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Turmeric (*Curcuma longa*) -Herbal Remedies in Neurodegenerative Disorders

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Abstract: Turmeric is obtained from the dried rhizome of *Curcuma longa* L., also known as *Curcuma domestica* Valeton, a perennial plant belonging to the family Zingiberaceae. It is widely cultivated in countries such as India, China, Sri Lanka, Indonesia, and Peru. The rhizome exhibits a characteristic yellowish-brown color due to the presence of curcuminoids, which are responsible for turmeric's distinctive pigmentation. Turmeric has a distinct aroma and a slightly bitter taste. The major bioactive constituent of turmeric is curcumin, which accounts for approximately 50–60% of its total composition, along with volatile oils and resins that constitute about 5%. Historically, turmeric has played a significant role in traditional medicinal systems of East Asia, including Traditional Chinese Medicine and Indian systems such as Ayurveda. In India, turmeric has been used for centuries to manage disorders related to the skin, upper respiratory tract, and digestive system. The extensive historical use of turmeric in traditional healing practices has prompted modern scientific investigations into its therapeutic potential. Recent studies have focused on its possible role in the prevention and management of neurodegenerative diseases, which are characterized by the progressive loss of structure and function of neurons, ultimately leading to neuronal death. Neurodegeneration is commonly associated with factors such as chronic neuroinflammation, metabolic dysfunction, genetic predisposition, and the accumulation of insoluble protein aggregates. Curcumin, the principal active component of turmeric, exhibits notable neuroprotective and cognitive-enhancing properties, suggesting its potential in slowing the progression of neurodegenerative disorders such as Alzheimer's and Parkinson's diseases. However, pharmacokinetic studies indicate that curcumin undergoes rapid metabolism and systemic elimination, resulting in poor bioavailability, which remains a major limitation for its clinical application.

Keywords: Turmeric, Curcumin, Neuroprotective, Neurodegenerative diseases, Phytochemistry, Anti-inflammatory, Anti-oxidant.

1. Introduction

Since ancient times, humans have relied on nature as a primary source of remedies for maintaining health and treating diseases [1]. Herbal medicines are therapeutic preparations that contain active compounds derived from various plant parts, including leaves, roots, rhizomes, and flowers [2]. In recent years, the use of herbal medicines has increased significantly due to their generally good tolerability and lower incidence of severe adverse effects. Herbal remedies form a core component of traditional medical practices across diverse cultures worldwide [3]. India has a rich heritage of herbal medicine use within its officially recognized traditional healthcare systems, including Ayurveda, Yoga, Naturopathy, Unani, Siddha, and Homeopathy, which coexist alongside allopathic medicine [4]. Among medicinal plants, turmeric has been valued for its therapeutic properties for approximately 4,000 years (**Figure 1**). In addition to its medicinal applications, turmeric is a widely used culinary spice and holds cultural and religious significance in Southeast Asia. It is commonly referred to as “Indian saffron” due to its bright yellow color. Over the past 25 years, more than 3,000 scientific studies have been published on turmeric, highlighting its growing importance in modern medicine [5].

Figure 1: Turmeric.

Turmeric exhibits a wide range of pharmacological activities, including digestive support, antibacterial and antiviral effects, anti-inflammatory action, inhibition of tumor growth, antioxidant activity through free radical scavenging, and antiseptic properties [6]. Furthermore, turmeric has shown potential in the prevention and management of neurodegenerative diseases [7]. In India, turmeric is highly valued not only as a medicinal agent but also as a key culinary spice, a natural food preservative, and a coloring agent [8]. It is known by several names, including curcumin, Curcuma, and *Curcuma aromatica* [9]. In northern regions of India, turmeric is commonly referred to as “haldi” [5]. Turmeric is generally considered safe and well-tolerated. However, some individuals may experience mild adverse effects such as gastrointestinal discomfort, nausea, dizziness, or diarrhea. In rare cases, excessive consumption—particularly doses exceeding 1,500 mg twice daily—has been associated with serious adverse effects, including dangerous cardiac arrhythmias [10].

1.1 Biological Source

The biological source of turmeric is *Curcuma longa* Linn., also known as *Curcuma domestica*, a perennial plant belonging to the family Zingiberaceae. Turmeric is obtained from both the fresh and dried rhizomes (underground stems) of the plant. The rhizomes contain not less than 1.5% of curcumin, the principal bioactive constituent responsible for the therapeutic properties of turmeric [11].

1.2 Geographical Source

Turmeric is believed to have originated in South or Southeast Asia, particularly in regions such as India, China, and Vietnam. It is a fully domesticated plant and is not known to occur in the wild. India is the largest producer, consumer, and exporter of turmeric; however, it is also widely cultivated in several other countries, including Cambodia, Bangladesh, Nepal, Indonesia, Thailand, and Malaysia. The turmeric plant requires warm climatic conditions with abundant rainfall for optimal growth and can reach a height of up to one meter. It thrives in both tropical and subtropical regions worldwide [12].

