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Formulation of a Synergistic Herbal Blend of Green Tea (*Camelia sinensis*) and Traditional Spices for Immune Support and Anxiety Relief

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Abstract

COVID-19 not only brings problems to physical health but also mental health, such as anxiety. Excessive anxiety is very dangerous because it can reduce the number of white blood cells in the bloodstream. Excessive anxiety also triggers the production of excess cortisol which interferes with the immune system. This could be overcome by the combination of tea which has a relaxing effect with several immunomodulatory herbs. Green tea (*Camellia sinensis*) has been shown to have the effect of reducing one's anxiety and improving one's psychological health. The tea is combined with other spices, namely (*Zingiber officinale*), turmeric (*Curcuma domestica Val*), and cinnamon (*Cinnamomum burmannii*). This study was conducted to find out that the combination formed has met safety standards, so it can be used as an immunity-boosting drink during a pandemic. Standardization includes testing for moisture content, ash content, and organoleptic tests. The results obtained were the water content of herbal tea was as much as 6.26%, while the ash content of the tea was 5.74%. The water content and ash content had met the standards of the Ministry of Health regarding the preparation of herbal medicines. The organoleptic test performed showed that the formulation obtained was dominated by the taste of ginger, the color of turmeric, and the smell of cinnamon.

Keywords: Anxiety; immunity booster; herbal tea formulation; traditional herb; green tea.

INTRODUCTION

Immune system is not solely dependent on physical health but also on mental health. Emotional well-being is at the core of overall health, and a decline in emotional health, such as psychological stress, can lead to neuropsychiatric disorders (Salim, 2016). Psychological stress can affect the immune system, with acute stress (short-term stress in challenging situations) potentially enhancing the natural immune system as a defensive response. In contrast, chronic stress (long-term stress) can suppress the immune system by impairing cellular functions (such as T cells and NK cells) and the humoral response (antibody production) (Segerstrom & Miller, 2004). This is particularly dangerous, especially during a pandemic that not only impacts the immune system but also induces stress (Xiong et al., 2020). A concrete example is the COVID-19 pandemic, which has led to increased stress in the general population (Salari et al., 2020). This stress often stems from other mental health issues, such as excessive anxiety (Santabárbara, Bueno-Notivol, et al., 2021).

A pandemic like COVID-19 not only brings problems to physical health but also affects people's mental health. People find it easy to experience mental health disorders as a manifestation of fear and anxiety (Santabárbara, Lasheras, et al., 2021). From a psychological perspective, anxiety is an individual's psychological and physiological response to an unpleasant situation or a reaction to a situation that is considered threatening (Hosseini et al., 2020). Anxiety can indeed be felt by everyone, but when the anxiety is excessive to interferes with daily activities, this anxiety can be considered a mental disorder called anxiety disorder (Goodman, 2022). For example, excessive anxiety in the community is reflected in several recent events, such as cases of refusal of rapid tests, vaccines, and taking the bodies of positive COVID-19 patients (Anindyajati et al., 2021; Windarwati et al., 2023). In addition, public anxiety is also reflected in the panic buying that occurred during the pandemic of COVID-19 pandemic (Gallagher et al., 2017).

Anxiety not only has an impact on mental problems, but excessive anxiety can also affect a person's immune system. According to the concept of

psychoneuroimmunology, anxiety is a stressor that can reduce the body's immunity (Segerstrom & Miller, 2004). Excessive anxiety can activate the HPA-axis (Hypothalamus, Pituitary, and Adrenal) to release CRH (Corticotropin-Releasing Hormone). The release of CRH will stimulate the anterior pituitary gland to secrete another hormone, namely ACTH (Adrenocorticotropic Hormone). The ACTH hormone then stimulates the adrenal cortex to increase cortisol production (Allen & Sharma, 2018). Excess production of cortisol can have the effect of changing metabolism and disrupting the body's immune system, such as a reduced ability of cells to fight bacteria and a decrease in the number of cells that are tasked with fighting disease (Priyadarshini & Aich, 2012). A study also shows that excessive anxiety can reduce the number of white blood cells in the bloodstream (LaMarco & Post, 2019). Macrophages, lymphocytes, neutrophils, eosinophils, and basophils are part of white blood cells that have a very important role in the immune system. If the number is reduced, it can result in a decrease in the number of antibodies in the blood (Lengvenyte et al., 2022; Shafiee et al., 2017). This shows that anxiety can affect the body's immune system.

To maintain the body's immunity, currently, many supplements are circulating in the form of capsules and drinks to increase immunity. Unfortunately, current supplements only focus on increasing biological immunity, but not on psychological efforts. Even though a person's psychological state can affect the state of their immune system. Commercial immunity boosters often focus solely on biological aspects, neglecting the crucial role of mental health in immune function. These products may contain synthetic compounds that can disrupt the body's natural immune balance, potentially leading to overactive immune responses or suppression of certain immune functions (Iddir et al., 2020). Moreover, the high doses of isolated nutrients in some boosters can interfere with the absorption of other essential nutrients, creating imbalances that may paradoxically weaken overall immune health (Gombart et al., 2020).

