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CURCUMIN IN CHRONIC KIDNEY DISEASE: FROM EXPERIMENTAL EVIDENCE TO CLINICAL APPLICATION

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ABSTRACT
Chronic kidney disease (CKD) is a major global health challenge characterized by progressive renal dysfunction, chronic inflammation, oxidative stress, fibrosis, and increased cardiovascular risk. Curcumin, the principal bioactive compound of Curcuma longa, has attracted considerable scientific interest because of its pleiotropic biological properties, including anti-inflammatory, antioxidant, antifibrotic, and immunomodulatory activities. Experimental studies have consistently demonstrated renoprotective effects in several models of kidney injury, including diabetic nephropathy, ischemia-reperfusion injury, obstructive nephropathy, and toxic renal damage. Human studies have shown encouraging effects on proteinuria, inflammatory biomarkers, and oxidative stress, although evidence regarding long-term preservation of renal function remains inconclusive. This review summarizes current knowledge regarding the molecular mechanisms, preclinical evidence, clinical studies, safety profile, and future perspectives of curcumin in CKD.

KEYWORDS: Chronic kidney disease, curcumin, diabetic nephropathy, inflammation, oxidative stress, fibrosis, renal protection.

INTRODUCTION

Chronic kidney disease affects approximately 10% of the adult population worldwide and is associated with increased morbidity, mortality, and healthcare expenditures. Despite advances in nephrology, including renin-angiotensin-aldosterone system inhibitors, sodium-glucose cotransporter-2 (SGLT2) inhibitors, and non-steroidal mineralocorticoid receptor antagonists, residual risk of disease progression remains substantial.[1]

A growing body of evidence indicates that persistent inflammation, oxidative stress, endothelial dysfunction, and tissue fibrosis are central drivers of CKD progression irrespective of the underlying etiology.[2] Consequently, increasing attention has focused on compounds capable of simultaneously targeting multiple pathogenic pathways.

Curcumin, a natural polyphenol extracted from the rhizome of Curcuma longa, has been used for centuries in traditional medicine and has emerged as a promising therapeutic candidate. Its biological activities extend beyond simple antioxidant effects, involving modulation of transcription factors, cytokines, growth factors, and signaling pathways implicated in kidney injury.[3,4]

MOLECULAR MECHANISMS OF RENOPROTECTION

Anti-inflammatory Activity

Inflammation represents a fundamental mechanism in CKD progression. Curcumin inhibits activation of nuclear factor-kappa B (NF-κB), one of the principal regulators of inflammatory gene expression.[5]

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NF-κB inhibition results in reduced production of:
Tumor necrosis factor-alpha (TNF-α), Interleukin-1β (IL-1β), Interleukin-6 (IL-6)
Experimental studies have demonstrated reduced macrophage infiltration and attenuation of inflammatory damage within renal tissue following curcumin administration.[5,6]

Antioxidant Properties
Oxidative stress contributes significantly to progressive nephron loss. Reactive oxygen species promote cellular damage, endothelial dysfunction, and activation of fibrotic pathways.

Curcumin activates the Nuclear factor erythroid 2-related factor 2 (Nrf2) system, leading to increased expression of antioxidant enzymes such as:
Superoxide dismutase, Catalase, Glutathione peroxidase, Heme oxygenase-1, activation of Nrf2 reduces oxidative injury and improves cellular resistance to stress.[6,7]

Antifibrotic Effects
Renal fibrosis represents the final common pathway leading to end-stage kidney disease, extracellular matrix deposition and fibrogenesis.[7]

Experimental studies have reported significant reductions in:
Collagen accumulation, Fibronectin deposition, Mesangial expansion, Tubulointerstitial fibrosis.
These findings suggest a direct role in slowing structural kidney damage.

