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Quantification of Total Phenolics and Curcumin Content in Different Turmeric Germplasm

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A B S T R A C T

Phenolics are secondary metabolites known as the natural antioxidants. They play significant role in plant defence against the pathogens, therefore used as treatment and to control the pathogenic infections in human also. Turmeric is well-known and valued medicinal plant due to the presence of natural occurring secondary metabolite. The present study aimed to evaluate the total phenolics and curcumin content from the leaves and rhizomes of turmeric germplasms. For this purpose, 30 turmeric germplasm with diverse background were used. The total phenolics were isolated from methanolic extracts of leaves and rhizome. Whereas curcumin content were only quantified from rhizomes samples. In leaves, the total phenolic content was found from minimum 89.36 mgGAE/100g to maximum 282.52 mgGAE/100g. On the other hand, the total phenolics from rhizomes of turmeric was found minimum 49.12 mgGAE/100g to maximum 142.06 mgGAE/100g and in rhizome extracts. The curcumin content ranged from 0.50 g/100g to 1.32 g/100g in rhizomes of turmeric.

Introduction

Turmeric belongs to the genus *Curcuma* is a member of the family Zingiberaceae having 2500 years old medicinal history (Namratha *et al.*, 2013). In plants various metabolic pathways are responsible for the synthesis of variety of compounds. These compounds are generally differentiated into primary and secondary metabolites. Although to know the presences of secondary metabolites, various study have been done at the tiny extent only in small proportion of all plants species and about 100,000 plant secondary metabolites are already knows (Verpoorte *et al.*, 2007). Phenolic compounds are synthesized in plants partly as a response to ecological and physiological pressures such as pathogen and insect attack, UV radiation and wounding (Napal *et al.*, 2010; Kennedy and Wightman, 2011; Zulak *et al.*, 2006; Chung *et al.*, 2003; Vishakha *et al.*, 2019). The basic structural feature of phenolic compounds is an aromatic ring bearing one or more hydroxyl groups

(Chirinos *et al.,* 2009). Therefore, in the present study aimed to analysed phytochemical constituent of s turmeric germplasm.

Materials and Methods

30 turmeric germplasm with diverse background were used in the present study.

Phytochemical profiling of turmeric germplasm

Extraction of total phenolic compounds from turmeric germplasm

The Total phenolic acids were extracted from the leaves and rhizomes of turmeric germplasm using the standard method (Bray and Thorpe, 1954). For this, 0.5 gm of leaf and rhizome sample was taken and homogenized in 10 ml 80% methanol in a mortar pestle.

Spectrophotometric quantitative determination of total phenolics in turmeric germplasm

0.5 ml of the sample was mixed with 8.0 ml double distilled water and 0.5 ml follin ciocalteu's reagent (this was diluted 1:2 with double distilled water before use) was added. The reaction mixture was incubated for 3 min and then 1 ml of Na_2CO_3 (25% in water) was added to stop the reaction. The reaction mixture was left at room temperature for 1 hour and the absorbance was recorded at 725 nm. The following reagents were used for quantitative estimation of phenolic compounds extracted from leaves and rhizomes of different germplasm of turmeric

Quantitative analysis of Curcumin

1gm of rhizome of turmeric germplasm was weighed and made extract with methanol and made up to 100 ml. From this solution 5 ml was pipette out and absorbance was taken out at 425 nm in a spectrophotometer. The Curcumin content was calculated using the following formula (Sadasivam and Manickam, 2008),

$$\text{Curcumin content gm /100 gm} = \frac{0.0025 \times A425 \times \text{volume made up} \times \text{dilution factor} \times 100}{0.42 \times \text{weight of the sample (gm)} \times 1000}$$

Results and Discussion

Phenolic compounds are the most abundant phytochemicals which is synthesized the plants and accumulate under adverse environmental condition. These are natural occurring antioxidant in the plants. Organic solvent extraction is the main method used to extract phenolics. Chemical procedures are used to detect the presence of total phenolics, while spectrophotometric and chromatographic techniques are utilized to identify and quantify individual phenolic compounds.

The total phenolics were analyzed from the leaves and rhizomes samples of 30 turmeric germplasm. The total phenolics from the leaves of turmeric germplasm in terms of mg/g values are shown in Table 1 and their graphical representation are shown in Figure 1(A). In the leaves samples, the total phenolic content was found to be varied from a lower value of 89.36mg/g in germplasm 21and 30 to a higher value of 282.52 mg/g in germplasm 18 and 20. However other germplasm like germplasm 4, 7, 8, 10 and 13 also showed good amount of total phenolics in leaves of turmeric. Whereas the germplasm 6 showed very less amount of total phenolics in leaves of turmeric.

