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Functionality of Green Tea (*Camellia sinensis*) Blends – Effects of Spice Concentration on Composition, Antioxidant Profile, Microbiological and Cup Quality

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Due to its functional advantages in addition to its flavor, tea's product diversification has grown in popularity and customer acceptability. In this study, different green tea blends with different amounts of cinnamon, lemon, and ginger (0–30%) were developed. The tea blends' compositional analysis, antioxidant, microbiological, and sensory profiles were assessed. The tea with cinnamon mix had a catechin mean value of 9.7%; the tea with ginger blend had a catechin mean value of 7.4%; and the tea with lemon blend had a catechin mean value of 8.0%. For lemon/tea at 15% and

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98.9g AAE/100g for cinnamon/tea at 20%, the best DPPH values were attained. For ginger/tea, cinnamon/tea, the total polyphenol value peaked at 19.02 g GAE/100g (20%), 18.62 g GAE/100g (20%), and 18.37 g GAE/100g (15%), respectively. According to microbiological analysis, no microbial growth was found in any of the tests run. The cup quality results showed that the panelists generally approved of the lemon/tea, which had a mean of 7.3 at a 15% inclusion level.

Keywords: Spices; green tea; antioxidant; epigallocatechin; crude fibre; Camellia sinensis; vegetative material; anticarcinogenic properties.

1. INTRODUCTION

Due to its therapeutic, refreshing, and somewhat stimulating properties, tea (*Camellia sinensis* L.) continues to be one of the most extensively consumed non-alcoholic beverages, being drank by almost two thirds of the world's population. Based on the various processing techniques utilized, there are four basic varieties of produced tea used for tea infusions. These include white, oolong, green, and black or red. Tea lovers all throughout the world continue to rank green tea as one of their top beverage choices. This is brought on by the associated health advantages that result from it. The leaves used to make it were pan-fired and contained a lot of EGCG. The main catechins found in green tea, such as (-)-epicatechin (EC), (-)- epigallocatechin (EGC), (-)-epicatechin 3-gallate (ECG), (-)- epigallocatechin 3-gallate (EGCG), and (-)- gallate (GCG), are indicated as major components of biologically active substances [1,2]. The most prevalent polyphenol in green tea, EGCG accounts for up to 10% of its dry weight and contains 60–70% of all the catechins and is thought to be responsible for many of green tea's health-promoting properties [3]. When compared to black tea or oolong tea, green tea, which has a mild flavor, has a considerable amount of catechins.

According to Chung et al [4] (2003), drinking tea lowers blood cholesterol, prevents the oxidation of low density lipoprotein, and lowers the risk of cancer and cardiovascular disease. The most biologically active class of tea constituents, polyphenols, have been shown to exhibit anti-oxidant, anti-mutagenic, and anticarcinogenic properties [5,6,7,8]. Fluoride, caffeine, and important minerals are among the additional chemicals in tea that are good for human health [9]. Other beverages are currently showing competitive interest in the global tea market, and the number of consumers with various requirements is growing. As a result, there is a need for product diversification, which has already begun in many places [10,11,12,13]. Value addition is predicted to boost production and usage of the tea crop. Value addition is still a solution to address these issues. Herath and De Silva [14] assert that product differentiation techniques like spicing can help add value to tea. One strategy for brand development and product distinction is to spice tea. Spices are primarily used to spice food, but they also have certain therapeutic benefits. A spice is a dried seed, fruit, root, bark, or vegetative material that is added to food in small amounts to add flavor, color, or as a preservative that fights off hazardous microorganisms or inhibits their growth. Cinnamon, cardamom, ginger, and cloves are a few varieties of locally available spices that are said to have significant bioactive components. The combination of tea with spices is anticipated to result in enhanced tea that not only has improved flavor or scent from a sensory perspective but also has more functional value for the body or health. According to reports, adding spices to tea may enhance its potential health advantages [15]. Therefore, adding these spices to tea can both benefit the general public's health and be utilized medicinally. Due to the presence of active ingredients, cinnamon has special health benefits. Tea made with cardamom lowers flatulence, soothes the stomach, and treats indigestion. According to a report by Chandini and Ravikumar, [16], drinking a cup of cardamom tea can benefit women who experience mood fluctuations during their period. Ginger provides a stimulating and energizing effect. Ginger tea stimulates and calms the digestive tract at the same time. Due to its anti-inflammatory qualities, ginger tea has proven to be beneficial for persons with arthritis. It is beneficial to combat the flu and the common cold [17]. One method of increasing the crop's value and resulting in financial rewards is to spice the tea. Naturally, green tea taste is bitter, hence might not appeal to many; however, spicing can help resolve this challenge. The combination of tea and spices is therefore expected to produce enriched tea that is not only being more acceptable from a sensory point of view due to flavor or aroma improvement but also offers more functional value for the body. This paper therefore reports the compositional analysis, antioxidant profile and the cup quality of spiced green tea.

