia assamica* (Yudana, 2004). Usually, some plant materials were used to make the herbal tea, such as: chamomile flower, mint leaf, rosella flower, ginger, turmeric, lemon, cinnamon, and ginseng (Krisnawati, 2008).

Zillicum tea is one of the innovative herbal tea beverage products that comes from a combination of herbal plants, such as: ginger, lemongrass, and star anise. The selection of ginger, lemongrass, and star anise in the *Zillicum tea* formulation is based on their functionality value. Ginger (*Zingiber officinale* var. amarum) contains major bioactive compound in fresh ginger, whereas shogaol is a derivative of gingeril formed during prolonged heating and strorage (Stoner, 2013). These two bioactive compounds funtion as antioxidants with anti-inflamatory properties, capable of alleviating inflammation and scavenging free radicals. In addition, ginger contains essential oils that impart a warming sensation and inhibit toxic substances responsible for diarrhea (Ratnaningrum, et al., 2017).

Lemongrass (*Cymbopogon citratus*) contains bioactive compounds such as tannnins, saponins, essential oils, and alkaloids, which exhibit antioxidant, analgesic, antibacterial, and aromatherapeutic properties due to their fresh and distinctive aroma (Putri, et al., 2019). In contrast, star anise (*Illicium verum*) contains active compounds including flavonoids, linalool, and anethole, which provide various health benefits. Anethole serves as the dominant component of star anise essential oil and is responsible for its characteristic sweet scent (Kusumiati & Rawar, 2022), whereas linalool contributes to the fresh scent of star anise (Lestari, et al., 2019).

The combination of three plants provides maxium health benefits. Although these plants are individually recognized for their functional properties,limited evidence is available regarding their optimal combination ratio. Therefore, formulation optimization is essential to maximize both the functional benefits and acceptance of the product. In this context, the present research aimed to assess the influence of various *Zillicum tea* formulations on antioxidant activity and sensory atributes, and to determine the optimal formulation for both antioxidant efficacy and hedonic acceptability.

RESEARCH METHODS

Materials and Equipment

The materials are consist of two parts: *Zillicum tea* processing and sample analysis. Tea processing uses ginger, lemongrass, star anise, tea bags, tissues, and gloves. Sample analysis uses Nutrient agar (NA) medium, Buffered Peptone Water (BPW) medium, Plate Count Agar (PCA) medium, sterile distilled water, alcohol, DPPH (2,2-diphenyl-1-1-picrylhydrazyl) solution, methanol, labels, and tea bags.

The equipment for *Zillicum tea* processing are including baking pans, knives, trays, cabinet dryers, grinders, blenders, strainers, and spoons. The equipment for sample analysis include analytical balance, Laminar Air Flow (LAF), micropipettes, hot plates, colony counters, incubators, fillers, vortexes, cuvettes, Shimadzu spectrophotometers UV-1280, Shimadzu MOC63u moisture analyzers, and cup glasses.

Research Design

This research used a Completely Randomized Design (CRD) with four treatments with the combination of ginger, star anise, and lemongrass: F1, F2, F3, and F4 (Table

1.). All treatment ws done five replications. This means that each treatment consisted of five tea bag, resulting in a total of 20 tea bag samples.

Table 1. Zillicum tea formulation

Material	Treatments	*Formulation (g/v)*
Ginger	F1	50%
Lemongrass Star		25%
anise		25%
Ginger	F2	25%
Lemongrass Star		50%
anise		25%
Ginger	F3	37.5%
Lemongrass Star		25%
anise		37.5%
Ginger	F4	12.5%
Lemongrass Star		37.5%
anise		50%

Data were analyzed using Analysis of Variance (ANOVA) and there was a significantly different effect using the Duncan Multiple Range Test (DMRT) with a test level of 5%. Meanwhile, for the hedonic test results, a non-parametric test (K-related sampels) was applied, and when significant differences were detected, post hoc comparisons were performed using the Wilcoxon Signed Rank Test.

The Processing of *Zilicum Tea*

The first step is sorting of the ginger, lemongrass, and star anise. Then, the lemongrass is opened from the defective bark of the stem until a yellowish-white layer is visible. The ginger and lemongrass are washed to clean off any dirt that sticks to them. Meanwhile, star anise does not need to be washed because it is in a dry state. Each sample is aired for 1 hour, then the sample is put into a cabinet dryer at a temperature of 65°C for 24 hours. The sample is removed and ground using a grinder until it becomes powder and filtered using a 20 mesh sieve. Then, the powder is fine and weighed according to the treatment, then put into a tea bag.

