

Effect of Temperature on Total Phenolic and Flavonoid Contents of *Coriandrum sativum*

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ABSTRACT

Coriandrum sativum is a promising functional food which not only provides nutrition, but also has medicinal benefits. It is a widely grown herb and most commonly used spice in India. Total phenolic and flavonoid content of ethanolic extracts of coriander leaves at different temperatures were evaluated to determine the effect of thermal processing on potential health benefits of coriander. The leaves were subjected to boiling (100°C) as well as storage at refrigerated temperature (4°C). A qualitative phytochemical screening was performed for the presence of phytochemicals. The ethanolic extracts were analyzed for total phenolic content using Folin-Ciocalteu assay and Flavonoid content by Aluminium chloride method. The extracts of fresh leaves showed the highest total phenolic and flavonoid content, which reduced significantly after treatment 100°C. Refrigeration also results in reduction of total phenolic and flavonoid content. This indicates that certain bioactive compounds such as polyphenols and phenolic acids are degraded during processing and thereby decreasing the medicinal value of herb. The study thus, suggests the consumption of fresh coriander leaves to obtain the maximum benefit.

Keywords: *Coriandrum Sativum* L., Total Phenolics, Antioxidant Potential, Phytochemical Screening.

I. INTRODUCTION

Coriander is a common food adjunct, which has been used for flavouring and seasoning throughout the world for thousands of years. Coriander (*Coriandrum sativum* L.) is an annual, herbaceous plant belonging to family Apiaceae. It is a flavouring substance used since ancient times and has been enjoyed by many cultures for its culinary and medicinal values (Hill and Sharma, 1998). The plant is widely grown for seed, leaf and essential oil. Seeds are widely used in curry powders, sausages and seasonings. Green leaves have a specific flavour and are used to garnish curries, in chutneys and soups.

Leaves spoil quickly when removed from the plant, and lose their aroma when dried or frozen (Brecht, 2012). Since heating also results in diminished flavour and hence, fresh leaves are preferred. Coriander contains many bioactive components - terpinene, cymene along with γ -pinene, α such as linalool, various non-linalool alcohols and esters. Other constituents include flavonoids, coumarins, isocoumarins, phthalides and phenolic acids (Verma et al., 2011). Coriander is well known for its antioxidant properties (Wang et al., 2004, Diederichsen, 1996) and recent research has indicated that it is a rich source of flavonoids such as

quercetin, kaempferol, and acacetin (Nambiar et al., 2010). The polyphenols constitute a wide and complex array of phytochemicals that exhibit antioxidant action and consequently a beneficial physiological effect (Al-Juhaimi and Ghafoor, 2011). They can protect human body from free radicals and could retard the process of many chronic diseases such as cancer, cardio-vascular disease and diabetes; they can also reduce lipid oxidative rancidity in foods (Regnault-Roger et al., 2004; Arts and Hollman, 2005; Williamson and Manach, 2005). Polyphenolic compounds have high antioxidant activity due to the reactivity of the phenol ring and are categorized into different classes depending upon the number of phenol rings. The main groups are flavonoids, phenolic acids, phenolic alcohols, stilbenes and lignans. The main reason for this interest is the recognition of the antioxidant properties of polyphenols, their great abundance in our diet and their probable role in the prevention of various diseases associated with oxidative stress, such as cancer, cardio-vascular and neurodegenerative diseases (Nambiar et al., 2010; Chawla and Thakur, 2013). The quantity of phenolic and flavanoid compounds present in plants is influenced by storage method and the environmental conditions. Thus, it is important to determine the level of these compounds present in the plant after different thermal treatments. The present paper highlights the effect of refrigeration and conventional cooking methods such as boiling on the total phenolic and flavanoid of coriander leaves. The plant extracts were also screened for qualitative phytochemical screening.