2. MATERIALS AND METHODS

Green tea processing: A bud and two leaves were obtained from the plant *Camellia sinensis*. The leaves were subjected to withering after which it was pan-fired and then rolled. The rolled tea leaves were then dried in an oven. Spices used for this work was obtained from the open market. The processed tea leaves were pulverized and blending was carried out.

Preparation of spice green tea: Three different types of spices (ginger, cinnamon and lemon) were blended with green tea and green tea without spice served as control sample for this study. Blending was done on a weight to weight ratio (w/w) of spice to processed tea in the ratio 0, 5, 10, 15, 20, 30 % (w/w) and coded as GCA, GCB, GCC, GCD, GCE, GCF; GGA, GGB, GGC, GGD, GGE, GGF and GLA, GLB, GLC, GLD, GLE, GLF for cinnamon, ginger and lemon respectively.

Moisture content: Tea moisture was measured using a vacuum oven and the international standard method (ISO 1573, 1981).

Water extract: Tea solution (50 ml) was placed in a weighed evaporation dish and was then evaporated to dryness over a water bath. The residue (tea extract) in the dish was fully dried in a vacuum oven at 75 ^{0}C with a negative pressure of 65 kPa for 4 h until the weight of the dish with extract was constant.

$$\text{Water extract (\%)} = (D_1\text{-}D_2) \times V_0 \times 100/V_1/W \quad \text{(Eq 1)}$$

Where D_1 is the weight of dry tea extract with the dish; D_0 is the weight of the dish; V_0 is the total volume of the tea solution (250 ml); V_1 is the volume used for the measurement (50 ml); W is the dry weight of the tea sample.

Crude fibre: The crude fibre content was determined by the general method [18] (ISO 15598, 1999) with modification. Briefly, 0.5g sample of tea was boiled in 0.255 M sulfuric acid solution for 30 min, then the insoluble residue was filtered and washed. The obtained substance was subsequently boiled in 0.313 M sodium hydroxide solution, filtered and washed. A sample thus prepared was dried for 2 h in the oven at 130 ± 2 C. Finally, mass loss was determined after ashing at 350 ± 25 oC. The content of crude fibre in the tea sample was calculated in mass percent relative to the content of dry mass in the product.

Mineral analysis: Minerals in tea samples such as calcium, magnesium, sodium, potassium and manganese were determined using AOAC methods of Analysis.

2.1 Determination of Antioxidant Activity

2.1.1 Free radical scavenging activity (DPPH)

The technique is based on the reduction of an alcoholic DPPH solution in the presence of an antioxidant that donates hydrogen as a result of the reaction's production of the non-radical form of DPPH-H. The 1,1-diphenyl-2-picrylhydrazyl (DPPH) technique was used to assess the free radical scavenging activity [19,20]. Varied test tubes were filled with green tea at varied concentrations (100, 200, and 300 ppm). Methanol was added to bring the volume to 1 ml. These test tubes received four ml of a 0.1 mM methanol solution of DPPH, which was then forcefully shaken. The tubes were then kept at room temperature for 20 minutes while being kept in the dark. As stated above, a control sample was made without extract, and methanol was used to adjust for baseline. A UV-visible spectrophotometer (GBC Cintra 10, Australia) was used to assess changes in the materials' absorbance at 517 nm. The results were averaged after each analysis was performed in triplicate. For each concentration, the percent drop in absorbance was noted, and the observed percent decrease in absorbance was used to compute the percent quenching of DPPH. Radical scavenging activity was expressed as the inhibition percentage and was calculated using the formula below:

