



***In vitro* antioxidant and alpha-glucosidase inhibitory activities of coriander (*Coriandrum sativum* L.) root extracts**

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ABSTRACT

Background: Coriander (*Coriandrum sativum* L.) is a versatile culinary herb known for its edible leaves, seeds, stems, and roots. It is widely utilized in traditional medicine across the globe and is reputed for its diverse biological properties, including significant antioxidant and antidiabetic effects. Nonetheless, the majority of research has primarily concentrated on the seeds, leaves, and stems, leaving the roots comparatively underexplored.

Objective: This research delved into the antioxidative capabilities and alpha-glucosidase inhibitory properties of coriander root extracts and assessed their phytochemical makeup.

Methods: The coriander roots were lyophilized, pulverized to powder, and extracted using two methods: boiling and maceration with water, 50% ethanol, or 100% ethanol.

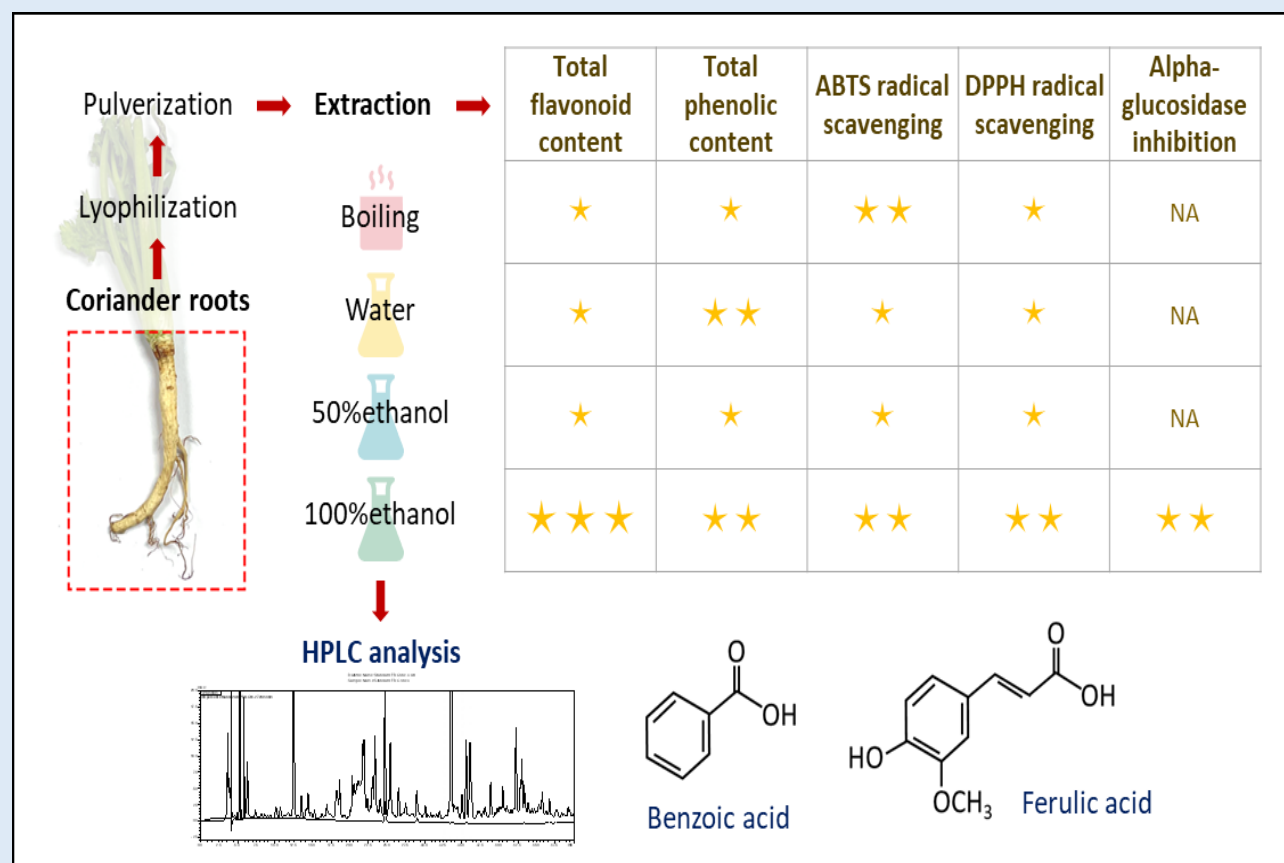
The extracts underwent assessment for antioxidant activity through ABTS and DPPH radical scavenging methods, total phenolic and flavonoid concentrations, and inhibition of the alpha-glucosidase enzyme. In addition, their phytochemical profiles were identified and quantified by HPLC.

