

Original Article

A comparative assessment of quality of different marketed turmeric powders

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ABSTRACT

Turmeric, or *Curcuma longa*, is a spice native to India. The main constituent group is polyphenolic curcuminoids which include: curcumin (diferuloylmethan), demethoxycurcumin, bisdemethoxycurcumin, and cyclocurcumin. Curcumin, containing a mixture of three curcuminoids namely; curcumin, demethoxycurcumin and bisdemethoxycurcumin can be isolated by various chromatographic techniques and identified by spectroscopic studies. In the present study five different turmeric powder samples were taken and a comparative organoleptic, physical and chemical evaluations was done to compare the quality of these different samples. Results show that T1 and T2 samples of turmeric powders are of better quality as compared to that of other samples. They have less ash value showing less earthy and mineral impurity, more extractive values showing increased amount of curcuminoids and less moisture content showing that they are less susceptible to degradation. T1 and T2 samples showed highest concentration of coloring matter present.

1. INTRODUCTION

Turmeric, or *Curcuma longa*, is a spice native to India. Historically, turmeric has been used throughout India, China and Indonesia as a spice and medicinal agent. Turmeric is a mild spice that enhances the flavour of other spices and foods and is the base of most Indian curries [1]. Traditionally, turmeric has been used topically to heal and reduce bleeding associated with bruises, sprains, leech bites and inflamed joints [2,3]. It has also been used internally for liver and digestive complaints, menstrual insufficiency and cramping, jaundice, and as an anti-inflammatory agent [4]. The rhizome, or root, of Turmeric is the part used medicinally. Numerous constituents have been identified in turmeric. The main constituent group are polyphenolic curcuminoids which include: curcumin (diferuloylmethan), demethoxycurcumin, bisdemethoxycurcumin, and cyclocurcumin. The yellow-pigmented curcuminoids represent 2% -5% of the root, typically composed of 85% as curcumin, 10% as demthoxycurcumin and 5% bisdemethoxycurcumin (Fig. 1). Curcumin is the most well studied constituent. Turmeric also contains: sesquiterpenes (turmerone, atlantone, zingiberone, turmeronol, germacrone, and bisabolene), carbohydrates, protein, resins, and caffeic acid [5].

Commercially available curcumin, containing a mixture of three curcuminoids namely; curcumin, demethoxycurcumin

and bis-demethoxycurcumin can be isolated by various chromatographic techniques and identified by spectroscopic studies. The purity of the curcuminoids was analyzed by improved HPLC / HPTLC methods. HPLC separation is performed on C₁₈ column using polar solvents and detected under UV- light at 425nm [6]. A rapid, simple, selective and precise high performance thin layer chromatographic method has also been developed for the determination of curcumin in poly herbal formulation. The separation was performed on TLC aluminium plates Precoated with silica gel G60 F254. Good separation was achieved in the mobile phase of Chloroform: methanol: Glacial acetic acid (7.5: 2.0: 0.5 v/v/v) at R_f= 0.18, 0.31, 0.56 for bisdemethoxy curcumin, demethoxy curcumin and curcumin respectively. The method was validated successfully by checking precision, repeatability and accuracy [7]. A UV-Visible Spectrophotometric method has been developed for the determination of curcumin in bulk and in nano-formulation. The spectrophotometric detection was carried out at an absorption maximum of 421nm using methanol as solvent. The method was validated for various validation parameters. The linearity range was found to be 5-25µg/ml with a correlation coefficient of 0.9997. The accuracy was found to be within limit. The LOD and LOQ were found to be 0.4 and 1.21µg/ml; respectively. The results demonstrated that the method can

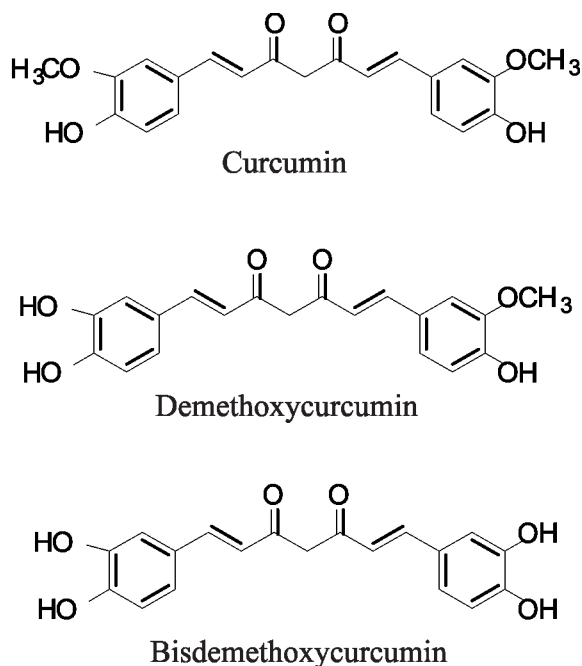


Fig. 1. Yellow-pigmented curcuminoids

be conveniently employed for routine quality control analysis of Curcumin in bulk and in formulations [8].