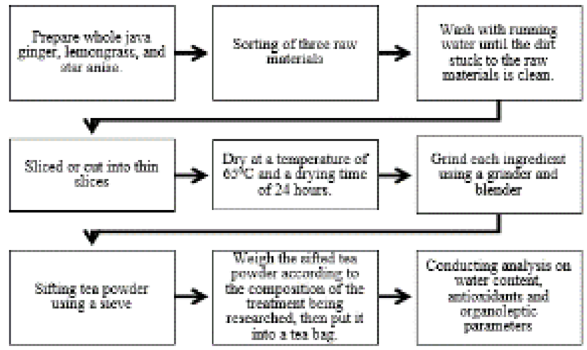


Figure 1. The processing of *Zillicum tea*

Moisture content .

Moisture content of *Zillicum tea* was determined using a Moisture Analyzer Shimandzu MOC63u. The procedure began by switching on the instrument and placing the pan sample handler at the center of the moisture analyzer. The program was then set to *"Auto* mode*"* with a temperature of 105°C. A 2 gram tea sample, according to the formulation, was evenly placed on the pan sampel handler, and the instrument was closed. During the drying process, the halogen lamp of the moisture analyzer was activated. The prosesses was continued until the halogen lamp automatically turned off, and the moisture content was displayed as a presentage (%). This process was performed on 20 samples according to the treatments.

Total Plate Count

This pour plate method aims to spread bacterial cells not only on the surface of the agar medium, but also on the cells submerged in the agar medium. The implementation of the TPC method followed safety procedures and aseptic work techniques. The first step is a 1 ml of the sample put into a test tube containing 9 ml of BPW media (suspension). Then, a 1 ml of the solution is taken into a test tube containing 9 ml of BPW media (dilution 10-1) and homogenized

(Wiratna, et al., 2019). Amount of 1 ml is taken and put into another test tube containing 9 ml of BPW media (dilution 10-2, and the method is carried out until the dilution is 10-4. Then, a 1 ml of each dilution is taken and put into a petri dish containing 15 ml of PCA media, homogenized, and closed. Next, incubation is carried out at a temperature of 37°C for 48 hours, after which the number of colonies in the petri dish is calculated using the following formula:

$$\text{CFU/g} = \text{Number of colonies per plate} \times \frac{1}{\text{Dilution}}$$

Antioxidant Activity

The assay was conducted using the DPPH method, following the method described by Kekuda, et al., (2009). A 1 gram of tea powder was weighed into a 25 mL erlenmeyer flask and 12 mL of aquades was added as the solvent. The solution was then diluted with methanol up to the mark. Subsequently, 2 mL of DPPH solution was added, and mixture was incubated at room temperature for30 minutes. After incubation, the solution was transferred to a cuvette, and its absorbance was measured at 517 nm using a spectrophotometer.

The results are in the form of a percentage of inhibition of DPPH radicals with the formula:

$$\text{Antioxidant activity} = \frac{Ba - Sa}{Ba} \times 100\%$$

Remarks:
Ba = Blanko Absorbance
Sa = Sample Absorbance

Organoleptic test

Organoleptic testing was conducted using an affective test method with a hedonic scale to evaluate the level of product liking. The attributes assessed included color, aroma, taste, and scoring was performed by 32 untrained panelists. All panelists agreed to conduct the hedonic acceptability test.

The panelists were 17 years of age or older, preferred tea, were familiar with tea characteristics, and were able to provide objective organoleptic assessments of *Zillicum tea*. Each panelist assigned scores to the samples according to their individual preferences using a predetermined scoring system.

Table 2. Organoleptic scoring of Zillicum tea

Scoring	Remarks
1	Dislike extremely
2	Dislike
3	Dislike slightly
4	Neutral
5	Like slightly
6	Like
7	Like extremely

REPORT SPSS ANALISYS

- Moisture content

Table 3. Result of normality test analysis on moisture content

Test of Normality			
Shapiro-Wilk			
Perlakuan	Statistic	df	Sig
F1	0.941	5	0.670
F2	0.974	5	0.902
F3	0.964	5	0.832
F4	0.881	5	0.312

Noted: p > 0.05 = normally distributed data

Table 4. Result of Homogeneity on moisture content

Test of Homogeneity of Variences			
Levene Statistic	df1	df2	Sig.
2.190	3	16	0.129

Noted: p > 0.05 = homogeneity distributed data

Table 5. Anova test result on moisture content

ANOVA					
	Sum of Squared	df	Mean Square	F	Sig.
Between Groups	1.068	3	0.356	2.898	0.067
Within Groups	1.966	16	0.123		
Total	3.034	19			

Noted: $p > 0.05$ = No significant difference.

