

Traditional uses, Phytochemistry and Pharmacology of *Curcuma xanthorrhiza* Roxb.: A Review

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ABSTRACT

The curcuma plant is traditionally used as a medicine for heartburn, diarrhea, hemorrhoids, coughs, asthma, and canker sores. Curcuma has properties as an appetite enhancer, improves digestive function, nourishes the liver, and relieves joint and bone pain. Curcuma rhizome is nutritious because it contains chemical compounds, including curcumin, essential oils, saponins, flavonoids, alkaloids, and tannins. Pharmacologically this plant is reported as antibacterial, antimicrobial, anti-cancer, anti-fungal, anti-acne, and antioxidant.

Keywords: *Curcuma xanthorrhiza*, traditional use, phytochemical, pharmacological.

INTRODUCTION

Curcuma (*Curcuma xanthorrhiza*) is a medicinal plant belonging to the tribe Zingiberaceae. *Curcuma* comes from Indonesia, especially the Island Java, then spread to several places in the region biogeography Malaysia. Currently, most of the curcuma cultivation is in Indonesia, Malaysia, Thailand, and Philippines. This plant, apart from Asia, can be found in China, Indochina, Barbados, India, Japan, Korea, United States of America, and several countries in Europe. This plant can grow well in the lowlands to an altitude of 1500meters above sea level and habitat in tropical forests. This rhizome can grow and develop well in loose soil. ^[1]



Figure 1. *Curcuma* plant ^[1]

Herb pseudo-trunk up to more than one meter high, but less than two meters high. The pseudo trunk is a part of the leaf midrib, which are erect and overlapping, they are green or dark brown. The color of the leaves is green, or purplish-brown from light to dark leaves 31 - 84 cm long and 10 - 18 cm wide, the length of the petiole includes 43 - 80 cm strands, each is connected to the midrib, and the petiole is rather long. The flowers are dark yellow, unique, and clustered, namely inflorescences lateral, slender stalk, and scaly stripe, 9-23 cm long and 4 - 6 cm wide, with multiple protective leaves whose length exceeds or is proportional to the flower crown. The petals are white hairy, 8 - 13 mm long, tubular petals with a total length of 4.5 cm, white elongated circular flower strands with red or dice red tips, 1.25 - 2cm long, and one cm wide. ^[1]



Figure 2. Rhizome of Curcuma [2]

Rhizome fully formed and strongly branched, large, branched, and reddish-brown, dark yellow, or dark green. Each shoot from the rhizome includes 2 - 9 leaves with a round shape extending to wake lanceolate, the flesh of the rhizome is dark orange or brown, has a strong, pungent aroma and bitter taste.

Scientific classification [1]

Kingdom : Plantae
Division : Magnoliophyta
Subdivisions : Angiosperms
Class : Monocotyledonae
Order : Zingiberales
Family : Zingiberaceae
Genus : Curcuma
Species : *Curcuma xanthorrhiza*
Binominal name : *Curcuma xanthorrhiza*
Roxb

DATA COLLECTION

In compiling this review article, the technique used is to use literature studies by looking for sources or literature in the form of primary data or the form of official books and international journals in the last ten years (2010-2020). Besides, in making this review article, data search was carried out using online media with keywords, namely *Curcuma xanthorrhiza*, phytochemistry, and pharmacology. Look for the primary references used in this review article through trusted websites such as Mendeley, ScienceDirect, PubMed, NCBI, Research Gate, Google Scholar, and other published and relied on journals.

TRADITIONAL USE

The dried curcuma rhizome, when brewed with hot water, can cure liver and bile disorders. If the rhizome is grated and squeezed and then drunk, it can facilitate bowel movements and increase breast milk. [Error! Reference source not found.]