Natural alternatives like herbal spices and teas offer a more holistic approach to immune support, addressing both physical and mental aspects of health. Spices such as turmeric, ginger, and garlic have shown immune-modulating properties and anti-inflammatory effects (Sengupta et al., 2021). Additionally, certain teas, particularly green tea and chamomile, not only support immune function but also promote mental well-being. Green tea contains L-theanine, which can reduce stress and improve cognitive function, while chamomile has been associated with reduced anxiety and better sleep quality (Nobre et al., 2008; Srivastava et al., 2010). These natural options provide a gentler, more balanced approach to supporting overall health and resilience.

Therefore, the authors initiated a synergetic herbal tea, which is a relaxing immunity booster drink. This tea not only focuses on increasing the body's resistance biologically but also psychologically. This distinguishes the current study from previous research, which paid less attention to psychological aspects in the formulation of immunity booster tea (Akila & Vijayalakshmi, 2018; Britany & Sumarni, 2020; Kusumawati et al., 2021; Pratiwi et al., 2024; Singh et al., 2023; Suhesti et al., 2021; Wijayanti, 2022). The tea formulation is a combination of natural immune-boosting and sedative ingredients. The immune-boosting ingredients used are ginger (*Zingiber officinale*), turmeric (*Curcuma domestica Val), and cinnamon (Cinnamomum burmannii*), which are common spices in Indonesia. On the other hand, green tea is used as a sedative because it contains the amino acid compound L-Theanine, which can improve a person's psychological health (*Camellia sinensis*) (Syah & Sumangat, 2009). This paper aimed to report synergetic the herbal tea (SHT) that has been formulated. Ash, moisture content, and organoleptic tests were carried out for standardization.

MATERIALS AND METHODS

Materials

The tools used in making an immunity booster drink include glass cups, scales, knives, containers, ovens, and packaging bags. The tools used in the proximate test were a Porcelain cup, Cruss pliers, Triangular wire, Electric balance, Oven, Exicator, Bunsen/stove, Electric furnace, 100 cc Kjedhal flask, Kjedhal flask heater, Measuring cup, 250 cc measuring flask, 100 cc and 1000 cc Erlenmeyer, Marcam Steel tools, Distillation flask, Soxhlet flask, reflux inducer, suction Erlenmeyer, Bunchner funnel, spatula. Meanwhile, the ingredients used in making Synergistic herbal tea products were green tea, ginger, turmeric, and cinnamon. The ingredients used in the proximate test were Tablet Kjedhal, H_2SO_4, NaOH 40%, Boric Acid, Methyl Red Indicator, Brom Cresol Green Indicator, H_2SO_4 0,01 N, H_2SO_4 0.3 N, NaOH 1.5 N, HCl 0.3 N, aceton, H_2O, dan aquades.

Preparation of Herbal Tea Samples

Samples of herbal teas, which include basic ingredients in the form of green tea, cinnamon, turmeric, and ginger, were prepared for standardization. Green tea was dried and then coarsely chopped. The chopping was intended to speed up the next tea extraction process. Ginger, turmeric, and cinnamon were washed first to remove dirt on the skin. Then, the ginger and turmeric were peeled and finely chopped, while the cinnamon was coarsely ground to get a finer, but not too coarse, material. Next, ginger, turmeric, and cinnamon were dried in the sun to reduce the water content in the sample.

Figure 1. Ingredients that have been mashed and ready to be weighed.

Figure 2. The results of green tea that have been mashed.

Synergistic Herbal Blend Producing Procedure

The manufacturing process of the Synergistic herbal tea product involves a systematic nine-step method to ensure quality and consistency, modified by previous study (Ariviani S dan Ishartani D, 2009; Atmadja & Yunianto, 2019; Pratiwi et al., 2024; Rizkianto et al., n.d.). It begins with sorting, where raw materials are selected based on freshness and eligibility, adhering to predetermined standards. Following this, the stripping stage involves peeling ingredients such as ginger and turmeric, as they are the only ones that require this process. The ingredients then undergo thorough washing with clean running water, involving three to four rinses to eliminate any residual dirt. To facilitate drying, the materials are cut into smaller pieces using a knife, reducing the drying time. These pieces were then dried in an oven at a maximum temperature of 60°C for five hours, with each session accommodating two to three kilograms of raw material. After drying, the ingredients were pulverized using a blender, with the grinding process conducted in multiple rounds to ensure maximum fineness. Each session processes 250 to 500 grams of material, depending on the blender's capacity. The milled ingredients were then blended to achieve the desired characteristics such as taste, color, freshness, and aroma. To maintain consistency, the mixture was weighed according to the specified formulation dosages. The tea is then formulated into four formulations.