1.3 Botanical characterization

Curcuma longa is characterized by sterile flowers that exhibit a pale yellow color with a reddish tinge, while the flowering bracts are green with a slight purple hue. The plant is primarily cultivated for its rhizome, which has a rough, segmented surface. The rhizome typically measures 2.5–7.0 cm in length and approximately 2.5 cm in width and is distinguished by its characteristic aromatic odor and bitter taste [13]. The genus Curcuma comprises approximately 42 species. Among these, *C. longa* is extensively cultivated across large regions of Andhra Pradesh (A.P.), India. Another important species, *Curcuma aromatica*, is locally grown in certain areas where it is commonly known as “kasturi.” This species is traditionally used in the preparation of “kumkum,” a ceremonial powder of cultural and religious significance [14].

2. Historical Use and Traditional Knowledge

Turmeric, a spice of profound religious and cultural significance, has been an integral part of Vedic culture in India for approximately 4,000 years. Historical evidence suggests that turmeric spread to China by around 700

AD, reached East Africa by 800 AD, and West Africa by 1200 AD. By the eighteenth century, it had been introduced to Jamaica [5]. According to the Ayurvedic compendium authored by Susruta, the medicinal use of turmeric can be traced back to as early as 250 BC, where it was applied in the form of a salve to counteract the effects of food poisoning. In Southeast Asia, turmeric has long been a staple in culinary traditions and has also played a vital role in religious and cultural rituals [15]. Turmeric occupies a place of special reverence in Hindu traditions. One notable example is the Haldi ceremony, a pre-wedding ritual in which a paste of turmeric is applied to the bride and groom. This practice is believed to bring good fortune and is traditionally performed to enhance, lighten, and balance skin tone before the wedding. Beyond its ceremonial use, turmeric has been widely employed as a cosmetic agent, particularly among Indian women, for skin brightening purposes.

In traditional Chinese medicine, turmeric is used for the management of abdominal disorders, while classical Ayurvedic texts recommend its application for the treatment of sprains and inflammatory conditions. Similarly, Unani medicine utilizes turmeric to expel phlegm (kapha) and promote vasodilation, thereby improving blood circulation [5]. In addition to its medicinal and cultural significance, turmeric has an extensive history as a culinary spice and dietary supplement. It is commonly used to enhance the flavor, color, and shelf life of food products due to its distinctive yellow pigmentation, taste, and antioxidant properties. In recent years, increasing scientific research has focused on turmeric, revealing several novel health benefits. Numerous studies suggest that curcumin, the principal bioactive compound of turmeric, may be effective in managing oxidative stress and inflammatory disorders, anxiety, arthritis, metabolic syndrome, and hyperlipidemia. Furthermore, curcumin has been shown to reduce exercise-induced inflammation and muscle soreness, thereby improving recovery and enhancing physical performance in active individuals [16].

3. Phytochemical Properties of Turmeric

Turmeric, scientifically known as *Curcuma longa*, is rich in a wide range of phytochemicals. Chemical evaluations, including qualitative phytochemical screening, have been carried out to identify the presence of various bioactive constituents in the powdered raw drug. Preliminary phytochemical analyses of aqueous, acetone, ethanolic, chloroform, and methanolic extracts of *Curcuma longa* rhizomes were performed using standard precipitation and colorimetric reactions. Numerous studies conducted by different researchers have confirmed the presence of several phytochemical groups, including proteins, carbohydrates, tannins, flavonoids, alkaloids, glycosides, terpenes, steroids, and saponins [17]. Chemically, turmeric comprises multiple components, including approximately 5% volatile oil, resin, a considerable amount of zingiberaceous starch granules, and yellow pigments collectively known as curcuminoids. Among these, curcumin is the principal constituent, accounting for about 50–60% of the total curcuminoid content. In general, species of the genus Curcuma contain volatile oils, starch, and curcumin as their major chemical constituents. Curcumin and its related curcuminoids—demethoxycurcumin and bisdemethoxycurcumin—not only impart the characteristic yellow color to turmeric but are also responsible for its wide range of therapeutic activities (**Figure 2**). Curcumin is a hydrophobic compound and is soluble in organic solvents such as dimethyl sulfoxide, acetone, ethanol, chloroform, and oils, but it is insoluble in water. The volatile oil content of turmeric varies from approximately 1% to 6.5% and consists mainly of mono- and sesquiterpenes, including α- and β-pinene, α-phellandrene, camphor, camphene, DL-ar-turmerone, zingiberene, and α- and β-curcumene [11, 18].