- Total Plate Count

Table 6. Result of normality test on total plate count

Test of Normality			
Shapiro-Wilk			
Perlakuan	Statistic	df	Sig
F1	0.807	5	0.092
F2	0.783	5	0.058
F3	0.940	5	0.663
F4	0.968	5	0.860

Noted: $p > 0.05$ = Normally distributed data

Table 7. Result of Homogeneity on total plate count

Test of Homogeneity of Variences			
Levene Statistic	df1	df2	Sig.
2.781	3	16	0.075

Noted: Homogeneity distribused data

Table 8. ANOVA test results on total plate count

ANOVA					
	Sum of Squared	df	Mean Square	F	Sig.
Between Groups	2.245	3	0.749	2.765	0.076
Within Groups	4.341	16	0.271		
Total	6.586	19			

Noted: $p > 0.05$ = No significant difference

- Antioxidant Activity

Table 9. Result of normality on antioxidant activity

Test of Normality			
Shapiro-Wilk			
Perlakuan	Statistic	df	Sig
F1	0.731	5	0.020
F2	0.940	5	0.666
F3	0.872	5	0.275
F4	0.814	5	0.104

Noted: $p > 0.05$ = Normality distributed data

Table 10. Result of homogeneity on antioxidant activity

Test of Homogeneity of Variences			
Levene Statistic	df1	df2	Sig.
2.558	3	16	0.092
Noted:$p > 0.05$ = Homogeneity distributed data			

Table 11. ANOVA test result on antioxidant activity

ANOVA					
	Sum of Squared	df	Mean Square	F	Sig.
Between Groups	1177.575	3	392.525	233.283	0.000
Within Groups	26.922	16	1.683		
Total	1204.497	19			

Noted: $p < 0.05$ = Significant difference data

• Hedonic Acceptability

- Colour

Table 12. Non-parametric test result on tea colour

Friedman Test	
Test Statistics	
N	32
Chi-Square	20.52
df	3
Asymp. Sig.	0.000

Noted: $p < 0.05$ = There are significant differences

Table 13. Post hoc Wilcoxon test result for tea colour

Wilcoxon Signed Rank Test						
Test Statistics						
	Colour F2 – Colour F1	Colour F3 – Colour F1	Colour F4 – Colour F1	Colour F3 – Colour F2	Colour F4 – Colour F2	Colour F4 – Colour F3
Asymp. Sig. (2-tailed)	0.007	0.002	0.001	0.220	0.054	0.456

Noted: $p > 0.05$ = No significant difference

- Aroma

Table 14. Non-parametric test result on tea aroma

Friedman Test	
Test Statistics	
N	32
Chi-Square	2.148
Df	3
Asymp. Sig.	0.542

Noted: $p > 0.05$ = No significant differences

- Taste

Table 15. Non-parametric test result on tea taste

Friedman Test	
Test Statistics	
N	32
Chi-Square	8.374
Df	3
Asymp. Sig.	0.39

Noted: $p > 0.05$ = There are significant differences

Table 16. Post hoc Wilcoxon test result for tea Taste

Wilcoxon Signed Rank Test						
Test Statistics						
	Taste F2 – Taste F1	Taste F3 – Taste F1	Taste F4 – Taste F1	Taste F3 – Taste F2	Taste F4 – Taste F2	Taste F4 – Taste F3
Asymp. Sig. (2-tailed)	0.037	0.037	0.010	0.713	0.278	0.398

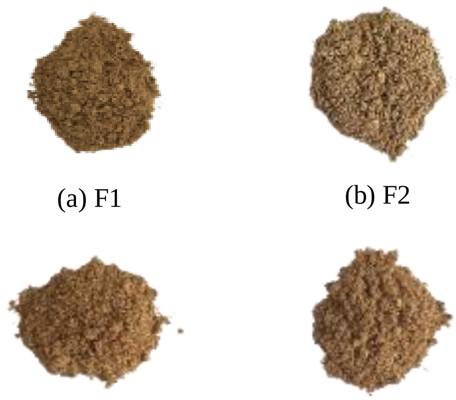
Noted: $p > 0.05$ = No significant difference

RESULTS AND DISCUSSION

"*Zillicum Tea*" Product

Zillicum tea with four treatments is an herbal tea that comes from a combination of three spice plants, specifically ginger, lemongrass, and star anise, producing powder as shown in Figure 2. Figure 2. shows that *Zillicum tea* has the physical characteristics of a powdered product, light brown, and a distinctive aroma from the combination of ginger, lemongrass, and star anise. However, the colours of the four treatments have different levels of brightness. The four herbal tea products above were tested to determine the formulation of a combination of tea that is acceptable to consumers and the best in terms of the chemical quality of herbal tea.

