ISSN 2583– 0260 (online) *ISSN 2394 -7837 (print)*

IMPACT OF PROCESSING OF CURCUMIN CONTENT AND ANTIOXIDANT POTENTIAL OF TURMERIC: A COMPARATIVE ANALYSIS OF FRESH , DRIED AND INDUSTRIAL PRODUCTS

Rajeswari, S.

Received: 15/5/2023 **Revised: 25/5/2023** **Accepted: 28/5/2023** **Published: 30/12/2023**

Abstract

The present study investigated curcumin content and antioxidant activity in various forms of Curcuma longa (fresh, dried, and industrial). Fresh turmeric rhizomes exhibited the highest curcumin content and antioxidant activity compared to dried and industrial forms. Industrial turmeric powders likely have lower curcumin content and antioxidant activity due to processing, suggesting reduced health benefits. The findings highlight fresh turmeric as a promising neutraceutical spice for commercial use in beverages and snacks.

Keywords: Antioxidant, Processing, Industrial

Introduction

Plants have been the main source of medicine since ancient period and they are still widely used in traditional as well as modern system of medicine. Use of plant-based remedies is also widespread in many developed countries and numerous pharmaceuticals are based on plant derived compounds. Similarly, cosmetics and other household products also derived plant resources. At present about 50% of the total plant derived drug market constituted by single entities, while the remaining 50% market share is comprised of herbal remedies. Although the latter have greater volumes of consumption, the relatively low volumes of single entities, which are mostly prescription products, are more than compensated by their higher prices. Single entity plant drugs, include atropine, digoxin, morphine, vincristine, curcumin *etc.* Several of the compounds were substituted by better alternatives that are chemically synthesized or modified for better stability or improved activity lead to decline in market demand of such pure plant derived single compounds. In recent years, there has been an increasing awareness and research about the importance of medicinal plants because the plant kingdom is a wonderful treasure house of potential drugs with magical curative effect (Cathrine and Nagarajan, 2011). Plant derived drugs are of great importance because they are efficient, easily available, safe, less expensive drugs available in the field with very less side effects. There is a growing tendency around the globe to shift from synthetic to naturally derived products including medicinal products. Because of this growing demand, medicinal plants constitute a group of industrially important crops which bring a commendable amount of income (Bhattacharjee, 1998). The present study was to conduct a comparative analysis of curcumin content and Anti- oxidant activity in fresh, dry and industrial product of turmeric (Eastern and Sabari). This study aimed to quantitatively compare curcumin levels and antioxidant capacity using established assays in fresh turmeric rhizomes, dried turmeric powder, and commercially available turmeric products.

Materials and Methods

Collection of Material

Fresh rhizome, dried rhizome and industrial product (Eastern and sabari) of *Curcuma longa* were used. Fresh and dried rhizome of Curcuma longa were collected from Thiruvananthapuram District. Industrial product of turmeric powder was collected from market at Thiruvananthapuram. The plant was properly identified with the help of Flora.

Quantification of Curcumin

Preparation of standard solution of Curcumin for UV Visible Spectroscopy

Curcumin 10mg was accurately weighed and transferred in a 100ml volumetric flask. Methanol was added upto the mark to obtain a concentration of 100µg/ml of Stock solution. From

Department of Botany, Sree Narayana, College, Chempazhanthy, Thiruvananthapuram, Kerala, India

Stock solution 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7 ml of solutions were withdrawn and diluted to 10ml with methanol to obtain concentrations of 1, 2, 3, 4, 5, 6, 7µg/ml, respectively

Preparation of standard calibration curve of Curcumin by UV Visible Spectroscopy

The standard calibration curve of curcumin was obtained by measuring the absorbance of curcumin solution in concentration range (1-7µg/ml) prepared from stock solutions in methanol at 424 nm. Calibration curve of curcumin was then plotted with absorbance on y-axis and curcumin concentration on x-axis.

Preparation of test solution for UV Visible Spectroscopy

For this, 0.1 mg of fresh (rhizome is grinded by using mortar and pestle),dried and industrial product of *Curcuma longa* powder was accurately weighed and transferred into 100 ml volumetric flask. 10 ml methanol was added and the resulting solution was used for analysis.

