



## Nutrient content, antioxidant activity, and organoleptic quality of coriander seeds (*Coriandrum sativum* L.) and white ginger (*Zingiber officinale* Rosc.) tea bags as functional drinks for hypertension

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### ABSTRAK

**Latar Belakang:** Prevalensi tekanan darah tinggi di Indonesia meningkat hingga tahun 2018 sebanyak 34,1%. Tekanan darah yang tinggi dapat disebabkan oleh diet yang kurang sehat seperti konsumsi natrium berlebih sehingga diperlukan konsumsi kalium dan antioksidan yang dapat menurunkan tekanan darah.

**Tujuan:** Menganalisis mutu gizi (kadar air, kadar abu, kadar kalium, dan aktivitas antioksidan) dan mutu organoleptik (warna, aroma, dan rasa) pada teh celup biji ketumbar dan jahe putih sebagai minuman fungsional bagi penderita hipertensi.

**Metode:** Penelitian menggunakan eksperimental dengan jenis penelitian Rancangan Acak Lengkap (RAL) 3 taraf perlakuan dan 3 kali pengulangan dengan proporsi biji ketumbar dan jahe putih: P1 (55:45), P2 (50:50), dan P3 (45:55). Menentukan mutu organoleptik dengan metode hedonik dan deskriptif, kadar air dengan metode oven, kadar abu dengan metode pengabuan, kadar kalium dengan calculated value, dan aktivitas antioksidan dengan metode DPPH.

**Hasil:** Kadar air, kadar abu, dan kadar kalium masing-masing formulasi teh celup biji ketumbar dan jahe putih telah memenuhi standar. Nilai IC50 pada masing-masing formulasi teh celup biji ketumbar dan jahe putih menunjukkan sifat antioksidan yang sangat kuat. Hasil mutu organoleptik warna menunjukkan bahwa P2 (50:50) memiliki nilai tertinggi dan berbeda nyata dengan P1 (55:45) dan P3 (45:55) ( $p$  value < 0,05), sedangkan pada aroma dan rasa P2 (50:50) memiliki nilai tertinggi namun tidak terdapat perbedaan yang nyata ( $p$  value > 0,05).

**Kesimpulan:** Formulasi terbaik teh celup biji ketumbar dan jahe putih sebagai minuman fungsional bagi penderita hipertensi yaitu P2 (50:50).

**KATA KUNCI:** biji ketumbar; hipertensi; jahe putih; teh celup



## ABSTRACT

**Background:** High blood pressure prevalence in Indonesia increased to 34.1% in 2018. High blood pressure can be caused by an unhealthy diet, including high sodium intake. Therefore, potassium and antioxidant intake are needed to lower blood pressure.

**Objectives:** Analyzing the nutritional quality (moisture content, ash content, potassium content, and antioxidant activity) and organoleptic quality (colour, aroma, and taste) of coriander seeds and white ginger tea bags as functional drinks for hypertension.

**Methods:** The study used experimental research with Completely Randomized Design (CRD) using three treatment levels and three repetitions with ratio of coriander seeds and white ginger used in this study is P1 (55:45), P2 (50:50), and P3 (45:55). Determinating organoleptic quality using hedonic and descriptive, water content using oven method, ash content using incineration method, potassium content using calculated value, and antioxidant activity using DPPH method.

**Results:** Moisture content, ash content, and potassium content of each coriander seed and white ginger tea bag formulation have met the standards. The IC50 values in each coriander seed and white ginger tea bag indicate very strong antioxidant properties. Organoleptic quality results for colour indicate that P2 (50:50) has the highest value and significantly differs from P1 (55:45) and P3 (45:55) ( $p$ -value < 0.05), while for aroma and taste, P2 (50:50) has the highest value but no significant difference was observed ( $p$ -value > 0.0).

**Conclusions:** The best formulation of coriander seeds and white ginger tea bags as a functional drink for hypertension is P2 (50:50).

**KEYWORD:** coriander seed; hypertension; tea bags; white ginger

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## INTRODUCTION

Basic Health Research in 2018 reported that the prevalence of hypertension in the population aged > 18 years increased from 25.8% in 2007 to 34.1% in 2018 (1). The prevalence of hypertension in 2018 in East Java was relatively higher than in Indonesia. Furthermore, the prevalence of hypertension in 2021 remained relatively unchanged, at 36.2% (2).