II. METHODS AND MATERIAL

2.1 Chemicals :

Ethanol, methanol, sodium carbonate, gallic acid, Folin Ciocalteu reagent, Aluminium Chloride, K acetate and rutin were used. All the chemicals and reagents used were of analytical grade.

2.2. Collection of plant material and sample preparation:

Fresh leaves of *Coriandrum sativum* were purchased from a local market of Sangamner and washed with tap water. 150 grams of leaves were taken and divided into 3 equal parts (50 grams each). One portion was retained fresh; others were given different thermal treatments, as given below.

Boiling : Leaves (50 g) were boiled for 15 min, drained off and cooled rapidly.

Refrigeration : Coriander leaves were kept at 4°C in refrigerator for 5 days.

2.3. Preparation of extracts :

Leaves of *Coriandrum sativum* were extracted with ethanol at room temperature. Coriander leaves were soaked in 500 ml of 99.9 percent ethanol for 2-3 days separately. The soaked material was filtered and the extracts were collected. The filtrates obtained were concentrated under vacuum on a rotary evaporator (Buchi Rotary Evaporator, Model R-124) and stored at 4°C for further use (Song et al., 2010).

2.4. Phytochemical screening :

Ethanolic extracts of fresh coriander leaves were used for qualitative screening of phytochemicals as per standard biochemical procedures. The tests were performed to confirm the presence of alkaloids, carbohydrates, proteins and amino acids, glycosides, flavonoids, tannins, phenolics, terpenoids and steroids (Tiwari et al., 2011).

2.5. Determination of total phenolic content

The total content of phenol in different fractions of CA was determined by Folin- Ciocalteu reagent using reported method with slight modification (Khatoon et al., 2013). TPC of various fractions was determined from a gallic acid calibration curve. Calibration curve was prepared by mixing 0.5 ml aliquots of 10, 20, 30, 40, 50, 60, 70,80, 90, 100 µg/ml methanolic gallic acid solution with 2.5 ml Folin- Ciocalteu reagent and 2.5 ml (7.5 g/100ml)sodium carbonate. All mixtures were kept for incubation at RT for 30 min and absorbance

was measured at 765 nm using spectrophotometer (Systronic UV-Visible -1203). Methanol was used as blank and gallic acid as a standard. A similar procedure was conducted for all fractions. All determinations were carried out in triplicates. TPC was determined from linear equation of standard calibration curve produced with GA and was expressed as gallic acid equivalent per milligrams (μg GAE/mg) of extracts.

2.6. Determination of total flavonoid content

The total flavonoid content of different fractions was determined by using aluminium chloride colorimetric method described by Maddanet al., 2011 and Saeed et al., 201. TFC of various extracts was determined from standard-rutin calibration curve. The solution of rutin of 100 $\mu\text{g}/\text{ml}$ concentration was prepared in 80% methanol and further diluted to 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 $\mu\text{g}/\text{ml}$. 0.5 ml aliquots of above concentrations were separately mixed with 1.5 ml of 95% methanol, 0.1 ml of 10% aluminium chloride. 0.1 ml of 1M potassium acetate and 2.8 ml distilled water. All mixtures were kept for incubation at RT for 30 min. Then absorbance of light pink coloured reaction mixture was measured at 415 nm versus reagent blank containing water instead of the sample. Rutin was used as a standard compound for the quantification of total flavonoids and the standard curve was drawn. A similar procedure was conducted for all extracts. All determinations were carried out in triplicates. Total flavonoid content was expressed in terms of rutin equivalent per milligrams (μg RE/mg) of extracts.