Turmeric (curcumin) shows many biological activities, to name some of them, anti-inflammatory activity [9], anti-amyloid [10], anti-oxidant [11-12], anti-bacterial [13-14], anti-HIV [15], and anti-tumor [16].

2. EXPERIMENTAL

This research work was carried out between the months of February - May 2016 in the pharmacognosy department of MET Faculty of Pharmacy Moradabad. All chemical and solvents were purchased from Mark (India), Spectrochem (India), Himedia (India) and SD Fine chemical (India) they were used without further purification.

2.1 Preparation of extract

50g of different commercially available turmeric powder samples were weighed (coded as T1, T2, T3, T4 and T5) and extracted with 150ml of ethanol by soxhlation and the solvent was recovered by distillation. The extracts were concentrated under reduced pressure and air dried.

2.2 Physical evaluation

2.2.1 Determination of total Ash value

2 g of sample powders of *Curcuma longa* were placed in silica crucible and incinerated at a temperature not exceeding 800 °C until free from carbon. The resultant ash was cooled and weighed. The percentage of ash was calculated with reference to the air dried drug.

2.2.2 Acid insoluble Ash value

The total ash obtained from the above step was boiled for 5 minutes with 25 ml of dilute hydrochloric acid and the insoluble matter was collected on an ashless filter paper. It was washed with hot water, ignited and weighed. The percentage of acid insoluble ash was calculated with reference to the air dried drug.

2.2.3 Water soluble value

The total ash obtained from the above step was boiled for 5 minutes with 25 ml of water and the insoluble matter was collected on an ashless filter paper. It was washed with hot water, ignited and weighed. The percentage of water soluble ash was calculated with reference to the air dried drug.

2.2.4 Separation of Curcumin by thin layer chromatography

For thin layer chromatographic studies of curcumin, pre-coated silica gel F₂₅₄ aluminium plates (20 × 20cm) were used. The curcumin was separated using petroleum ether : ethyl acetate [7:3]. The colour and R_f values were recorded by spraying the plates with alcoholic KOH solution.

2.2.5 Moisture content

About 20g of drug samples were weighed and kept in an empty crucible and placed in an oven at 115 °C for 2-3 hours. The crucible was allowed to cool and the drug samples re-weighed to calculate the moisture loss.

2.2.6 Extractive value

2 g of coarsely powdered drug samples were weighed in a weighing bottle and transferred in a dry conical flask. The conical flask was filled with 90% alcohol. The flask was corked and set aside for 24 hours, shaking frequently (maceration). The 25 ml of extract was transferred to a thin porcelain dish and evaporated to dryness on a water bath and for complete drying kept in an oven at 105 °C for 6 hours. The crucibles were cooled in desiccator for 30 minutes and weighed immediately. The percentage w/w of extractive value was calculated with reference to the air-dried drug.

2.3 Assay of curcumin by UV/Visible spectroscopic method

0.1 g of dried extract was dissolved in 25ml of ethanol. This solution was filtered and volume made up to 100 ml. Then 10 ml of above solution was taken in volumetric flask and again volume made up to 100 ml with ethanol. Determine the absorbance (A) at 425 nm in a 1-cm cell. The total colouring matters content of the sample was calculated using the following equation.

% Total Colouring matters:

$$A = 100 \times 10/W \times 1607$$

Where,

A = absorbance of sample

W = weight of sample (g)

1607 = specific absorbance of the curcumin standard in ethanol at 425 nm.

3. RESULTS AND DISCUSSION

Five different samples of turmeric powder were selected for the study. All the samples were subjected to extraction, physical evaluation studies and assay.

The extraction of curcumin was done using methanol as the solvent in soxhlet apparatus. The yield of the crude extracts obtained were compared (Table 1).

Table 1. Comparison of yield value of crude extracts of different samples of turmeric powder

Turmeric Samples (50g)	T1	T2	T3	T4	T5
Yield	700 mg	200 mg	200 mg	400 mg	300 mg
Percentage yield	1.4 %	0.4 %	0.4 %	0.8 %	0.6 %

Organoleptic evaluation of sample powder showed the following characters; **Colour-** brown, **Sensation-** coarse and **Odour-** odourless. The organoleptic studies indicated important characteristics such as typical tongue sensitizing aromatic taste, aromatic odour, etc, which are useful diagnostic characters.