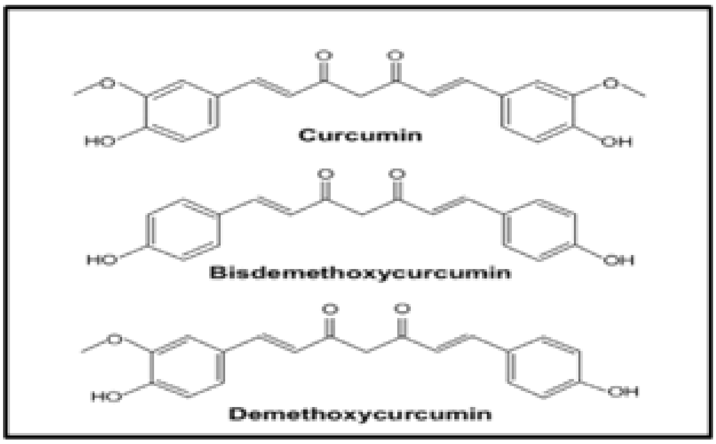

Figure 2: Chemical structure of phytochemical constituents.

4. Pharmacological Properties

Curcumin, chemically known as 1,7-bis-(4-hydroxy-3-methoxyphenyl)-1,6-heptadiene-3,5-dione, is the principal polyphenolic bioactive compound responsible for the diverse biological activities of turmeric. Curcumin was first isolated from turmeric in 1815; however, its complete chemical structure was elucidated much later, in 1913. Curcumin is insoluble in water but exhibits good solubility in organic solvents such as ethanol and acetone. In its natural form, curcumin exists as a mixture of curcuminoids, comprising approximately 80% curcumin, 15% demethoxycurcumin, and 5% bisdemethoxycurcumin [19]. The various pharmacological properties of turmeric are illustrated in **Figure 3**.

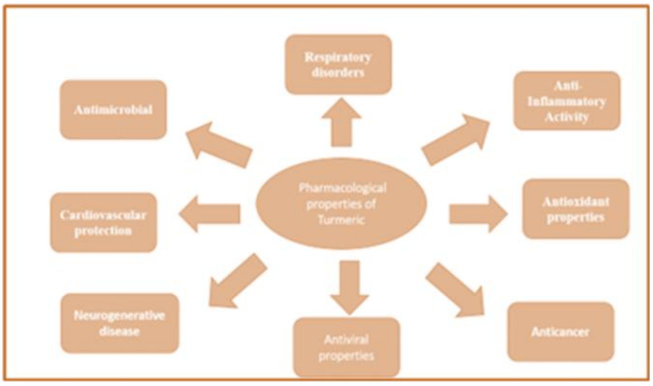

Figure 3: Pharmacological properties of turmeric.

4.1 Respiratory disorders

The active constituents of *Curcuma longa*, particularly curcuminoids and curcumin, have been reported to exhibit therapeutic properties that help alleviate symptoms of asthma [20]. Numerous experimental studies using animal models have investigated the effects of curcumin on pulmonary fibrosis. Findings from these studies suggest that curcumin may reduce lung injury and fibrosis induced by radiation exposure, chemotherapeutic agents, and various toxic substances. Furthermore, accumulating evidence from pharmacological investigations and animal studies indicates that curcumin may exert protective effects in several respiratory conditions, including acute lung injury, allergic asthma, acute respiratory distress syndrome (ARDS), and chronic obstructive pulmonary disease (COPD). These therapeutic effects are primarily attributed to curcumin's ability to modulate inflammatory pathways and attenuate oxidative stress [21].

4.2 Anti-Inflammatory Activity

Curcumin, a major bioactive constituent of turmeric, has long been recognized for its anti-inflammatory properties in traditional Asian medicinal systems [22]. A substantial number of preclinical and clinical studies have examined its effects across a wide range of inflammatory disorders. Major areas of investigation include inflammatory bowel disease, arthritis, psoriasis, depression, atherosclerosis, and coronavirus disease (COVID-19) [23]. Curcumin exerts its anti-inflammatory effects by attenuating inflammatory responses in human endothelial cells stimulated by tumor necrosis factor-α (TNF-α). This activity is primarily mediated through the inhibition of the nuclear factor kappa B (NF-κB) signaling pathway. In addition, curcumin has been shown to suppress the activity of platelet-derived growth factor (PDGF), further contributing to its anti-inflammatory and anti-proliferative effects [19].

4.3 Antioxidant properties

Curcumin, in its purified form, exhibits strong antioxidant properties. It has been shown to reduce serum levels of malondialdehyde (MDA) and may enhance total antioxidant capacity (TAC). The antioxidant effects of curcumin on oxidative stress markers are attributed to its ability to scavenge reactive oxygen and nitrogen species, chelate metal ions, and regulate the activity of various antioxidant and pro-oxidant enzymes [24]. In addition to curcumin, turmeric contains other bioactive compounds, particularly in its leaves, which are rich in phenolic compounds and flavonoids. These constituents are well known for their antioxidant potential, primarily due to their strong free radical–scavenging activity [25].