III. RESULTS AND DISCUSSION

3.1. Phytochemical screening :

The results of qualitative phytochemical analysis of ethanolic extracts of fresh coriander leaves showed the presence of proteins and amino acids, carbohydrates, glycosides, phenolics, tannins, saponins, terpenoids, sterols, and flavonoids in table no.1

Sr. No.	Photochemical	Coriander
1	Alkaloids	- +
2	Protein and Amino acids	+
3	Carbohydrate	+
4	Phenol	+
5	Terpenoide	+
6	Steroids	+
7	Saponin	-
8	Glycoside	+
9	Flavonoide	+
10	Tannin	+

3.2. Total phenolics content

The total Phenolic Content (TPC) was determined by using Folin- Ciocalteu reagent & it reported as microgram per milligram ($\mu\text{g}/\text{mg}$) of Gallic acid equivalent (GAE) by reference to Gallic acid standard Curve ($Y=0.0101X+0.0165$ & $r^2= 0.9902$). All the Fractions contained a considerable amount of phenolic content it was found that Fresh leaves Fraction had highest TPC (80.11 ± 0.55) μg of GAE/mg followed by refrigerated leaves (65.19 ± 0.00) & leaves after boiling (25.16 ± 0.00) $\mu\text{g}/\text{mg}$ of gallic acid equivalent respectively.

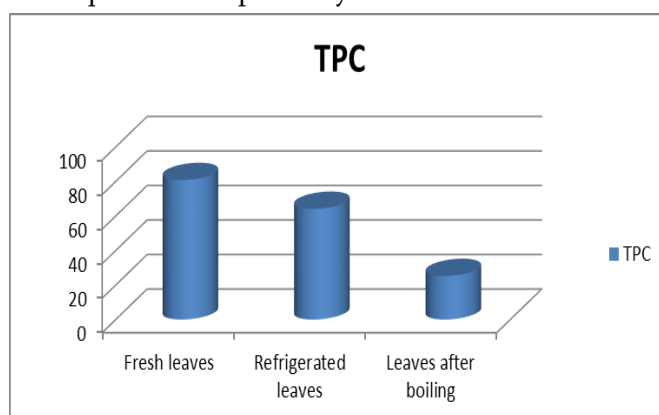


Fig. 1. Total phenolic content of various extract of *Coriandrum sativum*

3.3. Total flavonoids content-

Total Flavanoide Contents – The total Flavonoid Content (TFC) is expressed as microgram per

milligram ($\mu\text{g}/\text{mg}$) of rutin equivalent (RE) by reference to rutin standard Curve. It was found that fresh leaves Fraction had the highest TFC (81.38 ± 3.125) μg of RE/mg followed by refrigerated leaves (39.16 ± 1.804), & boiling leaves (14.48 ± 1.005) $\mu\text{g}/\text{mg}$ of rutin equivalent respectively.

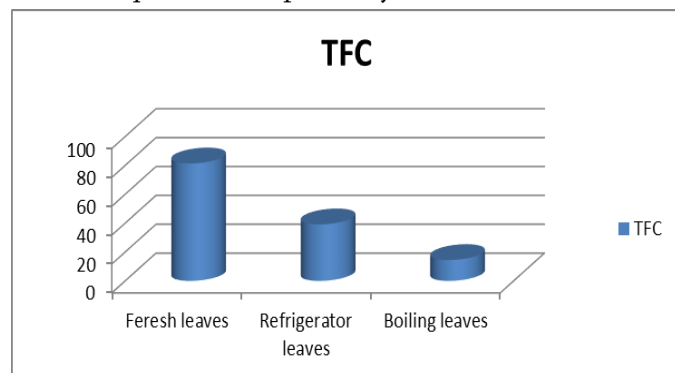


Fig. 2. Total Flavonoid content of various extract of *Coriandrum sativum*

IV. CONCLUSION

Phytochemical screening of fresh leaf extracts revealed the presence of phenolic and flavonoid compounds, which are responsible for potential health benefits of coriander such as antioxidant and antimicrobial activity. Due to the changes in the lifestyle, the consumption of fresh leaves has been minimized. The above results indicate that thermal processes like boiling as well as storage under refrigerated conditions for longer periods leads to destruction of phenolic and flavonoid compounds and other phytochemicals and hence, reduces the antioxidant potential of coriander. The study suggests the use of fresh coriander leaves in order to obtain the maximum potential.

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