Results: Among all the extracts, the 100% ethanol extract demonstrated the greatest levels of total flavonoids and phenolics, exhibited the strongest antioxidant activity against ABTS and DPPH radicals, and showed the most potent alpha-glucosidase inhibition. Notably, the boiling extract, although containing the lowest total phenolic and flavonoid contents, exhibited ABTS radical scavenging capacity comparable to the 100% ethanol extract. This suggested that the

boiling extract might contain non-phenolic antioxidant compounds and should be further studied. Additionally, HPLC analysis unveiled the novel identification of benzoic acid and ferulic acid within the coriander root extracts for the first time. The highest contents of these compounds were also found in the 100% ethanol extract.

Conclusion: Coriander roots, a common culinary ingredient, exhibited antioxidant and alpha-glucosidase inhibitory activities, suggesting potential as a functional food for preventing age- and lifestyle-related diseases, such as diabetes and certain cancers.

Keywords: Coriander roots, Antioxidants, Antidiabetics, Benzoic acid, Ferulic acid, HPLC analysis



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INTRODUCTION

Coriander or *Coriandrum sativum* L. is a well-known spice commonly used in culinary and traditional medicine worldwide [1, 2]. This plant belongs to the family of Apiaceae. The leaves and shoots are utilized as flavor enhancers for soups and salads, whereas the seeds and roots are incorporated into meat recipes and curry pastes. Furthermore, coriander and its bioactive

compounds have undergone extensive scrutiny, unveiling a variety of biological effects, including antioxidant and antidiabetic properties, as well as anticancer, neuroprotective, anti-inflammatory, analgesic, hypolipidemic, and hypotensive activities [1-4]. Accordingly, coriander, a culinary spice with various bioactivities, seems to be a promising functional food

that can potentially prevent age- and lifestyle-related diseases.

Type 2 diabetes mellitus (T2DM) stands as one of the prevalent lifestyle-related diseases, escalating into a global health concern as its prevalence surges across the globe. In 2021, there were an estimated 536.6 million diabetes cases worldwide, and by 2045, it is expected to grow to 783.2 million [5]. T2DM is a chronic disease that causes life-threatening, disabling, and costly complications. It is characterized by chronic hyperglycemia and insulin resistance, which is associated with oxidative stress [6]. Increased free radicals and oxidative stress are proposed to be responsible for insulin resistance and impairment of pancreatic beta-cell function, leading to persistent hyperglycemia. On the other hand, hyperglycemia can also induce oxidative stress through different signaling pathways [7]. Therefore, daily consumption of antioxidants with hypoglycemic effect, particularly via alpha-glucosidase inhibition, might be a therapeutic strategy to prevent or delay the development of T2DM by preserving beta-cell function, improving insulin sensitivity, and decreasing hyperglycemia [7, 8].

Interestingly, previous studies of coriander extracts reported antioxidant and antidiabetic activities from various parts of the plant [9-14]. For example, the decoction extract from coriander seeds showed an antihyperglycemic effect in streptozotocin-diabetic mice [9]. The water extracts of coriander roots and leaves exhibited antioxidant activity and an inhibitory effect on PAH8 formation in roasted duck wings [10]. The ethyl acetate fractions from the aqueous alcohol extracts of coriander leaf and stem possessed significant antioxidant and hypoglycemic effects in alloxan-induced diabetic rats and exhibited a strong scavenging effect on DPPH radical and lipid peroxidation inhibition [13]. The various extracts of coriander leaf showed antioxidant effects on DPPH radical, metal chelating, and FRAP activities, as well as enzyme inhibitory activities against alpha-glucosidase,

alpha-amylase, and lipase [14]. In addition, the aqueous ethanol extract of coriander leaf exhibited antioxidant activity toward DPPH, FRAP, and ORAC assays and inhibited alpha-amylase and alpha-glucosidase activities. These activities were suggested to be derived from the extract's phenolic compounds like quercetin, kaempferol, p-coumaric acid, caffeic acid, and vanillic acid [12]. However, these studies have been investigated from the seed, leaf, and stem parts. The root part, widely used in cuisine and medicine, remains under-investigated. Therefore, this study aims to investigate the antioxidative and alpha-glucosidase inhibiting properties of coriander root and identify its phytochemical profile

MATERIALS AND METHODS

Reagents and chemicals: Supplied by Sigma Aldrich Chemical were alpha-glucosidase from *Saccharomyces cerevisiae*, acarbose, pNPG (4-nitrophenyl alpha-D-glucopyranoside), phosphate buffered saline (PBS), caffeic acid, gallic acid, quercetin, Folin-Ciocalteu phenol reagent, ABTS (2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid)), Trolox (6-hydroxy-2,5,7,8-tetramethylchromane-2-carboxylic acid), DPPH (2,2-diphenyl-1-picrylhydrazyl), and Dimethyl sulfoxide (DMSO). Ajax Finechem supplied Aluminum chloride and potassium persulfate. CARLO ERBA Reagents provided anhydrous sodium carbonate. Fluka supplied linalool and ascorbic acid. Benzoic acid and ferulic acid were purchased from Supelco. All remaining chemical reagents met analytical grade standards.

