

## PERSPECTIVE

# Outpatient Dietary Management of Electrolyte Disorders During COVID-19

## Food as Medicine

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"What should I eat?" is one of most common questions patients ask in the clinical setting. Patients with diabetes are asked to adhere to a low-carbohydrate diet, while patients with hypertension should consume a low-salt diet. But truthfully, the process of calculating the milliequivalents (mEq) of each food element is tedious and often not feasible. In this essay we describe a 97-year-old patient who learned to titrate condensed chicken soup like a medicine during the coronavirus 2019 (COVID-19) pandemic.

Without a doubt, this nonagenarian is a woman of great courage and wit. She first presented to the University of California, San Francisco, Nephrology and Hypertension clinic 2 years ago seeking guidance for hyponatremia management. At the age of 87 years, she had undergone a 3-vessel coronary artery bypass graft with residual reduced ejection fraction congestive heart failure. At the age of 94 years, she underwent a partial colectomy and en bloc resection of a 9-cm recurrent gastrointestinal stromal tumor. Unfortunately, for some time thereafter, she was hospitalized almost once every 2 months for heart failure exacerbations followed by hypovolemia-related hyponatremia.

Eventually, her hospitalizations decreased from 6 per year to 2 per year, as she was prescribed sodium citrate-citric acid for the mild metabolic acidosis she experienced from chronic kidney disease. This both treated her acidosis and provided additional sodium content for her hyponatremia. To manage her narrow window of euvolemia, she took furosemide whenever she was above a specific weight threshold, and her laboratory tests were checked at least once a month. However, even a minor episode of gastric reflux could tip her over into hypovolemic hyponatremia despite withholding diuretics. During one of her most recent hospitalizations, her intravenous catheter had infiltrated, leading to compartment syndrome requiring surgery. Consequently, she developed a healthy fear of the hospital, which was further exacerbated by the COVID-19 shelter-in-place order implemented in the spring of 2020.

In mid-April, her family called regarding her poor appetite. She was otherwise asymptomatic during her video visits, and they reported stable vital signs. Laboratory tests showed a decrease in her sodium level from 128 mEq/L to 123 mEq/L, while her creatinine level had risen from 0.92 mg/dL to 1.02 mg/dL. Her daily weights were drifting down. To better examine her volume status, we asked her to come to the clinic. Citing fears of contracting COVID-19, she refused the in-person visit. However, she reminded us that she still had cans of condensed chicken soup, which we had recommended she consume if her appetite was poor.

Adapting the high-salt oral repletion strategy of athletes who require rehydration during and after exercise,<sup>1,2</sup> she was salt-loaded orally at home with minimal free water. Each can of undiluted, condensed chicken soup has 321 mEq/L of sodium.<sup>3</sup> In comparison, 0.9% saline contains only 154 mEq/L of sodium. Presuming that she had additional free water intake throughout the day, she was asked to only dilute her condensed chicken soup with a half can, rather than 1 can, of free water. This changed the sodium concentration of the soup to 214 mEq/L and ensured that her daily oral intake would not be hypotonic after accounting for her other free water intake. She continued to monitor her weight and lower-extremity swelling daily. A week later, this patient reported feeling much better and was back at her goal weight, and repeated laboratory tests showed a sodium level of 134 mEq/L.

There are obvious caveats to this approach. This patient had a prior record of following instructions well and had family who could evaluate for clinical changes. While she had low sodium levels, she was at relatively low risk of central pontine myelinolysis with the use of carefully titrated sodium loading. At the age of 97 years, there was little reason to force her to be hospitalized, unless the condition was life threatening or hospitalization was within her goals of care. Yet this case ultimately serves as a reminder of the importance of providing patient-centered care and that clinicians should never forget the electrolytes in the most basic of items—food.

Internists often prescribe tablets for electrolyte repletion. The general feedback from patients is that these treatments, such as potassium chloride tablets, are unpalatable, like "horse pills."<sup>4</sup> The present case illustrates that basic pantry items may be used for electrolyte repletion under careful supervision, especially in times of shelter-in-place. Just as condensed chicken soup or bouillon cubes could be used to treat mild cases of hypovolemic hyponatremia, free water can be titrated to treat hypernatremia. Furthermore, orange juice, carrot juice, and a diet replete with bananas, sun-dried tomatoes, and avocados may be used instead of potassium tablets to treat hypokalemia. Milk, plain nonfat yogurt, and tofu may be used instead of calcium carbonate to treat hypocalcemia. In fact, dietary calcium may be superior to supplements in terms of bone health.<sup>5</sup> The Table lists some potential food substitutes using data from the US Department of Agriculture.<sup>3,6</sup> However, close clinical guidance is necessary to account for a patient's intake, output, and overall volume of distribution when managing electrolytes. In addition, sports drinks, often marketed for treatment of dehydration,

Table. Examples of Food Substitutions for Common Electrolyte Repletion Medications

Electrolyte	Medication	Amount	Repletion	Food substitute	Amount	Repletion
Sodium	Normal saline	1 L	154 mEq	Condensed chicken soup <sup>a</sup>	1 L	160 mEq
	Sodium chloride tablets	1 g	17 mEq	Chicken bouillon	1 Cube (10 g)	84 mEq
Potassium	Potassium chloride	10 mEq	750 mg	Orange juice	8 oz	451 mg
				Carrot juice	8 oz	590 mg
				Banana	1 (126 g)	451 mg
				Sundried tomatoes	1 Cup (55 g)	1880 mg
				Avocado	1 Cup (150 g)	728 mg
Bicarbonate	Sodium bicarbonate	650 mg	8 mEq	Baking soda	1 tsp	42 mEq
	Bicitra (sodium citrate/citric acid)	15 mL	15 mEq			
Calcium	Calcium carbonate	500 mg	200 mg	Milk (skim preferred)	8 oz	300 mg
				Yogurt (nonfat plain)	1 Cup	488 mg
				Raw tofu	0.5 Cup (126 g)	861 mg

Abbreviation: mEq, milliequivalents.

<sup>a</sup> Prepared as instructed.

may vary in tonicity and usually do not contain sufficient sodium to treat hypovolemic hyponatremia.

In conclusion, food appears to be a viable alternative to medications, especially in cases of electrolyte repletion. Further studies should be conducted to evaluate differences between intravenous, oral tablet, and dietary supplementation, considering that food has other ingredients that may change electrolyte absorption. For example, glucose tablets have been noted to relieve

symptomatic hypoglycemia better than dietary sugars.<sup>7</sup> However, as we seek ways to keep our patients safe and healthy during times of pandemic, this patient reminds us that food may serve as an accessible, cheap, and more palatable alternative. As clinicians, we know that treatment effectiveness requires adherence. Increased adherence to food recommendations compared with manufactured tablets may sometimes cause food to be an even better medicine.

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