Gut-Kidney Axis Modulation
Recent evidence suggests that curcumin may influence CKD progression through effects on intestinal permeability and gut microbiota composition.[8]
Curcumin stimulates intestinal alkaline phosphatase activity, improves epithelial barrier integrity, and may reduce systemic exposure to uremic toxins derived from bacterial metabolism.
This emerging mechanism may partly explain the anti-inflammatory effects observed in CKD patients.[8]

Experimental Evidence
Diabetic Nephropathy
Diabetic kidney disease remains the most extensively investigated nephropathy in curcumin research.
Animal studies have shown:
Reduction of albuminuria, Improvement of glomerular morphology, Decreased oxidative stress,
Suppression of inflammatory pathways, Attenuation of renal fibrosis.
Soetikno et al. demonstrated significant reductions in proteinuria, mesangial expansion, and renal inflammation in diabetic rats treated with curcumin.[9]

Ischemia-Reperfusion Injury
Acute ischemic kidney injury contributes to CKD progression.
Curcumin appears to reduce:
Tubular apoptosis, Oxidative stress, Endothelial dysfunction, Cytokine release.
Experimental models consistently show improved renal function after ischemic injury when curcumin is administered before or shortly after the insult.[10]

Obstructive Nephropathy
In unilateral ureteral obstruction models, curcumin reduces macrophage infiltration and significantly limits tubulointerstitial fibrosis.[11]
These observations support the hypothesis that curcumin acts as a broad-spectrum modulator of renal injury pathways.

Clinical Evidence
Diabetic Kidney Disease
Among human studies, diabetic nephropathy provides the strongest evidence.
Khajehdehi et al. conducted a randomized clinical trial involving patients with overt diabetic nephropathy and reported significant reductions in proteinuria, TGF-β, and inflammatory markers after turmeric supplementation.[12]
Subsequent investigations confirmed favorable effects on:
Urinary protein excretion, Oxidative stress biomarkers, Inflammatory cytokines.
These findings suggest that curcumin may enhance the antiproteinuric benefits of standard renin-angiotensin system blockade.

Chronic Kidney Disease
Clinical studies in CKD patients have generally demonstrated improvements in surrogate biochemical markers.
Observed benefits include:
Reduced C-reactive protein levels, Lower oxidative stress markers, Improved antioxidant capacity, Reduced inflammatory cytokines.
However, improvements in estimated glomerular filtration rate (eGFR) have been inconsistent.[13]
The largest trial conducted to date was the MPAC-CKD study. Despite enrolling a large population of albuminuric CKD patients, microparticle curcumin supplementation failed to demonstrate significant benefits on albuminuria reduction or renal function decline over six months.[14]
This study highlights the discrepancy between promising biological effects and clinically meaningful renal outcomes.

Hemodialysis Patients
Inflammation and oxidative stress are particularly pronounced in maintenance hemodialysis patients.
Several small trials have demonstrated reductions in:
High-sensitivity C-reactive protein, Malondialdehyde, TNF-α, IL-6.

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Improvement of oxidative stress parameters may have cardiovascular implications, although hard endpoint data remain unavailable.[15]

Lupus Nephritis

Limited randomized evidence suggests that curcumin supplementation may reduce proteinuria, blood pressure, and inflammatory activity in lupus nephritis when used as adjunctive therapy.[16]

These findings are encouraging but require confirmation through larger multicenter studies.

Bioavailability Challenges

One of the most important limitations of curcumin therapy is poor oral bioavailability.

Factors responsible include:

Limited intestinal absorption, Rapid metabolism, Extensive first-pass hepatic elimination, Low aqueous solubility.

To overcome these limitations, several formulations have been developed:

Curcumin plus piperine, Liposomal curcumin, Nanoparticle formulations, Phospholipid complexes, Microparticle technologies.

Future studies should evaluate whether enhanced systemic availability translates into improved renal outcomes.[17]

Safety Profile

Curcumin is generally considered safe and well tolerated.

Reported adverse effects are usually mild and include:

Dyspepsia, Nausea, Abdominal discomfort, Diarrhea.

Nonetheless, nephrologists should consider potential interactions with:

Anticoagulants, Antiplatelet agents, Immunosuppressive drugs, Antihypertensive medications.

Special attention is warranted in transplant recipients due to possible pharmacokinetic interactions.[17]

Future Perspectives

Future research should focus on:

Large multicenter randomized trials, Longer follow-up periods, Standardized formulations.

