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A review on medicinal properties of turmeric (*Curcuma longa* L.)

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Abstract
Nature is teeming with priceless gifts that can treat a wide range of illnesses. *Curcuma longa* is a medicinal plant belonging to the Zingiberaceae family (Chattopadhyay *et al*., 2004). It is commonly used as a spice, food preservative, and coloring agent (Aggarwal *et al*., 2007; Menon *et al*., 2007). It is native to tropical South Asia but is now widely cultivated in the tropical and subtropical regions of the world (Shiyon li *et al*., 2011). Curcumin (Diferuloylmethane), turmeric's main yellow bioactive component has been shown to have a wide spectrum of biological actions. These include its anti-inflammatory, antioxidant, anti-carcinogenic, Antimutagenic, anticoagulant, antifertility, antidiabetic, antibacterial, antifungal, antiviral, anti-fibrotic, anti-venom, and hypocholesterolemic activities. For traditional Ayurvedics, the turmeric plant was an excellent natural antiseptic, disinfectant, anti-inflammatory, and analgesic, while at the same time, the plant has been often used to aid digestion, improve intestinal flora, and treat skin irritations. According to the current assessment, *Curcuma longa* is a multipurpose plant that is native to the Indian subcontinent. It is economically significant and can be encouraged for a variety of applications, including medicinal and other potential uses.

Keywords: *Curcuma longa*, turmeric, curcumin, medicinal plant, phytochemical

Introduction
Since more than 6000 years ago, *Curcuma longa*, sometimes known as turmeric, has been used both as a spice in regular cuisine and in traditional medicine. Originally from South and Southeast Asia, the plant rhizome known as *Curcuma longa* is also native to Pakistan, China, Indonesia, India, Nepal, Jamaica, Bangladesh, Malaysia, El Salvador, Taiwan, and Haiti. The Curcuma genus includes roughly 70 species that are recognized as medicinal herbs with therapeutic benefits. These plants have long been used as food preservatives, coloring agents, and spices and have a large amount of therapeutic potential. Zingiberaceae, which includes the plant family *Curcuma longa*, is widely cultivated in South East Asia, primarily in China and India.

This medicinal plant stands 91.44 cm tall and has broad, lance-shaped leaves and yellow blooms that mature in the fleshy rhizome or subterranean stem. Turmeric is produced from boiling and dried *Curcuma longa* rhizome, which contains the phytochemical components used in the form of medicinal powder in orange color. Along with a variety of chemical components, curcumin-also known as saffron or Haridra (Sanskrit, Ayurvedic) in India, Jianghuang (yellow ginger) in China, and Kyoo or Ukon in Japan-is a key phytochemical that gives turmeric its characteristic yellow hue. Its anti-inflammatory, antioxidant, anti-carcinogenic, anti-mutagenic, anticoagulant, antifertility, anti-diabetic, antibacterial, antifungal, antiviral, antivenom, and hypocholesterolemic properties are a few of these. The turmeric plant was a good natural antiseptic, disinfectant, anti-inflammatory, and painkiller in traditional Ayurvedic medicine. It was also frequently used to enhance intestinal flora, help digestion, and heal skin irritations. Additionally, turmeric contains volatile oils including turmerone, atlantone, and zingiberene as well as fibre, proteins, resins, and resins, all of which may have pharmacological effects (Shep *et al*. 2019) [24]. For the purpose of the current review, two major search engines: Scopus and Google Scholar were used.

Taxonomical classification
Kingdom: Plantae
Subkingdom: Tracheobionta

Super division: Spermatophyta
Division: Magnoliophyta
Subclass: Zingiberidae
Order: Zingiberales
Family: Zingiberaceae
Genus: Curcuma
Species: longa
Scientific name: *Curcuma longa* L.