The content of compounds such as alkaloids in the curcuma rhizome candenature protein, thereby impairing enzyme activity and causing cell death. [3] Curcuma rhizome is nutritious because it contains chemical compounds, including curcumin, essential oils, saponins, flavonoids, alkaloids, and tannins. Traditionally, the curcuma rhizome is used as a treatment for heartburn, diarrhea, piles, coughs, asthma, and canker sores. [Error! Reference source not found.] Curcuma has seven properties, namely using appetite, improving digestive function, maintaining the liver function, relieving liver function, relieving joint and bone pain, reducing blood, fat, and as an antioxidant. [5]

Several quality aspects that need to be considered in making or consuming a natural product as a medicine are the heavy metal contamination of lead (Pb) and cadmium (Cd). Thick extracts or extracts derived from natural ingredients before being processed into herbal products must also meet applicable quality requirements, such as lead (Pb) and cadmium (Cd) contamination. Heavy metal contamination of lead (Pb) and cadmium (Cd) can occur in herbal medicinal products. [21]

The results of phytochemical screening tests showed that curcuma rhizome contained several compounds, namely flavonoids, alkaloids, glycosides, and triterpenoids. Compounds that are thought to be responsible for inhibiting the action of the xanthine oxidase enzyme so that it can hinder the formation of uric acid in the body, namely flavonoids. This research is an experimental study with a pre-test and post-test control group design. It can be concluded that the administration of the ethanol extract of curcuma rhizome can reduce uric acid levels with the

percentage of decreasing uric acid levels, respectively, by 19.53%, 28.80%, and 43.04%. The ethanol extract of curcuma rhizome with a dose of 200 mg/kg weight has the most optimal ability to reduce uric acid levels compared to the doses of 50 mg/kg and 100 mg/kg. [22]