Hard renal endpoints

Combination therapies with SGLT2 inhibitors and finerenone.

Biomarker-guided patient selection.

Gut-kidney axis modulation.

The emerging understanding of cardio-renal-metabolic interactions creates new opportunities for integrating curcumin into comprehensive nephroprotective strategies.

CONCLUSIONS

Curcumin represents one of the most extensively studied phytotherapeutic compounds in nephrology. Strong experimental evidence supports potent anti-inflammatory, antioxidant, and antifibrotic effects capable of attenuating multiple mechanisms involved in CKD progression. Clinical studies suggest favorable effects on proteinuria and inflammatory biomarkers, particularly in diabetic kidney disease. However, current evidence remains insufficient to conclude that curcumin significantly slows renal function decline or prevents end-stage kidney disease. Well-designed randomized controlled trials using optimized formulations are needed before curcumin can be incorporated into routine nephrological practice.

REFERENCES

1. KDIGO Clinical Practice Guideline for Chronic Kidney Disease Evaluation and Management. Kidney Int Suppl. 2024.
2. Ruiz-Ortega M, Rayego-Mateos S, Lamas S, Ortiz A, Rodrigues-Diez RR. Targeting inflammation to treat CKD. Nat Rev Nephrol, 2020; 16: 493-509.
3. Gupta SC, Patchva S, Aggarwal BB. Therapeutic roles of curcumin. AAPS J., 2013; 15: 195-218.
4. Hewlings SJ, Kalman DS. Curcumin: a review of its effects on human health. Foods, 2017; 6: 92.
5. Jurenka JS. Anti-inflammatory properties of curcumin. Altern Med Rev., 2009; 14: 141-153.
6. Trujillo J, Chirino YI, Molina-Jijón E, et al. Renoprotective effect of the antioxidant curcumin: recent findings. Redox Biology, 2013; 1: 448-456.
7. Menon VP, Sudheer AR. Antioxidant and anti-inflammatory properties of curcumin. Adv Exp Med Biol, 2007; 595: 105-125.
8. Ghosh SS, Gehr TWB, Ghosh S. Curcumin and CKD: stimulation of intestinal alkaline phosphatase. Molecules, 2014; 19: 20139-20156.
9. Soetikno V, Sari FR, Lakshmanan AP, et al. Curcumin alleviates oxidative stress and renal fibrosis in diabetic nephropathy. Mol Nutr Food Res., 2013; 57: 1849-1859.
10. Tapia E, Soto V, Ortiz-Vega KM, et al. Curcumin induces Nrf2 activation and protects against renal ischemia. Free Radic Biol Med., 2012; 52: 1272-1284.
11. Tapia E, Zatarain-Barrón ZL, Hernández-Pando R, et al. Curcumin reverses kidney damage associated with chronic renal failure. Kidney Int., 2012; 82: 1026-1037.
12. 1Khajehdehi P, Zanjaninejad B, Aflaki E, et al. Oral turmeric supplementation attenuates proteinuria in diabetic nephropathy. Scand J Urol Nephrol, 2011; 45: 365-370.
13. Bagherniya M, Soleimani D, Rouhani MH, et al. Curcumin for renal disorders: systematic review of randomized controlled trials. Adv Exp Med Biol., 2021; 1291: 327-343.
14. Weir MA, Walsh M, Cuerden MS, et al. MPAC-CKD randomized clinical trial. Nephrol Dial Transplant, 2023; 38: 2192-2200.
15. Alizadeh F, Javadi M, Karimi G, et al. Curcumin supplementation in hemodialysis patients: effects on oxidative stress and inflammation. J Ren Nutr., 2020; 30: 486-493.

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16. Khajehdehi P, Pakfetrat M, Javidnia K, et al. Oral supplementation with turmeric improves lupus nephritis. Phytother Res., 2012; 26: 293-296.
17. Ofori-Attah E, Aning A, Simón L. Curcumin in the treatment of kidney disease: a systematic review with focus on drug interactions. Antioxidants, 2025; 14: 1369.

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