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Comparative Pharmacognostical and Phytochemical Evaluation of Curcuma Longa Rhizome Dried by Different Traditional and Modern Methods

Radhika[1*]; Akanksha Sharma[2]; Sanjiv Duggal[3]

[1;2;3]Department of Pharmacy, Global College of Pharmacy, Kahanpur Khui, Anandpur Sahib, Ropar, Punjab, India

Correspondence Author: Radhika[1*]

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Abstract: Turmeric (Curcuma longa Linn.), a well-known medicinal plant of the family Zingiberaceae, is widely used in traditional medicine and pharmaceutical formulations due to its therapeutic properties mainly attributed to curcumin and other curcuminoids. However, limited information is available on the influence of different drying methods on its pharmacognostical quality. The present study aims to develop a comparative pharmacognostical monograph of Curcuma longa rhizomes dried by various traditional and modern techniques. Fresh rhizomes were collected, authenticated, and subjected to sun drying, shade drying, oven drying (40–50°C), and traditional household drying. The dried samples were powdered and evaluated for organoleptic characteristics, loss on drying, total ash, acid-insoluble ash, and extractive values using standard procedures. Preliminary phytochemical screening was performed to detect bioactive constituents such as alkaloids, flavonoids, phenolics, tannins, and curcuminoids. Thin layer chromatography (TLC) fingerprinting was carried out using chloroform: methanol (95:5) as the mobile phase, and chromatograms were observed under UV light at 254 nm and 366 nm. The results revealed significant variations in physicochemical parameters and phytochemical profiles depending on the drying method. Shade-dried samples showed better retention of curcuminoids and superior overall quality, as indicated by distinct TLC spots. The study highlights the importance of appropriate drying methods for ensuring quality, authenticity, and standardization of turmeric in pharmaceutical applications.

Keywords: *Curcuma Longa, Pharmacognostical Monograph, Turmeric, Drying Methods, Phytochemical Screening, TLC Fingerprinting.*

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I. INTRODUCTION (7-19)

Medicinal plants have been used for healthcare since ancient times and continue to play an important role in modern medicine. One of the most important medicinal plants is Curcuma longa (turmeric), which belongs to the Zingiberaceae family. The rhizome (underground stem) of turmeric is widely used in Ayurveda and traditional medicine for treating many diseases such as skin disorders, wounds, cough, cold, asthma, diarrhoea, and joint inflammation. Turmeric contains an important active compound called curcumin, which has strong anti-inflammatory, antibacterial, antioxidant, anti-allergic, and anti-arthritic properties. Because of these medicinal properties, turmeric is known as the “yellow spice” or “spice of life.”

Turmeric is also used as a spice in food, as a natural dye for cloth, and as a cosmetic in many cultures. According to the World Health Organization, about 80% of the world’s population depends on traditional medicine for primary health care. India is the largest producer of turmeric, and it has been used in Indian culture and medicine for thousands of years. Pharmacognostical and phytochemical studies are important to evaluate the identity, purity, quality, and therapeutic value of turmeric. Modern techniques such as Thin Layer Chromatography are also used for the standardization and quality control of herbal medicines containing turmeric.

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Fig 1 Turmeric - Photo the Gourmantic Garden

➢ *Objective:*

- To evaluate the pharmacognostic parameter of turmeric rhizomes dried by different methods.
- To perform phytochemical screening of dried turmeric samples.
- To develop TLC fingerprint profiles of turmeric samples and compare curcumin content.
- To identify the most suitable drying method for maintaining turmeric quality.
- To evaluate the organoleptic properties of dried turmeric powder.
- To carry out TLC analysis of turmeric extract.
- To identify the best drying method for turmeric.
- To prepare a pharmacognostic monograph of curcuma longa.

➢ *Historical and Background (20-25):*

India has a rich variety of medicinal plants used in traditional systems like Ayurveda, Siddha, Unani, and folk medicine. These plants contain natural compounds with medicinal properties such as antibacterial, antioxidant, and anti-inflammatory effects. Pharmacognostic and phytochemical studies help in identifying plants and analyzing their active compounds. Modern techniques like chromatography and spectroscopy are also used for the study and standardization of herbal medicines. Curcuma longa (turmeric) is an important medicinal plant from the Zingiberaceae family. Its rhizome is widely used as a spice and medicine to treat problems like cold, cough, digestive disorders, wounds, and inflammation. The yellow colour and medicinal activity of turmeric are mainly due to curcumin, its major active compound. Turmeric is also widely used in traditional medicine for its healing properties and plays an important role in herbal drug preparation and research.