The quality of herbal tea can be determined from the water content and total plate count, because the water content can determine the durability of a product. The total plate count also can determine the total microbes that contaminate the product.



(a) F1 (b) F2

(c) F3 (d) F4

Figure 1. The formulations of *Zillicum tea*

Moisture Content

The moisture content of *Zillicum tea* serves to determine the shelf life and durability of this product. The ANOVA analysis showed an F (2.898) with a significanly level of 0.067, that the moisture content di not significant differences among all treatments, as the $p > 0.05$.

In the processing of *Zillicum tea*, the tea is dried at a temperature of 65°C for 24 hours. According to (Assya, et al., 2022), the longer the drying time, the greater the decrease in moisture content, because a longer drying period allows more water to evaporate. The moisture content in both high and low quality tea is influenced by the composition of the three raw materials, as each raw material has a different moisture content (Table 17).

Table 17. The water content a of *Zillicum tea*

Treatments	Water Content (%)
F1	7.03 ± 0.06^a
F2	6.64 ± 0.37^a
F3	7.09 ± 0.34^a
F4	7.28 ± 0.48^a

Remarks:
The same superscripts on the mean value indicate that the treatments are not significantly different.

Herawati & Nurawan (2007) reported that a relatively high moisture content in dry tea products can increase humidity, which allows microbes to grow in tea products. Based on SNI dry tea (Standard Nasional Indonesia) No: 01-3836-2013 states that the standard of moisture content in dry tea is a maximum of 8%. So, the moisture content test of *Zillicum tea*, the four treatments have met the SNI quality standards because the water content obtained is below 8%.

Total Plate Count

Total Plate Count (TPC) represent the amount of microbial contamination contained in a food and beverage product, so that the quality of the product is by the established standards (Sundari & Fadhliani, 2019). The ANOVA test showed that the TPC result of *Zillicum tea* had a significance value 0.76, which mean $p > 0.05$, indicating that there were no significant differences among the four formulations.

SNI 3836-2013 (BSN, 2013) is stated that the maximum tolerance for bacterial contamination of Total Plate Numbers in dry tea is 3×10^3 coloni/g. The TPC results of the four treatments obtained the number of colonies that were not more than the maximum threshold of tolerance for bacterial contamination that has been determined. This analysis was carried out because *Zillicum tea* is a product that uses raw materials, such as ginger rhizomes and lemongrass that come from the ground. Its implied that this parameter aims to ensure that the contamination in this tea is still below of the maximum standard.

Table 18. Total plate count of *Zillicum tea*

Treatments	TPC (Log_{10} CFU/g)
F1	3.71 ± 0.48[a]
F2	4.29 ± 0.56[a]
F3	3.92 ± 0.70[a]
F4	3.37 ± 0.16[a]

Remarks:
The same superscripts on the mean values indicate that the treatments are not significantly different.

Bacterial contamination in the four *Zillicum tea* treatments did not exceed the maximum limit because ginger, lemongrass, and star anise have antimicrobial compounds. This is supported by Ayuratri, et al., (2017) which found that the growth of *Escherichia coli* and *Bacillus subtilis* bacterial colonies was inhibited by using ginger extract in instant powdered functional drinks. Ginger rhizomes contain antimicrobial chemical compounds such as phenol groups, including gingerol and zingerone (Putri, et al., 2018). Then, according to Howarto et al., (2015), lemongrass contains essential oils which consist of geranial, neral, and myrcene, and these compounds have antimicrobial activity, and star anise contains active compounds that have antimicrobial activity (Perumal & Mary, 2016).

Antioxidant Activity

The antioxidant activity is a compound that can provide one or more electrons to pro-oxidant compounds and then change into a more stable compound. Its compound can inhibit free radicals in the body (Musdalifah, 2016). The analysis results of the *Zillicum tea* antioxidant activity obtained a value (p-value) <0.05. It's meaning that the four treatments of antioxidant activity had a significant effect (Table 11). The high antioxidant activity in F4 is supported by Intan (2021), namely testing the antioxidant activity of star anise extract, which obtained results of 97.6%. Therefore, if associated with these four treatments, antioxidant activity increases along with the increasing ratio of star anise powder combined, and from the F4 formulation. It is known that the star anise powder added more greater than the other three treatments.

