

Impact of COVID-19 on Kidney Function Decline in Chronic Kidney Disease

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Description

Chronic Kidney Disease (CKD) presents a significant public health challenge, often going unnoticed until reaching an advanced stage. It involves a gradual decline in kidney function, ultimately leading to end-stage renal disease, requiring dialysis or transplantation and imposing substantial economic burdens on healthcare systems and society. Type 2 Diabetes Mellitus (T2DM), along with hypertension, obesity, inflammation and oxidative stress, accelerates CKD progression, contributing to macro- and microvascular complications and increased mortality rates. Despite intensive management of blood glucose and pressure, some patients experience steady CKD progression, suggesting the involvement of other crucial factors. Therefore, identifying additional CKD risk factors is essential to implement early interventions and preventive strategies, particularly in T2DM contexts. Advanced Glycation End products (AGEs) are a group of compounds generated non-enzymatically through reactions between reducing sugars and proteins, lipids, or nucleic acids, leading to stable and irreversible end products with pro-oxidant, pro-inflammatory and cytotoxic properties. While AGEs occur naturally, chronic inflammation, hyperlipemia and oxidative stress accelerate their formation, modifying short-lived proteins and contributing to the pathogenesis of chronic diseases. Elevated levels of circulating AGEs and AGE-modified proteins are associated with T2DM, CKD and cardiovascular disease. Recent research highlights the association between specific circulating AGE free adducts and subsequent decline in kidney function in individuals with T2DM.

Coronary heart disease

The formation of endogenous Advanced Glycation End products (AGEs) constitutes a small portion of the total body burden of AGEs, with diet serving as the primary external source. The amount of dietary AGEs depends on nutrient composition and food processing techniques. Studies have demonstrated that adhering to AGE-restricted diets can lower circulating AGE levels, leading to improved insulin sensitivity and reduced markers of inflammation and oxidative stress in patients with Type 2 Diabetes Mellitus (T2DM). Research indicates that Mediterranean-style diets, as opposed to Western diets, are low in dietary AGEs and can decrease circulating AGEs by influencing their metabolism, thereby reducing oxidative

stress and inflammation in elderly individuals and those with metabolic syndrome. Our recent findings suggest that sustained adherence to a Mediterranean diet may reduce circulating AGEs, particularly Methylglyoxal (MG) and could be associated with diabetes remission in newly diagnosed T2DM patients with Coronary Heart Disease (CHD). Given these observations, the primary aim of this secondary prevention study was to investigate whether modifying AGE metabolism and consequently reducing AGE levels by consuming two healthy dietary patterns (a Mediterranean diet rich in Extra-Virgin Olive Oil (EVOO) versus a low-fat diet rich in complex carbohydrates) could potentially delay the decline in kidney function in CHD patients with T2DM.

Kidney function

While definitions have varied across studies, rapid decline in kidney function has been linked to cardiovascular events, hospitalization, development of end-stage kidney failure and mortality. Investigations conducted prior to the COVID-19 pandemic have indicated associations between psychosocial factors and the risk of rapid kidney function decline. For instance, the China Health and Retirement Longitudinal Study found that individuals with normal kidney function who experienced depression or social isolation were more likely to undergo rapid kidney function decline. Similarly, a pre-pandemic study in the US revealed a correlation between depression and rapid kidney function decline among individuals with Chronic Kidney Disease (CKD). An analysis involving US veterans with CKD further confirmed this association, demonstrating longitudinal connections with the onset of dialysis, hospitalization and mortality. Additionally, findings from the Jackson Heart Study, which focused on African Americans before the pandemic, suggested that stress was associated with rapid kidney function decline, while optimism seemed to offer protection against such decline. However, the overall impact of the prolonged COVID-19 pandemic on rapid kidney function decline within the CKD population remains unexplored. To address this, we utilized a cohort of insured individuals with moderate-to-severe CKD to compare rates of rapid kidney function decline between the pre-pandemic and pandemic periods and to assess the influence of COVID-19 on kidney function decline.