Sample preparation: In December 2022, coriander roots were procured from a local market in Bangkok, Thailand. Following a thorough wash with running tap water and subsequent air-drying, the roots underwent separation from the stems using a knife, as depicted in Figure 1. Subsequently, the roots were lyophilized, pulverized via a blender, and preserved at a temperature of -80°C until extraction.

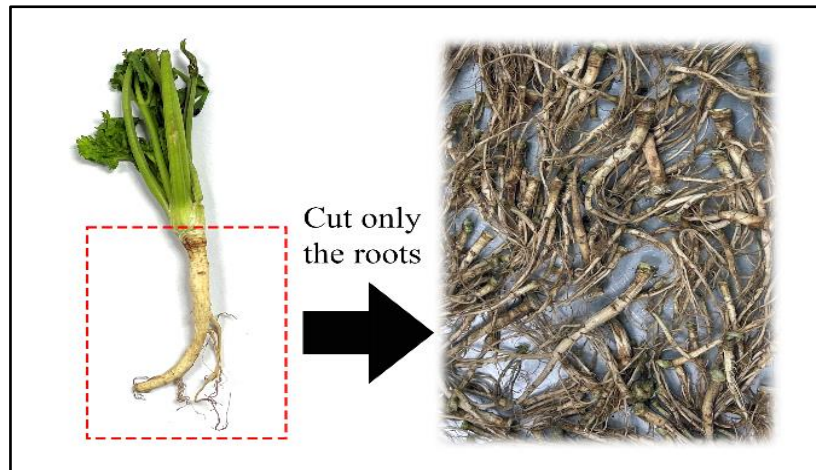


Figure 1: The root sample of coriander

Sample extraction: The root powder was extracted using two methods: which mimics the cooking process, and maceration with different solvents. To prepare the decoction, 750 mL of deionized water was used to soak 50 g of root powder, which was subsequently boiled for 30 minutes. As for maceration, 20 g of root powder was combined with either 300 mL of deionized water, 50% ethanol, or 100% ethanol. The mixture was stirred with a magnetic stirrer for 6 hours, followed by an additional 18 hours of settling at room temperature without agitation. The extracts underwent filtration using filter paper and were freeze-dried at -50°C for 72 hours. They were freeze-dried after concentrating the ethanol extracts under reduced pressure at 40°C using a rotary evaporator. Subsequently, all dried extracts were stored at -20°C until required. To generate stock solutions of the extracts, each dried extract was dissolved in deionized water or DMSO at a concentration of 10 mg/mL. These solutions were then diluted to the necessary concentration for subsequent experiments.

Determination of total phenolic content (TPC) and total flavonoid content (TFC): The total phenolic content (TPC) was determined using the Folin-Ciocalteu reagent method. In contrast, the total flavonoid content (TFC) was assessed using the aluminum chloride colorimetric

technique, following previously described methodologies [15].

To determine the total phenolic content (TPC), 20 μL of each sample was combined with 50 μL of 10% Folin-Ciocalteu reagent in 96-well plates. Following a 3-minute incubation period, 80 μL of 7.5% sodium carbonate solution was included, and the mixture was incubated at room temperature in darkness for 2 hours. Absorbance readings were taken at 765 nm using a microplate reader (SPECTRO star nano, BMG Labtech, Germany) against a blank. Gallic acid was used to construct the standard curve, and the results were expressed as milligrams of gallic acid equivalent per gram of extract (mg GAE/g extract). The total flavonoid content (TFC) was measured by adding 100 μL of each sample to 100 μL of a 2% aluminum chloride solution in 96-well plates. After incubating at room temperature for ten minutes, the absorbance was measured at 415 nm using a blank as the reference. A standard curve was established using quercetin, and the results were expressed as milligrams of quercetin equivalent per gram of the extract (mg QE/g Extract).

Evaluation of antioxidative potentials: The antioxidant capacity was determined by ABTS and DPPH radical

scavenging assays, following methodologies in a previous study [15].

The ABTS radical scavenging assay began with preparing the ABTS⁺ radical by mixing equal parts of 7.4 mM ABTS solution with 2.6 mM potassium persulfate solution, followed by a 12-hour incubation in darkness at room temperature. Before the assay, the ABTS⁺ radical underwent dilution with methanol until achieving an absorbance of 1.10 ± 0.02 at 734 nm. Subsequently, 10 μ L of each sample was blended with 200 μ L of the ABTS⁺ radical solution in 96-well plates and incubated for 6 minutes in darkness at room temperature. 734 nm absorbance readings were recorded against a blank. Trolox was used to establish the standard curve. The results were expressed as milligrams of Trolox equivalent antioxidant capacity per gram of the extract (mg TEAC/g Extract).