$$\text{Antiradical activity (\%)} = (\text{Control Absorbance} - \text{Sample Absorbance}) \times 100/\text{Control Absorbance} \quad \text{(Eq 2)}$$

2.1.2 FRAP assay

Following the Benzie and Strain method, 3 mL of the FRAP (Ferric reducing antioxidant power) reagent (10:1:1 of 300 mM pH 3.6 sodium acetate buffer, 10 mM 2, 4, 6-tripyridyls-triazine solution, and 20 mM FeCl3.6H2O solution) was added to 10 mL of the filtrate mixture and mixed before being incubated at 37°C for 30 min. The mixture's absorbance was measured at a wavelength of maximum 593 nm, and the FRAP value was given as mM FeSO4/100g sample.

2.1.3 Total polyphenols

The Folin-Ciocalteu technique [21] was used to determine the total polyphenol content of the samples. After being dissolved in 10 ml of water with 10 mg of tea sample, the mixture was centrifuged. Folin-Ciocalteau reagent (0.5 mL), 1.5 mL of saturated Na2CO3 solution, and 0.5 mL of the resultant solution were combined. This was diluted to a volume of 10 ml with distilled water and incubated for two hours at 27 oC. With the aid of a UV-visible spectrophotometer (GBC Cintra 10, Australia), the optical density was determined at 765 nm. The results were expressed as a percentage of Gallic acid equivalents. The total phenol content was determined by comparing with the calibration curve created from the analysis of Gallic acid solution.

2.1.4 Microbiological analyses

The samples of tea were examined microbiologically. In order to do this, 10g of each sample were dissolved in 100ml of sterile distilled water in three different flasks, 1ml of each sample was placed in 9ml of sterile distilled water in a test tube, and 9ml of each sample was serially diluted in 9ml of sterile distilled water in various test tubes [22] (Meynell and Meynell, 1970). Pour plate technique was used to inoculate Yeast Extract Agar (YEA) and PDA medium in duplicate with one milliliter (1ml) of each appropriate dilution. Both media included Streptomycin antibiotics at a concentration of 40.0 g/ml. Nystatin and Macconkey agar are each present in a separate Nutrient Agar media. The petri dishes were inverted and incubated at the proper temperatures after solidification, and afterwards growth was checked.

2.1.5 Cup quality evaluation of tea samples

To establish preference ratings of tea for flavor, taste, color, and overall acceptability, cup quality or sensory evaluation of tea samples was carried out. 250ml of freshly boiled water was used to infuse 5g of tea samples, and the resulting beverage was then tasted to determine the quality. Six professional judges were used to assess the sensory quality of tea samples. A 15-minute training session with the panelists was held prior to the evaluation's start. After that, each member was given a sample one at a time. The panel room's controlled temperature and relative humidity were used for the sensory testing. Unnecessary noise and smells of chemicals or food were absent from the panel room. A prescribed questionnaire was made available to judges so they may record their sensory observation. According on the sensory performance data, the following ratings were given: 9 = Extremely like, 8 = Very much like, 7 = Like, 6 = Slightly like, 5 = Neither like nor dislike, 4 = Slightly dislike, 3 = Moderately dislike, 2 = Dislike, and 1 = Extremely dislike [23].

Statistical analysis: Results generated from the study were expressed as mean ± standard deviation of three replicate determinations. Statistical analysis was performed on the data using one-way analysis of variance (ANOVA) using statistical package for social sciences (SPSS) software version 18.0 and differences in means were compared by the Duncan's multiple range test.

