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The Effect of Black Tea (*Camelia sinensis* L) and Clover Flower (*Syzygium aromaticum* L) Formula on The Characteristics of Bagged Tea

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ABSTRACT

Tea (Camellia sinensis L) is a type of plant that contains various compounds and beneficial for health. The research objective was to determine the effect of black tea and clove flower formulations as a refreshing and healthy drink. Data were analyzed using a completely randomized design (CRD) with black tea and clove flower formulations namely P0(100:0)%, P1 (80:20,)%, P2 (85:15)%, P3(90:10)% and P4(95:5)%, data were analyzed using analysis of variance (ANAVA). If the results of the ANOVA test show a significant difference then continue with Duncan's test. The results showed that the best formulation of black tea and clove flower for water content was the P4 treatment of 9.16%, the P3 treatment of 731.95 ppm of phenol, the P3 treatment of 0.16 mg/gr plavonoids, the antioxidant treatment of 5.82 ppm. Organoleptic tests for color, aroma and taste are neutral. However, the overall formulation is in the P3 treatment (90:10)%.

KEYWORDS: Formula, black tea, *Camelia synensis* L, clove flower, *Syzygium aromaticum* L

I. INTRODUCTION

Indonesia is an agricultural country with a large expanse of land, abundant biodiversity, as well as favorable natural and climatic conditions. The climatic conditions in Indonesia with its tropical climate are very supportive for farmers to be able to plant all year round because of the availability of sunlight throughout the year. Coupled with the existing soil structure makes it possible for farmers to grow all kinds of plants. One of the agricultural commodities in Indonesia that is widely found and growing quite rapidly is tea (*Camellia sinensis* L) (Riza Ibnu Fajar, et al 2018). Tea (*Camellia sinensis* L) is a drink containing caffeine, an infusion made by brewing the leaves, leaf buds, or dried petioles of the Camellia sinensis plant with hot water. Based on the method of processing, tea is divided into four types, namely black tea, green tea, white tea and oolong tea. Tea leaves are used in traditional Chinese medicine and other medical systems to treat asthma (functions as a bronchial dilator), angina pectoris, peripheral vascular disease, and Black tea is referred to as red tea by the Chinese, Japanese and Koreans. It is the most popular type of tea and is often consumed in Asia, including Indonesia, this is due to its taste and aroma (Setiani, 2014). Black tea undergoes an oxidation process longer than other teas. This type of tea has a strong aroma and can last a long time if stored properly. Fewer catechins in black tea and three cups of black tea every day are believed to reduce the risk of cardiovascular disease such as heart disease, lower cholesterol levels, hypertension and stroke. Because the flavonoids quercetin, kaempfrol, and myricetin in tea can prevent damage to blood vessels due to cholesterol oxidation, affecting stress hormone levels. Flavonoids are secondary metabolites of polyphenols, found widely in plants and foods and have various bioactive effects including anti-viral, anti-inflammatory (Qinghu Wang et al, 2016), cardioprotective, anti-diabetic, anti-cancer, (M.M. Marzouk, 2016) anti aging, antioxidants (Vanessa et al, 2014) and others. Flavonoid compounds are polyphenolic compounds that have 15 carbon atoms arranged in a C6-C3-C6 configuration, meaning that their carbon skeleton consists of two C6 groups (substituted benzene rings) connected by a three-carbon aliphatic chain. (Tiang-Yang et al, 2018).coronary heart disease. (Wikipedia, 2023).

Flavonoids are a class of compounds that are widely represented in nature. To date, more than 9000 flavonoids have been reported, and the required amount of flavonoids varies between 20 mg and 500 mg, mainly occurring in dietary supplements including tea, red wine, apples, onions and tomatoes. Flavonoids are found in plants, which contribute to the production of the yellow, red, orange, blue, and purple pigments of fruits, flowers, and leaves. Flavonoids belong to the water-soluble polyphenol family. Phenolic compounds are bioactive secondary metabolites widely

distributed in plants mainly synthesized by sikamic acid, pentose phosphate and phenylpropanoid pathways (Balasundram et al., 2006). Structurally, phenolic compounds include a number of compounds having aromatic rings with one or more hydroxyl groups and can vary from simple molecules to complex polymers (Haminiuk et al., 2012; Singh et al., 2015). Phenolic compounds are divided into subgroups of phenolic acids, flavonoids, tannins, and stilbenes based on the number of phenolic hydroxyl groups attached and the structural elements connecting the benzene ring (Singh et al., 2016). These phenolic compounds affect the sensory properties of food and especially tannins contribute to astringency in food (Landete, 2012; Singh et al., 2016). The group that includes flavonoids is flavonols, flavones, flavanols, flavanones, anthocyanidins, and isoflavones.