Table 19. Antioxidant activity of *Zillicum tea*

Treatments	Inhibition of Antioxidant activity (%)
F1	33.20 ± 0.83 [a]
F2	39.86 ± 0.60[b]
F3	43.00 ± 1.61[c]
F4	54.41 ± 1.75[d]

Remarks:
The different superscripts on the mean value indicate that the treatments are significantly different

The low antioxidant activity contained in the F1 treatment can be due to drying carried out at temperatures that are too high. So, the compounds contained in raw materials such as ginger (gingerol, shogaol, *zingerone*), lemongrass (citral (α-citral and β-citral)) and star anise (anethole) evaporate or are defective. The results of research by Sayekti, et al. (2016) showed that high heating temperatures can cause antioxidant activity to be low and defective.

Widiyana, et al. (2021) stated that ginger contains oleoresin which is an antioxidant, because it can prevent the oxidation process by capturing free radicals. When the oleoresin is damaged, the oxidation process will occur, so the antioxidant compound decreases. Then, Shadri, et al., (2018) reported that the antioxidant activity in lemongrass oil was 35.06% to 30.87% at a temperature of 50°C. The process of making *Zillicum tea* powder with the drying temperature used, namely

65°C, is suspected to be a factor in reducing antioxidant activity.

The weight comparison of each *Zillicum tea* formulation also has a significant effect on the antioxidant activity produced, because Gorman, et al. (2024) stated that the combination of raw materials makes the antioxidant activity more stronger than its single form. Based on this statement, it is proven that the combination of ginger, lemongrass, and star anise will make antioxidant activity strong, because the content of antioxidant compounds such as: star anise, ginger, and lemongrass is quite high. This statement is also proven by Nadia, et al., (2016) that combining several antioxidants can provide greater protection against oxidation when compared to using one antioxidant.

The high antioxidant in F4 is attributed to the elevated levels of phenolic and flavonoid compounds present in ginger, lemongrass, and star anise. According to Siagian, et al. (2020), higher levels of phenolics and flavonoids in a material result in increased antioxidant activity. Therefore, it can be concluded that in formulation F4, the phenolic and flavonoid compounds of java ginger, lemongrass, and star anise act as antioxidants capable of binding ions that contribute to the formation of free radicals in catalytic reaction.

Hedonic Acceptability

Organoleptic testing through hedonic acceptability is essential for evaluating the appearance, aroma, and taste of a product to determine consumer acceptance. The following are the results of organoleptic testing of *Zillicum tea* products on untrained panelists.

Colour

Colour in organoleptic evaluation serves to enhance the visual appeal of the product to panelists and acts as an indicator of the expected taste (Lamusu, 2018). The results of the organoleptic test on this attribute showed that treatment F1 with 3 other treatments, had a significant difference in the level of organoleptic assessment the panelists gave. Treatments F2, F3, and F4 did not have a significant colour difference, as assessed by the panelists (Table 20). The colour of tea has a standard that has been determined by SNI 3836-2013, specifically having a colour that is typical of tea products, namely brownish green. In this study, *Zillicum tea* produced a colour of brownish-yellow-dark chocolate.

Table 20. The colour of *Zillicum tea* product

Treatments	Colour
F1	4.81 ± 1.03^{a}
F2	5.41 ± 1.04^{a}
F3	5.66 ± 1.20^{a}
F4	5.84 ± 1.13^{a}

Remarks:
The same superscripts the mean value results indicate that the treatments are not significantly different.

The colour that appears in each of these treatments occurs during brewing. The factor that makes the colour turn yellowish brown is thought to be due to the comparison of the combination of the three powders used. If more ginger is used, the colour that will form when the tea is brewed a slightly brownish-yellow colour. Aryadi, et al., (2017) reported thattheir research, tea brewing water with a lighter colour (yellowish brown) shows the desired characteristics of tea.

In this treatment, the colour results that produce a rather bright yellow are treatments F1 and F2, where in the combination of these two treatments the dominant ones are ginger and lemongrass. Meanwhile, if the composition of star anise used is increasing, the colour of the tea brew that appears is brownish, because the physical form of star anise is dark brown. When it is processed into powder and brewed, the same colour will appear and be more dominant.