Fig 2 Turmeric Rhizome Powder

Table 1 Historical and Backgrounds

Aspect	Description
Country with rich medicinal plant	India has a wide variety of medicinal plants used in traditional system of medicine.
Traditional systems of medicines	Ayurveda, Siddha, Unani and folk medicines widely used medicinal plant.
Medicinal properties of plants	Many plants contain natural compounds with anti-bacterial, anti-oxidant, and anti-inflammatory properties.
Role of pharmacognostic studies	Pharmacognostic and phytochemical studies help in identification of plants and analysis of their active compounds.
Important medicinal plants	Curcuma longa is an important medicinal plant belonging to zingiberaceae family.
Use of turmeric	The rhizome is used as spice and medicines for cold, cough and digestive disorders, then bounds and inflammation
Major active compounds	The yellow colour and medicinal activity are mainly due to curcumin.

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➢ *Plant Profile:*

Fig 3 Plant Profile

➢ *Synonyms:*

- Sanskrit: Ameshta
- English: Indian saffron
- Hindi: Haldi
- Bengali: Halud
- Telgu: Haridra
- French: Curcuma
- Indonesian: Kunyit
- Malay: Kunyitbasah

- Family: Zingiberaceae

- Biological Source: It consists of the dried rhizomes of the plant Curcuma longa. Curcuma longa is a herbaceous perennial plant. It belongs to the family Zingiberaceae (ginger family). It is native to tropical South Asia. The rhizome is processed to produce the yellow spice turmeric, rich in curcumin. It is used in cooking and traditional medicine (25-26).

➢ *Chemical Constituents (26-32):*

- *Curcuminoids*

✓ Curcumin → Main active compound; gives yellow colour; strong anti-inflammatory & antioxidant
✓ Demethoxycurcumin → Similar to curcumin; supports anti-inflammatory activity
✓ Bis-demethoxycurcumin → Less potent but contributes to overall therapeutic effect

- *Volatile Oils*

✓ Ar-Turmerone → Major oil; shows anti-inflammatory & neuroprotective effects
✓ Zingiberene → Provides aroma; has mild anti-inflammatory action
✓ Atlantone → Contributes to flavour & medicinal activity
✓ Sabinene → Has antioxidant & antimicrobial properties
✓ Borneol → Acts as antiseptic & cooling agent

- *Other Constituents*

✓ Starch → Acts as energy storage; gives bulk to rhizome
✓ Resin → Contributes to medicinal and protective properties
✓ Proteins & Amino acids → Help in nutrition and body repair
✓ Carbohydrates → Provide energy

- *Phytochemicals*

✓ Tannins → Show astringent & antimicrobial action
✓ Saponins → Have antimicrobial & immune-boosting effects
✓ Flavonoids → Strong antioxidants
✓ Phenolic compounds → Responsible for antioxidant & anti-inflammatory activity

- *Minerals & Vitamins*

✓ Iron → Helps in hemoglobin formation
✓ Potassium → Maintains fluid balance & nerve function
✓ Manganese → Supports enzyme activity & metabolism
✓ Vitamin C → Boosts immunity & antioxidant defense
✓ Vitamin B-complex → Helps in energy metabolism

- Origin (33-44): Curcuma longa (turmeric) is believed to have originated in India and other parts of South and Southeast Asia. From India, it spread to countries like Sri Lanka, China, and Indonesia through trade and cultivation. Turmeric has been cultivated in India for more than 4000 years and is widely used in Ayurveda, food, and religious practices. Today, India is the largest producer, consumer, and exporter of turmeric in the world.
- Naturalised distribution and habitat of Curcuma longa (Turmeric): Turmeric is native to India and southeast Asia, but it is now widely Naturalised in many tropical and subtropical regions of the world due to long term cultivation and adaptation.
- Habitat of curcuma longa: Curcuma longa grows best in warm, humid tropical climated. It thrives in areas with:

✓ Temperature: 20 -35 c
✓ Rainfall: moderate to high rainfall
✓ Soil: Well -drained, fertile loamy or sandy- loam soil rich in organic matte
✓ PH: Slightly acidic to neutral soil (PH 5.5 - 7.0)
✓ Light: Partial shade to full sunlight
✓ Altitude: Sea level up to about 1500m