Anti- oxidant activity

DPPH Assay

Ascorbic acid was used as a reference standard and was dissolved in distilled water to make a stock solution with the concentration (1mg/1000µL). The solution of DPPH in methanol (60µM) was freshly prepared each day before UV measurements. This solution (3.9ml) was mixed with various concentrations of samples (25, 50, 100 & 200µL). The mixture was kept in the dark for 15 minutes at room temperature and the decrease in absorbance was measured at 515 nm. Control of the same volume was prepared without the extract and reference ascorbic acid. 95% methanol was used as the blank.

Free radical scavenging activity was calculated by the formula

$$\text{Percentage Inhibition} = \frac{(\text{Absorbance of Control at 0 minute} - \text{Absorbance of Test})}{\text{Absorbance of Control at 15 minutes}} \times 100$$

Sample concentration providing 50% inhibition (IC_{50})was calculated from the graph plotting inhibition percentage against concentration.

Results

The absorbance of sample was measured at 424 nm and quantity of curcumin present in extract was calculated by using standard graph of curcumin (figure 1). The result was reported in Table 1.

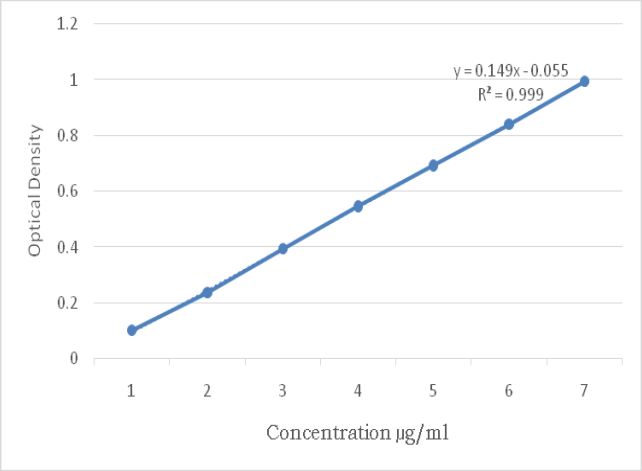

Figure 1. Standard graph of Curcumin

Table 1. Quantification of Curcumin from *Curcuma longa*

Sl . No.	Sample	OD	Curcumin content (µg/100µg)
1	Fresh	0.389	2.23
2	Dried	0.251	1.30
3	Eastern	0.112	0.36
4	Sabari	0.110	0.30

DPPH assay

Different concentration (25 µg - 200 µg) of fresh, dried and industrial product of *Curcuma longa* and standard ascorbic acid are used. Maximum anti-oxidant capacity showed in 200µg of fresh rhizome of *Curcuma longa* (99.04%) followed by dried (78.02%) and industrial product (Eastern) (70%). Low percentage of anti-oxidant activity observed in industrial

product (Sabari) of *Curcuma longa* (Table 2, Table 3, Table, 4, Table 5 and Table 6). The study observed various qualitative aspects, with the result presented in figure 2, figure 3, figure 4, figure 5, and figure 6.

Table 2. DPPH assay in Standard

Sample	Concentration µg	OD at 515nm	% of Inhibition
Control after 0 min	-	0.388	-
Control after 15 min	-	0.314	-
Ascorbic acid	3	0.320	21.6
	6.25	0.264	39.4
	12.5	0.205	58.2
	25	0.101	91.4

Table 3. DPPH assay in Fresh Curcuma longa

Sample	Concentration (µg)	OD at 515nm	% of Inhibition
Control after 0 min	-	0.388	-
Control after 15 min	-	0.314	-
Fresh	25	0.134	80.89
	50	0.109	88.85
	100	0.09	94.9
	200	0.077	99.04

Table 4. DPPH assay in Dried Curcuma longa

Sample	Concentration µg	OD at 515nm	% of Inhibition
Control after 0 min	-	0.388	-
Control after 15 min	-	0.314	-
Dried	25	0.238	47.7
	50	0.207	57.6
	100	0.143	78.02
	200	0.103	90.76

Table 5. DPPH assay in industrial product of Curcuma longa (Eastern)

Sample	Concentration µg	OD at 515nm	% of Inhibition
Control after 0 min	-	0.388	-
Control after 15 min	-	0.314	-
Eastern	25	0.364	7.64
	50	0.259	41.08
	100	0.206	57.96
	200	0.168	70.06

Discussion

The *Curcuma longa*, belonging to the ginger family (*Zingiberaceae*), is a perennial herbaceous plant special since ancient times for its tuberous rhizomes. These underground stems serve different usess, acting as a condiment, a textile dye, and a medicinal agent prominent for its aromatic stimulant properties. Curcumin, a component derived from *Curcuma longa*, possesses a numerous of beneficial effects, including antioxidant, anti-inflammatory, antiviral, and antifungal properties. Particularly, a number

of studies have established the non-toxic nature of curcumin in humans. Its anti-inflammatory effects are attributed to its ability to inhibit different molecules pivotal in the inflammatory process (Akram *et al.*, 2010).