Botanical Description, Geographical Distribution, and Cultivation of *Curcuma longa*

A perennial plant called *Curcuma longa* lacks a stem and rootstock. Their 1-meter-long, lanceolate, or oblong leaves are dark green above and pale green underneath. About the same length as the blade is the petiole and sheath. Before the leaves, a spike first appears. The flowering bract is green with a rich ferruginous purplish hue, and the sterile flowers are a pale yellow with a reddish coating. It is typically grown in rural home gardens and has a 2-m-long, erect leafy shoot (Pseudostems) containing 8–12 leaves (Rajkumari and Sanatombi, 2017) [20]. The rhizomes taste harsh and have a balsamic odour (Puteri *et al*., 2020) [30]. It is thought that turmeric originated in South or Southeast Asia, most likely in western India, China, or Vietnam. It has never been discovered in the wild and is only known as a cultivated plant. The largest producer, consumer, and supplier is India; however, it is also widely grown in the following countries: Cambodia, Bangladesh, Nepal, Indonesia, Thailand, Malaysia, West Bengal, Madagascar, Tamil Nadu, Maharashtra, Madras Indonesia, and the Philippines (Royal Botanic Gardens Kew, 2021) [19].

The turmeric plant needs a good annual rainfall and an average temperature of 20 to 30 °C to thrive. Some plant species have long, oblong leaves and can grow to be 1 m tall. Both tropical and subtropical areas contain turmeric. If not overcrowded, this will grow best in the dark, yet it also seems to grow bigger and better rhizomes when exposed to sunshine. Typically, turmeric grows best under moist conditions. Typically, harvest season lasts from January through March or April. While medium varieties take 8 to 9 months to grow, early forms are ready in 7-8 months. The crop is ready to be harvested once the leaves turn yellow and start to dry out (Soudamini and Kuttan, 1989) [25]. When the rhizomes are ready, the leaves are chopped off closer to the soil's surface, the earth is ploughed, and the rhizomes are either hand-picked or gently lifted with a spade. The soil should be rich, friable, and contain only a small amount of sand for the turmeric plant. It thrives on light black, ashy loam, red soils, and stiff loams in both irrigated and rain-fed locations. The climatic and soil conditions will decide how much irrigation is needed for turmeric. Medium-heavy soils require 15–25 irrigations, while light-texture red soils require 35–40 irrigations, depending on the soil types and rainfall. Typically, rhizomes are stacked under trees for shade or in ventilated shelters, and then they are wrapped in turmeric leaves. In sawdust pits, mature rhizomes could be preserved as seeds (Aggarwal *et al*., 2004) [1].