3. RESULTS AND DISCUSSION

3.1 Proximate Characteristics of Spiced Green Tea

Figs. 1a, 1b, and 1c, respectively, show the outcomes of the proximate analyses of the Green Tea/Cinnamon, Tea/Ginger, and Tea/Lemon blends. The three main components of crude fiber are cellulose, hemicellulose, and lignin, which are present in plant cell walls. The amount of crude fiber is one of the main factors used to describe tea quality. According to the specifications for green tea, the crude fiber concentration cannot exceed 16.5%. The crude fiber content of the tea/cinnamon blend in the current study ranged from 13.6% to 14.9%. The addition of more cinnamon to the green tea did not cause a discernible difference in the crude fiber content. The crude fiber was highest at GCE (20% spice incorporation. With increasing spice integration in the Tea/Ginger blend, crude fiber value likewise adopted a declining trend. For the Tea/Lemon blend, the crude fiber for virgin tea was 13.2%, while the highest figure for GLE (20% w/w tea/spice) was 14.52%. The result thus demonstrates that adding spice to green tea has no adverse effects on the product's quality. The lowest and greatest moisture concentrations were found in GCF (30% spice) and GCA (0% spice), respectively, with mean moisture values of 5.6% and 5.1-6.2%. The Tea/Ginger blend had a mean moisture content of 7.5%, with 8.1% for 20 and 30% w/w spice incorporation. Increased microbial activity, oxidation/reduction reactions, and fungi development are all made easier by high moisture content. The relevance of this study's findings suggests that, with proper storage, spiced tea can have a longer shelf life. Due to its polyphenol content, tea has antibacterial effects [24].

Catechins are mostly unaltered during the production of green tea. This is due to the deactivation of polyphenol oxidase that is accomplished by steaming or pan-firing freshly picked tea leaves. Green tea mostly contains the catechins ()-epigallocatechin-3-gallate (EGCG), ()-epigallocatechin (EGC), ()-epigallocatechin-3-gallate (ECG), and (EC). The former makes up 10% of the dry weight and 59% of the catechins overall. However, of the total catechins, the three latter catechins account for roughly 19%, 13.6%, and 6.4%, respectively. They are in charge of the biological effects of green tea since they have demonstrated promise in treating a number of illnesses, such as cancer, cardiovascular diseases, and metabolic problems. According to the study's findings, tea's catechin content drops as the spice ratio rises. The average figure was 9.7%. or the tea/cinnamon mix, a mean value of 9.7% was achieved, with variations between 6.8 and 11.2%; for the tea/ginger blend, a mean value of 7.4%; and for the tea/lemon blend, a mean value of 8.0%; variations between 6.31 and 11.2%. Tea/Lemon, Tea/Ginger, and Tea/Cinnamon blends all have ether extracts that fall between 35.6 and 39.9%, 35.6-44.1%, and 23.2-35.6%, respectively. The Tea/spices blend's inclusion has not changed significantly. Except when there is a favorable balance of the important minerals, a sample's ash content, which shows the amount of its mineral content, does not necessarily suggest excellent quality.

3.2 Mineral Analysis of Spiced Tea

In ginger/tea combinations, the results for mineral contents showed 1.9-2.63 for Na, 3.44-3.78 for Ca, 2.31- 3.14 for Mn, 5.49-5.98 for Zn, and 4.94-5.37 mg/100g for K. In comparison to lemon/tea combination, Na was between 1.94 and 3.33, Ca was between 3.55 and 3.69, Mn was between 2.31-3.14, Zn was between 5.49 and 5.98, and K was between 4.94-5.37 mg/100g for cinnamon/tea combination. It is clear that the levels of Mn in lemon and tea were higher than those in cinnamon and ginger and tea. Additionally, compared to the other two pairings, the level of Zn in the lemon/tea combination was greater. When an enzyme is active, zinc performs both structural and catalytic roles. It is an antioxidant that can shield cells from the harmful effects of released oxygen radicals.