Fitri et al. (2018) research showed that 82.4% of hypertensive elderly respondents consumed sodium (3). The research results by Rohatin and Prayuda (2020) showed that among 34 elderly respondents with low potassium intake, 28 elderly respondents had hypertension (4). According to Kurniadi and Nurrahmani (2017), sodium consumption should be balanced with potassium consumption. An increased concentration of potassium in the intracellular fluid will lower blood pressure (5).

Afifah's (2019) research showed that there was a decrease in blood pressure from 170/100 mmHg to 145/80 mmHg after being given a decoction of coriander seeds 1.5% in 100 mL for

3 days (6). With the same amount of decoction, the research results by Rahmah (2021) also showed a significant decrease in blood pressure from 156/94 mmHg to 124/82 mmHg (7). The Indonesian Nutritionist Association (2018) states that 100 g of coriander seeds contains 1787 mg of kalium, which can lower blood pressure (8). Widiyari (2018) explained that flavonoid content in coriander seeds also has an antihypertensive effect that lowers oxidative stress levels, inhibiting angiotensin-converting enzyme (ACE), which acts as a regulator of artery blood pressure and electrolyte and promotes endothelial relaxation (9).

Tamrin et al. (2015) research showed that 52.8% of respondents experienced a decrease in blood pressure after being given 4% white ginger extract for five consecutive days (10). Kristiani and Ningrum (2020) explain that gingerol compounds in white ginger are capable of lowering blood pressure by blocking calcium channel voltage in blood vessel cells, resulting in vasodilation (11). Andini et al. (2023) research

showed that the addition of ginger powder up to 40% resulted in colour and aroma with the highest level of panelist's favorability, namely 3.65 (like) and 4.20 (like) (12).

Each coriander seed and white ginger are great ingredients in herbal tea, but both are only processed by boiling the ingredients. Therefore, this process caused the tea to not last long. Research by Septiwi et al. (2019) showed that drying by the roasting method reduced the moisture content in bay leaves and red ginger rhizomes by 3% and 5%, respectively (13). Based on these facts, a study needs to be conducted on formulating coriander seeds and white ginger tea bags to prolong their shelf life without reducing or altering the nutrient component in both ingredients, which can be utilized in tea as functional drinks. Functional drinks or foods should help to prevent a disease occurrence; they should do more than just provide basic nutrition and can be consumed as a normal diet (14).

## **MATERIALS AND METHODS**

The study uses experimental research with a Completely Randomized Design (CRD) design using three treatment levels and three repetitions. The treatment levels are determined based on the lack of potassium consumption by 1056.2 mg. The treatment levels using ratio of coriander seeds and white ginger used in this study is P1 (55:45), P2 (50:50), and P3 (45:55). The research was conducted from January to June 2023 at 1) the Food Material Science Laboratory, 2) the Ministry of Health Malang Health Polytechnic for the processing of coriander seed and white ginger tea ingredients, 3) the Faculty of Public Health Laboratory, Airlangga University for testing water content, ash content, and antioxidant activity, and 4) the Organoleptic Laboratory, Ministry of Health Malang Health Polytechnic for organoleptic quality testing.

The formulation of coriander seed and white ginger tea bags uses coriander seeds, white ginger tea bags, and mineral water. Coriander seeds are processed by roasting for 1 hour and then blended after cooling. White ginger is processed by blanching in boiling water at 100 °C for 1 minute and then cut crosswise. Additionally, white ginger is dried in an oven at 60 °C for 6 hours, and then it is blended. Afterward,

coriander seed powder and white ginger powder are mixed and weighed according to treatment levels. Finally, the mixture of coriander seed powder and white ginger powder is placed in tea bags at 2 g each and sealed with a string.

Nutrient content analysis using provisions in accordance with the Indonesian National Standards Number 01-2891-1992. Water content is measured using the oven method, and ash content is measured using the ashing method; meanwhile, potassium content is measured using the calculated value method. Analyzing potassium content using calculated value by determining retention factor first based on the Food and Agriculture Organization (FAO) (2002) according to the type of material and its processing method, and then estimating potassium content using the formula potassium content raw material multiplied by its retention factor then divided by yield factor. Antioxidant activity is measured using the DPPH method based on research by Dinanti (2016) (15). Organoleptic quality preference testing uses a hedonic test with 30 untrained panelists from the Nutrition Department, Malang Ministry of Health Polytechnic. The hedonic test scale ranges: 1 = strongly dislike, 2 = dislike, 3 = like, and 4 = strongly like. Descriptive testing uses a descriptive test with 10 trained panelists from the Nutrition Department, Malang Ministry of Health Polytechnic, where panelists assess the sensory evaluation strength of the product using a scale ranging from: 1 = very weak, 2 = weak, 3 = moderately strong, 4 = strong, and 5 = very strong. Test results data are processed using SPSS 20. Water content, ash content, and antioxidant activity data are analyzed using One Way Anova and the post-hoc Duncan Multiple Range Test. Preference test data is analyzed using Kruskal-Wallis analysis and post-hoc Mann Whitney test.