On the other hand, the total phenolics from rhizomes of turmeric germplasm in term of mg/g units were shown in Table 1 and their graphical representation are shown in Figure 1(B). In the rhizomes samples, the total

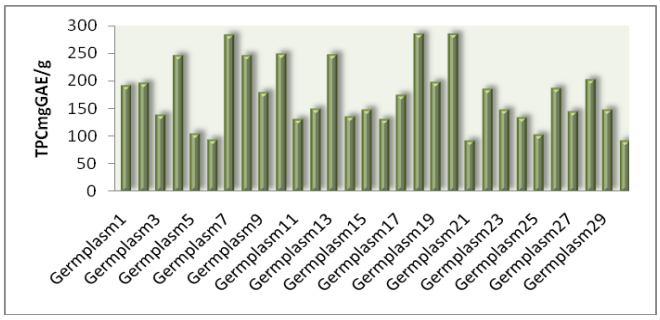
phenolics were found to be varied from a lower value of 49.12 mg/g in germplasm 25 to a higher value of 142.06 mg/g unit in germplasm 26. However in some other germplasm like germplasm 4, 8, 10, 20, 22 and 28 were also showed a good amount of total phenolics in rhizomes of turmeric. Whereas in germplasm 5 and 15 were showed very less amount of total phenolics content in rhizomes of turmeric.

Curcumin content in methanolic extract of rhizomes of thirty turmeric germplasm were quantified in term of g/100 g of rhizomes were shown in table 1 and their graphical representation are shown in Figure 1(C). In the rhizome extract of turmeric germplasm the curcumin content was found minimum 0.50 g/100g in germplasm 27 and maximum 1.32 g/100g in germplasm 20.

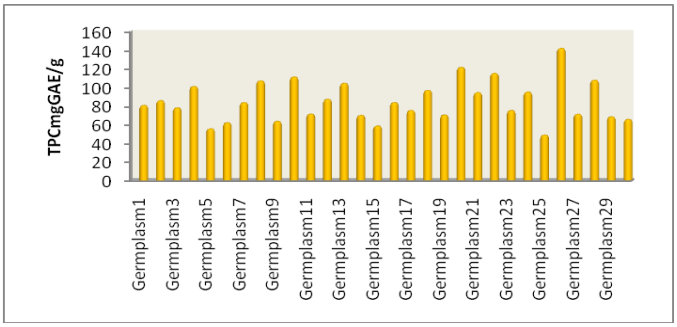
Table.1 Total phenolic content of 30 turmeric germplasm

S.no	Turmeric Germplasm	Leaves samples TPCmg GAE/g	Rhizomes samples TPCmg GAE/ g	Curcumin content g /100 g
1.	Germplasm 1	188.88	080.95	00.65
2.	Germplasm 2	193.99	086.03	00.61
3.	Germplasm 3	136.48	078.30	00.68
4.	Germplasm 4	243.75	101.20	00.94
5.	Germplasm 5	102.76	055.83	00.63
6.	Germplasm 6	091.71	062.32	00.61
7.	Germplasm 7	280.82	083.84	00.60
8.	Germplasm 8	244.48	107.20	00.65
9.	Germplasm 9	177.32	063.90	00.68
10.	Germplasm 10	246.67	111.42	00.91
11.	Germplasm 11	128.26	071.59	00.73
12.	Germplasm 12	146.77	087.49	00.63
13.	Germplasm 13	245.94	104.59	00.96
14.	Germplasm 14	133.12	070.25	00.78
15.	Germplasm 15	145.97	058.85	00.68
16.	Germplasm 16	128.26	083.89	00.63
17.	Germplasm 17	172.19	075.50	00.79
18.	Germplasm 18	282.52	096.95	00.74
19.	Germplasm 19	195.22	070.64	00.79
20.	Germplasm 20	282.52	121.63	01.32
21.	Germplasm 21	089.36	094.73	00.80
22.	Germplasm 22	182.92	115.24	00.86
23.	Germplasm 23	145.18	075.50	00.65
24.	Germplasm 24	131.44	095.24	00.66
25.	Germplasm 25	100.38	049.12	00.51
26.	Germplasm 26	184.63	142.06	00.94
27.	Germplasm 27	142.63	071.43	00.50
28.	Germplasm 28	199.94	107.95	01.00
29.	Germplasm 29	145.97	068.66	00.76
30.	Germplasm 30	089.36	065.89	00.81