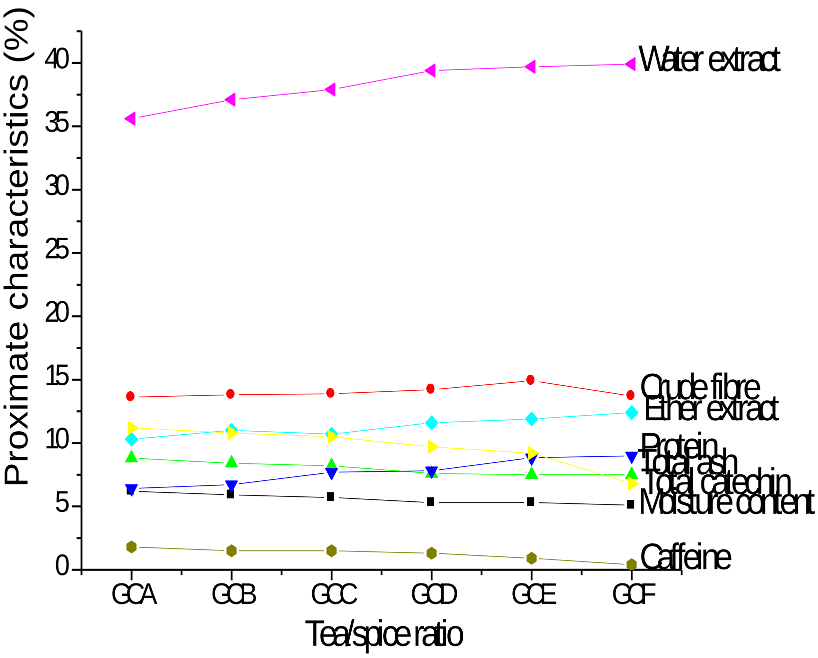

Fig. 1a. Proximate characteristics of green tea/cinnamon blend

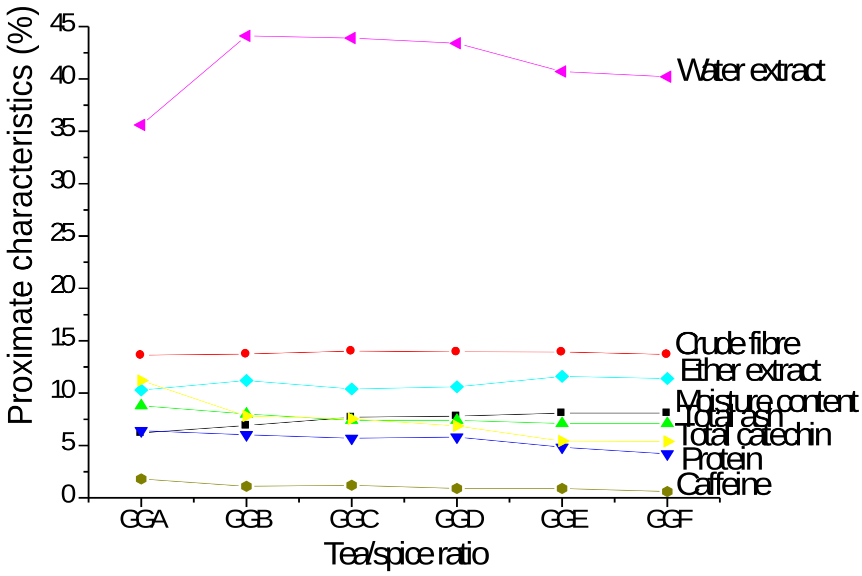

Fig. 1b. Proximate characteristics of green tea/ginger blend

Table 1. Mineral content of green tea blends

Sample	Element			Percentage	Inclusion		
	(mg/100g)	GGA	GGB	GGC	GGD	GGE	GGF
	Na	1.94	1.99	2.06	2.18	2.46	2.63
Ginger/Tea	Ca	3.67	3.71	3.74	3.62	3.78	3.44
	Mn	2.31	2.96	2.49	2.98	2.79	3.14
	Zn	5.49	5.92	5.98	5.75	5.63	5.60
	K	4.94	4.97	5.21	5.03	5.37	5.30
		GCA	**GCB**	**GCC**	**GCD**	**GCE**	**GCF**
	Na	1.94	1.99	2.06	2.18	2.46	2.63
Cinammon/	Ca	3.67	3.71	3.74	3.62	3.78	3.44
Tea	Mn	2.31	2.96	2.49	2.98	2.79	3.14
	Zn	5.49	5.92	5.98	5.75	5.63	5.60
	K	4.94	4.97	5.21	5.03	5.37	5.30
		GLA	**GLB**	**GLC**	**GLD**	**GLE**	**GLF**
	Na	1.94	1.97	2.05	2.68	2.74	3.33
Lemon/Tea	Ca	3.67	3.55	3.59	3.64	3.69	3.69
	Mn	2.31	2.09	2.14	2.39	2.53	2.89
	Zn	5.49	5.67	5.74	5.91	6.32	6.37