Fig 4 Turmeric - Photo the Gourmantic Garden

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➢ *Use:*

- Reduces inflammation – helpful in pain and swelling.
- Promotes wound healing – helps wounds heal faster.
- Prevents infections – has antibacterial and antifungal properties.
- Boosts immunity – improves the body's defence against diseases
- Useful for skin problems – used for pimples, spots and skin infections.
- Helpful in cold and cough – commonly taken as turmeric milk.
- Improves digestion – supports healthy digestion.
- Acts as a blood purifier – traditionally believed to cleanse the blood.
- Supports liver health – shows hepatoprotective activity.
- Powerful antioxidant – protects the body from damage.
- Relieves joint pain – beneficial in arthritis.
- Used as a natural food color and preservative.

II. MATERIAL AND METHODS

➢ *Collection and Identification of Plant Material:*

The plant material was purchased from the local market and identified as Curcuma longa Linn. (rhizome) of the family Zingiberaceae. Identification was done by comparing its morphological and microscopic characters with standard literature. The organoleptic properties such as colour, odour and taste of fresh and powdered rhizomes were examined. Macroscopic characters like size, shape, surface, and fracture were also evaluated according to WHO guidelines, Curcuma longa (turmeric) is widely cultivated in countries such as India, Indo-China, Sri Lanka, Indonesia, Jamaica, and Peru. India is the largest producer of turmeric. The crop grows for about 7–9 months, after which the rhizomes are harvested, boiled, dried, and processed into powder, oleoresin, and curcumin. High-yield and high-curcumin varieties have also been developed through tissue culture and clonal propagation(45-46).

➢ *Macroscopic Characters:*

Turmeric rhizomes are yellowish-brown in colour with a characteristic aromatic odour and slightly bitter taste. The round variety is oblong in shape, while the long variety is cylindrical with short branches. The surface shows root scars and ring-like markings (annulations). On breaking, the fracture is hard and horny, and the inner surface appears orange in colour. The rhizomes are usually 5–10 cm long and 2–4 cm thick(47-48).

