Mesoamerican Nephropathy: An Emerging Entity Associated With Consumption of Sugary Drinks

By Jorge Rico Fontalvo and Vicente Sánchez Polo

Chronic kidney disease (CKD) is a highly prevalent condition with a high incidence (1, 2). Diabetes mellitus (DM), hypertension (HT), cardiovascular disease, metabolic syndrome, and obesity, are among the best known causes of CKD globally, with DM being the leading factor (1, 2).

However, in agricultural communities in Mesoamerica—a region and cultural area that begins in the southern part of North America and extends to the Pacific coast of Central America—as well as other regions of the world, heatstroke has been associated with CKD, along with other potential variables such as exposure to environmental toxins, infections, and genetic factors. Often, individuals are exposed to heatstroke and strenuous exercise during agricultural work, leading to dehydration that gradually causes kidney damage at the tubulointerstitial level (3). This entity is referred to as CKD of unknown origin (CKDu) or Mesoamerican nephropathy. Factors associated with kidney damage in CKDu include sustained dehydration, strenuous exercise, and rehydration with sweet and carbonated beverages. Additionally, social determinants such as poverty, low birth weight, and malnutrition contribute to the development of a slow, progressive, and irreversible form of CKD (3, 4) (Figure 1).

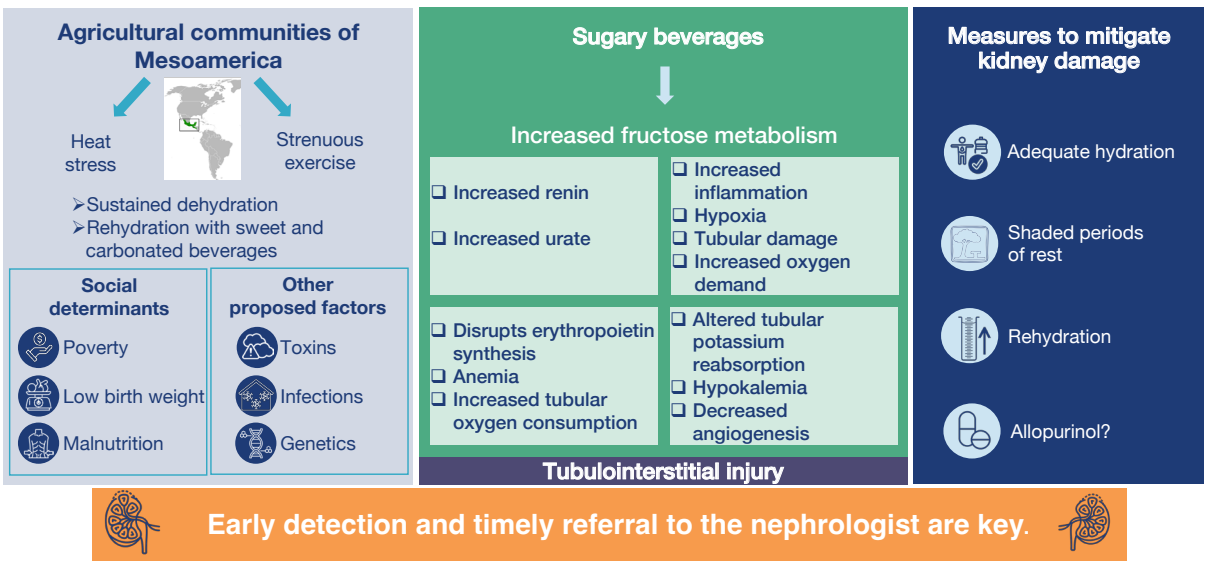
There is sufficient evidence that high consumption of sugary beverages is associated with DM, HT, obesity, and the consequent incidence and progression of CKD (5–7). Several indirect and direct mechanisms could explain this association. Sugary beverages contain added sugars and associated energy, which, when consumed regularly, lead to a high positive-energy balance, resulting in weight gain and obesity development. Obesity is a risk factor for DM, cardiovascular disease, and CKD. Additionally, these beverages, with high fructose as well as other sugars, can increase serum renin and urate concentrations, leading to interstitial fibrosis and renal vascular disease, all directly contributing to the development of kidney diseases (5).

On the other hand, in the physiology of CKDu, rehydration with sugary beverages after strenuous exercise and heatstroke exposure stimulates fructose activity, which generates inflammation, hypoxia, and tubular damage, increasing oxygen demand. In addition, this disrupts erythropoietin synthesis, causing anemia, which also increases tubular oxygen consumption. Tubular potassium reabsorption is also altered, leading to hypokalemia, which limits angiogenesis, further affecting oxygen consumption. All of this causes tubulointerstitial damage, which, with continued exposure to heat and probably other insults such as environmental toxins, produces chronic tubulointerstitial damage. This repeated damage leads to a slow, progressive, and asymptomatic form of CKD in the young population of the agricultural zones of Mesoamerica. Furthermore, fructose activation is also implicated in kidney damage in this population. Additionally, there is a local accumulation of uric acid, which induces hypoxia, inflammation, and general tubular damage (8–10) (Figure 2).