Taste

Taste is an important hedonic acceptability parameter in a food and beverage product, because it determines the quality and acceptance of the panelists towards the product. The taste of the product is influenced by the raw materials used, so it gives a distinctive taste like herbal tea (Priyanto, 1988). The results of the organoleptic test showed that the taste of *Zillicum tea* was not significantly different in each treatment (Table 21). However, even though there was no significant difference, from these results it can be seen that the one that received a high score from the panelists was the F4 treatment. This is because there is a slightly sweet taste and not too spicy in this treatment.

Table 21. The taste of *Zillicum tea* product

Treatments	Taste
F1	$4.53^{a} \pm 1.19$
F2	$5.00^{ab} \pm 1.24$
F3	$5.09^{ab} \pm 1.20$
F4	$5.28^{b} \pm 1.27$

Remarks:
The same superscripts the mean value results indicate that the treatments are not significantly different.

In the F4 treatment, the star anise powder given was greater than that of ginger and lemongrass, making the taste of this treatment stronger. Star anise and the taste of ginger are not too strong. Star anise has a distinctive sweet taste that is slightly spicy (Putri, et al., 2021) and ginger has a spicy taste because it contains more essential oils when compared to eginger (Pebiningrum, 2017). Panelists prefer F4 because of the distinctive taste such as sweet and spicy taste which is balanced compared to the other three treatments.

However, although the panelists were more interested in giving a higher taste to the F4 treatment, these four treatments were not significantly different, allegedly because the panelists felt that the differences in the four treatment formulations were still relatively small, although there was a slightly sweet taste in one of the treatments. However, the spicy taste was present in it, and that was a difference in preference from each panelist. This is supported by Hasanah, et al. (2014), that the senses that influence taste preferences, namely cultural variations, have a very real influence on food and beverage habits, thus influencing preferences for basic taste.

Aroma

Aroma gives a good impression of the product being tested, thus offering an appealing attraction to the panelists. The aroma is produced by volatile compounds from the raw materials used (Arziyah, et al., 2022).

Table 22. The aroma of *Zillicum tea* product

Treatments	Aroma
F1	5.72 ± 1.19^{a}
F2	5.84 ± 1.24^{a}
F3	5.47 ± 1.20^{a}
F4	5.31 ± 1.27^{a}

Remarks:
The same superscripts the mean value results indicate that the treatments are not significantly different.

Table 22. shows the results of the hedonic test on the aroma of *Zillicum tea* treatment did not have a significant effect or was not significantly different, with the results having an average of 5.31-5.84. Although not significantly different, the results clearly indicate that be seen that the treatment with the highest value is treatment F2 (5.84) and the lowest is treatment F4 (5.31).

The aroma in these four treatments is due to the use of three spices that have a distinctive aroma. In the ginger used, the aroma that appears because in ginger there is an essential oil that produces aroma (Koswara, 1995). Likewise, star anise contains high essential oils such as anethole, linalool, and limonene which make star anise have an aromatic smell (Fardeau, et al., 2013).

The assessment and comments from the panelists, F2 after brewing, the aroma is more dominated by lemongrass than the other two ingredients. It's because the composition of lemongrass powder is more than the composition of ginger and star anise. Nugroho (2022) stated that lemongrass is a spice plant that has aromatic compounds, so the addition of lemongrass can add aroma to tea. When associated with the aroma in this *Zillicum tea* treatment, lemongrass with a larger composition than the composition of ginger and star anise can provide a strong and distinctive aroma, and this assessment, it can be concluded that the panelists prefer the aroma of tea that is dominated by lemongrass.

CONCLUSION AND SUGGESTION

Based on the objectives and results of the study, it can be concluded that there is an influence of the four formulations of *Zillicum tea* on antioxidant activity because the combination of ginger, lemongrass, and star anise used is different, resulting in different strengths of the binding antioxidant activity compounds. In addition, the effect of temperature and drying time affects the size of the antioxidant activity because the antioxidant compounds are degraded. *Zillicum tea* also affects hedonic acceptability such as taste, aroma and color in each treatment. The best formulation for *Zillicum tea* based on antioxidant and hedonic acceptabelity is formulation F4 (Jahe 12.5%;35.5%;50%).

REFERENCES

Aryadi, F., Wahyuni, S. & Rejeki, S., 2017. *Analisis Organoleptik Produk Teh Celup Tawaloho (Spondias pinnata)*. Jurnal Sains dan Teknologi Pangan, 2(5). 792-799.

