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USE OF CURCUMA LONGA L. AS AN HERBAL MEDICINE IN CLINICAL PRACTICE: AN INTEGRATIVE REVIEW*

USO DA CURCUMA LONGA L. COMO FITOTERÁPICO NA PRÁTICA CLÍNICA: REVISÃO INTEGRATIVA

ABSTRACT

This study comprised an integrative review of the literature on *Curcuma longa* L. aimed at analyzing its pharmacological action, mechanisms of action and therapeutic applicability. Publications made between 2014 and 2025 in PubMed, Scopus and SciELO's databases were surveyed. Results indicate that the plant, which is rich in curcuminoids, offers consistent anti-inflammatory, antioxidant, and antimicrobial properties, in addition to neuroprotective effects. It was observed that curcumin modulates pro-inflammatory cytokines and transcription factors and enzymes such as Nuclear Factor Kappa B (NF-κB) and Cyclooxygenase-2 (COX-2). In the field of oncology, the compound has demonstrated an adjuvant potential by interfering with apoptosis and angiogenesis pathways. However, the low bioavailability of curcumin, methodological heterogeneity and a lack of standardization of doses are the main limitations in consolidating the use of curcumin in clinical practice. It was concluded that, although promising, the use of turmeric requires more robust clinical trials to establish definitive therapeutic protocols.

Descriptors: Turmeric. Curcumin. herbal medicine. anti-inflammatory. general medicine.

RESUMO

O presente estudo consistiu em uma revisão integrativa da literatura sobre a *Curcuma longa* L., com o objetivo de analisar suas ações farmacológicas, mecanismos de ação e aplicabilidades terapêuticas. A busca foi realizada nas bases de dados PubMed, Scopus e SciELO, abrangendo publicações entre 2014 e 2025. Os resultados indicam que a planta, rica em curcuminoides, apresenta propriedades anti-inflamatórias, antioxidantes, antimicrobianas e neuroprotetoras consistentes. Observou-se que a curcumina atua na modulação de citocinas pró-inflamatórias e fatores de transcrição e enzimas como Fator Nuclear Kappa B (NF-κB) e Ciclo-oxigenase-2 (COX-2). No campo oncológico, o composto demonstra potencial adjuvante ao interferir em vias de apoptose e angiogênese. Contudo, a baixa biodisponibilidade da curcumina, a heterogeneidade metodológica e a ausência de padronização de doses configuram-se como as principais limitações para sua consolidação na prática clínica. Conclui-se que, embora promissora, a utilização da cúrcuma demanda ensaios clínicos mais robustos para o estabelecimento de protocolos terapêuticos definitivos.

Descritores: Cúrcuma; Curcumina; fitoterapia; anti-inflamatórios; medicina geral.

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1 INTRODUCTION

Curcuma longa L., which belongs to the Zingiberaceae family, is an herbaceous plant used in both foods and traditional medicine. Its main bioactive compound, curcumin, has attracted increasing scientific interest due to its anti-inflammatory, antioxidant, antimicrobial, and antineoplastic properties, as well as its neuroprotective effects. Curcumin has a wide range of pharmacological properties, which include multiple molecular pathways linked to inflammation, oxidative stress, apoptosis and cell proliferation¹.

Additionally, recent studies demonstrate that curcumin exerts modulatory effects on pro-inflammatory cytokines, transcription factors, and enzymes involved in the inflammatory cascade, such as Nuclear Factor Kappa B (NF- κ B), Cyclooxygenase-2 (COX-2), and Tumor Necrosis Factor Alpha (TNF- α). Curcumin determines multiple molecular targets, which in turn reduces the expression of inflammatory mediators and attenuates pathological processes associated with chronic diseases². Similarly, studies have shown that curcumin is capable of regulating inflammatory mediators, thus corroborating its therapeutic potential in diseases with an inflammatory profile³.

In addition to its anti-inflammatory effects, phytochemical analyses demonstrate that *Curcuma longa* L. rhizome is rich in curcuminoids (curcumin, demethoxycurcumin and bisdemethoxycurcumin), phenolic compounds, and flavonoids, which are responsible for its high antioxidant activity. Additionally, the *Curcuma longa* L.'s ethanol extract showed a high concentration of phenolic compounds related to the intense antioxidant activity and inactivation of α -glucosidase⁴.