Phytoconstituents

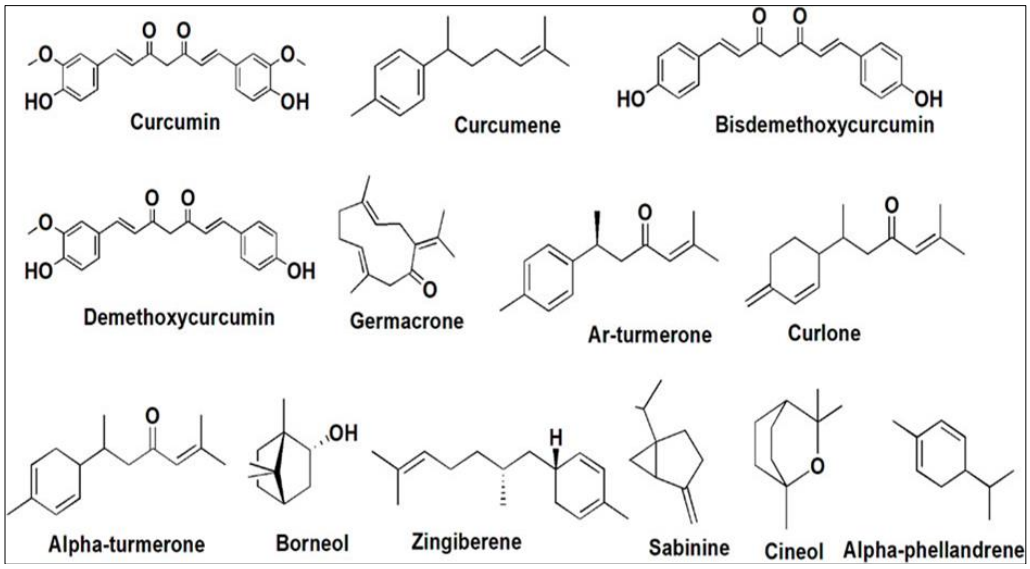

Fig 1: Chemical structure of phyto constituents present in *Curcuma longa*

a) 1, 8-cineole, 2-borneol, 2-hydroxy-methyl-anthraquinone, 4-hydroxybisabola-2.
b) 10-diene-9-one; 4-methoxy-5- hydroxybiosabola; 4-hydroxy-cinnamoyl- (Feruloyl)-methane, Alpha-atlantone, Alpha-pinene, Alphaterpineol, Ar-turmerone, Arabinose.
c) Ascorbic acid, Ash, Azulene, Beta-carotene, Beta-pinene, Beta- sesquiphellandrene, Bis-(Para-hydroxy-cinnamoyl)-methane.
d) Bis-desmethoxycurcumin, Bisabolene, Bixin, Borneol, Boron, Caffeic-acid, Calcium, Caprylic-acid, Caryophyllene, Chromium, Cineole, Cinnamic-acid, Cuminyl-alcohol, Curcumene, Curcumenol, Curcumin, Curdione, Cobalt, Copper.
e) Eugenol, Epiprocurcumenol; Eucalyptol; Eugenol; Feruloyl-p-coumaroyl-methane, Gamma-atlantone, Germacrone, Germacrone-13-al; Guaiacol, Isoborneol, L-alpha-curcumene.
f) L-beta-curcumene, Limonene, Manganese, Monodesmethoxycurcumin, Niacin, Nickel, norbixin; O-coumaric-acid, P-coumaric-acid, P-methoxy cinnamic-acid, Pcymene, P-tolymethylcarbinol, Phosphorus, Protocatechuic -acid, Procurcumadiol.
g) Acidic polysaccharides: utonan A, B, C, D.

h) Volatile Oil (4.2%), its main content is turmerone, Arturmerone, Curcumene, germacrone, ar-curcumene,
i) The herbal classics CHMM (Chinese Herbal Materia Medica).
j) Other chemicals: Turmeric contains protein (6.3%), fat (5.1%), minerals (3.5%), carbohydrates (69.4%) and moisture (13.1%). Phenolic diketone, curcumin (Diferuloylmethane) (3-4%) is responsible for the yellow colour, and comprises curcumin I (94%), curcumin II (6%) and curcumin III (0.3%).
k) Other chemicals compound is copper/zinc, campesterol, stigmasterol, beta-sitosterol, cholesterol, fatty acids and metallic elements potassium, sodium, magnesium, calcium, manganese, and iron. The main phyto compounds are presented in Figure 1.

Medicinal properties of *Curcuma longa*

Antibacterial activity

Sankaranarayanan and colleagues conducted a study in 1993 to assess the antibacterial properties of dried turmeric rhizome extracts in chloroform-ethanol water and petroleum ether. On agar plates, they applied the extracts at a concentration of 250 mg/ml. The study's findings demonstrated antibacterial activity against Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and Bacillus subtilis. In a separate investigation done in 1991 by Naovi *et al*., antibacterial assaying was performed on ethanol (95%) and water extracts of the dried rhizome of turmeric at concentrations of 10.0 mg/ml for each. According to the findings, Corynebacterium diphtheria, Diplococcus pneumonia, Staphylococcus viridian, and Streptococcus pyogenes were not affected by the ethanol (95%) extract. Additionally, water extract was found to have modest action against Staphylococcus aureus, Streptococcus viridian, and Streptococcus pyogenes and to be ineffective against Corynebacterium diphtheria and Diplococcus pneumonia (Naovi *et al*., 1991). Other researchers have looked into the antibacterial properties of various dried turmeric rhizome parts. As an illustration, Elkeltawi *et al*. (1980) investigated the antibacterial activity of turmeric rhizome essential oil on an agar plate; the findings revealed no antibacterial activity against Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, and Staphylococcus aureus. Another study, Dhar *et al*. (1968) [8], assessed the effectiveness of an ethanol extract of rhizome against Salmonella typhosa, Staphylococcus aureus, Lactobacillus acidophilus, and Staphylococcus aureus. According to the findings, the extracts were active against the first three bacterial species but ineffective against Salmonella typhosa and inconclusive against Escherichia coli. Undiluted essential oil on an agar plate did not have any effect on Bacillus cereus, Escherichia coli, Pseudomonas aeroginosa, or Staphylococcus aureus in a study by Ross *et al*. (1980).

Anti-inflammatory Effects.