Tannins occur in complexes with polysaccharides, proteins, and alkaloids and are subdivided into hydrolysable and condensed tannins. Some of these compounds are water soluble (phenolic acids and flavonoids), while some are insoluble (some condensed tannins). Flavonoids (60%) and phenolic acids (30%) are phenolic compounds found in our food (Haminiuk et al., 2012). Polyphenols are natural compounds in plants that have millions of health benefits. If consumed, this substance acts as an antioxidant that can reduce the morbidity of various serious diseases such as cancer, diabetes, infections, and hypertension. Su Peng, 2021, stated that a large number of vegetables and fruits generally contain polyphenolic compounds. Some that are high in chocolate, berries, apples, seeds, nuts, soy, black tea, and green tea. The use of black tea which is varied with spices is still rare. One of the spices that can be used is clove flower. Extracts from clove flowers have previously been reported to have biological activities, such as antibacterial, antifungal, insecticide, and antioxidant. Clove flowers are used traditionally as a flavoring and antimicrobial agent. Clove flowers are reported to contain a compound called eugenol acts as an antioxidant and contains terpenoid compounds (Harborne, 1987). Based on the source, clove essential oil is divided into 3 parts, namely clove leaf oil (1-4%), clove stem oil (5-10%) and clove bud oil.) (10-20%) (Nurdjannah, 2016). According to Bhuiyan (2012) the main ingredients in clove essential oil are eugenol compounds (49.7%), caryophyllene (18.9%), 1-ethyl-3-nitro benzene (11.1%) and 3-1-methylethyl benzoic acid (8.9%). Eugenol is widely used in the food and pharmaceutical industries as an antibacterial and antifungal (Suhendar & Fathurrahman, 2019); Huda et al. (2018). The pharmacological activity of eugenol compounds is as a stimulant, local anesthetic, analgesic, antispasmodic, antiseptic, anti-fungal and anti-inflammatory (Pramod et al., 2010). This study aims to determine the black tea formula varied with clove flower on the characteristics of bagged tea.

II. MATERIALS AND METHODS

The research materials consisted of black tea obtained from the PT Cigaru Sukabumi tea factory, clove flowers obtained from an online store. The equipment used in this study were glassware, ANDGR202 analytical balance, aluminum foil, cuvettes, filter paper, rotary evaporator, spectrophotometer (UV-Vis Shimadzu UV PharmaSpec 1700), Halogen Moisturizer Analyzer (Mettler Toledo), maceration tool, water bath, micropipette, Buchner funnel.

The chemicals used included: distilled water, methanol PA (Merck), 96% ethanol, Folin-Ciocalteau (Merck), DPPH (Diphenylpicryl-hydrazyl) (Sigma), standard gallic acid (Merck), Na 2 CO 3 (Merck) , AlCl 3 (Merck), NaNO 2 (Merck), 1 M NaOH (Merck), quercetin (Sigma), ice water.

Research design

The research method used laboratory experimental methods with an experimental design using a completely randomized design (CRD) with 1 factor, namely the composition of black tea and clove flowers with variations P0 = black tea without clove flowers (100: 0)%, P1 = black tea: clove flowers (80 : 20), P2 = black tea : clove flower (85 : 15)%, P3 = black tea : clove flower (90 : 10)%, P4 = black tea : clove flower (95 : 5)%. Each treatment was repeated 5 times. The data obtained were analyzed by means of variance and if the treatment affected the observed variables, it was followed by Duncan's test (Steel and Torrie, 1993).

Parameters observed:

Parameters observed were: Moisture content (Sudarmadji et al., 1997), total phenols with a spectrophotometer, total flavonoids using a spectrophotometer, antioxidant activity with the DPPH method (Conducted in the Laboratory of Analyst Bhakti Asih High School) and sensory characteristics.

III. RESULTS

Water content

Water is a very important ingredient in food ingredients, because water can affect the appearance, texture and taste of a food. All foodstuffs contain water in varying amounts, both animal and vegetable foods (Winarno, 1991). The results of the research on black tea formula with clove flowers are presented in Table 1.

Table 1. Water content in black tea and clove flower formula

Black Tea Treatment: Clove Flowers	Water content (%)	Signification
P4 (95 : 5)%	9.16	a
P3 (90 : 10)%	9.43	b
P2 (85 : 15)%	9.47	b
P0 (100 : 0)%	9.55	b
P1 (80 : 20)%	9.66	b

Note: Lowercase letters indicate a significant difference according to Duncan's range test at the 5% level.