4.4 Anticancer

Curcumin exhibits both chemopreventive and therapeutic potential against various types of cancer. It has been shown to inhibit the expression of cyclin D1 in several malignancies, including cancers of the head and neck, colon, bladder, breast, cervix, and pancreas. This effect is largely attributed to curcumin's ability to suppress the activation of nuclear factor kappa B (NF-κB), thereby downregulating the expression of downstream oncogenic genes [26]. Extensive scientific evidence indicates that the co-administration of curcumin with conventional chemotherapeutic agents enhances the efficacy of both chemotherapy and radiotherapy. This synergistic interaction contributes to prolonged patient survival, increased expression of anti-metastatic proteins, and a reduction in the adverse side effects commonly associated with cancer treatments [27].

4.5 Antiviral properties

Curcumin, the principal bioactive constituent of turmeric, has demonstrated broad-spectrum antimicrobial activity, effectively inhibiting the growth and proliferation of a wide range of microorganisms, including bacteria, fungi, and viruses [28]. In particular, curcumin has been reported to exert protective effects against several clinically significant viruses, including human immunodeficiency virus (HIV), hepatitis C virus (HCV), Influenza A virus, and severe acute respiratory syndrome coronavirus (SARS-CoV) [29].

4.6 Neurodegenerative disease

Neurodegenerative diseases (NDs) comprise a group of disorders characterized by progressive dysfunction and eventual loss of nerve cells. Common examples include multiple sclerosis (MS), Alzheimer's disease (AD), and Parkinson's disease. *Curcuma longa* (turmeric) is well recognized for its potent antioxidant and anti-inflammatory properties, which make it a promising therapeutic candidate for the management of neurodegenerative disorders. In neurodegenerative diseases, elevated levels of proinflammatory cytokines play a crucial role in enabling the host to respond to various insults, such as stress, injury, infection, and pathological conditions involving protein aggregation and mitochondrial dysfunction. Persistent neuronal damage activates microglia and astrocytes, leading to the sustained release of proinflammatory cytokines. These mediators recruit immune cells to the affected regions, resulting in chronic neuroinflammation and progressive neuronal injury. Due to its pronounced anti-inflammatory activity, turmeric has attracted considerable attention as a potential therapeutic agent for the prevention and treatment of neurodegenerative diseases [30].

4.7 Cardiovascular protection

Cardiovascular diseases (CVDs) remain a leading cause of mortality worldwide. Aging and obesity, which are major risk factors for CVDs, are increasingly prevalent public health concerns. Curcumin has emerged as a promising nutraceutical for the prevention and management of cardiovascular disorders associated with aging. Its anti-aging effects are thought to result from its ability to modulate cellular aging processes within the cardiovascular system through multiple mechanisms. In addition to aging, obesity and dysfunction of white adipose tissue (WAT) play a critical role in the development of cardiovascular diseases. Recently, natural plant-derived compounds have gained attention for their potential in novel anti-obesity strategies. Curcumin has been shown to enhance fatty acid oxidation, inhibit lipogenesis, suppress the differentiation of preadipocytes into mature adipocytes, and induce apoptosis in adipose cells. These actions suggest that curcumin may help prevent the excessive expansion and hypertrophy of WAT, which are early events in obesity-related cardiovascular pathogenesis [31].

5. Neuroprotective Effects of Turmeric: Clinical Evidence

Curcumin, the primary bioactive compound in turmeric, has gained worldwide recognition for its potent antioxidant, anti-inflammatory, anticancer, and antimicrobial properties. In recent years, increasing attention has been given to its potential in preventing or slowing the progression of neurodegenerative diseases. Several studies have highlighted the neuroprotective effects of curcumin [32]. These effects are attributed to its anti-inflammatory, antioxidant, and anti-protein aggregation properties. A variety of animal studies have demonstrated curcumin's beneficial impact on neurodegenerative disorders. For example, regular dietary intake of turmeric provided neuroprotection in a Parkinson's disease mouse model [33]. Similarly, a study conducted at UCLA investigated curcumin's effect on macrophages' ability to clear amyloid plaques, a hallmark of Alzheimer's disease (AD). In this study, blood-derived macrophages from nine participants—six with AD and three healthy controls—were treated with curcumin before exposure to β-amyloid. Macrophages from AD patients treated with curcumin exhibited enhanced uptake and clearance of amyloid plaques compared to untreated cells, suggesting that curcumin may improve the immune system's capacity to remove amyloid proteins [34-35]. Another study evaluated the neuroprotective effects of curcumin in an AD mouse model and in vitro. AD-like conditions were induced in mice, followed by curcumin treatment, resulting in significant improvements in memory performance, as assessed by the step-through test. Curcumin also reduced neuropathological changes in the hippocampus and inhibited apoptosis.