Among the actions proposed to prevent and delay the progression of kidney damage are: 1) removing the individual from the risk area, 2) ensuring adequate hydration with electrolyte-based solutions, 3) increasing the periods of rest in the shade, and 4) rehydrating during work. Due to the potential involvement of uric acid in the pathophysiology of the disease, the use of allopurinol has also been proposed to mitigate kidney damage (11, 12).

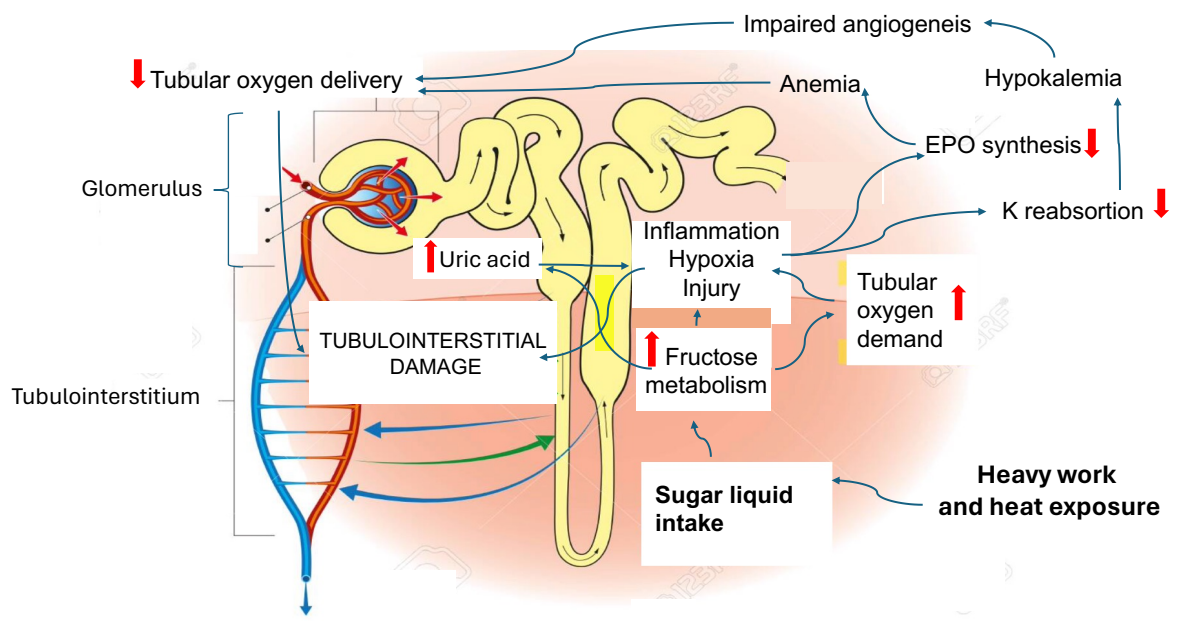
The hydration pattern of individuals, especially those with risk factors for developing CKD, should be based on healthy fluids with a good electrolyte content and low sugar. ■

Figure 1. Mesoamerican nephropathy: What we know about the etiology and effects of consuming sugary drinks



Infographic by Priyadarshini John, MD, DM

Figure 2. Pathophysiology of CKDu: Sugar liquid intake and kidney risk



EPO, erythropoietin; K, potassium.

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The authors report no conflicts of interest.

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Nutritional Screening and Assessment in Chronic Kidney Disease

By Guillermina Barril and Mar Ruperto

Nutritional risk and malnutrition related to chronic kidney disease (CKD) are common disorders that usually appear from CKD stages 3–5 and are more frequent among patients undergoing renal replacement therapy, mainly among those receiving hemodialysis therapy.

The prevalence of malnutrition has been reported in up to 54% of patients living with CKD, leading to a significant increase in morbidity and mortality (1–3). Nutritional screening is a preassessment method of nutritional status to identify patients at risk of malnutrition and, in turn, to indicate nutritional assessment for those with increased nutritional risk and/or probable malnutrition. Since the 1980s, several nutritional screening tools have been implemented in CKD (Figure 1).

The subjective global assessment (SGA), originally developed by Detsky and colleagues in the 1980s (4), was adapted and validated in 1996 as a seven-point scale (7-point SGA) (5, 6). Recommended by clinical practice guidelines for regular nutritional assessment in patients with CKD and undergoing dialysis (7), this 7-point SGA is based on clinical history data (body weight, dietary intake, gastrointestinal symptoms, and functional capacity, as well as comorbidities related to nutritional needs) and includes a physical examination of body mass (subcutaneous fat and muscle) and the detection of edema. Studies (8, 9) have shown that low 7-point SGA scores are associated with a high risk of mortality in patients living with CKD and undergoing dialysis. In 1999, the dialysis malnutrition score (DMS) was developed (10), which used the original 7-point SGA scale and included a score from 1 to 5 for each item. Subsequently, the Malnutrition-Inflammation Score (MIS) questionnaire, a semiquantitative tool that is based on the subjective 7-point SGA and also includes objective parameters (body mass index, serum albumin, and total iron binding capacity) (11), has been extensively correlated in previous studies (11, 12) with hospital admission and mortality. MIS is a validated nutritional screening tool for patients with CKD and undergoing dialysis (11, 12) and has been recommended for routine use for the nutritional assessment of patients with kidney failure (7). The Dialysis Outcomes and Practice Patterns Study (9) used the quantitative modified SGA (m-SGA), developed in 2002, based on caregiver ratings of weight loss, appetite loss, gastrointestinal symptoms, and disease burden. Patients with a severe m-SGA score had significantly higher mortality risk compared with those with moderate or normal m-SGA scores.