Table 1 shows that there is a very significant difference, the difference is found in treatment P1 with the highest water content, namely 9.66%, followed by P0 of 9.55%, P2 of 9.47%, P3 of 9.43% and the lowest is in P4 of 9.16% The higher the addition of clove flowers the higher the water content, which is equal to 9.66%, this is because water is an important component in food. Water in food plays a role in influencing the level of freshness, stability, durability and ease of occurrence of chemical reactions, enzyme activity and microbial growth (Kusnandar, 2010). This is also supported by Noviati (2002), water content is a quality parameter that is very important for a product because water content can cause reactions that can reduce the quality of an ingredient, so that some of the water must be removed from the food. The lower the water content of a product, the longer the shelf life of a product.

Phenol

Phenol is an aromatic organic compound that is very common in the medical and health world. Phenol is also called ascorbic acid, this organic compound can be harmful and toxic to the body, but in limited doses phenol has a number of very useful uses in the medical field.

Table 2: Phenol Content in Black Tea and Clove Flower Formulas

Black Tea Treatment: Clove Flowers	Phenol Content (ppm)	Signification
P0 (100 : 0)%	484.66	b
P2 (85 : 15)%	672.48	a
P4 (95 : 5)%	695.97	a
P1 (80 : 20)%	728.14	a
P3 (90 : 10)%	731.95	a

Note: Lowercase letters indicate a significant difference according to Duncan's range test at the 5% level.

Based on Table 2, it shows that the phenol content in the black tea and clove flower formulations has a very significant effect at the 5% level of total phenol. The total phenol in the treatment was (4.84.66 – 731.95) ppm. When viewed from the phenol content in the formulation, the highest phenol content was found at P3 = 731.95 ppm, followed by P1 = 728.14 ppm, P4 = 695.97 ppm, P2 at 672.48 ppm and the smallest P0 at 484.66 ppm. The addition of clove flower to black tea did not show a significant difference in the P1, P2, P3 and P4 treatments but was significantly different to P0. Phenolic compounds in clove flowers, namely eugenol, have activity as antibacterial bacteria (Suhendar, 2014). The antibacterial activity of phenolic compounds in inhibiting bacteria is by denaturing cell proteins through the cell membrane. Hydrogen bonds that form between phenol and protein cause the protein structure to be damaged. The presence of clove flowers in black tea increases the phenol content, the eugenol found in clove flowers is a phenolic compound (Anonymous, 2023). So by adding clove flowers to black tea, it enriches the benefits of this drink. Lots of clove research studies have been carried out including clove extract oil can be used as an active ingredient or for making mouthwash because of its antimicrobial properties (Kristijanto, 2010). The results of the study (Suryo, 2012) stated that the resulting mouthwash formula could inhibit the growth of Streptococcus mutans and Streptococcus viridians which can cause dental plaque.

Flavonoids

Flavonoids are found in all parts of the plant, namely roots, stems, leaves, skin. Flowers, fruit and seeds. Flavonoids consist of several main main groups including anthocyanins, flavanols and flavones in plants, while chalcones, ourones, flavonols, dihydrochalcones and isoflavone groups are limited to certain groups (Haerbone, 1987). The research results are presented in Table 3.

Table 3: Flavonoid Content in Black Tea and Clove Flower Formulas

Black Tea Treatment: Clove Flowers	Flavonoid Content(mg/gram)	Signification
P0 (100 : 0)%	0.10	a
P2 (85 : 15)%	0.14	a
P4 (95 : 5)%	0.15	a
P3 (90 ; 10)%	0.16	a
P1 (80 : 20)%	0.49	b

Note: Lowercase letters indicate a significant difference according to Duncan's range test at the 5% level

Based on Table 3, it shows that the levels of flavonoids from all treatments showed a very significant difference. However, if seen from the content of each treatment, the highest content was found in P1 of 0.49 mg/g, followed by P3 of 0.16 mg/g, P4 of 0.15 mg /g , P2 was 0.14 mg/g and the lowest was P0 at 0.10 mg/g. The addition of clove flowers to black tea is very significant for the levels of flavonoids. Thus the addition of clove flowers to black tea affects the amount of flavonoid content. This is understandable because flavonoids are needed by the body because of their many benefits and they are easy to find in plant parts. Flavonoids include phenolic compounds which are commonly found in stems, leaves, flowers and fruit (Waji and Andis, 2009). Flavonoids are one of the antioxidant compounds that can inhibit the clotting of platelets, stimulate the production of nitric oxidants which can dilate (relax) blood vessels, and also inhibit the growth of cancer cells (Winarsi, 2011). Flavonoids function to increase levels of vitamin C in cells, reduce the level of damage to blood vessels, protect cells from damage caused by free radicals, and support collagen in the joints of the body (Lau, 2009).

