QUALITATIVE AND BIOCHEMICAL ANALYSIS OF FRESH, DRY RHIZOMES AND PACKED DRY POWDER OF Tumeric (CURCUMA LONGA) FROM NORTH INDIA

Nidhi Mittal¹, Rashi Goel², Manpreet Kaur² & Avneet Kaur²*
¹Dept of Biochemistry, GGDS College, Sector-32 C, Chandigarh (UT) India -160030
²Dept of Biotechnology, GGDS College, Sector-32 C, Chandigarh (UT) India -160030
*Corresponding author email: avbawa@yahoo.co.in

ABSTRACT
India has rich history of using plants for medicinal purposes. Curcuma longa is a rhizomatous herbaceous perennial plant of the ginger family, Zingiberaceae. The deep orange-yellow powder known as turmeric is prepared from boiled and dried rhizomes which have found its use in modern pharmaceuticals. In the present study, different phytochemical analysis were performed to detect the presence of carbohydrates, proteins, starch, steroids, tannins, glycosides in fresh rhizomes and dry turmeric rhizomes of the local variety grown in North India and powdered turmeric from 3 branded companies. The total phenolic, flavanoid content and the total antioxidant capacity was also estimated. The extracts (fresh rhizome, dry rhizome, packed powdered turmeric of 3 locally available brands) of Curcuma longa revealed the presence of proteins, carbohydrates, starch, tannins and steroids. In fresh rhizomes, the phenolics (0.7416 ±0.56 mg TAE/g) were significantly higher as compared to dry rhizome (0.6095 ±0.15 mg TAE/g) and powdered turmeric (0.4004 ±0.156 mg TAE/g). The flavanoids were highest in fresh rhizome (5.5793 ±0.34 mg AAE/g) followed by dry rhizome (2.234 ±0.10 mg AAE/g), and powdered turmeric (0.5957 ±0.24 mg AAE/g). There were significantly high amount of antioxidants present in fresh rhizome as compared to dry rhizomes and packed powdered turmeric.

KEYWORDS: fresh rhizome, dry rhizome, powdered turmeric, antioxidants, phytochemicals, North India.

INTRODUCTION
Turmeric (Curcuma longa) is an ancient and sacred spice and medicine of India known as ‘Indian Saffron’ or the ‘Golden Spice of life’. In fresh state, the rhizome has an aromatic and spicy fragrance which on drying gives more medicinal aroma. In India, Turmeric is the most commonly used ingredient in curries and other ethnic meals integrating the medicinal properties of herbs with food. India is the world’s largest manufacturer of turmeric contributing to 78% of world’s total production. In traditional Indian medicine, turmeric is extensively used for the treatment of sprains and swelling, biliary disorders, anorexia, coryza, cough, diabetic wounds, hepatic disorders, rheumatism and sinusitis. Dry turmeric contains 69.43% carbohydrates, 6.3% proteins, 5.1% oils, 3.5% minerals, and other elements. Various bioactive chemical constituents in turmeric especially phenolics and terpenoids, have been identified which include diarylheptanoids and diarylpentanoids, phenylpropenes as well as other phenolics (Tanvit et al., 2017). Curcuminoids (mostly curcumin) and essential oils (primarily monoterpenes) are the major bioactive constituents showing different bioactivities. Caledin-A, vanillic acid, vanillin, quercetin, and other phenolic compounds have also previously been identified from turmeric (Gupta et al., 2013). Curcumin has antioxidant, anti-inflammatory, antiviral and antifungal actions (Ammon and Wahl, 1991) and exhibits free radical scavenging antioxidant property which acts as an inhibitor for cyclooxygenase, 5-lipoxygenase and glutathione S-transferase (Jayaprakashan et al., 2006). It possesses therapeutic activities and has been used by medical practitioners as an anti-diabetic, hypolipidemic anti-inflammatory, anti-diarrhoeal, hepatoprotective, anti-asthmatic and anti-cancerous drug (Chunekar, 2010; Krup et al., 2013). Curcumin also possesses anti-cancer activities and anti-proliferative effect in multiple cancers as it acts as an inhibitor of the transcription factor NF-B and downstream gene products including c-myc, Bcl-2, COX-2, NOS, Cyclin D1, TNF-a, interleukins and MMP-9. It plays a significant role in biological pathways involved in mutagenesis, oncogene expression, cell cycle regulation, apoptosis, tumorigenesis and metastasis. Curcumin is also a potent drug resistance preventer and exhibits novel ability to prevent the up-regulation of P-glycoprotein and its mRNA.