An expert panel in 2008 (13) suggested using specific markers from four different categories—biochemistry, body mass, muscle mass, and dietary intake—for the clinical diagnosis of the so-called protein-energy wasting (PEW) syndrome. Three of these four categories should be included, with at least one being a biochemical marker. PEW is a complex syndrome that, combined with the inflammation, uremic toxicity, and endocrine-metabolic disorders of CKD, has been shown to significantly increase the mortality rate at a 5-year follow-up (13) (Figure 2).

Most recently in 2019, unified diagnostic criteria for disease-related malnutrition were proposed within the framework of the Global Leadership Initiative on Malnutrition (GLIM) (14). The GLIM approach includes one phenotypic criterion (low body mass index, unintentional body weight loss, or low muscle mass) and at least one etiologic criterion (reduced food intake, disease burden, or inflammation state) for diagnosing disease-related malnutrition. At present, the applicability of GLIM criteria in CKD and dialysis is still being developed. Further studies with large samples are warranted to validate GLIM criteria for the diagnosis of PEW.

In summary, the first step in detecting nutritional risk can be performed using well-established and validated nutritional screening tools, whereas nutritional assessment requires the combination of several parameters to diagnose PEW in populations with CKD and undergoing dialysis. A single marker by itself is not able to identify or diagnose nutritional disorders. ■

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The authors report no conflicts of interest.

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Figure 1. Timeline of nutritional screening tools and diagnostic criteria used in populations with CKD and undergoing dialysis

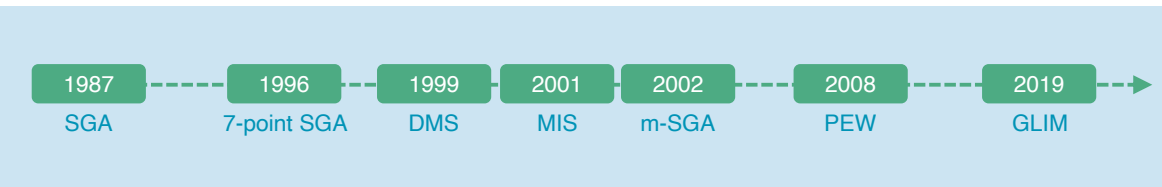
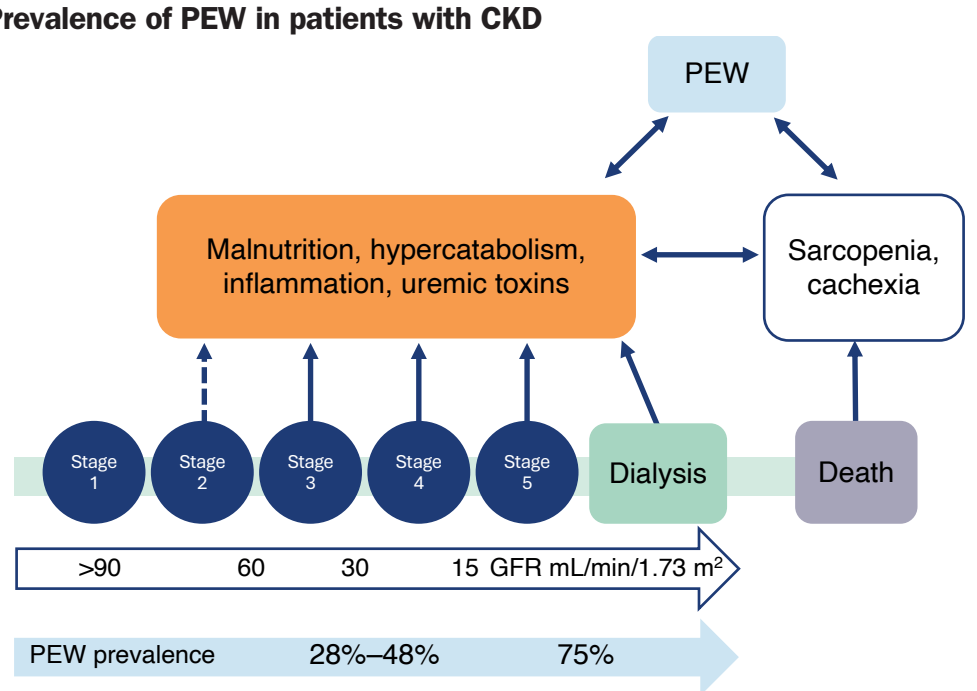


Figure 2. Prevalence of PEW in patients with CKD



Conceptual scheme modified from Hanna et al. (15). GFR, glomerular filtration rate.