Mechanistically, this effect was associated with an increase in Bcl-2, an anti-apoptotic protein, while levels of Bax, a pro-apoptotic protein, remained unchanged. In vitro experiments using PC12 cells exposed to $AlCl_3$—a compound that induces AD-like conditions—showed reduced cell viability, which was reversed by curcumin treatment. Curcumin increased cell survival and decreased apoptosis, correlating with elevated Bcl-2 levels. These findings suggest that curcumin may protect neurons and improve cognitive function by inhibiting apoptosis, potentially via Bcl-2 upregulation [36]. Clinical evidence also supports the neuroprotective potential of turmeric. In one case study, an 83-year-old woman with progressive dementia, whose symptoms began at age 76, including memory loss, disorientation, and impaired daily functioning, showed significant improvement after turmeric supplementation. Despite previous treatment with an acetylcholinesterase inhibitor and Yokukansan (a traditional Japanese medicine), her cognitive decline continued. At age 83, her Mini-Mental State Examination (MMSE) score was 1/30, and cerebral MRI revealed symmetrical bilateral temporal atrophy. After 12 weeks of turmeric treatment (764 mg/day, including 100 mg/day of curcumin), improvements were observed in both symptom severity and caregiver burden, as measured by the Japanese version of the Neuropsychiatric Inventory-Brief Questionnaire (NPI-Q). After more than one year, she regained recognition from family members and displayed a noticeable improvement in daily functioning, with no significant behavioral or psychological symptoms of dementia (BPSD). This case highlights the potential neuroprotective effects of turmeric in patients with dementia [37].

6. Mechanisms of Action in Neurodegenerative Disorders

The accumulation of misfolded proteins in the endoplasmic reticulum (ER) and their subsequent aggregation trigger ER stress and inflammation. This pathological process results in the deposition of toxic proteins in body tissues, particularly in the brain, contributing to the onset and progression of neurodegenerative diseases [38]. Curcumin, a bioactive compound in *Curcuma longa*, is a multifunctional molecule that not only directly interacts with misfolded proteins to limit their accumulation but also modulates the inflammatory response. It facilitates the clearance of toxic protein aggregates from the brain, scavenges free radicals, chelates iron, and activates antioxidant response elements. Although curcumin affects multiple cellular pathways, its effects are often mediated through a limited number of molecular targets. Evidence suggests that *Curcuma longa* has potential in preventing or mitigating a variety of neurodegenerative disorders [32]. In Alzheimer's disease (AD), curcumin targets the two major pathological hallmarks: amyloid-β (Aβ) plaques and tau protein tangles. The formation and accumulation of Aβ plaques are central to AD pathology, and studies indicate that curcumin can inhibit both their generation and aggregation, suggesting a potential role in slowing disease progression. Excessive phosphorylation of tau proteins and their aggregation into neurofibrillary tangles are also critical contributors to AD development. Curcumin has been shown to prevent tau hyperphosphorylation and associated neurotoxicity. Glycogen synthase kinase-3 (GSK-3) is an enzyme responsible for adding phosphate groups to serine and threonine residues on tau, and its overactivity promotes tau pathology. Curcumin acts as a GSK-3 inhibitor, thereby offering neuroprotection against tau-induced toxicity and highlighting its therapeutic potential in managing Alzheimer's disease [39].

7. Pharmacokinetic Properties of Turmeric

The bioavailability of curcumin is limited due to its poor gastrointestinal absorption, rapid metabolism, short systemic half-life, and low water solubility [40]. Various pharmacokinetic studies have investigated the absorption, distribution, metabolism, and excretion of curcumin in both animals and humans. Over the past three decades, at least ten studies have examined these parameters in rats, consistently indicating that curcumin undergoes rapid and extensive metabolism, which significantly reduces the systemic availability of the parent compound [41]. In animal studies, oral administration of curcumin has demonstrated limited bioavailability, primarily due to poor absorption and fast metabolic clearance. For example, following an oral dose of 500 mg/kg in rats, the peak plasma concentration of curcumin reached only 1.8 µg/mL.

Additionally, after intravenous administration of 40 mg/kg, curcumin was almost eliminated from plasma within one hour. The rapid metabolism of curcumin occurs via two primary pathways. In Phase II conjugation, curcumin is converted into curcumin glucuronide and curcumin sulfate, whereas Phase I enzymatic reduction leads to the formation of dihydrocurcumin, tetrahydrocurcumin, hexahydrocurcumin, and hexahydrocurcumin. These metabolic processes substantially limit the bioactive concentration of curcumin in systemic circulation, posing a challenge for its therapeutic application [42].

8. Applications of Turmeric

Turmeric (*Curcuma longa*), a member of the Zingiberaceae family, is widely used in traditional medicine in India and China for managing jaundice and liver disorders. It exhibits broad pharmacological activities, including antimicrobial, antimalarial, antiproliferative, anti-aging, and antitumor effects [43]. Recent studies highlight curcumin, turmeric's principal bioactive compound, as a potential therapeutic agent for neurodegenerative disorders such as Parkinson's and Alzheimer's diseases due to its potent antioxidant and anti-inflammatory properties that counteract brain oxidative stress and inflammation [44].