## **RESULTS AND DISCUSSIONS**

### **Water Content**

One Way Anova test shows that there are significant differences in the variables of water content. Duncan's post-hoc tests on water content showed marked differences between P1 and P2 with P3. The water content of coriander seed and white ginger tea bag formulations ranges from 2.47 – 4.12%. The results showed that the higher

the proportion of white ginger, the higher the water content in coriander seed tea bags and white ginger.

The water content at each treatment level has met the requirements based on the Indonesian National Standard (SNI) 3836-2013, where the maximum water content is 8%. This is in line with the results of research by Andini et al. (2023), which show that the higher the proportion of ginger addition, the higher the water content in tea (12). The Indonesian Nutritionist Association (2018) states that fresh white ginger contains 55% water content, so the addition of ginger to tea will increase water content (8).

### Ash Content

Duncan's post-hoc test on ash content showed that the P1 treatment level was significantly different from P2 and P3, the P2

treatment level was significantly different from P1 and P3, and the P3 treatment level was significantly different from P1 and P2. The ash content of coriander seed and white ginger tea bag formulations ranges from 1.34 – 1.96%. The lower the proportion of coriander seeds, the higher the ash content in coriander seed tea bags and white ginger.

The ash content at each treatment level has met Indonesian National Standard (SNI) 3836-2013 requirements with a maximum ash content of 8%. The results showed that the ash content at each treatment level of coriander seed tea bags and white ginger was below the specified requirements. In line with the results of research, Siagian et al. (2020) showed that the processing of herbal tea with the same drying time and temperature of 8 hours and a temperature of 50 °C resulted in an ash content of 1.04 – 1.20% (16).

**Table 1. Average nutrient levels and IC50 value of coriander seed and white ginger tea bags**

Treatment levels (%) *	Water content (%) **	Ash content (%) **	Potassium content (mg)	IC50 value (ppm) **
P <sub>1</sub> (55:45)	2.47 ± 0.26 <sup>a</sup>	1.34 ± 0.09 <sup>a</sup>	1151.47	48.71 ± 0.49 <sup>a</sup>
P <sub>2</sub> (50:50)	3.02 ± 0.30 <sup>a</sup>	1.67 ± 0.10 <sup>b</sup>	1027.43	37.24 ± 7.78 <sup>a</sup>
P <sub>3</sub> (45:55)	4.12 ± 0.67 <sup>b</sup>	1.96 ± 0.16 <sup>c</sup>	903.39	31.35 ± 0.24 <sup>b</sup>

\*) Proportion of coriander seeds and white ginger

\*\*\*) Values followed by the same letter indicate non-significant difference

The ash content describes the minerals and contaminants contained in tea. The higher the ash content, the higher the contaminants in tea. This is due to the presence of soil or sand residues on the surface of the material. Low ash content in tea indicates good tea quality, but the lower the ash content, the lower the mineral content in the tea (17).

### Antioxidant Activity

Duncan's post-hoc test results at IC50 values showed that the level of P3 treatment was significantly different from P1 and P2. The IC50 values of coriander seed and white ginger tea bag formulations range from 31.35 to 48.71 ppm. The lower the proportion of coriander seeds, the lower the IC50 value in the formulation of coriander seed tea bags and white ginger.

Martinez et al. (2020) explain that the lower the IC50 value, the stronger the antioxidant properties in the material. IC50 values below 50

ppm fall into the category of very strong antioxidant properties (21). Its powerful antioxidant abilities can affect blood pressure drops. Antioxidants such as flavonoids have antihypertensive effects that can reduce oxidative stress and inhibit ACE. Gingerol compounds in white ginger are able to prevent blood clots so that blood vessels dilate and blood pressure decreases (9).

