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GINGER AND TEMULAWAK BASED HERBAL TEA AS POTENTIAL FUNCTIONAL DRINK PRODUCTS IN THE ERA OF COVID-19

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ABSTRACT

To optimize the benefits of herbal processed products, especially in the era of the COVID-19 pandemic, an evaluation of the antioxidant and antimicrobial functional properties of herbal teas has been carried out. The ginger and temulawak herbal tea products in this study showed the quality that met the qualifications of the Indonesian National Standard (SNI) 3836:2013, with low levels of metal and microbial contamination and high antioxidant and antimicrobial activity against *Escherichia coli* and *Salmonella Typhimurium*. In general, the ginger and temulawak teas produced have a distinctive taste, aroma, color, and texture, with a water content of 7.26-7.61%, ash 6.12-6.71%, water-soluble ash 95.48-97.01%, acid insoluble ash 0.160-0.275%, crude fiber 4.63-14%, phenolic 66.15–95.58%, flavonoids 36.53–67.10%.

Keywords: Herbal, Tea, Functional Drink, Ginger, Temulawak.

INTRODUCTION

Severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) is a new corona-β virus that is responsible for COVID-19.[1-2] As of April 24, 2020, the overall outbreak has caused more than 191,000 deaths and an estimated 2,700,000 infected worldwide.[2-3] COVID-19 provokes a wide spectrum of clinical manifestations, which lead to acute respiratory distress syndrome (ARDS).[2,4-5] Although several interventions have been reported, both in prevention and treatment, none have been proven to be effective against COVID-19.

A large number of the world's population depends on herbal commodities for primary health needs.[6-8] Herbal drinks are a form of herbal-based health care and medicine that produce a broad spectrum of biological activity, inducing positive effects in the treatment of many diseases.[9]

Ginger and temulawak are widely used as functional ingredients in herbal beverages production worldwide. Ginger (*Zingiber officinale*) is reported to have antioxidant, antimicrobial, and anti-inflammatory activity.[10-13] Temulawak (*Curcuma zanthorrhiza Roxb*) is a rhizomatous herb containing xanthorrhizol which is reported to have anti-cancer, anti-microbial, anti-inflammation, anti-oxidant, antihyperglycemic, antihypertensive, antiplatelet activity, nephroprotective, hepatoprotective, and estrogenic effects.[14-25]

In this research, ginger and temulawak are processed into practical teabags through a series of standardized production stages. The increased practicality of consumption and the taste of the ginger and

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temulawak processed products is expected to encourage more people who are willing to consume regularly, to increase endurance in the era of the COVID-19 pandemic.

EXPERIMENTAL

Making of Ginger Tea

The ginger was cleaned, sliced 0.15 cm thick using a Bosch MUZ4DS3 slicing machine, weighed, and placed thinly on a baking sheet. Drying was carried out using an oven at 60 °C until a constant mass was obtained. For ginger tea products made from elephant ginger, a ratio of ginger simplicia to tea leaves was 5:1, while for those made from emprit ginger, a ratio of ginger simplicia to tea leaves was 2:1. In a different place, the production of temulawak tea products was carried out with the same procedure, with a ratio of temulawak simplicia to tea leaves of 1:1.

Herbal Tea Quality Test

The quality testing of herbal teas includes (1) organoleptic, proximate, and crude fiber using the gravimetric method; (2) total flavonoids, phenolic, antioxidant activity using the UV-Vis spectrophotometric method; (3) antimicrobial activity using the diffusion method with the cup plate technique.

RESULTS AND DISCUSSION

Physico-chemical Properties

The herbal tea produced has a distinctive taste and aroma, with a creamy color for ginger, and a yellowish-brown for temulawak tea. The organoleptic properties of both herbal teas meet the requirements of the SNI 3836:2013.

The water content greatly affects the dry tea shelf life. Dry teas with high water content tend to be moist and perishable. The water content analysis showed that the ginger tea from both raw materials showed a lower water content than that of temulawak. This is consistent with Wiranata's (2016) publication which reports that fresh temulawak has a higher water content (86%) than the elephant and emprit ginger, which were 71.15% and 70.31%, respectively.[26-27]

Table–1: Physico-chemical Properties of Herbal Tea

Raw Material	Organoleptic Properties					Proximate Level (%)				Crude Fiber (%)
	Taste	Smell	Color	Texture	Shape	Water	Ash	Water-soluble Ash	Acid Insoluble Ash	
Standard 2 (SNI 3836:2013)	Tea distinctive	Tea distinctive	Dark chocolate	-	-	Max. 8	Max. 8	Min. 45	Max. 1.0	Max. 16.5
A = Elephant Ginger	Ginger distinctive	Ginger distinctive	Cream	Rough	Flakes	7.26	6.44	95.48	0.170	5.43
B = Emprit Ginger	Ginger distinctive	Ginger distinctive	Cream	Rough	Flakes	7.49	6.12	97.01	0.275	4.63
C = Temulawak	Temulawak distinctive	Temulawak distinctive	Yellowish-brown	Rough	Flakes	7.61	6.71	95.48	0.160	14.00