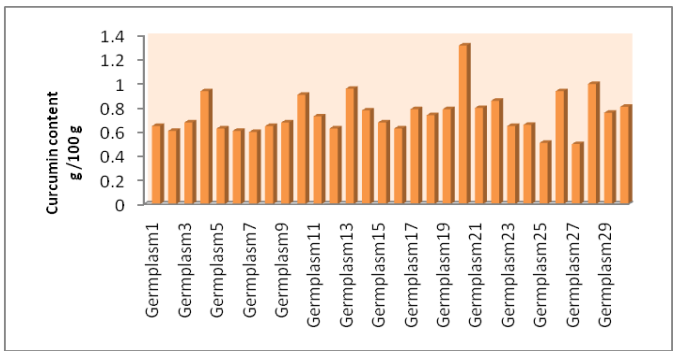
Fig.1 Graphical Representation of total phenolic content in 30 turmeric germplasm (A)- in leaves samples and (B)- in rhizomes samples (C)-Curcumin content



(A)



(B)



(C)

For phytochemical profiling of thirty turmeric germplasm, the total phenolics were isolated from leaves and rhizome extract. The extract was analyzed quantitatively as well as qualitatively. In the leaves samples, the total phenolic content was found a minimum of 89.36 mgGAE/100g in germplasm 21and 30, and maximum 282.52 mgGAE/100g in germplasm 18 and 20. On the other hand, the total phenolics from rhizomes of turmeric was found a minimum of 49.12 mgGAE/100g in germplasm 25 and maximum 142.06 mgGAE/100g in germplasm 26.

Yan et al (2010) determine the total phenolic content from the leaf sample of turmeric and reported 348.75mg GAE/100g of total phenolic. Kim *et al.*, (2019) quantified the total phenolic content in turmeric leaves. In this study, the total phenolic content was found 3.65mgGAE/g in the turmeric leaves which is of similar range as obtained in the present study. These findings are in agreement with the present study were by a little higher amount of total phenolics may be

due to the cell wall disruption which is responsible for stimulating the release of an oxidative and hydrolytic enzyme that would decrease the amount of some phenolics in the present study.

The leaves of turmeric are in much more because quantity the plants have a substantial volume with the large surface area makes turmeric leaves a plentiful resource. Moreover, the leaf extract of turmeric show potential as a functional source of food because of its total phenolic compound.

Kumar et al (2016) evaluate the total phenol content from the flower of *Curcuma longa*. They found a significant amount of phenolics (210.45±1.32 mg GAE/100 g) was present in the turmeric flowers also.

Similar to the present study, Maizura *et al.*, (2011) analyzed total phenolic content (TPC) in kesum, ginger and turmeric. Their result shows that kesum had the highest total phenolic content followed by ginger and rhizome of turmeric, which is 165.34 mg GAE/100g, 101.56 mgGAE/100g and 67.89 mgGAE/100g, respectively. The results of this study are in accordance with the present study. Likewise, Madhusankha *et al.*, (2018), studied total phenolic content in turmeric rhizomes. They reported total phenolic content among the turmeric ranged from 627.4 to 422.68mg GAE/100g which is slightly higher than the present study. A similar study has also been done by Gezici (2019). In the present study the leaf extract of turmeric elicited a relatively higher amount of total phenolic content as compare with rhizome extract which may be due to the fact that it contains more phenol compound. The difference observed in Total Phenolic Content content might be due to the number of active substances, solvent, extraction method and geographical condition for the cultivation of turmeric germplasm.

Curcumin content in methanolic extract of rhizomes of thirty turmeric germplasm was quantified. In rhizome extract of turmeric germplasm the curcumin content found minimum 0.50 g/100g in germplasm 27 and maximum 1.32 g/100g in germplasm 20. Anjusha et al (2014) analysed the curcumin content in *Curcuma aromatica* and *Curcuma xanthorrhiza*. In this study, they reported the curcumin content was 1.0863 g/100 g of rhizome in *C. xanthorrhiza* and 0.0175 g/100 g in *C. aromatic* which is of similar range to present study. Curcumin is the major compound present in the rhizome of turmeric and is commonly used as a natural dye in food industries, cosmetics and in pharmaceutical industries. The genotypes which show high curcumin content may exhibit strong antioxidant, anti-inflammatory, antimicrobial and anticarcinogenic activity (Anand *et al.*, 2008; Vishakha *et al.*, 2019).

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