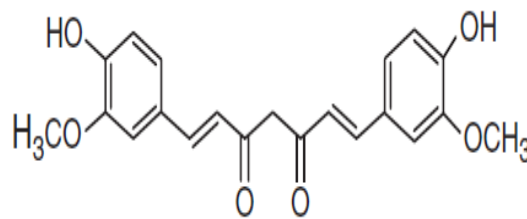


Figure 3. Chemical Structure of Curcumin

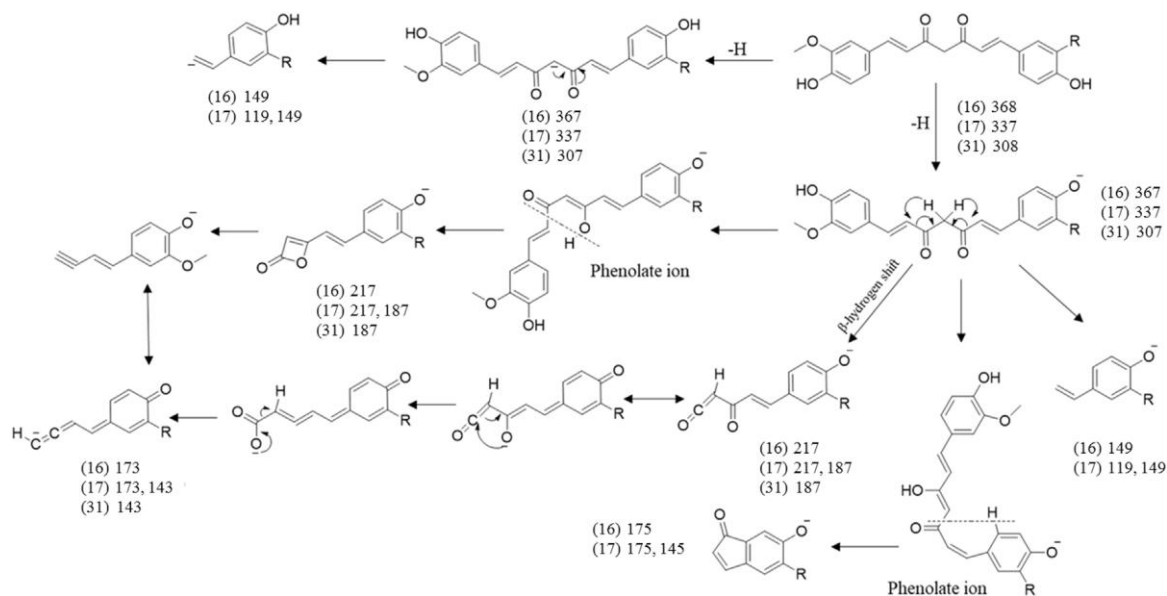
PHYTOCHEMICAL

Curcumin is a colorant in curcuma in the form of orange, yellow crystals. To find out the best condition for curcumin from curcuma, using ethanol as a solvent. The ethanol concentration variations used were 50%, 70%, and 96%. The highest curcumin content was 2,617%. Curcumin (1,-bis (4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3, 5-dion) is a yellow pigment extracted from the curcuma rhizome plant. [7]

Curcuma is very closely related to the bioactive compounds in it, especially curcuminoids. The curcuminoid structure is a group of phenolic compounds and is composed of curcumin, demethoxycurcumin, and bidesmethoxycurcumin compounds. [8]

Table 2. Curcuminoid structure

No.	Compound Name	R1	R2
1	Curcumin (C ₂₁ H ₂₀ O ₆)	O CH ₃	OCH ₃
2	Demethoxycurcumin (C ₂₀ H ₁₈ O ₅)	H	O CH ₃
3	Bisdemethoxycurcumin (C ₁₉ H ₁₆ O ₄)	H	H



Several chemical elements, such as curcumin, demethoxycurcumin, 1-hydroxy-1,7-bis (4-hydroxy-3-methoxyphenyl) -6-heptene- 3,5-dione and 1- (4-hydroxy-3,5-dimethoxyphenyl) -7- (4-hydroxy-3-methoxyphenyl) -1,6-heptadiene-3,5-dione was identified in the ethyl acetate fraction of *C. xanthorrhiza*. In addition, bidesmethoxycurcumin and 1,7-bis (4-hydroxy-3-methoxyphenyl) -heptane-3,5-diol were detected only using UPLC-MS / MS. [9]

In this research, determination of levels of lead (Pb) and cadmium (Cd) contamination using atomic absorption spectrometry is valid for samples of methanol extract and curcumarhizome (*Curcuma xanthorrhiza* Roxb.). The levels of lead contamination (Pb) in methanol extract and curcumarhizome were 2.10 ± 0.001 mg/kg and 4.34 ± 0.001 mg/kg, respectively, and cadmium (Cd) levels were not detected. [20]

PHARMACOLOGICAL EFFECTS

Antibacterial

Curcuma contains chemical compounds that have physiologically active compounds, namely curcuminoids and essential oils. Curcuminoid content in curcuma has pharmacological effects as antibacterial, anti-cancer, anti-tumor, and contains antioxidants. Curcuminoid content in curcuma ranges from 1-2%, and essential oil content in curcuma ranges from 3 - 12%. Curcuma rhizome extract is antibacterial against *Staphylococcus aureus* and *Staphylococcus epidermidis*, *Bacillus cereus*, *Streptococcus mutans*, which are gram-positive bacteria. [10]

Based on the results of the study, it can be concluded that the ethanol extract of 96% of curcuma rhizome (*Curcuma xanthorrhiza* Roxb.) can inhibit the growth of the bacteria *Staphylococcus epidermidis*. The ethanol extract of 96% curcuma rhizome (*Curcuma xanthorrhiza* Roxb.) had a significant difference in inhibition in each concentration group. The concentration of curcuma rhizome extract 25% have been able to inhibit the growth of *Staphylococcus epidermidis* bacteria, and the most massive inhibitory response lies in the curcuma rhizome extract with a concentration of 100%. The results of this study illustrate that the active ingredients in curcuma can be useful for antibiotic treatment in the future. [17]

Anti-fungal

Curcuma methanol extract has an anti-fungal function against *Candida albicans* by invitro, using a concentration of 10% curcuma methanol extract can produce an inhibition zone diameter of 16.2 mm. [11]