Ash is an inorganic residue that results from burning organic material. Ginger tea shows lower ash content than temulawak tea. Specifically, the tea produced from elephant and emprit ginger had an ash content of 6.44% and 6.12%, respectively, while temulawak tea was 6.71%. The ash content of fresh ginger was reported to be 6.60-7.57% for elephant ginger and 7.39-8.90% for emprit ginger.[28] Meanwhile, fresh temulawak ash content reported was 5.26-7.07%.[29-30] Although it is reported to have lower ash content in its fresh ingredients, tea produced from elephant ginger is known to have higher ash content. This was triggered by the dominance of non-volatile minerals in elephant ginger compared to emprit ginger. Similar conditions also cause temulawak tea to have higher ash content than ginger.

Acid insoluble ash is closely related to mineral content, purity, and cleanliness of foodstuffs.[31-32] The results in Table-1 show that the acid insoluble ash content of all herbal tea is less than 1%. Specifically, tea produced from emprit ginger has higher acid insoluble ash content than elephant ginger. This result is predicted to be closely related to the higher contamination level of fresh emprit ginger compared to elephant ginger. Temulawak tea has lower acid-insoluble ash content than ginger. This shows the dominance of the acid-soluble mineral in fresh temulawak.

In contrast, water-soluble ash content indicates the mineral content that can dissolve in water. According to SNI 3836:2013, the required water-soluble ash content in dry tea is at least 45%. All herbal tea produced has met the requirements. Specifically, herbal tea produced from emprit ginger had the highest water-soluble ash.

In the publication of McDonald et al. (2002), fiber is the cell wall of plant tissue which includes lignin, cellulose, and hemicellulose, while crude fiber is composed of 50–80% of total cellulose, 10–15% lignin, and 20% hemicellulose.[33-35] The results of crude fiber analysis showed that the temulawak tea had higher crude fiber than ginger. However, it should be noted that too high crude fiber content can have an impact on the digestibility of food products after consumption. When crude fiber is too high, food will stay in the stomach system longer, resulting in lower food intake. Overall, the herbal tea produced has met the SNI requirements, which is lower than 16.5%.

Total Phenolic and Flavonoid Compound

Phenolic are compounds that have one or more hydroxyl groups attached to aromatic groups.[36-38] This compound has several biological effects such as antioxidant activity through mechanisms as reducing and scavenging of free radicals, metal chelating, reducing singlet oxygen formation, and electron donors.[39] Meanwhile, flavonoids are a group of polyphenolic compounds in fruits, vegetables, tea, and medicinal plants, which has attracted a lot of attention in recent decades due to its broad bioactive benefits including antioxidant, anti-cancer, anti-inflammatory, and antibacterial activity.[40-45]

The analysis results of the phenolic compounds showed that ginger tea showed greater phenolic content than temulawak. In line with this, the results of the flavonoid compounds analysis showed that ginger tea had more dominant levels of flavonoids. More specifically, emprit ginger has higher levels of total phenolic and flavonoids compounds than elephant ginger. The pharmacological activity of ginger is closely related to the presence of phenolic and flavonoids compounds in a fresh ginger rhizome, which includes 6-gingerol, 6-shogaol, and zingerone. Among the three, 6-gingerol was reported to be the most abundant bioactive compound in ginger with various pharmacological effects including antioxidant, analgesic, anti-inflammatory, and antipyretic properties.[46-47] Zingerone compounds that are found in ginger essential oil are known to have antimicrobial activity.[48] Correspondingly, the phenolic compounds, xanthorrhizol, and curcuminoids in temulawak were also reported to produce antioxidant activity.[49] Meanwhile, one of the elements of temulawak essential oil, namely terpenoids, produces antibacterial activity, which involves breaking down the membrane by lipophilic components.[50]

Table–2: Total Flavonoid & Phenolic Compound of Herbal Teas

Type	Total Flavonoid (mg/100g)	Total Phenolic (mg/100g)	IC_{50} (ppm)	Inhibition Zone (mm)	
				Escherichia coli	*Salmonella Typ*
A	51.83	70.26	0.02116	11.06	9.21
B	67.10	95.58	0.00912	11.15	9.58
C	36.53	66.15	0.08785	11.58	10.37

Antioxidant and Antimicrobial Activity

The antioxidant in the chemical understanding is electron donor compounds. However, biologically the antioxidants definition has become broader, namely compounds that can reduce the negative impact of oxidants.[51-52] The body needs antioxidants to protect cells from free radical damage. Antioxidants can donate electrons to free radical molecules, stabilizing free radicals and stopping chain reactions. Naturally, several types of plants are a source of antioxidants. Plant-based antioxidants are polyphenol/phenolic, flavonoid, cinnamic acid derivatives, coumarin, tocopherols, and organic acids.[52-53]