In India, 80% of turmeric produced is consumed in various forms such as fresh rhizomes, dried rhizomes and most commonly as dry powdered. Arutselvi et al. (2012) have done the phytochemical screening of leaves and rhizomes of turmeric varieties from Tamil Nadu. However, very few studies have been done to compare the antioxidant levels in turmeric variety from North India and commercially available packed turmeric powder. The present study aimed at comparing phytochemicals and the antioxidant levels in fresh rhizomes and dry rhizomes of turmeric of the local variety grown in North India and packed powdered turmeric from 3 branded companies available in the supermarket of Chandigarh.
MATERIALS & METHODS

Extraction of soluble protein from rhizomes
Fresh turmeric, dry rhizome powder, powdered turmeric (3 local brands) (10g) was extracted twice with distilled water. The solution was centrifuged at 10,000xg for 30 minutes and the clear supernatant was precipitated with 3 volumes of acetone. The precipitate was air dried and then extracted with cold 10% TCA and centrifuged at 10,000xg for 15 min. The supernatant containing polysaccharides was decanted and the protein residue was collected, washed with acetone until acid free and then air dried. The protein concentration determination was done by the Lowry protein assay method (Lowry et al., 1951).

Identification tests
Test for carbohydrate: To 2 ml of test solution added two drops of Molish reagent (a solution of α-naphthol in 95% ethanol). The solution was poured slowly into a tube containing 2 ml of concentrated sulphuric acid so that two layers form. Of the formation of purple product at the interface of two layers showed the presence of carbohydrates.

Test for protein: To 3 ml of test sample added 3% of NaOH and few drops of 1% CuSO4. The solution turns from blue to violet (purple) or pink showed the presence of proteins.

Test for starch: Mixed 3 ml of test solution and few drops of dilute iodine solution. Blue color appeared. It disappeared on boiling and reappears on cooling.

Test for steroids: To 2 ml of extract add 2 ml of chloroform and 2 ml of concentrated sulphuric acid. Shake well. Chloroform layer appears red and acid layer shows yellow greenish florescence in the presence of steroids.

Test for glycoside: To the solution of extract added glacial acetic acid. Few drops of 5% ferric chloride and concentrated sulphuric acid was added and observed for a reddish brown coloration at the junction of two layers and the bluish green colour in the upper layer.

Test for tannin: To 0.5 ml of extract solution, 1 ml of water and 1-2 drops of ferric chloride solution was added. The blue and green black colour confirmed the presence of tannins.

Total sugar content: The sugar content was estimated at 620nm using glucose as a standard. α-amylose activity was determined using a colourimetric method with 3, 5-dinitrosalicylic acid (DNS) reagent (Dubois et al., 1951).

TABLE 1-Phytochemical screening of turmeric (Curcuma longa Linn.) samples

<table>
<thead>
<tr>
<th>Estimations</th>
<th>Fresh rhizome</th>
<th>Dry rhizome</th>
<th>Powdered Turmeric (3 locally Available brands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Proteins</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Tannin</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Steroids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Glycoside</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Starch</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