### Potassium Content

The higher the proportion of coriander seeds, the higher the potassium levels in coriander seed tea bags and white ginger. The highest potassium levels were produced at the P1 treatment level with a proportion of coriander seeds and white ginger of 50:50, which was 1151.47 per 100 g. The Tea Council of Canada (2023) states that a good serving dose of tea bags for high potassium consumption is as much as three tea bags with a weight per bag of 2 g (18). The results of a study

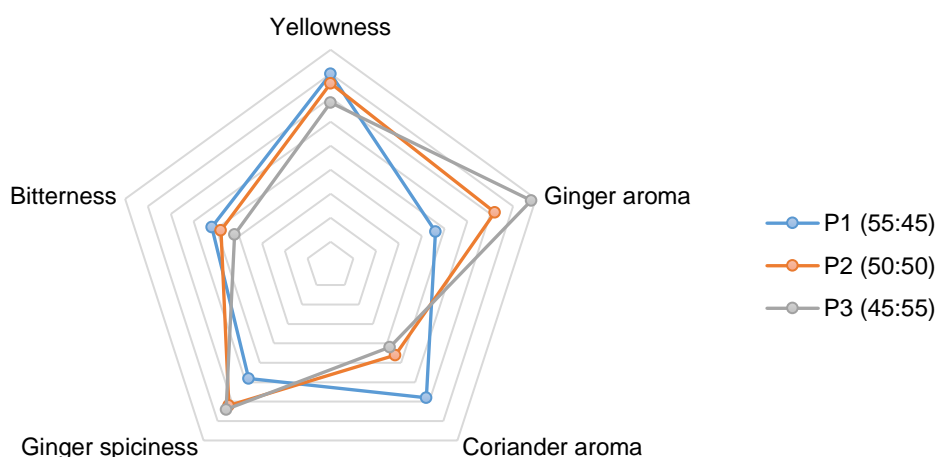
by de Abreu et al. (2023) showed that root vegetables and herbs, after soaking for 5 minutes in deionized water heated to boiling point, can reduce potassium content by up to 15% (19). Therefore, coriander seed tea bags and white ginger can meet the lack of potassium consumption by 1 – 2%, which is 15 – 19 mg per serving.

A food product can be said to be a source of potassium if it has met 15% of the needs based on the Recommended Dietary Allowance per 100 g of ingredients (20). The results showed that in 100 g of coriander seed and white ginger tea bags ingredients, they met the standard for P1 formulation with a proportion of coriander seeds and white ginger 55:45 by 24.5%; P2 formulation with a proportion of coriander seeds and white

ginger 50:50 by 21,9%; and P3 formulation with a proportion of coriander seeds and white ginger 45:55 by 19,2% from potassium intake based on Recommended Dietary Allowance.

### Organoleptic Preference

Organoleptic characteristics of coriander seeds and white ginger tea bags in **Figure 1** showed that the bitterness was strongest at the P1 treatment level of 2.6 (moderately strong). The strongest spiciness was felt at the P3 treatment level of 3.7 (strong). Coriander aroma is strongest at the P1 treatment level of 3.4 (rather strong). The distinctive ginger aroma is the strongest at the P3 treatment level of 4.4 (strong). The yellowness at the P1 treatment level has the highest yellow color level of 4.0 (strong).



**Figure 1. Organoleptic characteristics of coriander seeds and white ginger tea bags**

The results of the Kruskal-Wallis test showed that there was a significant difference in the color preference between the formulation of coriander seed and white ginger tea bags, while there was no significant difference in aroma and taste preferences. The color preference was significantly different in P2 treatment with P1 and P3. The P2 treatment level with a proportion of coriander seeds and white ginger of 50:50 resulted in the panelist preference level for the highest color, aroma, and taste quality, with values of 3.43 for color, 3.33 for aroma, and 2.97 for taste.

Panelist's preference level for formulations of coriander seed and white ginger tea bags was highest when the proportion of white ginger was up to 50%. However, at the P3 treatment level, which had the highest proportion of white ginger at 55%, the panelist favorability decreased. A proportion of white ginger more than 50% resulted in an herbal tea with a stronger aroma that was less preferred by panelists. The level of taste preference in coriander seed and white ginger tea bags increased in the proportion of coriander seeds up to 50%. However, when the proportion

of coriander seeds exceeded 50%, panelist favorability decreased.