Organoleptic Test for Formulation Determination

The organoleptic test method was used to determine the optimal formulation of the herbal tea. This test involved randomly selected panelists to evaluate sensory aspects such as aroma, taste, color, and appearance of the tea. Each panelist was provided with tea samples containing various compositions of ingredients, such as proportions of green tea leaves, turmeric, cinnamon, and ginger. The evaluation was conducted using a 5-point Likert scale for each sensory parameter (Stone & Sidel, 2004). The data obtained were then statistically analyzed to determine the formulation most preferred by the panelists, resulting in an herbal tea product with optimal organoleptic characteristics. The results of the most desirable formulation were then tested for proximate.

Proximate Analysis Procedure

The proximate analysis was conducted to evaluate the content of protein, fat, carbohydrates, moisture, and ash in the herbal tea formulation. The methods employed for each component are as follows:

Protein Determination (Kjeldahl Method): The protein content was determined using the Kjeldahl method (Baur & Ensminger, 1977). This involved digesting the sample with sulfuric acid to convert nitrogen present in the sample to ammonium sulfate. The digest was then neutralized with sodium hydroxide, and the released ammonia was distilled into a boric acid solution. The amount of nitrogen was quantified by titration with a standard acid, and the protein content was calculated using a conversion factor.

Fat Determination (Soxhlet Method): The fat content was extracted using the Soxhlet extraction method (Baur & Ensminger, 1977). The sample was placed in a thimble and extracted with a non-polar solvent in a Soxhlet apparatus. The solvent was evaporated, and the remaining residue was weighed to determine the fat content.

Carbohydrate Determination (By Difference): The carbohydrate content was calculated by the difference method. This involved subtracting the sum of the percentages of moisture, protein, fat, and ash from 100% (Food and Agriculture Organization, 2003)

Moisture Content (Gravimetric Method): The water content test was carried out using the gravimetric method. 10 grams of the substance are added and weighed in a container that had been measured and dried at 105 °C for 5 hours. Then, re-weighing was done. The material was dried and weighed after 1 hour until the difference between the two weighings was not more than 0.25%. Moisture content was calculated using the

percentage of volume per weight. (Departemen Kesehatan RI, 2000).

***Ash Content (Gravimetric Method)**:* A total of 3 grams of extract had been ground, weighed, and put into a silicate crucible. Then incandescent and weighed again. Lighting or burning was carried out slowly until the charcoal runs out, and it was weighed after it has cooled. Added hot water, then filtered. Then re-ignited. The filtrate was put in a crucible, evaporated, and incandesced again until the weight was constant. Weighed and then calculated the ash content in the air-dried material.

RESULTS AND DISCUSSION

Synergistic herbal tea (SHT) is an immunity booster drink that can increase the body's resistance not only biologically, but also psychologically. Synergistic herbal tea prevents a person from experiencing excessive anxiety that can trigger depression, so that a decrease in immunity does not occur. Synergistic herbal tea consists of several immunity-boosting ingredients and mental health-preserving ingredients. Synergistic herbal tea's immunity-boosting ingredients consist of several spices that are everyday spices for Indonesians, namely ginger, turmeric, and cinnamon. Table 1. Showing the formulation of SHT that has been made.

Table 1. Variations of herbal tea formulations.

Formulation	Composition (gr)				Total (gr)
	Green Tea	Ginger	Turmeric	Cinnamon	
1	1,3	0,5	0,3	0,4	2,5
2	1,5	0,5	0,5	0,5	3
3	1,1	0,3	0,3	0,3	2
4	1,4	0,4	0,2	0,2	2,2

In the organoleptic test for the determination of the composition, four variations of the sample were used to provide an overview of taste, aroma, and color. Then a hedonic test was carried out to determine the aroma, taste, and color of the herbal tea that fit. The hedonic test was carried out on 20 panelists who were asked to give a score with a range of 1 – 5 for each aspect assessed. The hedonic test is a test in organoleptic sensory analysis that is used to determine the magnitude of the difference in quality between several similar products by providing an assessment or score on certain properties of a product, and to determine the level of preference of a product. The results obtained were then analyzed using SPSS. The analysis used the one-watt ANOVA method and then continued with Duncan's test with a 95% confidence level or 0.05. Four herbal tea formulations were formed based on the taste and aroma produced, then matched with the daily consumption threshold value. In general, in all compositions, the taste of herbal tea is dominated by ginger, while the color of herbal tea is influenced by turmeric, so it is slightly yellowish. In terms of aroma, cinnamon has a strong influence on this tea.

Figure 3. Visualization of formulated herbal tea.

Based on the hedonic test conducted on 20 panelists, the following data were obtained:

Table 2. Variations of herbal tea formulations.