The presence of flavonoids in the all the three forms (fresh, dry, powdered) turmeric confirms that turmeric contains natural flavonoids which contribute to its antioxidant activity, free radical-scavenging capacity, coronary heart disease preventive activities, and anticancer activities (Tanvir et al., 2017). The flavonoids were highest in fresh rhizome (5.5793 ±0.34 mg AAE/g) followed by dry rhizome (2.234 ±0.10 mg AAE/g), and powdered turmeric (0.5957 ±0.24 mg AAE/g) (Table 2). Tilak et al. (2004) reported a TFC of turmeric from India ranging from 3.58 to 7.86 mg/g of turmeric. The flavonoid levels were significantly higher in fresh (p ≤0.05) and dry
rhizome (p<0.05) of turmeric as compared to powdered turmeric. There was significant amount of tannins in fresh, dry, powdered turmeric as found in turmeric from Bangladesh (Tanvir et al., 2017). Tannin exerts antimicrobial activities by iron deprivation, hydrogen bonding or specific interactions with vital proteins such as enzymes in microbial cells (Scalbert, 1991). The phenolics present in fresh turmeric were in significantly higher amount (0.7416±0.56 mg TAE/g) (p<0.05) as compared to dry rhizome (0.6095±0.15 mg TAE/g) and powdered turmeric (0.4004±0.156 mg TAE/g) (Table 2). These phenolics contribute to the functional quality, color, and flavor of turmeric and also act as singlet oxygen quenchers and free radical scavengers (Tanvir et al., 2015). The phenolic compounds including curcumin and curcuminoids contribute to its antioxidant activity (Zaeoung et al., 2005). Curcuminoids hinder the biosynthesis of leukotriene antineoplastic, antiangiogenic, anti-apoptotic, cytotoxic, through lipoxygenase pathway and it also decreases the antithrombotic, immune modulatory, wound healing and anti-formation of prostaglandins. The higher antioxidant activity in fresh rhizomes reported in our study as compared to dry one could be due to presence of essential oil (ar-Turmerone and alpha-turmerone) and oleoresin present in fresh rhizomes as compared to dry ones (Singh et al., 2010b). The presence of significantly low antioxidant level in powdered turmeric could be attributed to the reduction of curcuminoid content by 20–50% after drying (Suresh et al., 2007). Tiwari and Vankar (2008) have also reported loss of antioxidant properties during the dry spice preparation which signifies that drying reduces beneficial pharmacological activities of turmeric. Buescher and Yang (2000) have reported that decrease in antioxidant activity and phenolics could be due to vaporization or thermal degradation through the heating process damage to Curcumin and its relative compounds. The significant differences in antioxidant levels in fresh rhizomes and dry rhizomes could also be attributed to different chemical composition. The major components were alpha-turmerone (53.4%), beta-turmerone (18.1%) and aromatic-turmerone (6.2%) in fresh rhizome and aromatic-turmerone (9.6%), alpha-santalex (7.8%) and alpha-turmerone (6.5%) in dry rhizome. The significantly less amount of alpha-turmerone and beta-turmerone in dry rhizome could contribute to its low antioxidant activity. The present study confirmed that the turmeric showed great antioxidant activity and can be used as beneficial nutraceutical spice to be used commercially in teas, milk shakes, snacks, and ready-to-drink smoothies.

**TABLE 2:** Table depicting total phenolics content and total flavonoid content present in fresh turmeric, dry turmeric rhizome and dry powdered turmeric.

<table>
<thead>
<tr>
<th></th>
<th>Fresh rhizome</th>
<th>Dry rhizome</th>
<th>Powdered Turmeric (3 locally available brands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Phenolics</td>
<td>0.7416±0.56</td>
<td>0.6095±0.1</td>
<td>0.4004±0.156 mg</td>
</tr>
<tr>
<td>(mg TAE/g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total flavonoid</td>
<td>5.579±0.34</td>
<td>2.234±0.10</td>
<td>0.5957±0.24</td>
</tr>
<tr>
<td>(mg AAE/g)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ACKNOWLEDGEMENT**

We are highly grateful to the principal GGDSD College, Chandigarh for providing us the infrastructure to carry out this research project. It is declared that there is no commercial or financial conflict of interest

**REFERENCES**


Analysis of fresh, dry rhizomes and packed dry powder of turmeric