To perform the DPPH radical scavenging assay, the DPPH radical was freshly prepared by methanol dilution to a concentration of 152 μ M. Then, 100 μ L of each sample at different concentrations was combined with 100 μ L of the DPPH radical solution in 96-well plates. After a 30-minute incubation in darkness at room temperature, absorbance readings were recorded at 517 nm against a blank. Ascorbic acid served as the standard reference. The percentage of DPPH radical scavenging capacity was calculated using the following formula:

$\% \text{ DPPH radical scavenging capacity} = [1 - (As/Ac)] \times 100$, where As represents the absorbance of DPPH reacting with the sample and Ac denotes the absorbance of DPPH reacting with deionized water instead of the sample. The results for each sample were expressed as an IC₅₀ value, calculated through interpolation.

Assessment of alpha-glucosidase inhibitory activity: The determination of alpha-glucosidase inhibitory activity

followed methodologies outlined in a previous study, albeit with minor adjustments [15].

The positive control, acarbose, was diluted to different concentrations (ranging from 1.25 to 10 mg/mL) using deionized water. In 96-well plates, 20 μ L of each sample at a concentration of 10 mg/mL was combined with 20 μ L of 0.5 U/mL alpha-glucosidase and 60 μ L of 0.1M phosphate buffer (pH 6.9). Following a pre-incubation at 37 °C for 10 minutes, 20 μ L of 5 mM pNPG was introduced as a substrate, and the mixture was further incubated at 37 °C for 20 minutes to facilitate the reaction. The absorbance of p-nitrophenol was measured at 405 nm against a blank. The percentage of alpha-glucosidase inhibitory activity was determined using the following formula:

$\% \text{ Alpha-glucosidase inhibitory activity} = [1 - (As/Ac)] \times 100$, where As represents the absorbance of alpha-glucosidase reacting with the sample and Ac denotes the absorbance of alpha-glucosidase reacting with PBS instead of the sample.

High performance liquid chromatographic (HPLC)

analysis: The quantification of linalool, ascorbic acid, and various phenolic compounds, including caffeic acid, gallic acid, ferulic acid, benzoic acid, and quercetin within different coriander root extracts, was conducted through HPLC analysis using a Prominence HPLC system from Shimadzu Co., Kyoto, Japan. The system was equipped with binary pumps (LC-20AD), an autosampler (SIL-20A HT), a column oven (CTO-20A), and a photodiode array detector (SPD-M20A). Separation was achieved using a Shimadzu Shim-pack GIST C18 column (4.6 \times 250 mm, 5 μ m particle size).

For linalool determination, a mobile phase of deionized water (A) and acetonitrile (B) was applied, with a gradient program of 55% B from 0 to 20 minutes, 100%

B from 21 to 30 minutes, and back to 55% B from 31 to 45 minutes. The flow rate remained constant at 0.7 mL/min, and the column temperature was held at 25 °C, with detection at 210 nm [16].

Regarding ascorbic acid and phenolic compounds, the mobile phase comprised 1% acetic acid in deionized water (A) and acetonitrile (B). The gradient program transitioned from 10% to 40% B over 28 minutes, to 60% B at 39 minutes, 90% B at 50 minutes, and back to 10% B at 55 minutes. The flow rate was consistent at 0.7 mL/min, and the column temperature was 28 °C. Detection wavelengths were either 272 nm or 310 nm, depending on the maximum absorbance [17].

The identification of linalool, ascorbic acid, and phenolic compounds within the extracts relied on comparing their retention times and UV absorbance spectra with those of reference standards. Quantification utilized calibration curves plotting peak area against reference standard concentration, with results expressed as milligrams per gram of the extract.

Statistical analysis: Each experiment was conducted in triplicate and replicated three times. Results were expressed as mean \pm standard deviation from the three experiments. Data were subjected to analysis of variance (ANOVA) with a significance level of 95%, followed by Tukey's test ($P < 0.05$) for post-hoc comparison. Spearman's correlation was employed to assess the correlation between phytochemical contents and bioactivities. Statistical analyses were carried out using SPSS software (version 18.0, SPSS Inc., Chicago, IL, USA).

RESULTS AND DISCUSSION

Extraction yields, total flavonoid content (TFC), and total phenolic content (TPC): The extraction method and choice of solvent significantly influenced the yields, types, and activities of the extracted compounds [14]. In

this study, we selected the extraction method for coriander root based on the cooking method and the expected active compounds. Since coriander roots are commonly utilized as an ingredient in various Thai foods, especially curries and soups [18], the root was subjected to extraction by boiling with water, mimicking the process of soup making. Moreover, various studies have documented the antioxidant and alpha-glucosidase inhibitory activities of coriander extracts obtained using water, ethanol, and aqueous ethanol solvents [12, 14, 19]. Therefore, the root was macerated with water, 50% ethanol, and 100% ethanol in this study.