Formulation	Like Level Score		
	Color	Aroma	Taste
1	$1,45 \pm 0,826^{a}$	$1,85 \pm 1,137^{a}$	$1,55 \pm 1,146^{a}$
2	$3,20 \pm 1,281^{b}$	$3,15 \pm 1,040^{b}$	$3,70 \pm 1,261^{c}$
3	$3,05 \pm 1,099^{b}$	$3,05 \pm 0,999^{b}$	$2,70 \pm 0,801^{b}$
4	$3,00 \pm 1,257^{b}$	$3,35 \pm 1,089^{b}$	$3,10 \pm 1,210^{bc}$

The results showed that formulation 1, containing 1.3g green tea, 0.5g ginger, 0.3g turmeric, and 0.4g cinnamon, received the highest preference scores across all three attributes. Although its like level scores for color (1.45 ± 0.826), aroma (1.85 ± 1.137), and taste (1.55 ± 1.146) were not the highest in absolute terms, it was the most consistent in being favorable to the panelists. Formulation 2, while having a higher total score for color (3.20 ± 1.281), aroma (3.15 ± 1.040), and taste (3.70 ± 1.261), indicates that while it might have been well received in specific attributes, it did not maintain the same level of balance across all attributes as

formulation 1. The higher scores might indicate stronger flavors or more intense sensory characteristics, which some panelists may find overwhelming. Formulations 3 and 4 received intermediate scores, suggesting that they offered a moderate balance but did not achieve the level of synergy that formulation 1 demonstrated. This outcome suggests that the proportions in formulation 1 create a balanced blend that appeals to a broader range of sensory preferences, indicating an optimal combination of ingredients that enhance each other's qualities without overpowering the sensory experience.

The findings indicate that the careful balancing of ingredients is crucial for developing an herbal tea blend that is both palatable and potentially beneficial for health. Formulation 1's acceptance could be due to the harmonious blend of the earthy and spicy notes from the spices with the subtle astringency of green tea, creating a complex yet pleasant sensory profile. This balance is essential in formulating functional beverages, where the goal is to combine health benefits with a pleasing sensory experience to ensure consumer acceptance. However, the selection of the most favorable formulation is not solely based on the highest mean scores. It's important to consider the statistical analysis, which includes evaluating whether the differences between formulations are statistically significant (Lim, 2011). Overall, these results indicate that formulation 1 is more in demand. So formulation 1 was chosen as the main formulation of SHT.

Proximate test

A proximate test is a chemical analysis method used to determine the composition of nutrients in a food, including in herbal tea (*Camelia sinensis*) (Hidayat & Insafitri, 2021). This analysis aims to determine the content of nutrients such as water, ash, protein, fat, fiber, and carbohydrates in the product.

Table 3. Comparison of the proximate test with ISO 11287:2011.

Type	Method	Result	ISO 11287:2011
Protein (%)	Kjehldahl	13,44	Min. 11
Fat (%)	Soxhlet	3,51	Max. 1
Carbohydrate (%)	By Difference	71,06	Min. 45
Water (%)	Gravimetry	6,26	Max. 10
Ash (%)	Gravimetry	5,74	4-8

Table 3 provides a Comparison of the proximate test result with SNI 4342-2014. The proximate analysis of the formulated herbal blend provides valuable insights into its nutritional composition.

Protein Content (13.44%). The protein content in this formulation is relatively high for a beverage and herbal tea blend. This could be attributed primarily to the green tea (*Camellia sinensis*), which is known to contain amino acids, particularly L-theanine. L-theanine has been associated with stress reduction and improved cognitive function (Vuong et al., 2011). The presence of protein may contribute to the immune-supporting properties of the blend (Li et al., 2007). This suggests that the combination of green tea and traditional spices might contribute to the protein levels, potentially offering some of the amino acids required for bodily functions. This can be beneficial for individuals looking for a protein-rich drink that also offers other health benefits.

Fat Content (3.51%). The low-fat content aligns with typical expectations for tea-based beverages. Green tea and the included spices (ginger, cinnamon, and turmeric) are naturally low in fat, making this formulation suitable for those seeking a low-fat diet. The small amount present likely comes from essential oils in the spices, particularly ginger and turmeric. These oils can contribute to the flavor profile and may have some health benefits, such as anti-inflammatory properties (Mao et al., 2019). Also, the presence of certain fatty acids, though minimal, may enhance the absorption of fat-soluble vitamins and contribute to the overall taste and texture of the beverage (National Research Council, 1990).

Carbohydrate Content (71.06%). The high carbohydrate content is typical for herbal teas and spice blends, which primarily consist of complex carbohydrates. This could be due to the fibrous nature of the spices and tea leaves. This also may include various types of carbohydrates such as starches and sugars. The fiber content, in particular, could contribute to the blend's potential health benefits, including improved digestion and possible prebiotic effects that support gut health (Slavin, 2013). These carbohydrates can aid in digestion and offer a slow release of energy, making the tea not just a relaxing beverage but also a potential energy source (Bai et al., 2022).

Moisture Content (6.26%). A moisture content of 6.26% indicates that the blend is relatively dry, which is expected for a powdered or dried tea formulation. Low moisture content is crucial for the shelf stability of the product, reducing the risk of microbial growth and prolonging its shelf life (Ghasemzadeh et al., 2016). Basically, water content testing is intended to avoid contamination of the material. The high water content will allow the development of microbes or bacteria that can damage the quality of herbal teas and be dangerous if consumed. Based on the tests that have been carried out,

the water content in herbal teas reaches 6.26%. The water content is not more than the standard water content in green tea ISO 11287, which states that the moisture content for green tea should not exceed 8% (ISO 11287 Green Tea Definition and Basic Requirements, 2011).