8.1 Turmeric in the treatment of Alzheimer's disease

Recently, there has been growing interest in the potential of herbal medicines as therapeutic options for Alzheimer's disease (AD). Turmeric is a prominent example, containing over 20 bioactive compounds with medicinal properties, among which curcumin is considered the primary bioactive constituent. Turmeric is particularly promising for preventing the accumulation of amyloid-β (Aβ) plaques, a hallmark of early-stage AD. Additionally, it may improve cognitive functions such as learning and coordination during the intermediate stages of the disease. Further studies suggest that curcumin exerts neuroprotective effects by scavenging reactive oxygen species (ROS), inhibiting tau protein aggregation, and modulating the distribution of pro-inflammatory molecules within the body [45].

8.2 Turmeric in the treatment of Parkinson's disease

Oxidative stress, which can lead to dysfunction of dopaminergic neurons in the substantia nigra, is widely considered a major contributing factor in the pathogenesis of Parkinson's disease (PD). Reactive oxygen species (ROS)—unstable oxygen-containing molecules that readily react with cellular components—can trigger the mitochondrial caspase cascade, ultimately leading to neuronal cell death. This process plays a critical role in the progression of PD. Antioxidants, particularly those derived from natural sources such as turmeric, have garnered attention for their capacity to counteract the damaging effects of ROS. Curcumin has demonstrated protective effects against the aggregation of A53T α-synuclein and the activity of monoamine oxidase B, highlighting its potential as a therapeutic agent for neurodegenerative disorders, including PD. Animal studies have further shown that curcumin can safeguard nigrostriatal dopaminergic neurons from oxidative and neurotoxic damage, suggesting its promise in PD management [46].

8.3 Cosmetic Uses

Curcumin, a bioactive compound in turmeric, has shown significant potential in the management of inflammatory and neoplastic skin disorders. Historically, turmeric is considered one of the earliest known cosmetics and has been traditionally used by women for topical applications. It is believed to help reduce facial hair growth, alleviate acne, and enhance skin tone. Moreover, curcuminoids are emerging as valuable ingredients in the cosmeceutical industry due to their antioxidant, anti-inflammatory, and skin-lightening properties. The characteristic yellow pigment of turmeric is also widely incorporated into various skincare formulations for both aesthetic and therapeutic purposes [47].

9. Conclusion

In conclusion, turmeric, derived from the *Curcuma longa* plant, has a long-standing history of use and numerous health benefits. Its primary bioactive compound, curcumin, is responsible for its characteristic yellow color and is widely recognized for its therapeutic properties, particularly in traditional Asian medicinal systems. Turmeric has been extensively utilized in Ayurveda and Chinese medicine to manage a variety of health conditions, and contemporary research increasingly validates these benefits. Curcumin exhibits potent anti-inflammatory, antioxidant, and neuroprotective effects, highlighting its potential in the prevention and treatment of neurodegenerative disorders such as Alzheimer's and Parkinson's diseases. Despite its promising pharmacological properties, curcumin's clinical utility is limited by poor bioavailability and rapid metabolism. Nevertheless, ongoing preclinical and clinical studies continue to demonstrate its potential to enhance cognitive function, protect neuronal health, and serve as a valuable adjunct in modern therapeutic strategies.