The extraction yields of the various coriander root extracts are presented in Table 1. The highest yield was obtained from the boiling extract, followed by the water extract, 50% ethanol extract, and 100% ethanol extract, respectively. This finding aligns with the research conducted by Maser et al. [14], which noted that the highest yields of coriander leaves were obtained from hot water extract, suggesting that higher yields are typically obtained from high polarity solvents. In addition, the root part of the plant mostly contains carbohydrates, which are extracted through water.

Phenolic compounds, especially flavonoids, are widely recognized for their antioxidant properties. These compounds contain hydroxyl groups, which are capable of scavenging ROS and chelating metal ions, resulting in a reduction of ROS and oxidative stress [20]. Thus, TFC and TPC are determined to predict the antioxidant capacity of the different extracts of coriander root. The findings are detailed in Table 1. The 100% ethanol extract exhibited the highest TFC at 31.39 mg QE/g Extract, a notably superior value to other extracts ranging from 0.11 to 1.08 mg QE/g Extract. For TPC, the root extracts contained total phenolics ranging from 1.22 to 2.46 mg GAE/g Extract. The highest TPC was found in the 100% ethanol extract, comparable to the water extract, followed by the

boiling and 50% ethanol extracts. These results differ from Saxena et al. [21], who reported that, among water, methanol, and ethyl acetate root extracts, the highest TFC was derived from methanol extract, which was 7.58 mg QE/ g Extract. Meanwhile, the highest TPC was derived from water extract, which was 62.60 mg GAE/ g

Extract. In another study, among different extracts, the ethyl acetate extract showed the highest TPC value of 31.38 mg GAE/ g Extract [22]. However, the variation in phytochemical contents might be due to the different sources of samples and the extraction methods and solvents used, which affect the extracted phytochemicals and yields.

Table 1: Extraction yields, total flavonoid content, and total phenolic content of the different extracts of coriander root.

Extracts	%Yields	Total flavonoid content (mg QE/g Extract)	Total phenolic content (mg GAE/g Extract)
Boiling extract	12.12	0.11 ± 0.02 ^a	1.22 ± 0.03 ^a
Water extract	11.05	0.14 ± 0.05 ^a	2.18 ± 0.02 ^b
50% ethanol extract	10.17	1.08 ± 0.69 ^a	1.44 ± 0.05 ^a
100% ethanol extract	1.21	31.39 ± 1.80 ^b	2.46 ± 0.34 ^b

The values are presented as the mean ± standard deviation of triplicate experiments (n = 3). Different superscript letters indicate statistically significant differences in mean values (P < 0.05, Tukey's test).

ABTS and DPPH radical scavenging capacities and alpha-glucosidase inhibitory activity of the different extracts of coriander root:

The antioxidant potential of the various coriander root extracts was evaluated using the ABTS and DPPH assays. These methods are valued for their simplicity, speed, cost-effectiveness, reproducibility, and widespread application in food antioxidant evaluations [23-25]. As shown in Table 2, the results of the ABTS assay revealed that the strongest antioxidant capacity was found in the 100% ethanol extract, which was comparable to the boiling extract, followed by the 50% ethanol and water extracts. For the DPPH assay, the positive control, ascorbic acid, had an IC₅₀ value of 9.08 ± 0.94 µg/mL, while the root extracts exhibited weaker antioxidant capacity with the IC₅₀ values ranging from 1.13 to 3.77 mg/mL. Among the root extracts, the 100% ethanol extract again showed the

strongest antioxidant capacity, followed by water, boiling, and 50% ethanol extracts. The antioxidant capacity of coriander root seemed to correlate with TFC and TPC. Several studies demonstrated a strong correlation between antioxidant capacity by both assays and the TFC and TPC values [15, 26-28]. However, it is worth noticing that boiling extract, which contained the lowest TFC and TPC, exhibited ABTS radical scavenging capacity comparable to 100% ethanol extract. This suggested that boiling extract might contain non-phenolic antioxidant compounds and should be further studied.

Alpha-glucosidases are a group of key enzymes essential in carbohydrate metabolism. These enzymes hydrolyze disaccharides and oligosaccharides into their monosaccharide components. Inhibition of alpha-glucosidases thereby retards glucose absorption and

reduces postprandial hyperglycemia and, consequently, plasma insulin levels. These mechanisms may improve insulin sensitivity and relieve the stress on beta-cells, which might prevent or delay the development of T2DM [8, 29, 30]. In this investigation, the alpha-glucosidase inhibitory potential of various coriander root extracts was evaluated at a concentration of 10 mg/mL, with results summarized in Table 2. Among these extracts, only the 100% ethanol extract demonstrated a 37.94% inhibition of alpha-glucosidase activity, while the standard drug, acarbose, showed a 64.03% inhibition at

the same concentration. The alpha-glucosidase inhibitory effect of the 100% ethanol extract appeared to be attributed to its phenolic content, particularly flavonoids. Many flavonoids have been reported to exhibit higher efficiency compared to acarbose and seem to be potential alpha-glucosidase inhibitors, especially quercetin [30, 31]. In addition, the study on the structure-activity relationship of flavonoids revealed that the chemical structure of flavonoids favors their ability to modulate the inhibition of alpha-amylase and alpha-glucosidase [31].