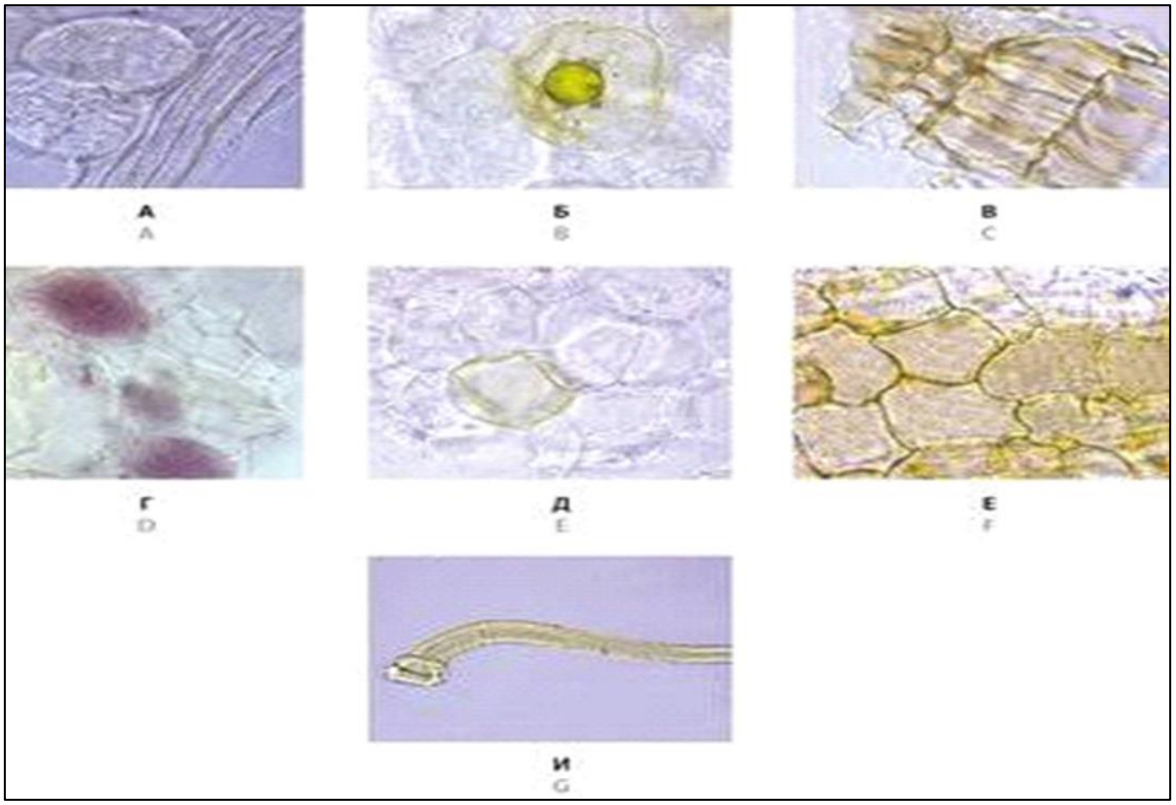

Fig 5 Different Macroscopic Image of Curcuma Longa Rhizome

➢ *Microscopic Characters:*

The transverse section of the turmeric rhizome shows 4–6 layers of brick-shaped cork cells followed by cork cambium. The cortex consists of thin-walled, rounded parenchyma cells with scattered vascular bundles. Oleo-resin cells containing brown material are present throughout the tissue, and the oil cells have thick suberized walls. The vascular bundles the endodermis. are collateral and occur in the cortex, while in the pith region they are scattered and form an incomplete ring below Numerous starch grains (about 5–15 µm in diameter) are also present(47-48).

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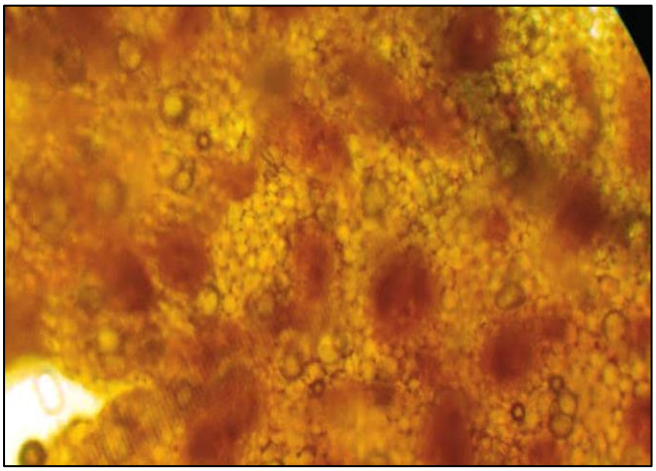

Fig 6 Different Microscopic Images in Transverse Sections Through the Rhizome of Zingiber Officinale:(a)-(d) Parenchyma Cells with Yellow Oil and Cells with Starch Granule

➢ *Raw Materials:*

Fresh rhizomes of Curcuma longa were collected from the local market, washed to remove impurities, and authenticated by their morphological characters. The rhizomes were cut into small pieces and dried by sun drying, shade drying, oven drying (40–50°C), and traditional drying methods. The dried material was powdered and stored in airtight containers for further pharmacognostical, phytochemical, and TLC analysis (49).

➢ *Pre-Treatment Before Drying:*

Fresh rhizomes of Curcuma longa were subjected to proper pre-treatment before drying to remove impurities and ensure uniform drying. The rhizomes were first washed thoroughly under running tap water to remove adhering soil, dirt and foreign matter. The outer rough surface and rootlets were carefully removed using a knife. The cleaned rhizomes were then blotted dry with a clean cloth to remove surface moisture. After cleaning, the rhizomes were cut into thin, uniform slices of approximately 3–5 mm thickness to facilitate proper and uniform drying. The sliced rhizomes were divided into four equal portions and then subjected to different drying methods such as sun drying, shade drying, oven drying and traditional household drying (50).