The application of curcumin in the prevention and adjuvant treatment of metabolic, cardiovascular, gastrointestinal and oncological diseases is also relevant. Curcumin's pleiotropic effects make it a promising candidate for clinical applications in several human pathologies⁵.

Within this context, the intersection between classic and current studies reinforces this herbal medicine's broad spectrum of pharmacological application. Turmeric's main components, including curcumin, demethoxycurcumin and bisdemethoxycurcumin, present relevant anti-inflammatory, antioxidant, and antimicrobial properties, as well as anticancer activity⁶. In a similar manner, there are different pharmacological activities attributed to *Curcuma longa* L., which have hepatoprotective, neuroprotective, antidiabetic and gastroprotective effects. These findings are supported by experimental and clinical evidence⁷.

This study involved a review of existing literature on *Curcuma longa* L., focusing on its main pharmacological action, mechanisms of action, phytochemical composition and therapeutic applicability. The available scientific evidence, as well as its clinical limitations, were also discussed.

2 METHODOLOGY

An integrative literature review of PubMed, Scopus and SciELO's databases was performed. These databases were surveyed according to the PICO⁸ strategy, and the following elements were defined:

P (Patient/Issue): individuals undergoing therapy with *Curcuma longa* L.;

I (Intervention): use of *Curcuma longa* L. (curcumin or turmeric) as a therapeutic agent;

C (Comparison): placebo or absence of treatment with turmeric;

O (Outcome): clinical efficacy, safety and therapeutic applicability.

The question guiding this strategy was "Does scientific evidence exist of *Curcuma longa* L.'s biological activities, and what is its clinical efficacy, safety and therapeutic applicability?"

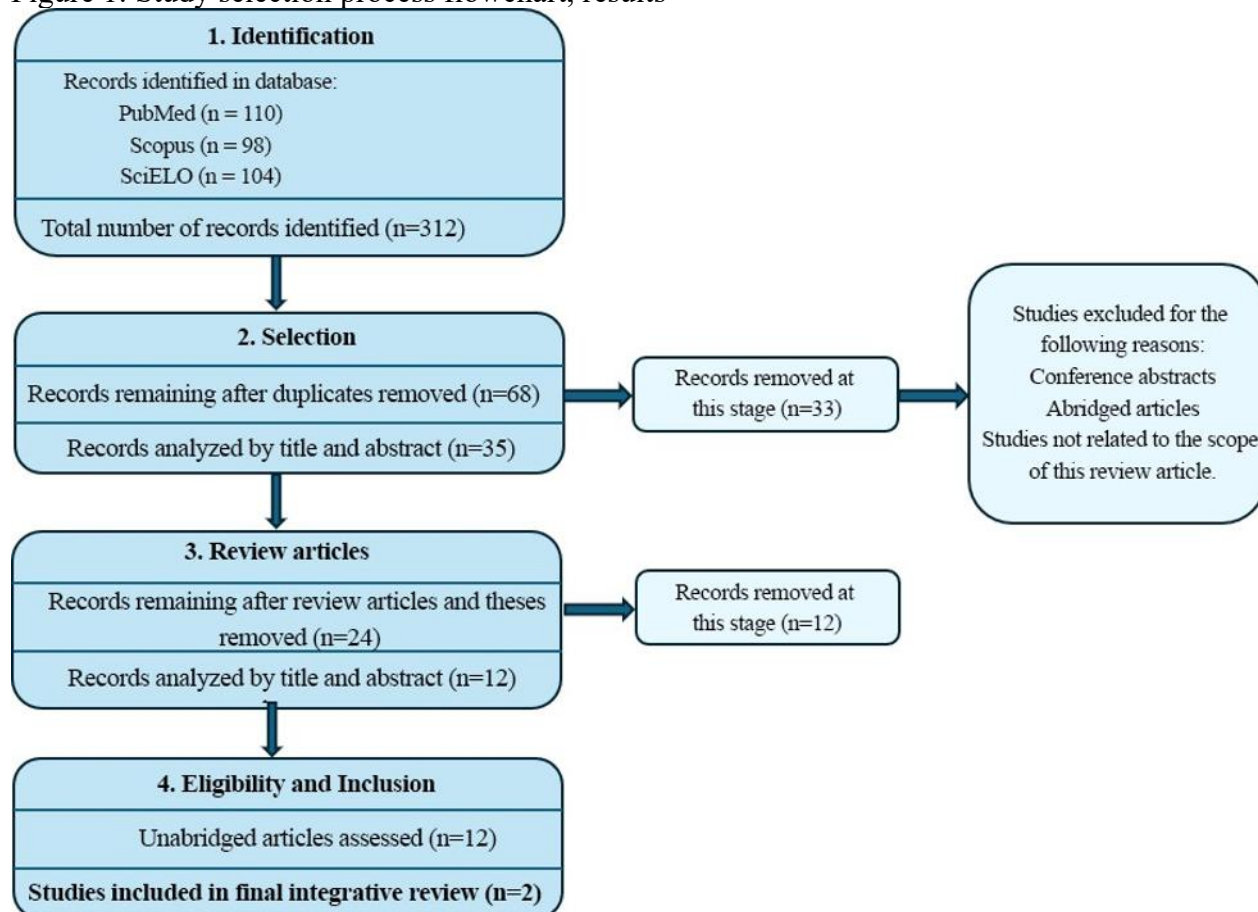
This survey strategy used controlled and uncontrolled descriptors that were combined with Boolean operators (AND, OR), including the terms: "*Curcuma longa*", "curcumin", "turmeric", "phytotherapy", "medicinal plants" and "clinical trial". Articles addressing the efficacy, safety and clinical applicability of turmeric published between 2014 and 2025 in Portuguese and English were included. Conference abstracts, abridged articles, and papers that did not directly address the clinical efficacy, safety or therapeutic applicability of *Curcuma longa* L. were excluded to remove any duplicate studies.