Fresh, dry, and industrial forms of *Curcuma longa* were used to measure curcumin levels and antioxidant activity in the present study. UV-Spectroscopy, a method measuring the absorption or transmission of UV or visible light compared to a reference sample, was in use to quantify curcumin content (Kleinebecker *et al.*, 2009). This method is widely used to analyze plant extracts for various secondary metabolites (Schulz *et al.*, 1999). The present study reveals curcumin's presence in fresh, dried, and industrial *Curcuma longa* forms, with fresh rhizomes exhibiting the highest content (2.23 µg/100 µg) compared to industrial products like Sabari (0.30 µg/100 µg).

In this study, fresh rhizomes showed the maximum antioxidant activity (99.04%), distinct with dried (90.76%) and industrial turmeric forms like Eastern (70.06%) and Sabari (65.28%). Industrial turmeric powders might have lower antioxidant levels due to curcumin content decrease during processing noticed a turn down in antioxidant properties during spice drying, indicating a loss of turmeric's pharmacological benefits. The present study established that the fresh turmeric showed high curcumin content and great anti-oxidant activity and can be used as useful nutraceutical spice to be used commercially in teas, milk shakes, snacks and ready to drink smoothies.

Table 6. DPPH assay in industrial product of Curcuma longa (Sabari)

Sample	Concentration µg	OD at 515nm	Percentage of Inhibition
Control after Zero min	-	0.388	-
Control after 15 min	-	0.314	-
Sabari	25	0.428	-
	50	0.293	30.25
	100	0.251	43.63
	200	0.183	65.28