Arziyah, D., Yusmita , L. & Wijayanti, R., 2022. *Analisis Mutu Organoleptik Sirup Kayu Manis dengan Modifikasi Perbandingan Konsentrasi Gula Aren dan Gula Pasir*. Jurnal Hasil Penelitian dan Pengkajian Ilmiah Eksakta, 1(2). 106-109.

Assya, A. A., Ikhlas, O., Putri, N. P. & Niawanti, H., 2022. *Pengaruh Pengeringan terhadap Kadar Tanin Teh Herbal Daun Belimbing Wuluh (Averrhoa bilimbi)*. Jurnal Atmosphere, 3(1). 1-7.

Ayuratri, Kristanti, M. & Kusnadi, J., 2017. *Aktivitas Antibakteri Kombucha Jahe (Zingiber officinale) Kajian Varietas Jahe dan Konsentrasi Madu*. Jurnal Pangan dan Agroindustri, 5(3). 95-107.

BSN, 2013. *SNI Syarat Mutu Teh Kering dalam Kemasan.* Jakarta: Badan Standarisasi Nasional.

Fardeau, M. L., Benmalek, Y., Yahia, O. A. & Belkebir, A., 2013. *Anti-microbial and Anti-oxidant activities of Illicium verum, Crataegus oxyacantha ssp Monogyna and Allium cepa Red and White Varieties.* Bioengineered Journal, 4(4). 244-248.

Gorman, M. I., Widyasaputra, R. & Sunardi, 2024. *Pembuatan Teh Celup Kulit Buah Naga Merah Variasi Penambahan Bunga (Rosella, Telang dan Krisan)*. Agroforetech, 2(2). 837-845.

Hasanah, U., Adawiyah, D. R. & Nurtama, B., 2014. *Preferensi dan Ambang Deteksi Rasa Manis dan Pahit Pendekatan Multikultural dan Gender*. Jurnal Mutu Pangan, 1(1). 1-8.

Herawati, H. & Nurawan, A., 2007. *Peningkatan Nilai Tambah Produk Teh Hijau Rakyat di Kecamatan Cikalong wetan-kabupaten Bandung*. Pengkajian dan Pengembangan *Teknologi Pertanian*, 3(10). 241-249.

Howarto, M. S., Wowoe, P. M. & Mintjelungan, C. N., 2015. *Uji Efektifitas Antibakteri Minyak Atsiri Sereh Dapur sebagai Bahan Medikamen Saluran Akar terhadap Bakteri Enterococcus faecalis*. Jurnal e-GIGI, 3(2). 432-438.

Intan, E. K., 2021. *Pharmacological Activities of Illicium verum*. Jurnal Info Kesehatan, 11(1). 388-393.

Kekuda, P. T., Vinayaka, K., Kumar, P. S. & Sudharshan, S. J., 2009. *Antioxidant and Antibacterial Activity of Lichen Extracts, Honey and Their Combination*. Journal of Pharmacy Research, 2(12). 1875-1878.

Koswara, S., 1995. *Jahe dan Hasil Olahannya*. Jakarta: Pustaka Sinar Harapan.

Krisnawati, I., 2008. *Teh Herbal Minuman Berkhasiat Pemulih Kesehatan*. Jakarta: PT. Gramedia Utama.

Kusumiati, M. & Rawar, E. A., 2022. *Perbandingan Kadar Fenolik Total dalam Minyak Atsiri dan Ekstrak Etanol Bunga Lawang (Illicium verum)*. Jurnal Media Farmasi Indonesia, 17(2). 75-80.

Lamusu, D., 2018. *Uji Organoleptik Jalangkote Ubi Jala Ungu (Ipomoea batatas L) sebagai Upaya Diversifikasi Pangan*. Jurnal Pengelolahan Pangan, 3(1). 9-15.

Lestari, E., Wahyudi, B. F., Ustiawan, A. & Dewi, D. I., 2019. *Potensi Minyak Atisiri Bunga Lawang (Illicium verum) sebagai Repelen Nyamuk Aedes aegypti*. BALABA Jurnal Litbang Pengendalian Penyakit Bersumber Binatang, 15(1). 13-22.

Musdalifah, 2016. *Penentuan Suhu dan Waktu Optimum Penyeduhan Daun Teh Hijau (Camellia sinensis* L.*) Terhadap Kandungan Antioksidan Kafein, Katekin dan Tanin*, Makassar: Universitas Islam Negeri Alauddin Makassar.