The physical parameters such as ash value (%), acid insoluble value, water soluble and extractive value were measured (Table 2). Total ash value of T5 sample was relatively high due to high content of carbonates, phosphates, silicates and silica. Ash value is useful in determining authenticity and purity of drug and also these values are important quantitative standards. They help to detect low grade products, exhausted products and excess of sandy and earthy matter in drug. As the study shows that turmeric of T1 and T2 have lowest ash value, hence are more pure than other samples. Acid insoluble ash value shows the presence of earthy matter and calcium oxalate crystals in drug. T1 sample has maximum impurity of earthy matter and calcium oxalate crystal. Water soluble ash shows the presence of material exhausted by water. T1 and T2 sample shows highest value of water soluble ash. Moisture content is used to determine the storability, microbiological stability, flow properties and concentrated of purity. The lowest moisture content is of T1 and T2 turmeric powder samples. It shows that T1 and T2 samples can be preserved for long time period. Different active

Table 2. Physical evaluation of different samples of turmeric powder

Characteristic	Different turmeric samples				
	T1	T2	T3	T4	T5
Total ash value	11.5%	11.0%	18.0%	19.0%	24.0%
Acid insoluble	11.5%	12.0%	14.5%	16.05	13.5%
Water soluble	8.5%	8.5%	14.5%	11.5%	11.0%
Extractive value	11.2%	11.0%	9.0%	13.0%	9.6%
Moisture content	1.40%	1.38%	5.40%	4.98%	3.01%

constituent of turmeric powder such as curcumin and curcuminoids were successfully detected directly from the ethanolic extract of *curcuma longa* by thin layer chromatography.

When a turmeric extract was separated on a TLC plate, using petroleum ether and ethyl acetate as developing solvents, we obtained three spots. According to R_f value studies, they correspond to the three main curcuminoids, ie. curcumin, dimethoxy curcumin and bis- methoxy curcumin. (Table 3).

Table 3. TLC profile of ethanolic extract of different samples of turmeric powder

Solvent system	Different turmeric samples (T1- T5)	R _f value	Inference
Petroleum ether:ethyl acetate (7:3)	T1	0.27	Curcumin, Dimethoxy-curcumin, Bismethoxy-Curcumin
	T2	0.27	
	T3	0.26	
	T4	0.25	
	T5	0.28	

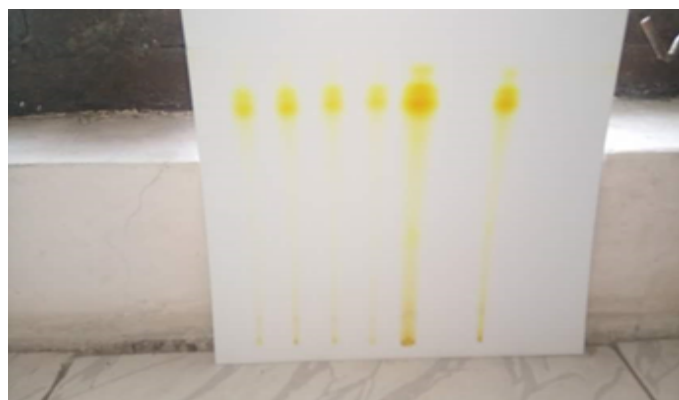


Fig. 2. TLC separation of curcuminoids present in different samples of turmeric powder

Finally assay of curcumin was performed by UV/Visible spectroscopic method to determine the percentage of curcuminoids present (Table 4). The assay was directed towards the estimation of percentage of coloring matter present. The principal coloring components in turmeric are curcumin and its desmethoxy and bis-desmethoxy derivatives. Results show that maximum % coloring

Table 4. Quantitative estimation of curcumin from ethanolic extract of *curcuma longa*

Samples	% Coloring matter present in different turmeric samples
T1	20%
T2	20%
T3	19%
T4	19%
T5	13%

matter is present in T1 and T2 samples of turmeric powder, followed by T3 and T4 turmeric powder. This can be inferred to that T1 and T2 samples of turmeric powder have highest concentration of curcumin and its derivatives.

Finally the turmeric samples were subjected to chemical characterization (Table 5).

Table 5. Chemical characterization of ethanolic extract of *curcuma longa*

Identification	Observation (T1- T5)
Alkaloids	(+)ve
Cardiac glycoside	(+)ve
Steroids	(+)ve
Flavonoids	(+)ve
Phenol	(+)ve

4. CONCLUSION

Turmeric, derived from the plant *Curcuma longa*, is a gold color spice commonly used in the Indian subcontinent, not only for health care but also for preservation of food and as yellow dyes for textiles. The main constituent group are polyphenolic curcuminoids which include: curcumin (diferuloylmethan), demethoxycurcumin, bisdemethoxycurcumin, and cyclocurcumin. Curcumin has been shown to exhibit antioxidant, anti-inflammatory, antiviral, antibacterial, antifungal and anticancer activities and thus has a potential against malignant diseases, diabetes, allergies, arthritis, Alzheimer's diseases and other chronic diseases.

In the present work we have investigated the quality of different turmeric powder samples available in the market. For this, five different market samples of turmeric powder were collected namely T1, T2, T3, T4 and T5 from local vendor. These samples were subjected to organoleptic, physical and chemical evaluations. Results make us to conclude that T1 and T2 samples of turmeric powders are of better quality as compared to that of other samples. They have less ash value showing less earthy and mineral impurity, more extractive values showing increased amount of curcuminoids and less moisture content showing that they are less susceptible to degradation. When amount of curcumin and its derivatives was estimated by UV visible spectroscopy, then also T1 and T2 samples showed highest concentration of coloring matter present.

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