Kidney diseases and antioxidants

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Abstract

The overproduction of free radicals impairs all cellular components such as lipids, proteins and DNA and causes chronic kidney disease (CKD). Antioxidants are beneficial to improve CKD caused by oxidative stress.

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hronic kidney disease (CKD) is considered as a serious public health problem and more than one-fifth of 65-year people and over have some CKD degrees. This problem is caused by oxidative stress (1, 2), which is the result of an increased reactive oxygen species (ROS) formation and antioxidant defenses reduction (3). Studies indicated that ROS metabolites such as superoxide (O2-), the hydroxyl radical (OH-) and hydrogen peroxide (H2O2) (4), react with all biomolecules in the cells through inactivating cellular components and oxidizing the nucleic acids (5). Therefore, oxidative stress triggers several diseases including cancer, diabetes and CKD (6). In CKD, this deregulated biochemical machinery was related to advancement of the disease and the start or progress of serious diseases such as atherosclerosis and other cardiovascular diseases. Moreover, it affects the major clinical outcomes remarkably (7). Hence, the use of modalities to reduce kidney injuries created by oxidative stress is useful. The antioxidant administration is one of the most efficient and useful strategies to alleviate the oxidative stress harmful effects on kidney health (6). Despite many studies have identified renal disease induced by oxidative stress, a little data exists on antioxidant therapy and its mechanism on kidney health. Therefore, this editorial paper was conducted to evaluate the effect of antioxidant therapy on CKD induced by oxidative stress.

L-Carnitine

4-N-trimethylammonium-3-hydroxybutyric acid or L-Carnitine is endogenously synthesized from lysine and methionine in the renal cell and hepatocytes (8). It was indicated that its deficiency caused increased mitochondrial dysfunction and production of ROS (9). Moreover, carnitine by ROS scavenging, chelating iron, enhancing of the expression and antioxidant enzymes activity operates as an antioxidant directly and indirectly (10). CKD is considered as a reduced adequate synthesis of L-carnitine, due to reduction of the glomerular filtration rate (GFR). In addition, it was detected that free plasma and muscle levels of L-carnitine level decreases in plasma of hemodialysis and peritoneal dialysis patients (11, 12). Administration of L-carnitine to hemodialysis patients induced an increase in glutathione content and activity of glutathione peroxidase, and a decrease in lipid peroxidation content, as a result of its antioxidant role (7).

Coenzyme Q10 (CoQ10)

CoQ10 is a molecule diffuse with high lipophilic that is concentrated in eukaryotic cells mitochondria (13). Due to its plenty propagation and high concentration into the cell membrane, CoQ10 inhibits lipid peroxidation of membrane since superoxide radicals and hydroxyl produced in the membrane during electron transport chain if not quickly react with adjoining protein and lipid (14). CoQ10 was detected to inhibit aging, atherosclerosis, and the development of the chronic disease like CKD. An inverse relationship was reported in CKD patients between CoQ10 and renal function (15).
Proanthocyanidin

Proanthocyanidin is a compound which is extracted from grape seed with catechin basic structure unit (16). The proanthocyanidin indicated pharmacological, chemoprotective and therapeutic effects against ROS (17). We indicated which proanthocyanidin can ameliorate antioxidant enzymes activity such as glutathione peroxidase, superoxide dismutase and catalase in CKD and decrease the malondialdehyde (MDA) content. The antioxidant properties of proanthocyanidin are likely to increase the antioxidant enzymes activity of the body (18).

Curcumin

Curcumin, as the chief component of the Curcuma Longa, has antioxidant, anti-inflammatory, antimicrobial and antibacterial properties, and is administered to treat the chronic diseases (19,20). Antioxidant effect of curcumin is caused by both the upregulation of antioxidant and cytoprotective genes and direct scavenger activity. It can scavenge free radicals such as superoxide anions, hydroxyl radicals and H2O2 (21), most likely through phenolic groups that exist in its molecular structure. Moreover, this compound has an indirect antioxidant capability which is mediated by increasing the expression of cytoprotective enzymes such as superoxide dismutase and catalase (22). Similarly, curcumin remarkably inverted interstitial tissue fibrosis, hypertension, proteinuria, tubular atrophy and mesangial cell expansion in a CKD experimental model (23).

Conclusion

Enhanced oxidative stress develops chronic kidney disease. Various antioxidants as either foods or drugs ameliorate the inflammatory state in CKD. Antioxidants act as either ROS scavenger or potentiate the antioxidant enzymes.

Authors’ contribution

Both of authors contributed equally to this work.

Conflicts of interest

The authors declared no competing interests.

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