➢ *Method of Drying:*

- Sun Drying: In the sun-drying method, slices and whole rhizomes of Curcuma longa were spread evenly on clean plates in sunlight. The samples were arranged to allow proper air circulation and were turned every hour for uniform drying. Observations were taken hourly up to four hours until the rhizomes reached a safe moisture level of about 9–10%(51).
- Hot Air Oven Drying: In the oven-drying method, a hot air oven was preheated for 15 minutes until the temperature reached about 50 °C. Whole and sliced samples of Curcuma longa were then placed on wire-mesh trays inside the oven to allow uniform drying, and moisture was removed at regular interval (52).
- Shade Drying: The cleaned and sliced rhizomes of Curcuma longa were spread in a single layer on trays and kept in a well-ventilated place away from direct sunlight. The slices were turned twice daily for uniform drying. Drying was carried out at room temperature (25–30 °C) for about 10–15 days until the rhizomes became hard and fully dry. The dried material was then powdered and stored in airtight containers for further study (53).
- Traditional Kitchen Drying: The cleaned and sliced rhizomes of Curcuma longa were placed on clean plates in the kitchen near a warm area but away from direct fire. The slices were turned twice daily for even drying. Drying was continued for 8–12 days until the rhizomes became hard and completely dry, after which they were powdered and stored in airtight containers (54-55).

➢ *Pharmacognostical Evaluation (56-58):*

- *Organoleptic Evaluation*

✓ Organoleptic evaluation means examining the powder of Curcuma longa using sense organs such as eyes, nose, and tongue.

- *Parameters Observed:*

✓ Colour: Yellow colour of turmeric powder.
✓ Odor: Characteristic aromatic smell.
✓ Taste: Slightly bitter taste.
✓ Texture: Powder may be fine or slightly coarse when felt between fingers.

III. PRELIMINARY PHYTOCHEMICAL SCREENING (57-65)

A. *Total Ash Value:*

Total ash value indicates the amount of inorganic matter (dirt, sand, minerals) present in turmeric powder.

➢ *Procedure:*

- Weigh 2 g turmeric powder in a silica crucible.
- Heat first on burner, then in muffle furnace at 450°C.
- Heat until white/grey ash forms.
- Cool in desiccator and weigh**.**

➢ *Formula:*

- Total Ash (% w/w) = Weight of ash\ Weight of sample × 100

B. *Powder Microscopy: Study of Turmeric Powder Under a Microscope.*

➢ *Procedure:*

- Put powder on slide.
- Add water/glycerine and cover slip.
- Observe under microscope.

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➢ *Characters:*

- Starch grains, fibres, vascular bundles, oil cells, parenchymatous cells.

C. *Water Soluble Ash: Shows the Amount of Ash Soluble in Water.*

➢ *Procedure:*

- Take total ash.
- Boil with 25 ml distilled water.
- Filter and wash with hot water.
- Dry, ignite, and weigh insoluble ash.

➢ *Formula*

- Water Soluble Ash = Total Ash - Insoluble Ash

D. *Solvent Extractive Value: Shows the Amount of Active Constituents of Turmeric Soluble in Water or Alcohol.*

➢ *Procedure:*

- Weigh 5 g turmeric powder.
- Add 100 ml solvent in flask.
- Shake 6 h and keep 18 h.
- Filter, evaporate 25 ml filtrate.
- Dry at 105°C and weigh

➢ *Formula:*

- Extractive value (% w/w) = Weight of dried extract×4 / Weight of sample × 100

E. *Loss on Drying: Shows the Moisture Present in Turmeric Powder.*

➢ *Procedure:*

- Weigh 2 g powder in a dish.
- Dry in oven at 105°C.
- Cool in desiccator and weigh.
- Repeat until constant weight.

➢ *Formula:*

- Loss on Drying (% w/w) Initial weight - Final weight / Initial weight × 100

➢ *Preparation of Extract:*

- Curcuma longa rhizomes were sun-dried, cut into pieces, outer bark removed, ground into fine powder, dried again, and stored for use.
- Collect rhizomes.
- Sun-dry for 3 days.
- Cut into small pieces.
- Dry again.
- Remove outer bark.
- Grind into powder.
- Dry and store

F. *Aqueous Extraction: Powder Extracted with 1000 ml Distilled Water + 3–4 Drops Chloroform for 48 h, Concentrated below 45°C, Dried and Stored in Refrigerator*

➢ *Procedure:*

- Take powder.
- Add 1000 ml distilled water and add 3–4 drops chloroform.
- Keep for 48 h.
- Filter and concentrate below 45°C.
- Dry residue and store in refrigerator

➢ *Ethanolic Extraction:*

- Take powdered sample.
- Extract with ethanol using Soxhlet (72 h).
- Concentrate below 45°C.
- Dry residue.
- Store in refrigerator.