Anti-acne

Curcuma rhizome extract was prepared by maceration method using 95% ethanol as a solvent. An ointment is used by dissolving nipagine with PEG 400, then melting PEG 400, and mixing nipagin as a preservative. The ointment then passed several tests, including an organoleptic test,

homogeneity test, pH test, spreadability test, and protective ability test. Based on the results of the curcuma rhizome extract, it can be made into an ointment that meets the requirements for testing ointment preparations. [12]

Antimicrobial

Analysis of gas chromatography/mass spectroscopy showed that the dominant monoterpene (88.53%) in the curcuma rhizome oil (*Curcuma xanthorrhiza*). Sesquiterpenes (50.10%) is a component of the most abundant essential oil of *C. glans*. As a comparison, it was found monoterpenes (45.55%) and sesquiterpenes (45.81%) in *C. aeruginosa* by a significant amount. The main component *C. aeruginosa* is characterized as camphor (29.39%) and germakron (21.21%). Germacrone (15.76%), b-pinene (9.97%) and camphor (9.96%) were identified as the main compounds in the oil rhizome *C. glans*. The third essential oil of curcuma species have a more significant activity against gram-positive bacteria (*Staphylococcus aureus* and *Bacillus cereus*) compared with gram-negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*). The results showed that the essential oil of fresh curcuma rhizome potential as a source of natural antimicrobial agent. [13]

The antimicrobial activity of essential oil from curcuma rhizome extract has xanthorihizol, camphene and curcumene derivatives, monoterpene hydrocarbons, oxygenated monoterpenes, sesquiterpene, and hydrocarbons. The antimicrobial activity of curcuma essential oil is known to inhibit bacteria such as *Aspergillus liger* and *Fusarium oxysporum* significantly. [14]

The minimum inhibitory level cannot be determined because the higher the concentration of curcuma rhizome extracts in the tube, the more cloudy. In comparison, the minimum kill rate is a concentration level of 6.25%. The test results using one-way ANOVA showed significant differences in treatment (P = 0.000). The

higher the concentration of curcuma rhizome, the greater the ability to inhibit and kill *Staphylococcus aureus* bacteria ($r = -0,788$). Giving the concentration of curcuma extract affected decreasing the number of bacterial colonies of *Staphylococcus aureus* Perml (106) ($r^2 = 62.1\%$).^[15]

Antioxidants

The type of solvent had a significant effect on antioxidants and affected curcumin levels. Total phenol, as well as the antioxidant activity of curcuma extract, did not affect yield. The best type of solvent for curcuma extraction is ethanol, which produces 14.90% yield, 1.74% curcumin, total phenol 51.56 mgGEA/100 g sample, the antioxidant capacity of 5.49 mgGAEAC / 100g sample, and antioxidant activity IC₅₀ amounting to 51.17 mg/L.^[16]

Anticancer

Xanthorrhizol (XNT) is a kind bisabolene sesquiterpenoids compound extracted from *Curcuma xanthorrhiza* Roxb. It has been demonstrated that curcuma has a variety of biological activities such as anti-cancer, antimicrobial, anti-inflammatory, anti-oxidant, anti-hyperglycemic, anti-hypertensive, anti-platelet, nefroprotektif, hepatoprotective, estrogenic and estrogenic effects. Because many synthetic drugs have toxic side effects and are not capable of supporting the increasing prevalence of the disease, the development of natural products for the treatment of uterine stem increasing. XNT is a potent natural bioactive compounds that can meet the needs of today's new drug discovery. Regardless of its importance, a comprehensive review of the pharmacological activity XNT not yet been published in the scientific literature to date. Here, this review aims to summarize the information available in this area, focusing on anti-cancer properties, and shows the status of current research. It also can help facilitate understanding of the role of pharmacological XNT in drug discovery,

thereby suggesting areas for further study.^[18]