In general, ginger tea has a higher IC_{50} value than temulawak. Specifically, emprit ginger tea shows lower IC_{50} compared to elephant ginger tea. This indicates a better antioxidant activity of emprit ginger. This result is following the phenolic and flavonoid content of this tea which is higher than elephant ginger tea.
Ginger and temulawak tea showed variable antimicrobial activity against *Escherichia coli* and *Salmonella Typ* (Table-2 and Figure-2). *Escherichia coli* is one of the microorganisms most often associated with food contamination.[54-55] *Escherichia coli* is a gram-negative mesophilic bacteria, non-spore-forming, facultative, anaerobic, rod-shaped, grows in a temperature range of 7–45 °C. The presence of *E. coli* in food is an indicator of poor hygiene. The pathogenic strain of *E. coli* causes poisoning by creating toxins and causes gastroenteritis, kidney, and brain damage.[56] While *Salmonella* is one of the foodborne gram-negative pathogens, in the form of rods and flagellates, which is one of the four main causes of world diarrhea disease.[57] Specifically, *Salmonella Typ.* is one type of *Salmonella* that may cause gastroenteritis, typhoid fever, and sepsis which can develop into serious illness and death in humans with an increased risk.[58-59]
Slightly different results were obtained in the analysis of antimicrobial activity, where temulawak showed its dominance by producing an inhibition zone of 11.58 mm against *Escherichia coli* and 10.37 mm against *Salmonella typ.* The antimicrobial activity shown by temulawak tea was not in line with the phenolic and flavonoid compounds. This indicates the presence of other functional compounds in temulawak which also have antimicrobial activity. Meanwhile, with an inhibition zone of 11.15 mm against *E. coli* and 9.58 mm against *Salmonella Typ.*, emprit ginger tea showed better antimicrobial activity than elephant ginger tea with an inhibition zone of 11.06 mm and 9.21 mm, respectively against *E. coli* and *Salmonella Typ.* This result is in line with the higher content of phenolic and flavonoids compounds in emprit ginger tea compared to elephant ginger tea.

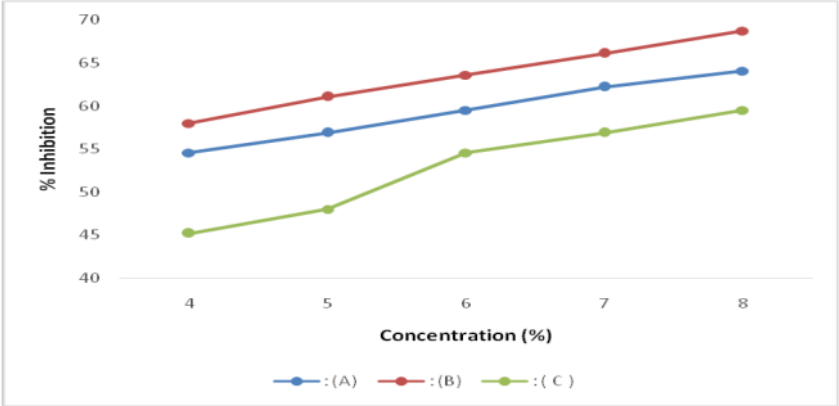

Fig.–1: Elephant Ginger (A); Emprit Ginger (B); and Temulawak (C) Tea Antioxidant Activity

CONCLUSION

Ginger-based herbal tea, both elephant and emprit, and temulawak have been made. The results of the analysis of organoleptic properties, proximate, crude fiber, phenolic, and flavonoids compounds levels, generally showed that emprit ginger herbal tea showed the best quality according to SNI 3836:2013. Antioxidant activity with IC_{50} 0.088-0.009 ppm and antimicrobials activity, measured from the zone of inhibition in the range 11.06 mm – 11.58 mm against *Escherichia coli* and 9.21 mm – 10.37 mm against *Salmonella Typ.* indicate the high functional benefits of this herbal beverage, especially in preventing the further spread of COVID-19 infection.

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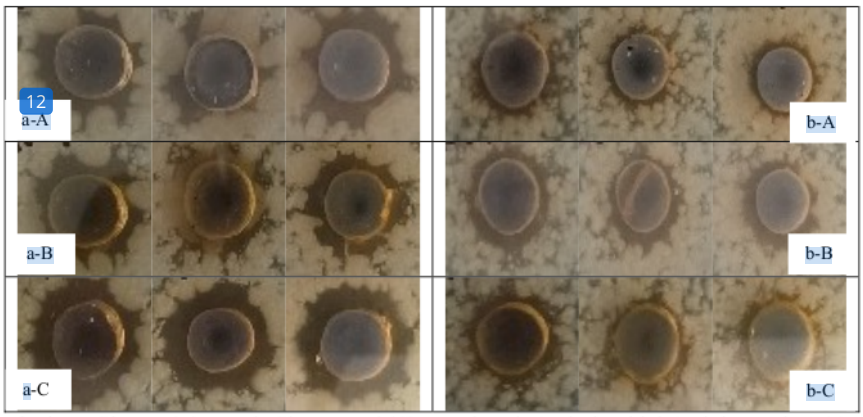

Fig.-2: (A) Elephant Ginger; (B)Emprit Ginger; and (C)Temulawak Antimicrobial Activity against (a) *Escherichia coli* and (b)*Salmonella Thy*

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