	K	4.94	3.88	3.72	3.54	3.77	3.93

GGA, GCA, GLA = 0 %; GGB, GCB, GLB = 5%; GGC, GCC, GLC = 10%; GGD, GCD, GLD =15%; GGE, GCE, GLE = 20%, GGF, GCF, GLF =30%

Table 2. Antioxidant profile of green tea blends

Sample	Antioxidant Profile		Percentage	Inclusion			
		GGA	GGB	GGC	GGD	GGE	GGF
Ginger/Tea	DPPH(gAAE/100g)	88.9	91.6	96.2	98.7	92.4	92.6
	FRAP (Mm FeSO4/100g)	0.34	0.39	0.43	0.49	0.49	0.37
	T.Polyphenols (g GAE/100g	17.19	17.31	18.53	18.71	19.02	18.24
		GCA	**GCB**	**GCC**	**GCD**	**GCE**	**GCF**
Cinnamon/ Tea	DPPH(gAAE/100g)	88.9	88.4	94.8	97.2	98.9	97.1
	FRAP (Mm FeSO4/100g)	0.34	0.38	0.40	0.45	0.49	0.48
	T.Polyphenols (g GAE/100g	17.19	17.90	17.95	18.23	18.62	17.84
		GLA	**GLB**	**GLC**	**GLD**	**GLE**	**GLF**
Lemon/Tea	DPPH(gAAE/100g)	88.9	90.22	94.22	95.56	91.09	87.46
	FRAP (Mm FeSO4/100g)	0.34	0.37	0.39	0.43	0.49	0.46
	T.Polyphenols (g GAE/100g	17.19	17.66	18.14	18.37	18.30	17.91