Table 2: ABTS and DPPH radical scavenging capacities and alpha-glucosidase inhibitory activity of the different extracts of coriander root

Extracts	ABTS radical scavenging (mg TEAC/g Extract)	DPPH radical scavenging (IC ₅₀) (mg/mL)	%Inhibition against alpha-glucosidase activity at 10 mg/mL
Boiling extract	16.86 ± 1.23 ^b	3.10 ± 0.12 ^a	No activity
Water extract	10.58 ± 2.32 ^a	2.78 ± 0.24 ^a	No activity
50% ethanol extract	11.35 ± 1.36 ^a	3.77 ± 0.90 ^a	No activity
100% ethanol extract	19.00 ± 1.16 ^b	1.13 ± 0.23 ^b	37.94 ± 2.24
Acarbose	-	-	64.03 ± 0.69

* IC₅₀ Acarbose = 4.37 ± 0.47 mg/mL. The values represent triplicate experiments' mean ± standard deviation (n = 3). Different superscript letters denote significantly different mean values (P < 0.05, Tukey's test).

High performance liquid chromatographic (HPLC)

analysis: Antioxidant and hypoglycemic effects of coriander have been reported to derive from linalool, ascorbic acid, and phenolic compounds [2, 4]. However, these compounds were previously found only in the above-ground part. This study represents the first attempt to identify and quantify linalool, ascorbic acid, and select phenolic compounds in coriander root using HPLC analysis. Linalool, a main constituent of essential oil

from coriander fruits and seeds, is responsible for several bioactivities, including antioxidant [3] and hypoglycemic effects [2]. In this study, the different extracts of coriander root were analyzed for linalool by HPLC and found a peak that matched the retention time of standard linalool (Figure 2). However, the UV spectra of those peaks did not match the UV spectrum of linalool. This indicated that these coriander root extracts did not contain linalool.

