“You are what you drink!” Focus on “Rehydration with soft drink-like beverages exacerabtes dehydration and worsens dehydration-associated renal injury”

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IN THE WORLD TODAY it is apparent that over or under consumption of food and beverages (including water) can adversely affect health. The impact of the quantity and type (macro and micronutrients) of food we consume has been extensively studied, far more so than the fluid we drink. In these studies the temporal pattern of feeding across a 24-h period and over the lifespan has been examined. It is clear that how much, when, and the nutrient content of what we eat has consequences for cardiovascular health and longevity (5) and this has lead to the catch phrase “You are what you eat.”

The study by Garcia-Arroyo et al. (2), in this issue of Am J Physiol-Regul Integr Comp Physiol raises some major concerns regarding fluid hydration and renal and cardiovascular health. Previously, Johnson and colleagues (4) demonstrated that recurrent heat stress and consequent dehydration causes chronic renal injury in mice. This study was designed to address the association observed between dehydration, hyperosmolarity, and the ongoing epidemic of chronic kidney disease (CKD) in Central American sugar cane workers, which has since also been shown to be a risk factor for CKD in other populations globally (1). The findings of this study clearly demonstrated that daily cycles of heat stress without access to water, followed by rehydration, causes renal injury in mice (4). Now Garcia-Arroyo et al. (2) have examined whether the type of fluid drunk during the immediate rehydration period after 1-h exposure to heat stress affects the degree of renal injury. Rats were given either plain water, an 11% fructose-glucose (FG) solution (similar in concentration to soft drinks), or water sweetened with noncaloric stevia for 2 h after heat stress exposure. Then all groups received plain water for the remainder of the day. This daily cycle was repeated over 4 wk. Activation of vasopressin and aldosterone pathways and enhanced renal oxidative stress and inflammation were observed in all groups compared with the control group given ad libitum access to water. Thus their observations reaffirm that cyclic dehydration causes renal injury. However, the crucial finding was that the renal injury was significantly exacerbated in the group drinking the FG solution during the immediate rehydration period. What this study showed was that despite a marked increase in fluid intake in the group receiving the FG solution, the degree of renal damage was greater in this group than the groups receiving plain water or stevia.

An important message of this study is that the first fluid you drink to rehydrate following a period of dehydration should be plain water not a sugar-laden drink. It may also be that these findings are more far reaching. It is common for individuals to go through daily cycles of dehydration and replenishment due to the time-consuming nature and physical demands of their work and home schedules, or simply out of habit. For other individuals, irregular water intake is a means of dealing with incontinence or a result of incapacity to acquire or consume fluids. Therefore, if a person habitually only drinks periodically and induces recurrent mild dehydration as a result, these people may be at increased risk of CKD.

The findings of this study certainly demonstrate that an 11% solution of glucose and fructose promotes renal injury in rats subject to heat stress. Whether, as the title of this study implies, this is applicable to “soft” or carbonated drinks is questionable. The effects of sugary carbonated drinks under these conditions of heat-induced dehydration have not been examined. However, plain carbonated water has been shown increase arterial PCO2 levels and reduced plasma pH and lactic acid levels in heat-stressed domestic fowl (3). Whether the effect of carbonation will limit or worsen the effect of rehydration with an FG solution remains to be seen and warrants further investigation. Studies into the impact of other beverages (tea, coffee, fruit juice, popular energy drinks, or electrolyte sports drinks) should also be examined.

The stevia-treated group was employed as a control group to account for increased fluid intake in the group given the sweetened fluid. The effects of this treatment are fascinating and worth further investigation. Not only was the renal injury reduced, arterial pressure, albeit determined via tail-cuff, was not increased in the stevia-treated group, in contrast to the increase in arterial pressure that was observed in both the water and FG solution groups. The mechanism underlying this improvement was not addressed and should be studied further. One wonders whether the stevia was acting as an osmotic diuretic to ameliorate the effects of dehydration-induced hypertension and renal injury.

It is a truism that adequate water intake is essential for life. The word in this statement that now should be focused on is what constitutes “adequate.” In answering this question, in the context of CKD, consideration should be given to the type of fluid, the quantity, and pattern of intake over a 24-h period, as should the age (infant, adult, elderly), sex, and health status of the individual.

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