Anti-inflammatory

The development of anti-inflammatory agents focused on the response to the proteins involved in inflammatory disorders. The ethanol extract of rhizome of *Curcuma xanthorrhiza* standards (CE) with xanthorrhizol evaluated to demonstrate the anti-inflammatory activity in a mouse model of 5% dextran sulfate sodium (DSS) colitis-induced colitis (UC). Treatment with CE (4 or 40 mg/kg) debilitating disease activity index, shortening of the colon, histologic changes, and myeloperoxidase activity. We concluded that CE is a natural plant material which is relatively edible and non-toxic which appears to be related to dietary supplements beneficial gut, and their use can provide an alternative approach to modulate inflammation. This discovery highlights the potential of CE as a functional food products, and cost-effective phytopharmaca.^[19]

CONCLUSION

The information collected above regarding the use of Curcuma (*Curcuma xanthorrhiza*) in the world is adjusted to the available literature. This plant is used in traditional alternative medicine systems against various diseases such as asthma, malaria, fever, dysentery, diarrhea, epilepsy, skin diseases, snake bites, and others. In recent years, the use of ethnobotany and traditional natural compounds, especially those of plant origin, has received much attention because of their well-tested efficacy and generally believed to be safe for human use. All available literature on curcuma (*Curcuma xanthorrhiza*) illustrates that curcuma is a popular medicine among various tribes and traditional practitioners for the treatment of diseases. Researchers are currently exploring the plant's therapeutic potential.