GGA, GCA, GLA = 0%; GGB, GCB, GLB = 5%; GGC, GCC, GLC = 10%; GGD, GCD, GLD =15%; GGE, GCE, GLE = 20%, GGF, GCF, GLF =30%

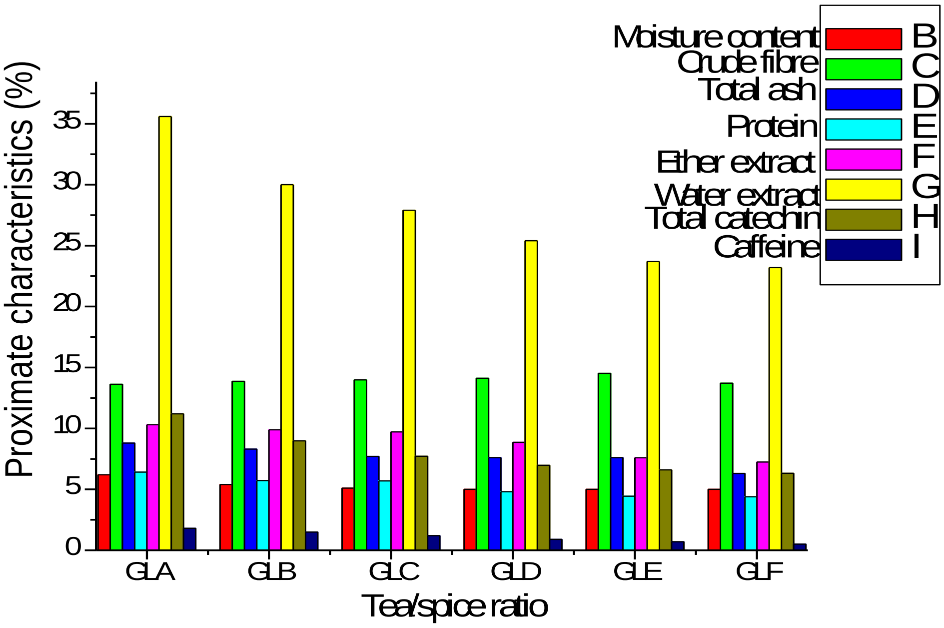

Fig. 1c. Proximate characteristics of green tea/lemon blend

3.3 Antioxidant Profile of Spiced Tea

An antioxidant is a chemical that prevents the generation of free radicals or increases the number of them so they can spread the oxidation reaction [25]. The combination of aromatic rings and hydroxyl groups, which creates their chemical structure and subsequently causes these hydroxyl groups to bind and destroy lipid free radicals, is primarily responsible for the antioxidant action of green tea polyphenols. In the current study, the DPPH of ginger/tea rises with ginger addition, reaching a maximum (98.7g AAE/100g) at 15%. It was ideal for lemon/tea at 15% (95.6g AAE/100g) and cinnamon/tea at 20% (98.9g AAE/100g). This implies that adding more spice than 20% will cause the DPPH of the tea combinations to decrease. A similar pattern was seen for ferric reducing antioxidant power (FRAP), where the three tea blends' best results at 20% inclusion were 0.49 Mm FeSO4/100g. For ginger and tea, cinnamon and tea, and lemon and tea, respectively, the total polyphenol value peaked at 19.02 g GAE/100g (20%), 18.62 g GAE/100g (20%), and 18.37 g GAE/100g (15%).

3.4 Microbiological Examination of Spiced Tea

Table 3 presents the microbiological assay of green tea blends. Result indicated that were no traces of E. coli and Salmonella in the samples. Yeast and mould and total viable counts were in the range of 10^3 to 10^4 Cfu/g. There is evidence of increased antimicrobial activity associated with high spice concentrations [26]. In the microbial assessment of the spiced tea formulation, it was discovered that no microbial growth was recorded in all the tests carried out; These results are consistent with findings in literature that the antimicrobial activities of extracts from several plants such as oregano, cumin, cinnamon, sage, and other spices possessed significant ($P < 0.05$) antibacterial and antifungal activities against wide range of food spoilage bacteria (Gram-positive and Gram-negative), as well as yeast and mold [27,28]. A decrease in cytoplasmic pH (pH_{int}) and cell wall disruption was observed in cells treated with spices and plant extracts, suggesting a possible mechanism of antibacterial action.

Food spoilage is often caused by the growth of many pathogenic organisms. Prevention of food spoilage in food industry is mainly based on the application of chemical preservatives. The adverse effect of these chemical preservatives on human health increases great concern; spices are examples of natural chemicals that are employed as food preservatives because they contain components with strong antioxidant and antibacterial capabilities [29]. Therefore, the tested spices (cinnamon, ginger and lemon) in this work which proved to be potentially effective can be used as natural alternative preservatives to control food spoilage organisms and preserve food stuff, thereby avoiding health hazards of chemically antimicrobial agent applications. Natural preservatives like spices have also been reported boost human health by protecting against diseases and can be with no restrictions on product dose [30]. Due to their widespread public acceptance, these products stand to replace synthetic preservatives in future.