3 RESULTS

The selection of studies for this integrative review was structured across four stages, starting with the identification of 312 records in the PubMed (n=110), Scopus (n=98) and SciELO's (n=104) databases. Once duplicates were removed, 68 articles were screened by title and abstract, which resulted in the exclusion of 33 records. An additional 12 articles were removed since they comprised review articles or theses. 35 articles were sent for detailed analysis (titles and abstracts). During the eligibility phase, 12 articles were evaluated in full, 10 of which were excluded since they comprised conference abstracts, the full text was unavailable or they did not directly address *Curcuma longa* L.'s efficacy, safety and applicability. After the

eligibility process was complete, 2 studies met the inclusion criteria and composed the final review sample, as shown in Figure 1.

Figure 1: Study selection process flowchart, results



Source: Authors of the study, 2025.

The final sample consisted of 2 articles published between 2020 and 2025. With regards to methodological design, review studies, including narrative, systematic and umbrella reviews with levels of evidence ranging from moderate to high were prevalent, followed by experimental studies and randomized clinical trials, which presented a high level of evidence.

As a result, in order to present the results of this review in an organized manner, a summary table was prepared (Table 1), which gathers relevant information from the selected studies, including their methodologies and main considerations.

Table 1: Summary of studies evaluated for the application of curcumin in phytotherapy

AUTHOR YEAR	TITLE	METHODOLOGY	CONSIDERATIONS
Sabir SM, Zeb A, Mahmood M, Abbas SR, Ahmad Z, Iqbal N. 2021	Phytochemical analysis and biological activities of ethanolic extract of <i>Curcuma longa</i> rhizome	Experimental study comprising phytochemical analysis and in vitro biological tests.	Confirmed the presence of bioactive compounds with antioxidant and anti- inflammatory properties.
Perez A, Martinez-Correa HA., Parada-Alfonso F, Suárez Montenegro ZJ, Ballesteros-Vivas D, Álvarez-Rivera G, Cifuentes A, Ibáñez E. 2025	Antioxidant, neuroprotective and anti-inflammatory activity of <i>Curcuma longa</i> extracts: from green extraction to nanoemulsion	Experimental study into nanoemulsion.	Demonstrated improved bioavailability and enhanced therapeutic potential.

Source: Authors of the study, 2025.