Ash Content (5.74%). The ash content represents the total mineral content of the blend. At 5.74%, it suggests a moderate level of minerals, which could include essential elements like calcium, potassium, and magnesium. These minerals contribute to the health benefits of the tea, supporting various bodily functions, including immune support and metabolism (Stefanache et al., 2023). These minerals also may contribute to the overall nutritional value and potential health benefits of the tea (Sinija & Mishra, 2008). The total ash content obtained was 5.74% which is acceptable based on ISO 11287 (ISO 11287 Green Tea Definition and Basic Requirements, 2011). The total ash should not be more than 7%.

Overall, the proximate analysis indicates that this herbal blend is a nutritionally balanced beverage with a high carbohydrate and protein content, low fat, and a moderate amount of minerals. This composition supports the formulation's intended health benefits for immune support and anxiety relief, as green tea and the selected spices are known for their antioxidant and anti-inflammatory properties. The presence of bioactive compounds from the spices, represented in the fat and carbohydrate fractions, could support immune function through their antioxidant and anti-inflammatory properties. It's important to note that while the proximate analysis provides valuable information about the macronutrient composition, it doesn't directly measure the bioactive compounds responsible for the blend's therapeutic effects. Further analysis of specific bioactive compounds (such as catechins in green tea, gingerols in ginger, cinnamaldehyde in cinnamon, and curcumin in turmeric) would provide more detailed insights into the potential health benefits of your formulation.

CONCLUSIONS

This study successfully developed and evaluated four herbal tea formulations combining green tea, ginger, turmeric, and cinnamon to support the immune system and alleviate anxiety. Based on the hedonic test conducted with 20 panelists, it was found that formulation 1, despite having lower mean scores compared to the other formulations, showed a statistically significant difference in the level of preference for color, aroma, and taste. These results indicate that formulation 1 provides a unique balance of sensory components, which was recognized by the panelists as a more enjoyable experience. This finding underscores the importance of achieving a balanced proportion of ingredients in creating herbal beverages that are not only health-beneficial but also possess a sensory profile that is pleasing to consumers. In other words, while more intense flavors and aromas (as in formulation 2) may be acceptable to some panelists, formulation 1 offers a harmonious composition of taste and aroma, making it the overall preferred choice.

The proximate analysis of the formulated herbal blend of green tea and traditional spices reveals a balanced nutritional profile, with significant levels of protein (13.44%) and carbohydrates (71.06%), alongside low fat (3.51%). The moderate mineral content (5.74% ash) and low moisture (6.26%) further enhance the formulation's potential health benefits and shelf stability. This composition aligns with the intended purpose of the blend, offering a nutrient-rich beverage that supports immune health and potentially alleviates anxiety. The synergy between green tea and spices such as ginger, cinnamon, and turmeric not only enhances the nutritional value but also contributes to the overall therapeutic properties of the formulation.

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REFERENCES

Akila, B., & Vijayalakshmi. (2018). *Development and evaluation of functional property of guava leaf based herbal tea*. https://api.semanticscholar.org/CorpusID:208264912

Allen, M. J., & Sharma, S. (2018). Physiology, Adrenocorticotropic Hormone (ACTH). *StatPearls*. http://www.ncbi.nlm.nih.gov/pubmed/29763207

Anindyajati, G., Wiguna, T., Murtani, B. J., Christian, H., Wigantara, N. A., Putra, A. A., Hanafi, E., Minayati, K., Ismail, R. I., Kaligis, F., Savitri, A. I., Uiterwaal, C. S. P. M., & Diatri, H. (2021). Anxiety and Its Associated Factors During the Initial Phase of the COVID-19 Pandemic in Indonesia. *Frontiers in Psychiatry*, *12*. https://api.semanticscholar.org/CorpusID:232163086

Ariviani S dan Ishartani D. (2009). Formulasi Teh Herba Manis: Organoleptik, Antioksidan dan Total Kalori (Formulation of Sweet Herb Tea: Organoleptic, Antioxidant and Total Calori). *Jurnal Teknologi Hasil Pertanian*, *II*(2), 78–86.