10. References

1. Petrovska BB. Historical review of medicinal plants' usage. Pharmacogn Rev. 2012;6(11):1.
2. National Health Service (NHS). Herbal medicines. 2022 [cited 2022 Oct 18]. Available from: https://www.nhs.uk/conditions/herbal-medicines/
3. Salm S, Rutz J, van den Akker M, Blaheta RA, Bachmeier BE. Current state of research on the clinical benefits of herbal medicines for non-life-threatening ailments. Front Pharmacol. 2023;14:1234701.
4. Vaidya AD, Devasagayam TP. Current status of herbal drugs in India: An overview. J Clin Biochem Nutr. 2007;41(1):1–11.
5. Prasad S, Aggarwal BB. Turmeric, the golden spice: From traditional medicine to modern medicine. In: Benzie IFF, Wachtel-Galor S, editors. Herbal medicine: biomolecular and clinical aspects. 2nd ed. Boca Raton (FL): CRC Press/Taylor & Francis; 2011. Chapter 13.
6. Alqaseer K, Idreess HG, Saed E, Radhi O, Shnain W, Falah MA, AL-Roubaey DAA, Habeeb N, Ali AH, Hashem FSA. Turmeric: An important medicinal plant in the treatment of many diseases—a review study. Kufa J Nurs Sci. 2023;13:13720.
7. Rai M, Feitosa CM, editors. Curcumin and neurodegenerative diseases: from traditional to translational medicines. Singapore: Springer; 2024.
8. Yashavanth HS, Haniadka R, Rao S, Rao P, Alva A, Palatty PL, Baliga MS. Turmeric and its principal polyphenol curcumin as a nontoxic gastroprotective agent. In: Watson RR, Preedy VR, Zibadi S, editors. Polyphenols: prevention and treatment of human disease. 2nd ed. Cambridge (MA): Academic Press; 2018. p. 319–325.
9. Bhalla A, Thirumalaikolundusubramanian P, Fung J, Cordero-Schmidt G, Soghoian S, Sikka VK, Dhindsa HS, Singh S. Native medicines and cardiovascular toxicity. In: Ramachandran M, editor. Heart and toxins. Academic Press; 2015. p. 175–202.
10. RxList. Turmeric: health benefits, side effects, uses, dose & precautions. 2024 [cited 2024 May 30]. Available from: https://www.rxlist.com/supplements/turmeric.htm
11. Kokate CK, Purohit AP, Gokhale SB. Pharmacognosy. 53rd ed. Pune: Nirali Prakashan; 2024. p. 14.136.
12. Fuloria S, Mehta J, Chandel A, Sekar M, Rani NNIM, Begum MY, Subramaniyan V, Chidambaram K, Thangavelu L, Nordin R, Wu YS, Sathasivam KV, Lum PT, Meenakshi DU, Kumarasamy V, Azad AK, Fuloria NK. A Comprehensive Review on the Therapeutic Potential of Curcuma longa Linn. in Relation to its Major Active Constituent Curcumin. Front Pharmacol. 2022;13:820806.
13. Iweala EJ, Uche ME, Dike ED, Etumnu LR, Dokunmu TM, Oluwapelumi AE, Okoro BC, Dania OE, Adebayo AH, Ugbogu EA. Curcuma longa (turmeric): ethnomedicinal uses, phytochemistry, pharmacological activities and toxicity profiles. Pharmacol Res Mod Chin Med. 2023;6:100222.
14. Krishi Vigyan Kendra Knowledge Network, ICAR. Turmeric botanical name: Curcuma longa and Curcuma aromatica [Internet]. Available from: https://kvk.icar.gov.in/API/Content/PPupload/k0331_69.pdf
15. Farooqui T, Farooqui AA. Curcumin: historical background, chemistry, pharmacological action and therapeutic value. In: Curcumin for neurological and psychiatric disorders. Academic Press; 2019. p. 23–44.
16. Hewlings SJ, Kalman DS. Curcumin: a review of its effects on human health. Foods. 2017;6(10):92.
17. Chanda S, Ramachandra TV. Phytochemical and pharmacological importance of turmeric (Curcuma longa): a review. Res Rev J Pharmacol. 2024;9(1):16-23.
18. Adinew B. Phytochemistry of turmeric: an overview. Chemistry. 2012;21:888–897.
19. Alok A, Singh ID, Singh S, Kishore M, Jha PC. Curcumin—pharmacological actions and role in oral submucous fibrosis. J Clin Diagn Res. 2015;9(10):ZE01–ZE03.
20. Vasavda K, Hegde P, Harini A. Pharmacological activities of turmeric (Curcuma longa Linn): a review. J Homeop Ayurv Med 2013;2(4):1000133.
21. Venkatesan N, Punithavathi D, Babu M. Protection from acute and chronic lung diseases by curcumin. Adv Exp Med Biol. 2007;595:379–405.