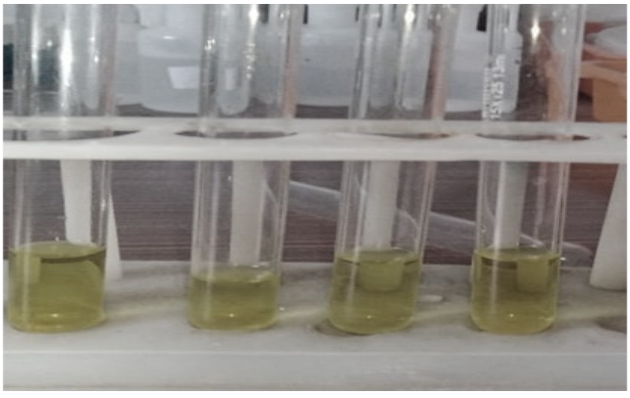

Figure 2

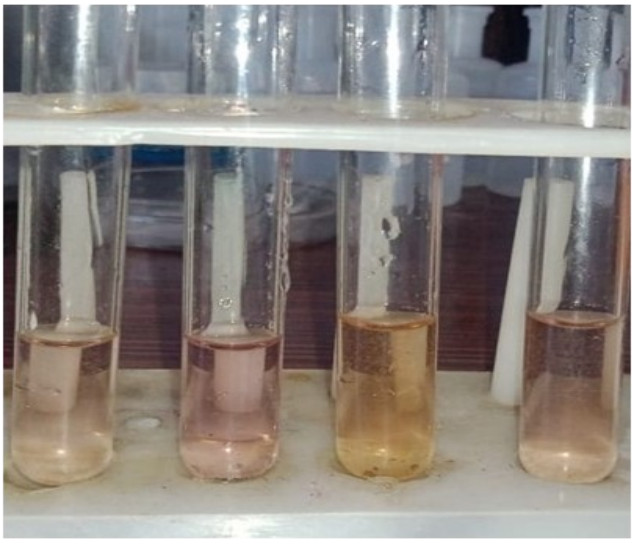

Figure 3

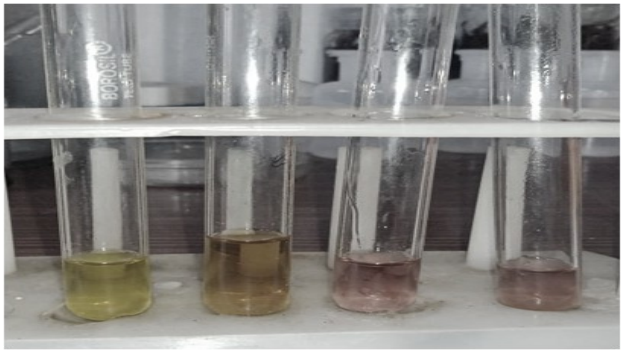

Figure 4

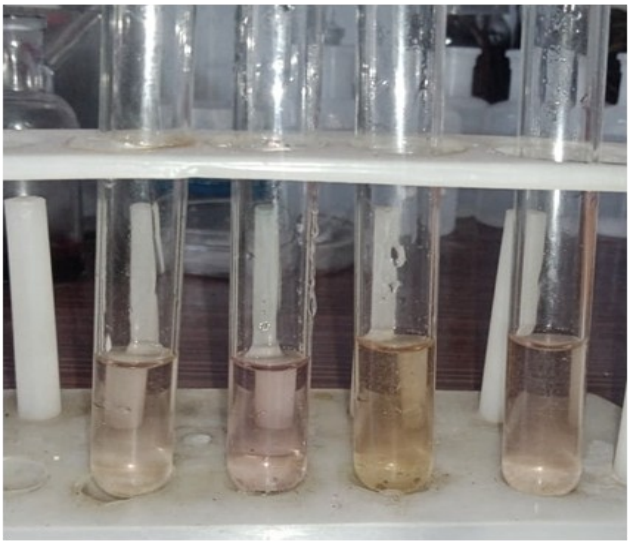

Figure 5

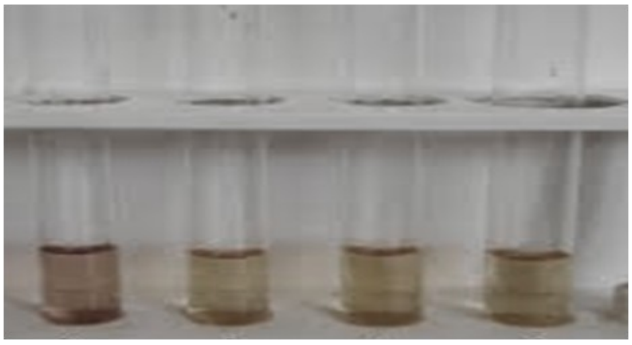

Figure 6

Figure 2. Quantification of curcumin from fresh, dry and industrial product (Eastern and Sabari) of *C. longa*; Figure 3- 6: Anti- oxidant activity of *C. longa*; fig 6: fresh *C. longa*; Fig 7: Dry; Fig 8: Eastern & Fig 9: Sabari

Summary and conclusion

The study examined Curcuma longa L., known for its curcumin-rich rhizome, to determine the most productive source of curcumin among fresh rhizomes, dried, and industrial turmeric products (Eastern and Sabari), alongside evaluating their antioxidant activity. The result shows that fresh rhizomes as the maximum curcumin source (2.23µg/100 µg), while Sabari industrial product contained the smallest amount (0.30 µg/100 µg). Fresh rhizomes exhibited better antioxidant activity (99.04%) compared to dried (90.76%), Eastern (70.06%), and Sabari (65.28%) industrial turmeric products. This underscores the potential health benefits of improved *Curcuma longa* consumption.

References

Akram, M.., Shahab-Uddin, A.A., Usmanghani, K., Hannan, A. Mohiuddin, E., Asif, M. (2010). Curcuma longa and curcumin: a review article. Rom J Biol Plant Biol,55, 65-70

Bhattacharjee, S. K. H. 1998. Book of Medicinal plant. *Pointer Publishers*, Jaipur, 1- 6

Cathrine, L., & Nagarajan, N. P. (2011). Preliminary phytochemical analysis and antibacterial activity of leaf extracts of *Vitex leucoxylon*. *International Journal of Current Pharmaceutical Research*, 3(2), 71-73

Kleinebecker, T., Schmidt, S. R., Fritz, C., Smolders, A. J., & Hölzel, N. (2009). Prediction of δ13C and δ15N in plant tissues with near-infrared reflectance spectroscopy. *New Phytologist*, *184*(3), 732-739.

Schulz H, Engelhardt UH, Wegent A, Drews HH, Lapczynski S (1999) Application of near-infrared reflectance spectroscopy to the simultaneous prediction of alkaloids and phenolic substances in green tea leaves. J Agric Food Chem 47:5064–5067.