Curcuma longa contains volatile oils and curcumin, both of which have strong anti-inflammatory properties. It was discovered that oral administration of curcumin was half as efficacious as cortisone or phenylbutazone in cases of acute inflammation and one-half as effective in cases of chronic inflammation. Oral treatment of *Curcuma longa* significantly decreased inflammatory swelling in comparison to controls in rats with Freund's adjuvant-induced arthritis. Curcumin prevented the inflammatory neutrophil aggregation seen in monkeys. The anti-inflammatory activities of C. longa may be explained by its capacity to suppress neutrophil function in inflammatory situations as well as the manufacture of inflammatory prostaglandins from arachidonic acid. In order to reduce inflammation and itchiness brought on by inflammatory skin disorders and allergies, curcumin may also be applied topically; however, caution must be taken to avoid garment stains caused by the yellow pigment.

Antifungal Activity

Some clinical isolates of dermatophytes have their growth reduced by the methanol extract of *Curcuma longa* (Wuthi-udomlert, *et al*., 2000) [31]. Curcumin, the active component of *Curcuma longa*, showed inhibitory effects on the growth of *R. solani*, *P. recondita*, and *P. infestans* when produced with ethyl acetate extract (Kim, *et al*., 2003) [15]. The methanol extract of *Curcuma longa* exhibited antifungal efficacy against Candida albicans and Cryptococcus neoformans (Ungphaiboon, *et al*., 2005) [27].

Anti-diabetic Properties

That turmeric has a substantial function in diabetes has been demonstrated by the experimental investigation. Adipocyte differentiation has been seen to be stimulated in a dose-dependent manner by hexane extracts containing ar-turmerone, ethanolic extracts containing ar-turmerone, curcumin, demethoxycurcumin, and bisdemethoxycurcumin, and ethanolic extracts from the residue of the hexane extraction containing these same compounds. The outcome demonstrates that the turmeric extract, which contains both sesquiterpenoids and curcuminoids, is more powerfully hypoglycemic than either sesquiterpenoids or curcuminoids alone. Turmeric has extraordinary effects on postprandial plasma glucose and insulin levels. It was found that consuming 6 g of curcumin did not significantly alter the glycemic response. Following the OGTT, insulin significantly increases at 30 and 60 minutes, including curcumin. Additionally, it has been noted that consuming *Curcuma longa* and doing an OGTT causes the AUC of insulin to rise noticeably. Additionally, turmeric reduces diabetes mellitus complications. An experimental investigation using albino rats demonstrates the impact of turmeric on the polyol pathway and blood sugar levels. It discovered that both turmeric and curcumin reduced blood sugar levels.

Anti-viral activity

Numerous studies have demonstrated that curcumin possesses broad-spectrum anti-microbial activity, such as antibacterial, antiviral, anti-fungal, and antimalarial activities. Curcumin has been utilised as a structural sample to develop new antimicrobial agents with modified and increased antimicrobial activities through the synthesis of various derivatives related to curcumin due to its extended antimicrobial activity and safety property even at high doses (12 g/day) as assessed by clinical trials in humans (Zorofchian Moghadamtousi *et al*. 2014) [32]. When taken in conjunction with graphene oxide to treat resveratrol infection, curcumin has a synergistic antiviral effect. Additionally, resveratrol causes significant lung damage in neonates by infecting their lower respiratory systems. Curcumin also has a dose-dependent antiviral effect (Dourado *et al*. 2021) [28]. In a non-competitive or

competitive manner, curcumin inhibits the inosine-monophosphate dehydrogenase (IMPDH) enzyme. Instead of influencing viral RNA replication, curcumin participates in viral entry and other phases of the life cycle. Curcumin may have antiviral, anti-proliferative, and anti-parasitic characteristics; hence, IMPDH should be suppressed (Faixová *et al*., 2021) [11].

Anti-Cancer activity

Turmeric's impact on carcinogenesis has been studied extensively in rat and mouse models as well as *in vitro* experiments using human cell lines. Curcumin is able to regulate three stages of carcinogenesis: angiogenesis, tumour promotion, and tumour growth, according to numerous *in vitro* studies. According to two studies on colon and prostate cancer, curcumin has an inhibitory effect on cell growth and tumour development. Turmeric and curcumin also inhibit the mutagenic and carcinogenic activity of a number of commonly found substances. The anti-carcinogenic properties of turmeric and curcumin have been linked to their direct antioxidant and free-radical scavenging effects, as well as their capacity to subtly raise glutathione levels, assisting in hepatic detoxification of mutagens and carcinogens, and preventing the formation of nitrosamine. Additionally, it has been demonstrated that curcumin reduces the UV radiation' capacity to cause mutations.

