



Nephroceuticals as a new hope for the treatment of kidney diseases

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Abstract

Nephroceuticals are natural or pharmacologically active compounds used to manage and even reverse certain kidney diseases. The term “nephroceuticals” is relatively new, although the study of utilizing natural or active compounds to manage kidney disease has been emerging for many years. Nephroceuticals have shown promise in supporting conventional therapies such as dialysis and kidney transplantation, and are purported to have fewer adverse effects compared to conventional chemical compounds.

Keywords: Chronic kidney disease, Nephroceuticals, Acute kidney injury, End-stage renal disease, Curcumin, Inflammation, Oxidative stress, Dialysis, Kidney transplantation

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Introduction

Nephroceuticals refer to the treatment of kidney disease using natural and/or pharmacologically active compounds. Various studies have focused on developing nephroceuticals to manage and even reverse renal insufficiency, and improve kidney dysfunction. In this paper, we will discuss the current concepts on nephroceuticals, their mechanisms of action, applications, and future directions (1,2).

Search strategy

For this review, we searched PubMed, Web of Science, EBSCO, Scopus, Google Scholar, Directory of Open Access Journals (DOAJ) and Embase, using different keywords including nephroceuticals, acute kidney injury, chronic kidney disease, end-stage renal disease, curcumin, inflammation, oxidative stress, reactive oxygen species, dialysis and kidney transplantation.

Mechanism of action

Nephroceuticals are compounds that play a role in modulating kidney function through a variety of mechanisms. These mechanisms can improve renal dysfunction, by enhancing antioxidant activity, anti-apoptosis effects, and anti-inflammatory activity (3,4). For instance, curcumin, an active ingredient in turmeric,

improves kidney function due to its antioxidant, anti-inflammatory, and antifibrotic effects (5). Similarly, Astragalus membranaceus powder, a commonly used traditional Chinese medicine, induce mesenchymal stem cells proliferation, and inhibits inflammatory cytokine release. This antifibrotic effect may help reduce inflammation and fibrosis, ultimately leading to improved kidney function (6,7).

Applications of nephroceuticals

Acute kidney injury

Acute kidney injury is characterized by sudden kidney function decline and inflammation. Nephroceuticals could help prevent acute kidney injury when used as prophylaxis or reduce symptoms when used as treatment (8).

Chronic kidney disease

Chronic kidney disease, a progressive loss of renal function over time, can lead to kidney failure. Nephroceuticals have the potential to reduce the risk of chronic kidney disease development and/or stop the progression of the disease (9).

End-stage renal disease

At the point of end-stage renal disease, conventional therapy such as dialysis and kidney transplantation may

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■ Implication for health policy/practice/research/medical education

Nephroceuticals may be useful for the prevention of acute kidney injuries, the reduction of symptoms of chronic kidney disease, and support dialysis treatment. More excitingly, nephroceuticals present hope for the reversal of renal damage by halting the progression of fibrosis and inflammation, and optimizing cellular repair and their regeneration. The beneficial effects of nephroceuticals in improving renal function against conventional therapies such as dialysis, and may reduce the risk and severity of developing chronic kidney disease, or cease the progression if kidney damage in some patients.

be the only available therapeutic option. Nephroceuticals may play a role in supporting these forms of therapy (10).

Renal fibrosis and inflammation

Nephroceuticals have been shown to decrease renal fibrosis and inhibit inflammation progression, which is of paramount importance to restore kidney function and protect against kidney damage (10, 11).

Proteinuria

Nephroceuticals have been investigated for their ability to reduce proteinuria levels, an essential marker for kidney function, and thus reducing the risk of further renal damage (12,13).

Renal oxidative stress

Nephroceuticals also address oxidative stress, which is an important factor in the development and progression of kidney disease by reducing the production of reactive oxygen species (ROS) in the renal tubules (14,15).

Future directions for nephroceuticals

Integrating nephroceuticals into clinical practice will require more extensive clinical trials to support their efficacy and safety, particularly regarding long-term usage. More research is needed to establish the optimal formulation, dosage, and delivery of nephroceuticals to maximize their efficacy and safety. Additionally, more attention should be directed towards identifying novel nephroprotective compounds to address new and emerging kidney diseases (16,17).

These compounds must have detailed scientific investigations to determine the optimal dosage, the route of administration, the purification process, and the safety profiles before being used for routine clinical management (2,18). Here are some reasons why investigating formulations, optimal dosage, and administration is crucial:

1. Determining safety profiles: Safety is critical when evaluating the efficacy of nephroceuticals in renal disease management. An investigation of the formulation provides an understanding of potential side effects and their management approach.

Standardization of the extraction and purification methods of natural compounds must be established to remove contaminants and verify the purity of each compound (19,20).

2. Establishing efficacious dosing ranges: Investigating the dose-response relationship of nephroceuticals is critical to establish an optimal dose range with the desired therapeutic effect. An appropriately selected dose of nephroceuticals is crucial to achieving the potential health benefits of the therapeutic agents while avoiding unwanted side effects (1,21,22).
3. Determining route of administration: The route of administration of a nephroceutical, whether through intravenous, oral, or topical application, could significantly affect its absorption, distribution, metabolism, and excretion. Determining the appropriate administration route is paramount to ensure the optimal therapeutic drug delivery and in achieving sufficient bioavailability that can produce the desired effect (23,24).
4. Establishing consistency: Investigating the formulation of nephroceuticals provides a means of ensuring reproducibility, efficacy consistency, and long-term stability. Standardization of the formulation and dosing principles provides the baseline of comparability with conventional therapy and methods of administration (25-27).

Conclusion

Nephroceuticals show a lot of promise in managing kidney diseases through a variety of mechanisms, including antioxidation, anti-inflammatory actions, neuro-regeneration and anti-apoptosis. These unique mechanisms of actions highlight the potential role of nephroceuticals as key management strategies for renal diseases. Proper investigations leading to their formulations, optimal dosage, and administration will help establish evidence of their efficacy in clinical settings. Although more substantial clinical trials are required, it is essential to recognize the potential roles of nephroceuticals in comprehensively improving outcomes in managing renal diseases.

Conflicts of interest

The author declares that he has no competing interests.

Ethical issues

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

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