IV. PHYTOCHEMICAL SCREENING (66-74)

A. *Test for Alkaloids:*

➢ *Mayer's Test:*

- Add 1 ml Mayer's reagent to 1 ml plant extract.
- Formation of a whitish-yellow/cream precipitate indicates the presence of alkaloids.

➢ *Wagner's Test:*

- Add 1 ml Wagner's reagent to 1 ml plant extract.
- Formation of a reddish-brown precipitate indicates the presence of alkaloids.

B. *Tests for Glycosides:*

➢ *Keller–Killiani Test:*

- Add glacial acetic acid and 1 drop of 5% $FeCl_3$ to 2 ml extract, then add conc. H_2SO_4.
- A reddish-brown ring and bluish-green upper layer indicate cardiac glycosides.

➢ *Baljet's Test:*

- Add 1 ml sodium picrate solution to 1 ml extract.
- A yellow to orange colour indicates the presence of glycosides.

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➢ *Foam Test:*

- Shake 0.5 g extract with water vigorously.
- Formation of a stable foam layer indicates glycosides.

C. Tests for Carbohydrates:

➢ *Benedict's Test:*

- Add 1 ml extract to 5 ml Benedict's reagent and boil for 2 minutes.
- A red precipitate indicates the presence of sugars.

➢ *Molisch's Test:*

- Add few drops of 20% α-naphthol to the extract, then add conc. H_2SO_4 along the side.
- A reddish-violet ring indicates carbohydrates.

➢ *Fehling's Test:*

- Hydrolyse extract with dilute HCl, neutralize with NaOH, then add Fehling's A & B and heat.
- A brick-red precipitate indicates carbohydrates.

D. Tests for Steroids:

➢ *Salkowski Test:*

- Dissolve extract in chloroform and add conc. H_2SO_4.
- A bluish-red/cherry colour with green fluorescence indicates steroids.

E. Test for Proteins:

➢ *Biuret Test:*

- Add NaOH and a few drops of $CuSO_4$ to 1 ml extract.
- A pink/violet/purple color indicates proteins.

F. Tests for Saponins:

➢ *Froth Test:*

- Boil extract with distilled water and shake well.
- Formation of stable froth (foam) indicates saponins.

➢ *Foam Test:*

- Shake extract with distilled water and sodium carbonate.
- Persistent foam indicates saponins.

G. Tests for Phenolic Compounds and Tannins

➢ *Lead Acetate Test:*

- Add basic lead acetate to the extract.
- A white precipitate indicates tannins.

➢ *Ferric Chloride Test:*

- Add few drops of $FeCl_3$ to 1 ml extract.
- A dark blue or greenish-black color indicates tannins.

➢ *Potassium Dichromate Test:*

- Add strong potassium dichromate solution to the extract.
- A yellow precipitate indicates tannins and phenolic compounds.

➢ *Potassium Ferricyanide Test:*

- Treat the extract with potassium ferricyanide and ammonia solution.
- A deep red color indicates tannins.

H. Tests for Flavonoids:

➢ *Shinoda Test:*

- Add Mg turnings and conc. HCl to the extract.
- A pink/red color indicates flavonoids.

➢ *Alkaline Reagent Test:*

- Add NaOH to the extract.
- An intense yellow color that becomes colourless with acid indicates flavonoids.

➢ *Lead Acetate Test:*

- Add lead acetate solution to the extract.
- A yellow precipitate indicates flavonoids.

Table 2 Physiochemical Evaluation

Sr. no	Test	Observation	Inference
1	**Alkaloids** • Dragendroff test: clean test tube +1ml plant extract+1ml Dragendroff reagent then mix • Mayer test:clean test tube in 1ml plant extract+1ml Mayer solution +mix.	Orange-red colour produce	+ +
2	**Test for glycoside** • . Keller- Killian test: 2ml plant extract in test tube +5%FeCl3 soln	Observe two layer reddish brown colour obtain	+
3	**Test for steroids** • Salkowski Test: Dissolve extract in chloroform +eq volume of con. H2SO4.	Bluish -red/ cherry colour and green fluorescence	+