22. Edwards RL, Luis PB, Varuzza PV, Joseph AI, Presley SH, Chaturvedi R, Schneider C. The anti-inflammatory activity of curcumin is mediated by its oxidative metabolites. J Biol Chem. 2017;292(52):21243–21252.
23. Peng Y, Ao M, Dong B, Jiang Y, Yu L, Chen Z, Hu C, Xu R. Anti-Inflammatory Effects of Curcumin in the Inflammatory Diseases: Status, Limitations and Countermeasures. Drug Des Devel Ther. 2021;15:4503–4525.
24. Jakubczyk K, Drużga A, Janda K, Skonieczna-Żydecka K. Antioxidant potential of curcumin: a meta-analysis of randomized clinical trials. Antioxidants (Basel). 2020;9(11):1092.
25. Kim S, Kim M, Kang MC, Lee HHL, Cho CH, Choi I, Park Y, Lee SH. Antioxidant Effects of Turmeric Leaf Extract against Hydrogen Peroxide-Induced Oxidative Stress In Vitro in Vero Cells and In Vivo in Zebrafish. Antioxidants (Basel). 2021;10(1):112.
26. Wilken R, Veena MS, Wang MB, Srivatsan ES. Curcumin: a review of anti-cancer properties and therapeutic activity in head and neck squamous cell carcinoma. Mol Cancer. 2011;10:12.
27. Mansouri K, Rasoulpoor S, Daneshkhah A, Abolfathi S, Salari N, Mohammadi M, Rasoulpoor S, Shabani S. Clinical effects of curcumin in enhancing cancer therapy: A systematic review. BMC Cancer. 2020;20(1):791.
28. Jennings MR, Parks RJ. Curcumin as an antiviral agent. Viruses. 2020;12(11):1242.
29. Bormann M, Alt M, Schipper L, van de Sand L, Le-Trilling VTK, Rink L, Heinen N, Madel RJ, Otte M, Wuensch K, Heilingloh CS, Mueller T, Dittmer U, Elsner C, Pfaender S, Trilling M, Witzke O, Krawczyk A. Turmeric Root and Its Bioactive Ingredient Curcumin Effectively Neutralize SARS-CoV-2 In Vitro. Viruses. 2021;13(10):1914.
30. Bássoli RMF, Audi D, Ramalho BJ, Audi M, Quesada KR, Barbalho SM. A systematic review of curcumin's impact on neurodegenerative diseases. J Herb Med. 2023;42:100771.
31. Cox FF, Misiou A, Vierkant A, Ale-Agha N, Grandoch M, Haendeler J, Altschmied J. Protective Effects of Curcumin in Cardiovascular Diseases-Impact on Oxidative Stress and Mitochondria. Cells. 2022;11(3):342.
32. Bhat A, Mahalakshmi AM, Ray B, Tuladhar S, Hediyal TA, Manthiannem E, Padamati J, Chandra R, Chidambaram SB, Sakharkar MK. Benefits of curcumin in brain disorders. Biofactors. 2019;45(5):666–689.
33. Mohseni M, Sahebkar A, Askari G, Johnston TP, Alikiaii B, Bagherniya M. The clinical use of curcumin on neurological disorders: an updated systematic review of clinical trials. Phytother Res. 2021;35(12):6862–6882.
34. Mishra S, Palanivelu K. The effect of curcumin (turmeric) on Alzheimer's disease: an overview. Ann Indian Acad Neurol. 2008;11(1):13–19.
35. Zhang L, Fiala M, Cashman J, Sayre J, Espinosa A, Mahanian M, Zaghi J, Badmaev V, Graves MC, Bernard G, Rosenthal M. Curcuminoids enhance amyloid-beta uptake by macrophages of Alzheimer's disease patients. J Alzheimers Dis. 2006;10(1):1–7.
36. Pan R, Qiu S, Lu DX, Dong J. Curcumin improves learning and memory ability and its neuroprotective mechanism in mice. Chin Med J (Engl). 2008;121(9):832–839.
37. Hishikawa N, Takahashi Y, Amakusa Y, Tanno Y, Tuji Y, Niwa H, Murakami N, Krishna UK. Effects of turmeric on Alzheimer's disease with behavioral and psychological symptoms of dementia. Ayu. 2012;33(4):499–504.
38. Mukherjee S, Mishra AK, Peer GDG, Bagabir SA, Haque S, Pandey RP, Raj VS, Jain N, Pandey A, Kar SK. The Interplay of the Unfolded Protein Response in Neurodegenerative Diseases: A Therapeutic Role of Curcumin. Front Aging Neurosci. 2021;13:767493.
39. Tang M, Taghibiglou C. The mechanisms of action of curcumin in Alzheimer's disease. J Alzheimers Dis. 2017;58(4):1003–1016.
40. Liu ST, Zheng SW, Hou AJ, Zhang JX, Wang S, Wang XJ, Yu H, Yang L. A Review: Phytochemistry, pharmacology, and pharmacokinetics of Curcumae Longae Rhizoma (turmeric). World J Tradit Chin Med. 2022;8(4):463–490.
41. Sharma RA, Steward WP, Gescher AJ. Pharmacokinetics and pharmacodynamics of curcumin. Adv Exp Med Biol. 2007;595:453–470.
42. Eke-Okoro UJ, Raffa RB, Pergolizzi JV Jr, Breve F, Taylor R Jr; NEMA Research Group. Curcumin in turmeric: basic and clinical evidence for a potential role in analgesia. J Clin Pharm Ther. 2018;43(4):460–466.
43. Kumar P, Sujata, Archana. Medicinal importance of turmeric (Curcuma longa) and its natural products. In Frontiers in Natural Product Chemistry. Vol 11, 2023. p. 1-31.

44. Saffarionpour S, Diosady LL. Curcumin, a potent therapeutic nutraceutical, and its enhanced delivery and bioaccessibility by Pickering emulsions. Drug Deliv Transl Res. 2022;12:124–157.
45. McQuade RM. The therapeutic role of turmeric in treatment and prevention of Alzheimer's disease [thesis]. Lakeland (FL): Southeastern University; 2015.
46. Patel A, Olang CA, Lewis G, Mandalaneni K, Anand N, Gorantla VR. An overview of Parkinson's disease: curcumin as a possible alternative treatment. Cureus. 2022;14(5):e25032.
47. Gopinath H, Karthikeyan K. Turmeric: a condiment, cosmetic and cure. Indian J Dermatol Venereol Leprol. 2018;84:16–21.

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