Anti-oxidant Activity

In vivo, curcumin reduces the generation of reactive oxygen species. Keeping antioxidant enzymes including catalase, glutathione peroxidase, and superoxide dismutase active recently, it has been discovered that curcumin inhibits oxidative damage during indomethacin-induced gastric lesions by directly scavenging H_2O_2 and OH in addition to inhibiting the inactivation of gastric peroxidase. Due to turmeric's strong antioxidant activity, which has been linked to the prevention of different pathological ailments, reactive oxygen species have the potential to control these illnesses.

Conclusion

Most traditional systems of medicine, particularly the Unani School of medicine, use *Curcuma longa* for its reported wealth of therapeutic virtues. The scientific research has produced enough evidence-based data to substantiate the same, based on the findings of several *in vitro* investigations, *in vivo* studies, and clinical trials. Additionally, the fact that curcumin is a safe natural chemical and is less expensive than many medications may suggest that curcumin is efficient in the management of a variety of illnesses. Even after in-depth research on this herb has been published, its considerable medical potential still remains untapped, opening the door for more study in this area.

Future Prospects

Turmeric has been employed in ayurveda medicine for several biological applications since ancient times. Researchers today are interested in using natural remedies to cure a variety of ailments. There has been some research on potential medical applications, but there hasn't been much work on drug development. A naturally occurring antioxidant molecule with a wide range of biological properties, curcumin is non-toxic and very promising. Since curcumin is now readily available in its purest form and exhibits a wide range of biological activities, it will be simpler to create new medications from this substance after thorough research on its mode of action and pharmacological effects. It is anticipated that curcumin will soon be used as a novel medicine to treat a variety of illnesses, disorders, and oxidative stress.

Reference

1. Aggarwal BB, Bhardwaj A, Aggarwal RS, Seeram NP, Shishodia S, Takada Y. Role of resveratrol in prevention and therapy of cancer: preclinical and clinical studies. Anticancer research. 2004;24(5A):2783-2840.
2. Agrawal N, Menon G, Aaker JL. Getting emotional about health. Journal of Marketing Research. 2007;44(1):100-113.
3. Akram M, Shahab-Uddin AA, Usmanghani KHAN, Hannan ABDUL, Mohiuddin E, Asif M. *Curcuma longa* and curcumin: a review article. Rom J Biol Plant Biol. 2010;55(2):65-70.
4. Ansar S, Jilani S, Abbasi H, Hashimi A, Ahmed Y, Khatoon R, *et al*. *Curcuma longa*: A treasure of medicinal properties. CELLMED. 2020;10(2):9-1.
5. Bhat SV, Amin T, Nazir S. Biological activities of turmeric (*Curcuma longa* Linn.)-an overview. BMR Microbiol. 2015;1(1):1-5.
6. Chanda S, Ramachandra TV. Phytochemical and pharmacological importance of turmeric (*Curcuma longa*): A review. Research & Reviews: A Journal of Pharmacology. 2019;9(1):16-23.
7. Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and curcumin: Biological actions and medicinal applications. Current science; c2004. p. 44-53.
8. Dhar ML, Dhar MM, Dhawan BN, Mehrotra BN, Ray C. Screening of Indian plants for biological activity: Part I; c1968.
9. Dobrowolski JW, Vohora SB, Sharma K, Shah SA, Naqvi SAH, Dandiya PC. Antibacterial, antifungal, antiamoebic, antiinflammatory and antipyretic studies on propolis bee products. Journal of ethno pharmacology. 1991;35(1):77-82.
10. Dulbecco P, Savarino V. Therapeutic potential of curcumin in digestive diseases. World journal of gastroenterology: WJG. 2013;19(48):9256.
11. Faixová D, Hrčková G, Kubašková TM, Mudroňová D. Antiparasitic effects of selected isoflavones on flatworms. Helminthologia. 2021;58(1):1-16.
12. Fuloria S, Mehta J, Chandel A, Sekar M, Rani NNIM, Begum MY, Fuloria NK. A comprehensive review on the therapeutic potential of *Curcuma longa* Linn. in relation to its major active constituent curcumin. Frontiers in Pharmacology. 2022, 13.
13. Ikpeama A, Onwuka GI, Nwankwo C. Nutritional composition of Tumeric (*Curcuma longa*) and its antimicrobial properties. International Journal of Scientific and Engineering Research. 2014;5(10):1085-1089.
14. Jyotirmayee B, Mahalik G. A review on selected pharmacological activities of *Curcuma longa* L. International Journal of Food Properties. 2022;25(1):1377-1398.