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	• LiebermannBurchard test: Test tube + extract +1ml acetic anhydride and warm gently + cool and mix few drops of con. H2SO4.	Blue colour	+
4	**Test for protein** • Biuret test: Add 1ml of 40% sodium hydroxide soln +2 drop of 1% copper sulphate soln blue colour appear + mix with 1ml extract	Pink, violet or purple colour	+
5	**Test of saponins** • Froth test: Extract boiled + 1ml distilled water and shake • Form test: Extract +2ml d.w.+sodium carbonate and shake	Formation of stable characteristics foam. Foam	+ -
6	**Test for phenolic compound and Tannins** • Lead acetate test • Ferric chloride test: Ferric chloride +1ml extract • Potassium dichromate: Potassium dichromate + extract	White precipitate Dark blue or greenish, black colour,red colour yellow precipitate	– + +
7	**Test for flavonoids** • Shinoda test: Magnesium turning to extracts + HCL drop wise	Pink, crison red sometime green/ blue colour	+

➢ *TLC Chromatography (75-80):*

Thin Layer Chromatography (TLC) is a technique used to separate and identify components of a mixture based on their interaction with stationary and mobile phases.

An alcoholic extract of Curcuma longa (turmeric) with hypoglycaemic activity was analysed using TLC.

- Method: The turmeric extract was spotted on a TLC plate, developed in solvent, dried, and visualized. Rf values were calculated.
- Rf Formula:Rf = Distance travelled by solute ÷ Distance travelled by solvent
- Column Chromatography: Curcuminoids were separated using silica gel as adsorbent and benzene as solvent with benzene extract sample. The column was packed with silica gel and benzene. The sample was added and separated into colored bands. Fractions were collected, concentrated, and purified.
- Curcumin Estimation: Turmeric powder was extracted, diluted, and absorbance measured at 430 nm using a spectrophotometer.
- Macromorphology:Rhizomes are yellow, cylindrical, aromatic, and slightly bitter with rough surface.
- Microscopy (T.S.):Shows cork, epidermis, cortex, and ground tissue with starch, oil cells, and vascular bundles.
- Organoleptic: Dark yellow, aromatic, spicy, bitter, fine powder.
- Powder Microscopy: Parenchyma cells, starch, vessels; no calcium oxalate. Market sample confirmed genuine.
- Morphology: Cylindrical, yellow to brown, aromatic, spicy, 3–5 cm with scale leaves and bud scars.
- Fluorescence: Shows fluorescence under UV light due to plant compounds.

➢ *TLC Procedure:*

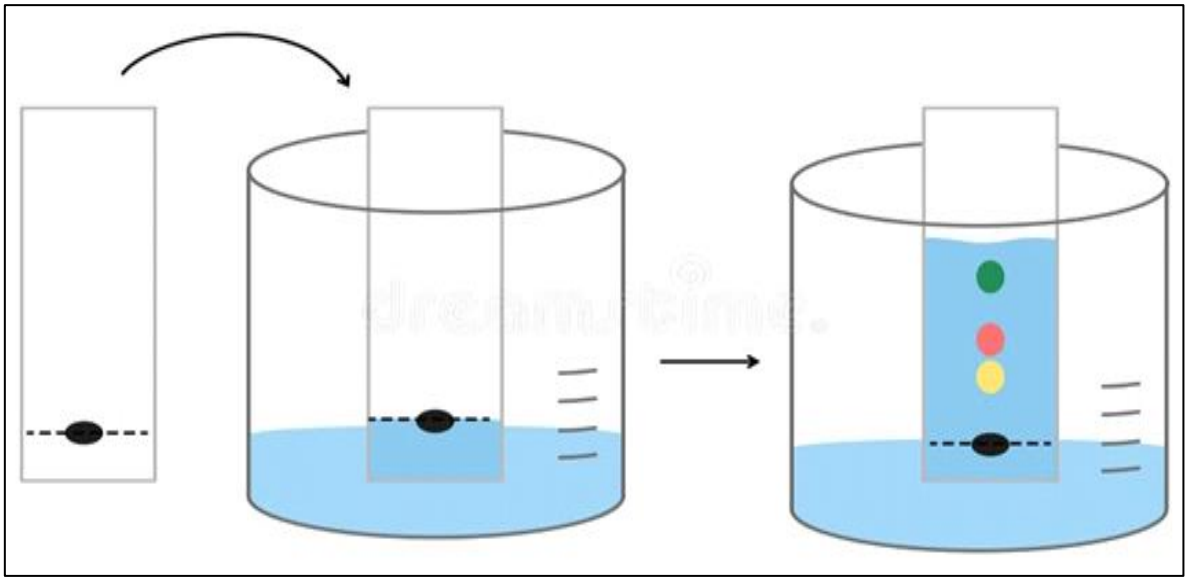

Fig 7 Thin Layer Chromatography

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- Prepare sample extract
- Spot sample on TLC plate
- Place plate in solvent system
- Allow solvent to run (development)
- Remove and dry the plate
- Observe spots under UV light