Nadia, S., Riyanti, R. & Nirmala, R., 2016. *Uji Aktivitas Antioksidan Kombinasi dari Kulit Buah Naga (Hylocereus costaricensis) dan Bunga Rosela (Hibiscus sabdariffa L.) dengan metode DPPH (1,1 Diphenyl-2-picrylhidrazyl) beserta Bentuk Tunggalnya*. Jurnal KesMaDaSKa, 7(2). 94-99.

Nugroho, M. E. A., 2022. *Aktivitas Antioksidan Teh Celup Kombinasi Teh Hotam dengan Serai Dapur (Cymbopogon citratus)*, Semarang: USM Science.

Pebiningrum, A., 2017. *Pengaruh Varietas Jahe (Zingiber officinale) dan Penambahan Madu Terhadap Aktivitas Antioksidan Minuman Fermentasi Kombinasi Jahe*. Jurnal of Food and Life Sciences, 1(2). 33-42.

Perumal, U. M. & Mary, B. L., 2016. *Characterization and Anti Microbial Effect of Methanolic Extract of Illucium verum on Pathogenic Bacteria*. World Journal of Pharmacy and Pharmaceutical Sciences, 5(9). 2040-2054.

Priyanto, G., 1988. *Teknik Pengawetan Pangan.* Yogyakarta: Pusat Antar Universitas Pangan dan Gizi Universitas Gadjah Mada.

Putri, M. T., Aditama, D. S. & Diyanty, D., 2019. *Efektivitas aroma terapi sereh (Cymbopogon citratus) dengan Teknik Relaksasi Genggaman Jari terhadap Penurunan Nyeri Pasca Sectio caesarea.* Wellness and Healthy Magazine, 1(2). 267-276.

Putri, R. M. S., Nurjanah & Tarman, K., 2018. *Analisis Kuantitatif Mikrobiologi Serbuk Minuman Fungsional Lintah Laut (Discaromais sp) pada Suhu yang Berbeda selama Penyimpanan*. Jurnal Majalah Ilmiah Biologi Biosfera, 35(3). 124-130.

Putri, U. M. et al., 2021. *Inovasi Pembuatan Bandrek Instan dengan Memanfaatkan Potensi Tanaman Herbal di Desa Dalu Sepuluh A Kecamatan Tanjung Morawa*. Jurnal Keluarga Sehat Sejahtera, 19(2). 63-69.

Ratnaningrum, D., Endah, E. S. & Pudjiraharti, S., 2017. *The effect of Themperature and Extraction Periode of Time on the Chemical Content of Emprit Ginger Ethanol Extract (Zingiber officinale var. Rubrum).* AIP Conference Proceedings, 1803(1).

Sayekti, D. E., Asngad, A. & Chalimah, S., 2016. *Aktivitas Antioksidan Teh Daun Katuk dan Daun Kelor dengan Variasi Suhu Pengeringan,* Surakarta: Universitas Muhammadiyah Surakarta.

Shadri, S., Moulana, R. & Safriani, N., 2018. *Kajian Pembuatan Bubuk Serai Dapur (Cymbopogon citratus) dengan Kombinasi Suhu dan Lama Pengeringan.* Jurnal Ilmiah Mahasiswa Pertanian Unsyiah, 3(1). 371-380.

Siagian, I. D., Bintoro, V. P. & Nurwantoro, 2020. *Karakteristik Fisik, Kimia dan Organoleptik Teh Celup Daun Tin dengan Penambahan Daun Stevia (Stevis rebaudiana bertoni) sebagai Pemanis*. Jurnal Teknologi Pangan, 4(1). 23-29.

Stoner, G. D., 2013. *Ginger: Is It Ready For Prime Time?.* American Association for Cancer Research, 6(4). 257-262.

Sundari, S. & Fadhliani, 2019. *Uji Angka Lempeng Total (ALT) pada Sediaan Kosmetik Lotion X di BBPOM Medan.* Jurnal Biologica Samudra, 1(1). 25-33.

Widiyana, I. G., Yusa, N. M. & Sugitha, I. M., 2021. *Pengaruh Penambahan Bubuk Jahe Emprit (Zingiber officinale var. Amarum) terhadap Karakteristik Teh Celup Herbal Daun Ciplukan (Physalis angulata L.).* Jurnal Ilmu dan Tenolohi Pangan, 10(1). 45-56.

Wiratna, G., Rahmawati & Linda, R., 2019. *Angka Lempeng Total Mikroba pada Minuman Teh di Kota Pontianak.* Jurnal Protobiont, 8(2), pp. 69-73.

Yudana, I. G. A., 2004. *Mengenal Ragam dan Manfaat Teh.* Yogyakarta: Indomedia.