The results of the research showed that P2 treatment levels with the proportion of coriander seeds and white ginger 50:50 have the highest color, aroma, and taste preference levels. Research by Andini et al. (2023) showed that adding white ginger up to 40% resulted in higher panelist likeliness by 3,65 (like) (12). Pebiningrum et al. (2017) explained that white ginger contains oleoresin, which is dark brown. This substance includes phenolic compounds that

are easily oxidized, causing the formation of quinones (ketone compounds) that are brown (22). The coriander aroma is produced from the essential oil content of coriander seeds, which ranges from 0.4 to 1.1%. Coriander seed essential oil has compounds that function as aromatic compounds so that they can cause aromas that overlap with other aromas in food (23). White ginger contains gingerol, shogaol, and zingerone, which are the components that produce a pungent, distinctive taste and aroma in ginger (24).

**Table 2. Panelist level of preference for organoleptic quality of coriander and white ginger tea bags**

Treatment levels (%) *	Strongly dislike		Dislike		Like		Strongly like		Average $\pm$ SD **
	n	%	n	%	n	%	n	%	
Color									
P <sub>1</sub> (55:45)	0	0	6	20	21	70	3	10	2.90 $\pm$ 0.55 <sup>a</sup>
P <sub>2</sub> (50:50)	0	0	3	10	11	36.7	16	53.3	3.43 $\pm$ 0.68 <sup>b</sup>
P <sub>3</sub> (45:55)	0	0	9	30	14	46.7	7	23.3	2.93 $\pm$ 0.74 <sup>a</sup>
Aroma									
P <sub>1</sub> (55:45)	0	0	7	23.3	13	43.3	10	33.3	3.1 $\pm$ 0.76 <sup>a</sup>
P <sub>2</sub> (50:50)	0	0	3	10	14	46.7	13	43.3	3.33 $\pm$ 0.66 <sup>a</sup>
P <sub>3</sub> (45:55)	0	0	6	20	17	56.7	7	23.3	3.03 $\pm$ 0.67 <sup>a</sup>
Taste									
P <sub>1</sub> (55:45)	2	6.7	9	30	17	56.7	2	6.7	2.63 $\pm$ 0.72 <sup>a</sup>
P <sub>2</sub> (50:50)	0	0	7	23.3	17	56.7	6	20	2.97 $\pm$ 0.67 <sup>a</sup>
P <sub>3</sub> (45:55)	2	6.7	7	23.3	15	50	6	20	2.83 $\pm$ 0.83 <sup>a</sup>

\*) Proportion of coriander seeds and white ginger

\*\*) Values followed by the same letter indicate non-significant difference

Coriander seeds have an earthy bitter flavor or bitter taste with earthy or typical plant nuances. Khetrupal (2021) explained that coriander seeds have a distinctive bitter taste caused by the content of linalool compounds in essential oils. Linalool compounds cause citrus and soapy flavor effects in coriander seeds (23). The distinctive spiciness taste of ginger is produced from the oleoresin compound content of white ginger. The content of oleoresin compounds includes gingerol, zingiberen, shagaol, essential oils, and resins. Gingerol compounds, together with zingeron and shogaol compounds, cause ginger to have a spicy taste (24).

The P2 treatment rate with the formulation of coriander seed tea bags and white ginger 50:50 can be consumed as a daily drink. The formulation of coriander seed tea bags and white ginger with a weight per bag of 2 g can be

consumed by brewing with 200 ml of mineral water at 100 °C for 5 minutes (25). Coriander seed and white ginger tea bags can be served without or with sweeteners.

## CONCLUSIONS AND RECOMMENDATIONS

Coriander and white ginger tea bags in the P2 formulation with a proportion of coriander seeds and white ginger of 50:50 is the best treatment level with a moisture content of 3.02%, ash content of 1.67%, potassium content of 21.9% RDA per 100 g of material, and an IC50 value of 37.24. The best treatment level of P2 has a yellow-orange gold color with a panelist favorability level of 3.43 (likes), a slightly concentrated ginger aroma with a panelist favorability level of 3.33 (likes), and a deep spicy taste with a panelist favorability level of 2.97 (likes).

Coriander seed tea bags and white ginger at the P2 treatment level can be recommended as functional drinks for people with hypertension with high potassium and antioxidant content. Steeping the formulation of coriander seed tea bags and white ginger produces a precipitate that causes a darker steeping color. This can be caused by tea powder that is too fine. It is necessary to study the length of the destruction of ingredients to produce coarse tea powder.

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