4 DISCUSSION

Experimental tests performed using High Performance Liquid Chromatography (HPLC) analysis demonstrate that the ethanolic extract of *Curcuma longa* L. rhizome revealed the presence of phenolic compounds such as curcumin, demethoxycurcumin and bisdemethoxycurcumin⁴. In vitro assays performed during the study demonstrated relevant biological activity, especially with regard to antioxidant and antidiabetic properties. Phenolic compounds are widely recognized in the literature for their pharmacological properties, including antioxidant, anti-inflammatory and metabolic action¹⁰. The antioxidant activity observed stems from the ability of phenolic compounds to act as electron or hydrogen donors, which neutralizes reactive oxygen species and reduces oxidative stress¹¹. The results obtained during the DPPH assay therefore indicate high free radical scavenging capacity and corroborate previous findings that associate *curcuma longa* with potent antioxidant activity¹². With respect to antidiabetic activity, inhibition of the enzyme alpha-glucosidase represents an important therapeutic mechanism since this enzyme is involved in carbohydrate digestion and glucose absorption. Inhibition of this enzyme contributes to the reduction of postprandial glucose levels, which is a widely used strategy in the control of diabetes mellitus¹³. The results observed in this study indicate that ethanolic extract has a significant inhibitory effect on this enzyme, which indicate its potential as an auxiliary agent in the management of hyperglycemia. It is important

to note that, according to the literature, oxidative stress plays a fundamental role in the pathophysiology of diabetes and its complications, which can indirectly contribute to glycemic control and the prevention of tissue damage¹⁴. However, despite these promising results, certain limitations must be considered. Firstly, this study was conducted exclusively *in vitro*. Additionally, aspects such as bioavailability, metabolism and possible adverse effects were not evaluated. The literature highlights that curcumin presents a low oral bioavailability, which may compromise its clinical efficacy¹⁵. Another relevant factor concerns variability in plant extracts' phytochemical composition, which can be influenced by factors such as geographical origin, environmental conditions and extraction methods. This variability can directly impact the standardization and reproducibility of results, making their clinical application difficult¹⁶.

By applying the combination of two green extraction techniques, researchers obtained a significant increase in bioactive compounds present in *Curcuma longa* L., which directly impacted an increase in the intensity of effects on biological activities⁹. The high concentration of phenolic compounds and curcuminoids resulting from the extraction techniques applied are directly associated with increased antioxidant activity, as demonstrated in the *in vitro* tests carried out during the study. These results corroborate evidence from the literature indicating that phenolic compounds play a fundamental role in the neutralization of free radicals and the reduction of oxidative stress and are essential in the prevention of chronic diseases¹¹. The inhibition of the enzyme acetylcholinesterase (AChE) observed in the study represents a relevant finding since this enzyme is directly involved in the degradation of acetylcholine, an essential neurotransmitter for cognitive function. AChE inhibition is one of the main therapeutic strategies used in the treatment of neurodegenerative diseases, such as Alzheimer's disease. These results therefore suggest that *Curcuma longa* L.'s extracts may potentially be used as natural neuroprotective agents. Additionally, the anti-inflammatory activity demonstrated by the inhibition of the enzyme lipoxigenase (LOX) reinforces the plant's therapeutic potential, given that this enzyme is associated with the production of inflammatory mediators and the progression of inflammatory and neurodegenerative diseases. The literature suggests that chronic inflammation is closely related to the development of several pathologies, including cardiovascular, metabolic and neurological diseases¹⁵. Curcuminoids' intrinsic limitations, especially with regard to their low bioavailability, reduced solubility and instability under certain physical and chemical conditions suggest that nanoemulsions may emerge as a promising strategy since they improve these compounds' solubility, stability and bioavailability. These results demonstrate that the stability of the developed nanoemulsion remained consistent over time, indicating potential for application in the pharmaceutical industry. Despite these promising

results, certain limitations must be considered. As seen in the previous study, the majority of analyses were performed in vitro, which limits the direct extrapolation of results to complex biological systems. Furthermore, although the nanoemulsion demonstrated physical and chemical stability, pharmacokinetic-related aspects or clinical effects were not evaluated, which is fundamental for therapeutic validation. Additionally, mentions of variability in extracts' chemical composition in the previous article must be considered.

5 CONCLUSION

Based on the studies analyzed in full, it was determined that *Curcuma longa* L. presents relevant potential as a source of bioactive compounds with antioxidant and antidiabetic properties and application in diseases associated with oxidative stress, inflammation and neurodegeneration. Green extraction techniques were also highlighted for their greater efficiency, selectivity and sustainability compared to conventional methods. However, their clinical application will depend on the presentation of more robust evidence, which requires in vivo studies, clinical trials and the development of formulations to increase curcumin's bioavailability

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