BIBLIOGRAPHY

1. https://id.wikipedia.org/wiki/Temu_lawak
2. https://id.wikipedia.org/wiki/Temu_lawak
3. Rismunandar. (1988). Rempah-rempah Komoditi Ekspor Indonesia. Bandung: Penerbit SINAR BARU
4. Robinson T. Kandungan Organik Tumbuhan Tingkat Tinggi. ITB. Bandung 1991.
5. Bermawie N, Rahardjo M, Wahyuno D, Mamun. Status Teknologi Budidaya Dan Pasca Panen Tanaman Obat Dan Aromatik. Bogor. 2008: 84-97.
6. BPOM (Badan Pengawas Obat Dan Makanan). Gerakan Nasional Minum Temulawak. 2005. Infopom; 6 (6): 1-4.
7. Anggoro D, Rezki, RS. MZ S. Ekstraksi Multi Tahap Kurkumin Dari Temulawak (*Curcuma xanthoriza* Roxb) Menggunakan Pelarut Etanol. Jurnal Teknik Kimia USU. 2015; 3 (2): 39-44.
8. Sari DLN, Cahyono B, Kumoro AC. Pengaruh Jenis Pelarut Pada Ekstraksi Kurkuminoid Dari Rimpang Temulawak (*Curcuma xanthoriza* Roxb). Fakultas Teknik Kimia, Universitas Diponegoro. Semarang. 2013; 1 (1): 101-107.
9. Awin T, Buzgaia N, Ghafar SZA, Mediani A, Fauzi SMM, Maulidiani M, Shaari K, Abas F. Identification Of Nitric Oxide Inhibitor Compounds From The Rhizome Of *Curcuma xanthorrhiza*. Putra Malaysia University. Food Bioscience, 2019; 29: 126134.<https://doi.org/10.1016/j.fbio.2019.04.009>.
10. Dermawati DE. Potential Ektrack *Curcuma* (*Curcuma xanthoriza* Roxb) As Antibacterials. Faculty Of Medicine, University Of Lampung. 2015; 4 (1): 5-11.
11. Novianti D. Kemampuan Antifungi Ekstrak Rimpang Temulawak (*Curcuma xanthoriza* Roxb) Terhadap *Candida Albicans*. Fakultas MIPA, Universitas PGRI Palembang. 2016; 13 (2): 69-79.
12. Selfi PJ, Ulaen, Bane Y. Suatan RA. Pembuatan Salep Anti Jerawat Dari Rimpang Temulawak (*Curcuma xanthoriza* Roxb). 2012; 4: 45-49.
13. Akarchariya N, Sirilun S, Julsrigivsl J, Chansakaowa S. Chemical Profiling And Antimicrobial Activity Of Essential Oil From *Curcuma Aeruginosa* Roxb, *Curcuma glans* K, Larsen & J Mood And *Curcuma Cf xanthorrhiza* Roxb Collected In Thailand. Faculty Of Pharmacy, Chiang Mai University, Thailand. 2017; 7 (10): 881-885.<http://doi.org/10.1016/j.apjtb.2017.09.009>.
14. Mary HPA, Susheela GK, Jayasree S, Nizy AM, Rajagopal B, Jeeva S. Phytochemical Characterization And Antimicrobial Activity Of *Curcuma xanthorrhiza* Roxb. Asian Pacific Journal Tropical Biomedicine. India. 2012; 2: 637-640.[http://doi.org/10.1016/s2221-1691\(12\)60288-3](http://doi.org/10.1016/s2221-1691(12)60288-3).
15. Masitha AR. Efek Antimikroba Ekstrak Rimpang Temulawak (*Curcuma xanthoriza* Roxb) Terhadap Pertumbuhan *Staphylococcus aureus*. Fakultas Kedokteran, Universitas Muhammadiyah Malang. Malang. 2014; 10 (20): 138-144.
16. Wahyuningtyas SEP, Permana DGM, Wiadnyani AAIS. Pengaruh Jenis Pelarut Terhadap Kandungan Senyawa Kurkumin Dan Aktivitas Antioksidan Ekstrak Temulawak (*Curcuma xanthoriza* Roxb). Fakultas Teknologi Pertanian, Universitas Udayana. Jurnal ITEPA. 2017; 6 (2): 61-70.
17. Warmasari NWM, Ernawati DS, Indrayani AW, Sucindra NW, Dewi, Jawi IM. Antibacterial Activity From Temulawak Ekstrak (*Curcuma xanthoriza* Roxb) On Growth Inhibition Of *Staphylococcus epidermis* In Vitro. Faculty Of Medicine, Udayana University. Denpasar Bali. 2020; 5 (1): 1-7.
18. Oon SF, Nallappan M, Tsui KT, Shohaimi S, Kassim NK, Sa'ariwijaya MSF, Cheah YH. Xanthorizol A Review Of Its Pharmacological Activities And Anticancer Properties. Faculty Of Science, University Putra Malaysia. Selangor Malaysia. Cancer Cell International. 2015; 15: 1-15.<http://doi.org/10.1186/s12935015-0255-4>.
19. Cho JY, Kim HY, Kim HM, Song HN, Hong E, Hwang JK, Chun HS. Standardized Ethanolic Extract Of The Rhizome Of *Curcuma xanthorrhiza* Prevents Murine Ulcerative By Regulation Of Inflammation. Chung-Ang University. Journal Of Functional Foods, Republic Of Korea. 2017;<http://doi.org/10.1016/j.jff.2017.01.020>.
20. Hanwar d, nitoviani DE, Suhendi A. Validation Of Atomic Absorption Spectrometry Method For Contamination Determination Of Lead (Pb) And Cadmium

- (Cd) In Methanol Extract And Product Of *Curcuma xanthorrhiza* Roxb. Faculty of Pharmacy, Muhammadiyah University of Surakarta. Jurnal Kimia Dan Pendidikan Kimia. 2017; 2 (3): 198-205.
21. Hina, B. Rizwani GH, Naseem S. Determination Of Toxic Metals In Some Herbal Drugs Through Atomic Absorption Spectroscopy. Faculty Of Pharmacy, University Of Karachi, Karachi, Pakistan. 2011; 24 (3): 353-358.
22. Megawati A, Yuliana S. Uji Efek Ekstrak Etanol Rimpang Temulawak (*Curcuma xanthorrhiza* Roxb) Terhadap Penurunan Asam Urat Tikus Wistar Yang Diinduksi Potassium Oksonat Secara In Vivo. Stikes Cendikia Utama Kudus. Cendekia Journal Of Pharmacy. 2019; 3 (2): 2599-2155.

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