3.5 Sensory Evaluation of Spiced Tea

In the range of 0 – 30%, Table 4 displays the sensory characteristics of adding spices to green or cup quality tea. For blending at 0%, 5%, 10%, 15%, 20%, and 30%, respectively, ginger had mean values of 5, 7, 6, 4, 6, and 5, respectively. This shows that a rise becomes unacceptable at 10%, where acceptance previously more advantageous. Cinnamon's mean value for blending at 0%, 5%, 10%, 15%, 20%, and 30%, respectively, was 5.5, 5.9, 6.6, 6.5, 6.2, 5.8, indicating that this combination was most agreeable at 10% inclusion. The lemon/tea blend was deemed to be most agreeable at 15%, with mean values of 5.5, 6.1,6.4,7.3,6.4, and 5.9 for blending at 0%, 5%, 10%, 15%, 20%, and 30%, respectively. In comparison to the other two, lemon/tea with a mean of 7.3 at 15% concentration was mostly preferred by the panelist.

Table 3. Microbiological assay of green tea blend

		Microbiological	Profile (Cfu/g)		
Spice	**Concentration**	**Yeast/Mould**	**E.coli**	**Salmonella sp.**	**TVC**
Ginger	GGA (0%)	10^4	Absent	Absent	10^3
	GGB (5%)	10^4	Absent	Absent	10^3
	GGC (10%)	10^3	Absent	Absent	10^3
	GGD (15%)	10^3	Absent	Absent	10^4
	GGE (20%)	10^3	Absent	Absent	10^4
	GGF (30%)	10^3	Absent	Absent	10^4
Cinnamon	GCA (0%)	10^4	Absent	Absent	10^3
	GCB (5%)	10^4	Absent	Absent	10^3
	GCC (10%)	10^3	Absent	Absent	10^4
	GCD (15%)	10^3	Absent	Absent	10^4
	GCE (20%)	10^3	Absent	Absent	10^4
	GCF (30%)	10^3	Absent	Absent	10^4
Lemon	GLA (0%)	10^4	Absent	Absent	10^3
	GLB (5%)	10^4	Absent	Absent	10^3
	GLC (10%)	10^3	Absent	Absent	10^4
	GLD (15%)	10^3	Absent	Absent	10^4
	GLE (20%)	10^3	Absent	Absent	10^4
	GLF (30%)	10^3	Absent	Absent	10^4

Table 4. Sensory characteristics of green tea blend

			Sensory	Attributes			
Spice	**Concentration**	**Flavor**	**Taste**	**Color**	**Texture**	**Acceptability**	**Mean**
Ginger	GGA	5.0	4.8	7.2	4.6	5.9	5.5
	GGB	5.5	5.1	6.9	4.9	6.1	5.7
	GGC	7.1	6.0	6.9	5.2	7.3	6.5
	GGD	6.8	6.5	6.4	5.7	6.8	6.4
	GGE	6.5	6.3	6.0	5.9	6.4	6.2
	GGF	6.0	5.8	5.9	6.3	5.5	5.9
Cinnamon	GCA	5.0	4.8	7.2	4.6	5.9	5.5
	GCB	5.4	6.3	6.5	5.8	5.5	5.9
	GCC	6.7	6.8	6.2	6.2	7.1	6.6
	GCD	5.8	5.5	7.4	5.9	7.8	6.5
	GCE	6.5	5.3	6.7	6.3	6.4	6.2
	GCF	6.3	5.8	5.6	5.8	5.3	5.8
Lemon	GLA	5.0	4.8	7.2	4.6	5.9	5.5
	GLB	6.2	5.9	7.5	5.4	5.5	6.1
	GLC	5.7	6.3	6.8	5.9	7.1	6.4
	GLD	7.8	7.5	7.8	5.6	7.8	7.3
	GLE	6.5	5.8	6.9	6.3	6.4	6.4
	GLF	6.6	5.3	6.4	5.8	5.3	5.9

4. CONCLUSION

The results reported in this article have shown that it is possible to blend spices with tea. There was also no detrimental effect of using spice in combination with green tea, rather an enhanced antioxidant and cup quality was noticed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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