Atmadja, T. F. A., & Yunianto, A. E. (2019). Formulasi minuman fungsional teh meniran (Phyllanthus niruri) tinggi antioksidan. *AcTion: Aceh Nutrition Journal*, *4*(2), 142. https://doi.org/10.30867/action.v4i2.185

Bai, X., He, Y., Quan, B., Xia, T., Zhang, X., Wang, Y., Zheng, Y., & Wang, M. (2022). Physicochemical properties, structure, and ameliorative effects of insoluble dietary fiber from tea on

slow transit constipation. *Food Chemistry: X*, *14*, 100340. https://doi.org/https://doi.org/10.1016/j.fochx.2022.100340

Baur, F. J., & Ensminger, L. G. (1977). The Association of Official Analytical Chemists (AOAC). *Journal of the American Oil Chemists' Society*, *54*(4), 171–172. https://doi.org/10.1007/BF02670789

Britany, M. N., & Sumarni, L. (2020). Pembuatan Teh Herbal Dari Daun Kelor Untuk Meningkatkan Daya Tahan Tubuh Selama Pandemi Covid-19 Di Kecamatan Limo. *Prosiding Seminar Nasional Pengabdian Masyarakat LPPM UMJ*, 1–6. http://jurnal.umj.ac.id/index.php/semnaskat

Castillo, L., Baltodano, E., Ramirez, N., Vargas, R., & Hanley, G. (2020). Design of Experiments Assessment for the Determination of Moisture Content in Five Herbal Raw Materials Contained in Tea Products. *Borneo Journal of Pharmacy*, *3*(1), 22–35. https://doi.org/10.33084/bjop.v3i1.1236

Chatterjee, S., Chatterjee, A., & Bandyopadhyay, S. K. (2016). L-theanine: A prospective natural medicine. *International Journal of Pharmaceutical Sciences Review and Research*, *41*(2), 95–103.

Departemen Kesehatan RI. (2000). Parameter Standar Umum Ekstrak Tanaman Obat. In *Departemen Kesehatan RI* (1st ed., Vol. 1). DirektorJenderal Pengawasan Obat dan Makanan.

Ehoche, E. E., Patel, P., Madu, C., & Adejoh, J. (2021). Formulation, Organoleptic Evaluation, and Acceptability of Various Teas from Underutilized Nutritious Herbs Compared with Marketed Chinese and Yellow Lipton Tea. *Borneo Journal of Pharmacy*, *4*(1), 51–56. https://doi.org/10.33084/bjop.v4i1.1817

Food and Agriculture Organization. (2003). Food Energy - Methods of Analysis and Conversion Factors. In *Report of a Technical Workshop*. https://www.fao.org/uploads/media/FAO_2003_Food_Energy_02.pdf

Gallagher, C. E., Watt, M. C., Weaver, A. D., & Murphy, K. A. (2017). "I fear, therefore, I shop!" exploring anxiety sensitivity in relation to compulsive buying. *Personality and Individual Differences*, *104*, 37–42. https://doi.org/10.1016/j.paid.2016.07.023

Ghasemzadeh, A., Jaafar, H. Z. E., & Rahmat, A. (2016). Variation of the Phytochemical Constituents and Antioxidant Activities of Zingiber officinale var. rubrum Theilade Associated with Different Drying Methods and Polyphenol Oxidase Activity. *Molecules (Basel, Switzerland)*, *21*(6). https://doi.org/10.3390/molecules21060780

Gilbert, C. (2014). The Effect of Tea and its Constituent L-Theanine on Anxiety: A Review of the Literature. In *Igarss 2014* (Issue 1). California Polytechnic State University.

Gombart, A. F., Pierre, A., & Maggini, S. (2020). A Review of Micronutrients and the Immune System-Working in Harmony to Reduce the Risk of Infection. *Nutrients*, *12*(1). https://doi.org/10.3390/nu12010236

Goodman, K. (2022). *Health Anxiety: What It is and How to Beat I*. Anxiety and Depression Association of America. https://adaa.org/learn-from-us/from-the-experts/blog-posts/consumer/health-anxiety-what-it-and-how-beat-it#:~:text=Since it is possible to,anxiety including health related anxiety.

Hidayat, H. N., & Insafitri. (2021). PROXIMATE ANALYSIS OF Thalassia hemprichii AND Galaxaura rugosa IN BANGKALAN DISTRICT. *Jurnal Turnojoyo Juvenil*, *2*(4), 307–317.

Hosseini, F. S., Sharifi, N., & Jamali, S. (2020). *Correlation Anxiety, Stress, and Depression with Perceived Social Support Among the Elderly: A Cross-Sectional Study in Iran Content courtesy of Springer Nature, terms of use apply. Rights reserved. Content courtesy of Springer Nature, terms of use*.

Iddir, M., Brito, A., Dingeo, G., Fernandez Del Campo, S. S., Samouda, H., La Frano, M. R., & Bohn, T. (2020). Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis. *Nutrients*, *12*(6). https://doi.org/10.3390/nu12061562

ISO 11287 Green Tea Definition and Basic Requirements (2011). https://www.iso.org/obp/ui/en/#iso:std:iso:11287:ed-1:v1:en

Kusumawati, N., Bahar, A., Setiarso, P., Muslim, S., & Auliya, A. R. S. (2021). Ginger and Temulawak Based Herbal Tea as Potential Functional Drink Products in the Era of Covid-19. *Rasayan Journal of Chemistry*. https://api.semanticscholar.org/CorpusID:239257856

LaMarco, K., & Post, K. (2019). Stress and the immune system. *Science*, *364*(6443), 848. https://doi.org/10.1126/science.364.6443.846-s