Table 3 Morphological Character

Feature	Fresh sample	Prepared sample	Market sample
Colour	Pale yellow	Yellowish-brown	Yellow to yellowish brown
Taste	Spicy bitter	Initially spicy later bitter	Spicy
Odour	Aromatic	Aromatic	Aromatic
Shape	Cylindrical	Cylindrical	Cylindrical
Size	3 to 5 cm and 1.8 cm	3 to 5 cm and 1.8 cm	3.5 cm and 1.8 cm
Fracture	Short	Short	Short
Fracture Surface	Yellowish orange	Reddish brown	Reddish brown
Surface	Note leave visible	A few scale leaves and roots branchlet, scar seen	Scale leaves and scar in root, branchlet seen
Bud	Apical bud present	Bud scar are seen	Bud scar are seen

➢ *Comparison of Traditional and Modern Methods:*

- *Nature and Principle of Methods:*

Traditional methods are based on physical and microscopic features (qualitative). Modern methods use analytical techniques for separation and estimation (qualitative + quantitative).

- *Accuracy and Validation:*

Traditional methods are less precise and depend on observation. Modern methods are accurate, reliable, and scientifically validated.

- *Sensitivity and Specificity:*

Traditional methods have low sensitivity. Modern methods can detect and separate even small amounts of compounds.

- *Cost and Equipment:*

Traditional methods are simple and low-cost. Modern methods require advanced instruments and are expensive.

- *Role in Quality Control and Standardization:*

Traditional methods help in identification. Modern methods ensure proper standardization and quality control.

Table 4 Comparison Between Traditional and Modern Methods

Basis of comparisons	Traditional method	Modern method	Which is best
Nature of evaluation	Mainly qualitative	Qualitative +Quantitative	Modern
Main technique	Organoleptic, Macroscopic, Microscopic	TLC	-
Principle	Morphological and anatomical basis	Physiochemical analytical basis	Modern
Accuracy	Moderate	High	Modern
Sensitivity	Low	High	Modern
Specificity	General identification	Specific compound detection	Modern
Reproducibility	Observer dependent	Instrument based reproducible	Modern
Equipment	Simple instrument	Advanced instrument	Depends
Cost	Low	High	Traditional
Time required	Less time	More time	Depends
Skill required	Basic knowledge	Technical expertise required	Depends
Role in quality control	Authentication	Standardization and quantification	Modern
Scientific validation	Limited	Strong scientific evidence	Modern

V. CONCLUSION

The present study on Curcuma longa rhizome was carried out to evaluate its pharmacognostical and phytochemical properties using both traditional and modern methods. The results confirmed the identity, purity and quality of the crude drug. Pharmacognostical evaluation, including organoleptic, macroscopical and microscopical studies, revealed characteristic features such as colour, odour, structure of rhizome, presence of starch grains, vascular bundles and oleoresin cells. These findings authenticated the plant material and ensured that it was genuine and free from adulteration. Preliminary phytochemical screening indicated the presence of important bioactive constituents such as curcuminoids, flavonoids and phenolic compounds. Among these, curcumin was identified as the major active constituent

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responsible for the medicinal properties of turmeric. Modern analytical techniques like Thin Layer Chromatography (TLC) showed characteristic spots with specific Rf values, confirming the presence of curcumin. Column chromatography enabled its isolation in pure form, while UV-Visible spectroscopy at 430 nm provided quantitative estimation, offering strong scientific validation. The comparative study between traditional and modern methods highlighted that traditional techniques are simple, economical and useful for basic identification and authentication. However, modern methods are more accurate, sensitive and reliable, as they provide both qualitative and quantitative data. These techniques play a crucial role in the standardization and quality control of herbal drugs. Overall, the study demonstrates that Curcuma longa rhizome is a valuable medicinal plant with significant therapeutic properties such as anti-inflammatory and antioxidant activity. The integration of traditional and modern methods provides a comprehensive and reliable approach for evaluation. Therefore, the combined use of both methods is essential to ensure the quality, purity and efficacy of herbal medicines.

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