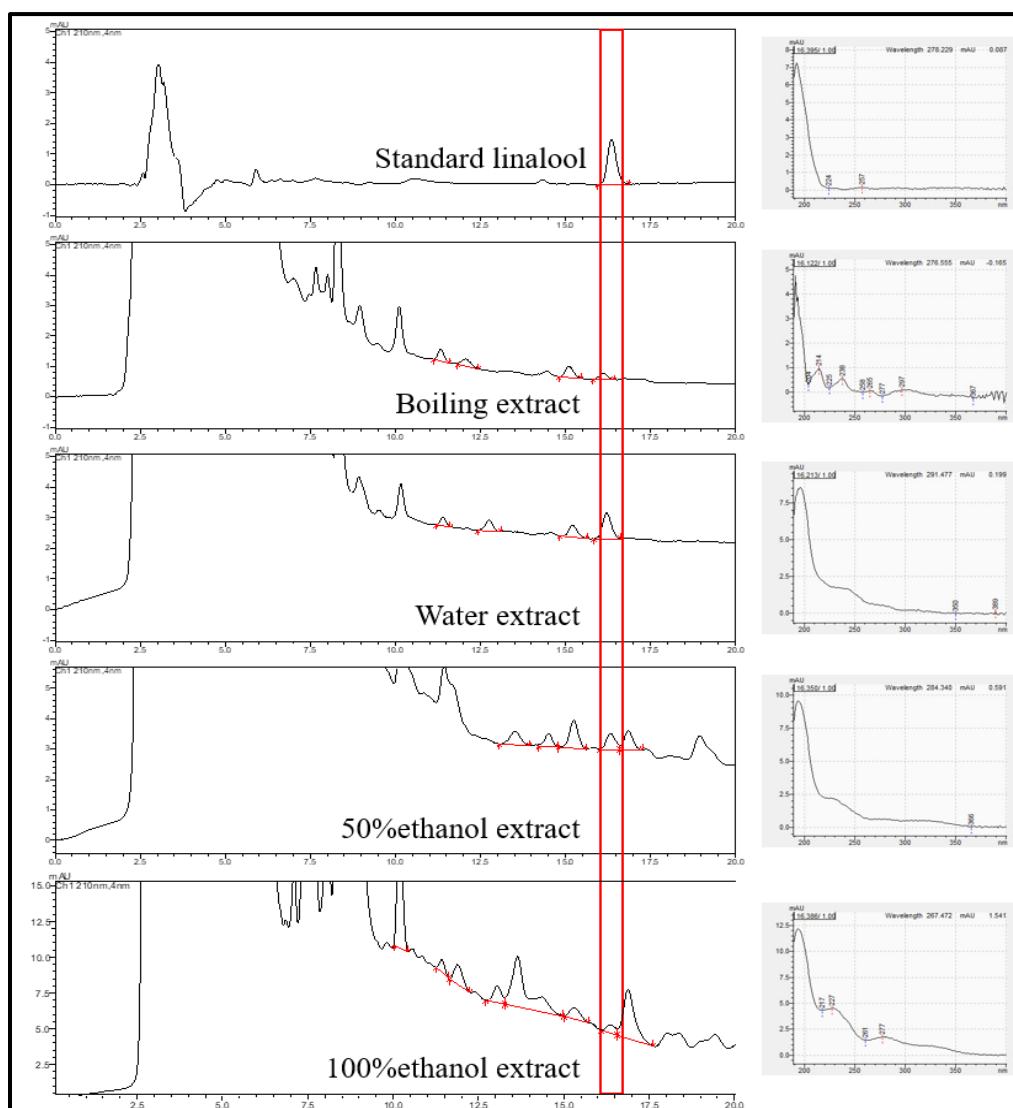


Figure 2: HPLC chromatograms for determination of linalool in the different extracts of coriander root and UV spectra of the peak at a retention time of linalool. UV detection at 210 nm.

Gallic acid, quercetin, ferulic acid, benzoic acid, caffeic acid, and ascorbic acid are antioxidant compounds found in coriander [2-4]. These antioxidant compounds were then determined using HPLC analysis by comparing the retention times and the UV spectra with reference standards. The HPLC chromatograms revealed that only two peaks matched standard ferulic and benzoic acid (Figure 3). Ferulic acid and benzoic acid were quantified, with results presented in Table 3. The 100% ethanol extract exhibited the highest concentrations of ferulic

acid and benzoic acid, measuring 0.75 and 0.93 mg/g Extract, respectively. Notably, this study marks the first identification and quantification of ferulic acid and benzoic acid in coriander root. To our knowledge, only one prior study has reported on phytochemicals in coriander root ethyl acetate extract, which included ascorbic acid, p-coumaric acid, 4,4,5,7,8-pentamethyl-3,4-2H-isocoumarin-3-one, cinnamic acid, 1,3,4 tris(trimethylsilyloxy)octadecan-2-amine, and L-valine [22].

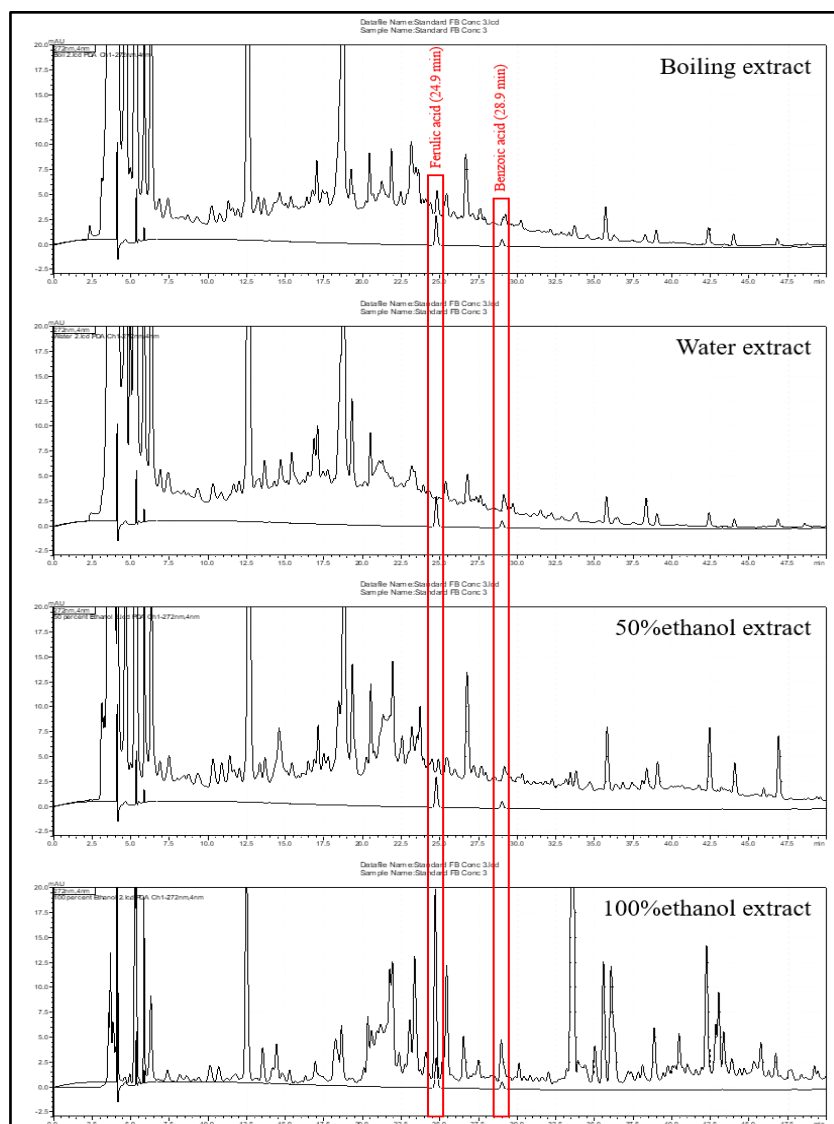


Figure 3: HPLC chromatograms were generated to determine the presence of ferulic acid and benzoic acid in various coriander root extracts. UV detection was performed at 272 nm.