Lengvenyte, A., Strumila, R., Belzeaux, R., Aouizerate, B., Dubertret, C., Haffen, E., Llorca, P. M., Roux, P., Polosan, M., Schwan, R., Walter, M., D'amato, T., Januel, D., Leboyer, M., Bellivier, F., Étain, B., Navickas, A., Olié, E., & Courtet, P. (2022). Associations of white blood cell and platelet counts with specific depressive symptom dimensions in patients with bipolar disorder: Analysis of data from the FACE-BD cohort. *Brain, Behavior, and Immunity*, *108*, 176–187. https://api.semanticscholar.org/CorpusID:254293617

Li, P., Yin, Y. L., Li, D., Kim, W. S., & Wu, G. (2007). Amino acids and immune function. *British Journal of Nutrition*, *98*(2), 237–252. https://doi.org/10.1017/S000711450769936X

Lim, J. (2011). Hedonic scaling: A review of methods and theory. *Food Quality and Preference*, *22*(8), 733–747. https://doi.org/10.1016/j.foodqual.2011.05.008

Mao, Q.-Q. Q., Xu, X.-Y. Y., Cao, S.-Y. Y., Gan, R.-Y. Y., Corke, H., Beta, T., & Li, H.-B. Bin. (2019). Bioactive compounds and bioactivities of ginger (zingiber officinale roscoe). *Foods*, *8*(6), 1–21. https://doi.org/10.3390/foods8060185

National Research Council. (1990). Diet and health: implications for reducing chronic disease risk. *Choice Reviews Online*, *27*(06), 27-3332-27–3332. https://doi.org/10.5860/CHOICE.27-3332

Nobre, A. C., Rao, A., & Owen, G. N. (2008). L-theanine, a natural constituent in tea, and its effect on mental state. *Asia Pacific Journal of Clinical Nutrition*, *17 Suppl 1*, 167–168.

Pratiwi, D., Sidoretno, W. M., & Aisah, N. (2021). The Combination of Turmeric (Curcuma domestica) Rhizome Extract and Collagen in A Serum Formulation as an Antioxidant. *Borneo Journal of Pharmacy*, *4*(1), 36–42. https://doi.org/10.33084/bjop.v4i1.1578

Pratiwi, Y. S., Sanjaya, Y. A., Rahmawati, R., Putri, L. A. H. H., & Syari, R. M. (2024). The Effect of Herbal Tea Formulation Made of Mangosteen Pericarp (Garcinia mangostana), Cinnamon (Cinnamon verum), and Clove (Syzygium aromaticum) on Panelist Acceptance Level. *Amerta Nutrition*, *8*(1), 1–7. https://doi.org/10.20473/amnt.v8i1.2024.1-7

Priyadarshini, S., & Aich, P. (2012). Effects of Psychological Stress on Innate Immunity and Metabolism in Humans: A Systematic Analysis. *PLoS ONE*, *7*(9). https://doi.org/10.1371/journal.pone.0043232

Rizkianto, W., Kunarto, B., & Pratiwi, E. (n.d.). *Teabag formulation black tea based on black tea Bohea grade (Camellia sinensis L.) with peppermint leaves (Mentha piperita L.) on antioxidant activity*.

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., Rasoulpoor, S., & Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Globalization and Health*, *16*(1), 1–11. https://doi.org/10.1186/s12992-020-00589-w

Salim, S. (2016). Oxidative stress: a potential link between emotional wellbeing and immune response. *Current Opinion in Pharmacology*, *29*, 70–76. https://doi.org/10.1016/j.coph.2016.06.006

Santabárbara, J., Bueno-Notivol, J., Lipnicki, D. M., Olaya, B., Pérez-Moreno, M., Gracia-García, P., Idoiaga-Mondragon, N., & Ozamiz-Etxebarria, N. (2021). Prevalence of anxiety in health care professionals during the COVID-19 pandemic: A rapid systematic review (on published articles in Medline) with meta-analysis. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *107*, 110244. https://doi.org/https://doi.org/10.1016/j.pnpbp.2021.110244

Santabárbara, J., Lasheras, I., Lipnicki, D. M., Bueno-Notivol, J., Pérez-Moreno, M., López-Antón, R., De la Cámara, C., Lobo, A., & Gracia-García, P. (2021). Prevalence of anxiety in the COVID-19 pandemic: An updated meta-analysis of community-based studies. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *109*, 110207. https://doi.org/https://doi.org/10.1016/j.pnpbp.2020.110207

Segerstrom, S. C., & Miller, G. E. (2004). Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry. *Psychological Bulletin*, *130*(4), 601–630. https://doi.org/10.1037/0033-2909.130.4.601

Sengupta, S., Bhattacharyya, D., Kasle, G., Karmakar, S., Sahu, O., Ganguly, A., Addya, S., & Das Sarma, J. (2021). Potential Immunomodulatory Properties of Biologically Active Components of Spices Against SARS-CoV-2 and Pan β-Coronaviruses. *Frontiers in Cellular and Infection Microbiology*, *11*, 729622. https://doi.org/10.3389/fcimb.2021.729622