Antioxidant

Antioxidants are compounds that can protect cells and inhibit oxidation reactions by binding to free radicals and highly reactive molecules. Antioxidants include electron donor compounds that work by donating an electron to compounds that are radical so that their activity can be inhibited. The results of research on antioxidants in black tea and clove flower formulas are presented in Table 4.

Table 4: Antioxidant Levels in Black Tea and Clove Flower Formulas

Black Tea Treatment: Clove Flowers	Antioxidant (ppm)	Signification
P0 (100 : 0)%	4.17	b
P2 (85 : 15)%	5.35	a
P4 (95 : 5)%	5.47	a
P3 (90 : 10)%	5.54	a
P1 (80 : 20)%	5.82	a

Note: Lowercase letters indicate a significant difference according to Duncan's range test at the 5% level

According to Duncan's test results at the 5% level, the addition of clove flower to black tea did not show a significant difference in treatments P1, P2, P3 and P4, but was significantly different in treatment P0. The smallest value was found in P0 of 4.17 ppm, followed by P2 = 5.35 ppm, P4 = 5.47 ppm, P3 = 5.54 ppm and the largest in P1 of 5.82 ppm. In the P1 treatment, the antioxidant contribution was the highest compared to the others. Higher intake of antioxidants in food, potentially provides better defense and protection against oxidative stress. That is a condition where the number of free radicals in the body exceeds the body's capacity to neutralize them. So we have to increase the levels of antioxidants in the body, both from food and supplements. The use of antioxidant and anti-radical compounds is increasingly widespread along with the great public understanding of their role in inhibiting degenerative diseases. This problem is related to the ability of antioxidants to work as inhibitors or inhibitors of oxidation reactions by active free radicals (Ikhrar, 2019).

Organoleptic Test

Organoleptic is a test of food ingredients based on preferences and willingness to use a product. In the assessment of food ingredients, the characteristic that determines whether a product is acceptable or not is its sensory properties

Table 5. The average value of the hedonic test for color, smel and taste

Black Tea Treatment: Clove Flowers	Color	smel	Flavor	Overall acceptance
P0	3.61	3.56	3.43	2,53
P1	2.82	2.86	2.06	2.58
P2	3.41	3.61	2.63	3.21
P3	3.41	3.00	3.73	3.38
P4	3.24	3.22	3.13	3.19

Note : 1 = really don't like it, 2. Don't like it, 3 = Neutral, 4 = Like it, 5 = Really like it

Color

The color of black tea and clove flowers is dark brown because the essence of the two ingredients dissolves the color when brewed with hot water, the color difference is almost the same from all treatments. the average sensory value by the panelists ranged from 3.30 (neutral) all treatments of the black tea and clove flower formulas showed neutral.

Smel

The most delicious smel was P1, the clove smel was very strong compared to other treatments. Feels fresh in the nose and throat The distinctive smel that arises is the result of a combination of black tea and clove flowers. The increasing ratio of clove flowers made the tea smel stronger which led to an increase in the panelists' preference for tea. The highest average value of the panelists' preference for the smel of bagged tea was obtained at 3.25 (Neutral).

Flavor

The distinctive taste of clove flowers found in tea tends to reduce the panelists' preference for tea. Taste is an important aspect in the assessment of a product. Taste assessment is carried out by the human sense of taste when food or drink is consumed (Meilgaard et al., 2000). Clove flowers are used traditionally as a flavoring and antimicrobial agent. Clove flowers are reported to contain eugenol compounds which act as antioxidants and contain terpenoid compounds (Harborne, 1987). The highest average panelist preference level for the aroma of tea bags was obtained at 3.00 (Neutral).

Community Acceptance

The results of the panelist's assessment of black tea with the addition of clove flowers brewed with hot water showed that all treatments had varying values. The most delicious treatment was P3 treatment (black tea 90: 10)% the clove aroma could be felt and the tea did not taste bitter and felt warm in the throat.

IV. DISCUSSION

The addition of clove flowers to black tea increases the water content, phenols, flavonoids and antioxidants, thus the

addition of clove flowers is very beneficial for improving health and can also be used as a mouthwash because it contains eugenol which functions as an antibacterial, antifungal, insecticide and antioxidant. . Clove flowers are used traditionally as a flavoring and antimicrobial agent. Clove flowers are reported to contain eugenol compounds which act as antioxidants and contain terpenoid compounds (Harborne, 1987).

V. CONCLUSION

From the results of this study it can be concluded that black tea added with clove flowers can increase the levels of water, phenols, flavonoids and antioxidants. The organoleptic test of the panelists was in the P3 treatment (black tea: clove bud, 90: 10)%. The formula of the two ingredients apart from functioning as a refreshing drink can also be used as a gargle

Thank-you note

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