15. Kim J, Chung HK, Chae C. Association of porcine circovirus 2 with porcine respiratory disease complex. The Veterinary Journal. 2003;166(3):251-256.
16. Krup V, Prakash LH, Harini A. Pharmacological activities of turmeric (*Curcuma longa* Linn): a review. J Homeop Ayurv Med. 2013;2(133):2167-1206.
17. Kumar N, Sakhya SK. Ethnopharmacological properties of *Curcuma longa*: a review. International Journal of Pharmaceutical Sciences and Research. 2013;4(1):103.
18. Labban L. Medicinal and pharmacological properties of Turmeric (*Curcuma longa*): A review. Int J Pharm Biomed Sci. 2014;5(1):17-23.
19. Rajaonah MT. Royal Botanic Gardens, K., & Tanintsika, N. Leaflet manual on winged and wild yam cultivation; c2021.
20. Rajkumari S, Sanatombi K. Nutritional value, phytochemical composition, and biological activities of edible Curcuma species: A review. International journal of food properties. 2017;20(sup3):S2668-S2687.
21. Roll R, Ross SA. An empirical investigation of the arbitrage pricing theory. The journal of finance. 1980;35(5):1073-1103.
22. Sabale P, Modi A, Sabale V. *Curcuma longa* Linn. A phytochemical and phyto pharmacological review. Research Journal of Pharmacognosy and Phytochemistry. 2013;5(2):59.
23. Salehi B, Stojanović-Radić Z, Matejić J, Sharifi-Rad M, Kumar NVA, Martins N, Sharifi-Rad J. The therapeutic potential of curcumin: A review of clinical trials. European Journal of Medicinal Chemistry. 2019;163:527-545.
24. Shepherd KI. Why I am not a Hindu: A Sudra critique of Hindutva philosophy, culture and political economy. SAGE Publications India; c2019.
25. Soudamini KK, Kuttan R. Inhibition of chemical carcinogenesis by curcumin. Journal of ethnopharmacolog. 1989; 27(1-2):227-233.
26. Sultana S, Munir N, Mahmood Z, Riaz M, Akram M, Rebezov M, *et al*. Molecular targets for the management of cancer using *Curcuma longa* Linn. Phyto constituents: A Review. Biomedicine & Pharmacotherapy. 2021;135:111078.
27. Ungphaiboon S, Supavita T, Singchangchai P, Sungkarak S, Rattanasuwan P, Itharat A. Study on antioxidant and antimicrobial activities of turmeric clear liquid soap for wound treatment of HIV patients. Songklanakarin Journal of Science and Technology. 2005;27(2):269-578.
28. Veiga VC, Prats JA, Farias DL, Rosa RG, Dourado LK, Zampieri FG, *et al*. Effect of tocilizumab on clinical outcomes at 15 days in patients with severe or critical coronavirus disease 2019: randomised controlled trial. Bmj. 2021, 372.
29. Verma RK, Kumari P, Maurya RK, Kumar V, Verma RB, Singh RK. Medicinal properties of turmeric (*Curcuma longa* L.): A review. Int. J Chem. Stud. 2018;6(4):1354-1357.
30. Wardhani BW, Puteri MU, Watanabe Y, Louisa M, Setiabudy R, Kato M. TGF-β-induced TMEPAI attenuates the response of triple-negative breast cancer cells to doxorubicin and paclitaxel. Journal of Experimental Pharmacology. 2020;12:17.
31. Wuthi-Udomlert M, Grisanapan W, Luanratana O, Caichompoo W. Antifungal activity of *Curcuma longa* grown in Thailand. The Southeast Asian journal of tropical medicine and public health. 2000;31:178-182.
32. Zorofchian Moghadamtousi S, Abdul Kadir H, Hassandarvish P, Tajik H, Abubakar S, Zandi K. A review on antibacterial, antiviral, and antifungal activity of curcumin. BioMed research international; c2014.