Table 3: The contents of ferulic acid and benzoic acid in the different extracts of coriander root

Extracts	Ferulic acid (mg/g Extract)	Benzoic acid (mg/g Extract)
Boiling extract	0.0412	0.0597
Water extract	Not detect	0.1495
50% ethanol extract	0.0199	0.1255
100% ethanol extract	0.7505	0.9270

Relationship between phytochemical contents and bioactivities: Spearman's correlation analysis was employed to explore the relationship between various phytochemical contents—such as benzoic acid, ferulic acid, total flavonoid, and phenolic contents—and bioactivities, encompassing DPPH and ABTS radical scavenging capacities, and alpha-glucosidase inhibitory activity, as depicted in Table 4.

Significantly, a positive correlation was noted between the content of benzoic acid and the total phenolic content. Conversely, the content of ferulic acid exhibited a significant positive correlation with the ABTS radical scavenging capacity. These findings suggest a potential role for ferulic acid as an antioxidant compound within coriander root extracts. Although benzoic acid and ferulic acid are both phenolic acids, a group of plant

metabolites recognized for their strong natural antioxidant and radical scavenging capacities [32], they have been reported to exhibit different antioxidant activities. Mathew et al. [33] studied the free radical scavenging activity and reducing power of phenolic compounds and found that ferulic acid exhibited higher activities than benzoic acid. In addition, there was a significant positive correlation observed between the total flavonoid content and the alpha-glucosidase inhibitory activity. As mentioned earlier, flavonoids seem to be potential alpha-glucosidase inhibitors due to their favorable chemical structures [31]. These findings supported and suggested that the alpha-glucosidase inhibitory activity of coriander root extracts was derived from flavonoids and needed to be further studied.

Table 4: The relationship between phytochemical contents and bioactivities

	BA	FA	TFC	TPC
TFC	.800 (P = 0.200)	.400 (P = 0.600)		
TPC	1.000** (P < 0.01)	.200 (P = 0.800)	.800 (P = 0.200)	
ABTS	.200 (P = 0.800)	1.000** (P < 0.01)	.400 (P = 0.600)	.200 (P = 0.800)
DPPH	-.800 (P = 0.200)	-.400 (P = 0.600)	-.400 (P = 0.600)	-.800 (P = 0.200)
AGI	.800 (P = 0.200)	.400 (P = 0.600)	1.000** (P < 0.01)	.800 (P = 0.200)

BA, Benzoic acid; FA, Ferulic acid; TFC, Total flavonoid content; TPC, Total phenolic content; ABTS, ABTS radical scavenging capacity; DPPH, DPPH radical scavenging capacity; AGI, Alpha-glucosidase inhibitory activity.

CONCLUSION

This study unveils the antioxidant and alpha-glucosidase inhibitory potentials of coriander root extracts, alongside identifying ferulic acid and benzoic acid via HPLC analysis. Intriguingly, despite its lower extraction yield compared to other extracts, the 100% ethanol extract demonstrated the most robust radical scavenging

capacities and alpha-glucosidase inhibitory activity among all tested extracts. This phenomenon could be attributed to the elevated levels of total flavonoids and phenolics. Conversely, the boiling extract, simulating the domestic cooking procedure, demonstrated the lowest levels of total flavonoids and phenolics. Nonetheless, it had the highest extraction yield and displayed ABTS

radical scavenging capacity comparable to the 100% ethanol extract, suggesting the existence of non-phenolic antioxidant compounds. These findings demonstrated that coriander roots, a common culinary ingredient, have potential as a functional food for preventing age- and lifestyle-related diseases, such as diabetes. For future research, both 100% ethanol and boiling extracts should be studied to identify their bioactive compounds and evaluate their efficacy in animal models to confirm their health benefits.

Competing interests: The authors declare no competing interests.

Authors' Contribution: LV: Investigation, Data collection and analysis, Writing - Original Draft. TN: Conceptualization, Methodology, Investigation,

Resources, Data collection and analysis, Visualization, Writing - Original Draft, Writing - Review & Editing. SC: Conceptualization, Methodology, Resources, Data analysis. JS: Conceptualization and Supervision. JS: Conceptualization, and Supervision. All authors have read and agreed to the published version of the manuscript.

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