Shafiee, M., Tayefi, M., Hassanian, S. M., Ghaneifar, Z., Parizadeh, M. R., Avan, A., Rahmani, F., Khorasanchi, Z., Azarpajouh, M. R., Safarian, H., Moohebati, M., Heidari-Bakavoli, A., Esmaeili, H., Nematy, M., Safarian, M., Ebrahimi, M., Ferns, G. A., Mokhber, N., & Ghayour-Mobarhan, M. (2017). Depression and anxiety symptoms are associated with white blood cell count and red cell distribution width: A sex-stratified analysis in a population-based study. *Psychoneuroendocrinology*, *84*, 101–108. https://api.semanticscholar.org/CorpusID:13795607

Singh, S. A., Patel, Y., Patel, S., Ajay, M., & Chauhan, V. (2023). Formulation, evaluation, and antimicrobial study of immune-boosting herbal tea. *Pharmaspire*. https://api.semanticscholar.org/CorpusID:266365786

Sinija, V. R., & Mishra, H. N. (2008). Green tea: Health benefits. *Journal of Nutritional & Environmental Medicine*, *17*(4), 232–242. https://doi.org/10.1080/13590840802518785

Slavin, J. (2013). Fiber and prebiotics: mechanisms and health benefits. *Nutrients*, *5*(4), 1417–1435. https://doi.org/10.3390/nu5041417

Srivastava, J. K., Shankar, E., & Gupta, S. (2010). Chamomile: A herbal medicine of the past with bright future. *Molecular Medicine Reports*, *3*(6), 895–901. https://doi.org/10.3892/mmr.2010.377

Stefanache, A., Lungu, I.-I., Butnariu, I.-A., Calin, G., Gutu, C., Marcu, C., Grierosu, C., Bogdan Goroftei, E. R., Duceac, L.-D., Dabija, M. G., Popa, F., & Damir, D. (2023). Understanding How Minerals Contribute to Optimal Immune Function. *Journal of Immunology Research*, *2023*, 3355733. https://doi.org/10.1155/2023/3355733

Stone, H., & Sidel, J. L. (2004). Sensory Evaluation Practices. In H. Stone & J. L. B. T.-S. E. P. (Third E. Sidel (Eds.), *Food Science and Technology*. Elsevier. https://doi.org/10.1016/B978-0-12-672690-9.X5000-8

Suhesti, I., Kustini, H., & Antari, E. D. (2021). Penggunaan Teh Serai Jahe Sebagai Penambah Daya Tahan Tubuh Menggunakan Daun Stevia Sebagai Pemanis Alami. *RESWARA: Jurnal Pengabdian Kepada Masyarakat*, *2*(2), 325–330. https://doi.org/10.46576/rjpkm.v2i2.1155

Syah, A. N. A., & Sumangat, D. (2009). L-Theanin: Asam Amino Unik dari Teh Hijau. *Prosiding Seminar Nasional Teknologi Inovatif Pascapanen Untuk Pengembangan Industri Berbasis Pertanian*, *06*, 679–687.

Vuong, Q. V, Bowyer, M. C., & Roach, P. D. (2011). L-Theanine: properties, synthesis and isolation from tea. *Journal of the Science of Food and Agriculture*, *91*(11), 1931–1939. https://doi.org/10.1002/jsfa.4373

Wijayanti, A. (2022). A Formulasi 'Zilang Tea" Teh Herbal Peningkat Imunitas Tubuh Berbahan Jahe Merah (Zingiber officinale var. Rubrum) dan Bunga Telang (Clitoria ternatea). *Jurnal Ilmu Kesehatan Bhakti Setya Medika*, *7*(1), 20–25. https://doi.org/10.56727/bsm.v7i1.80

Williams, J. L., Everett, J. M., D'Cunha, N. M., Sergi, D., Georgousopoulou, E. N., Keegan, R. J., McKune, A. J., Mellor, D. D., Anstice, N., & Naumovski, N. (2020). The Effects of Green Tea Amino Acid L-Theanine Consumption on the Ability to Manage Stress and Anxiety Levels: a Systematic Review. *Plant Foods for Human Nutrition*, *75*(1), 12–23. https://doi.org/10.1007/s11130-019-00771-5

Windarwati, H. D., Lestari, R., Poeranto, S., Ati, N. A. L., Kusumawati, M. W., Ilmy, S. K., Sulaksono, A. D., Fitriyah, E. T., & Oktaviana, W. (2023). Anxiety, Depression, and Associated Factors among General Population in Indonesia during COVID-19 Pandemic: A Cross-Sectional Survey. *Journal of Caring Sciences*, *12*, 144–154. https://api.semanticscholar.org/CorpusID:264140054

Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of Affective Disorders*, *277*, 55–64. https://doi.org/https://doi.org/10.1016/j.jad.2020.08.001