



# Plant-Based Enteral Formulas for Chronic Kidney Disease (CKD)



## Overview of Plant-based Enteral Formulas

The use of plant-based formulas is gaining more traction among clinicians and consumers and are increasingly included on enteral formularies. Plant-based enteral formulas are used in the same way as their conventional counterparts — either as the sole source of nutrition by mouth or tube feeding, or as supplementation for treating malnutrition and/or to provide additional nutrients to an inadequate oral diet. Macronutrient and micronutrient requirements are met with plant-based formulas to the same degree as with conventional formulas, and they are available in specialized formats such as peptide-based, calorically dense, and high-protein, while other formulations address the specific needs of children, and those with diabetes or kidney disease. Enteral formulas can also be made by blenderizing whole foods directly without any processing but palatability and accessibility for this format are limited.

Due to more naturally occurring fibers and phytonutrients in these formulas, along with fewer synthetic and/or allergenic ingredients such as wheat, egg, dairy milk, soy, and nuts, emerging evidence has demonstrated improved gut microbiome quality and gastrointestinal tolerance.<sup>1</sup> However, some products include additives that while plant derived, (e.g., cellulose gum, cellulose gel, and locust bean gum), may cause gastrointestinal distress.<sup>2</sup> Likewise, some products contain stevia leaf extract or monk fruit, the effects of which are less studied than other sweeteners but are generally recognized as safe and usually well tolerated.

The core ingredients in plant-based enteral formulas are processed from whole-food plant ingredients (e.g., fruits, vegetables, grains, legumes) into blended concentrates or extracts. Flavorings in plant-based formulas such as agave syrup undergo some processing, but less so than more processed flavorings such as the maltodextrin and corn syrup solids contained in many conventional formulas. To decrease allergenicity, the protein source in plant-derived formulas is usually one such as pea protein or fava bean isolate (with fava bean, be aware of potential danger for people with G6PD deficiency) rather than the dairy or soy-based proteins found in conventional formulas. Due to the high phytonutrient content of these formulas, they are rich in antioxidants and therefore may be helpful in reducing acute and chronic inflammation.

## Potential Benefits of Plant-based Diets in CKD

A plant-based diet is not necessarily vegetarian or vegan but rather focuses on eating foods that are predominantly plant derived, such as fruits, vegetables, whole grains, legumes, nuts, and seeds, while also eating less animal-based foods. A *healthy* plant-based diet includes eating less processed foods; a food product may be plant-based but can be unhealthy due to processing with additives such as inorganic phosphates, which are particularly harmful in CKD. Observational data reveal potential benefits of plant-based diets, including lowering the risk for developing CKD,<sup>3</sup> a slower decrease in eGFR,<sup>1</sup> and an association between the highest adherence to a healthy plant-

based diet and a decrease in mortality of 21-26%.<sup>4</sup> This data, along with greater understanding of the importance of phytonutrients in decreasing inflammation, improving hypertension and decreasing cardiorenal risk and damage, have all led to a paradigm shift in renal nutrition. This shift is most notable in the focus upon managing the metabolic acidosis of CKD through increased intake of fruits, vegetables, and plant-based proteins, all of which provide fiber, antioxidants, and a favorable lipid profile. It is now well accepted that potassium and phosphorus, both a concern at high levels in CKD, are less absorbed when consumed as plants, rather than from animal-based sources.<sup>5</sup>

## How Plant-based Enteral Formulas Potentially Align with Nutrition Goals in CKD

- Nutrient profile that may better support management of metabolic acidosis
- Potentially reduced potassium and phosphorus bioavailability due to higher fiber content while still providing nutrients that support cardiorenal health. However, processing of commercial products may impact bioavailability, and no studies have yet shown a direct link between the effects on bioavailability between whole foods and enteral formulas.
- Fewer inorganic phosphate additives for better management of bone-mineral disorder
- Lipid profile that supports cardiorenal health
- Anti-inflammatory properties to support cardiorenal and gastrointestinal health
- Plant-based compounds that are not regarded as essential, but which may be beneficial to the gut and gut-kidney axis (e.g., fiber, tannins)
- Better gastrointestinal tolerance to allow greater opportunity for meeting nutritional requirements

## Considerations for Using Plant-based Enteral Formulas in CKD

- Malnutrition and sarcopenia in the CKD, ESKD (including in-center and home dialysis), and pre-transplant populations are highly prevalent, therefore nutrition support that fosters cardiorenal health is often helpful in all settings. Renal-specific plant-based formulas may be needed in the setting of fluid overload, hyperkalemia, and hyperphosphatemia.
- Post-transplant patients are also at increased risk of developing obesity and diabetes but may still be malnourished and require nutrition support. Plant-based formulas can be beneficial in supporting cardiorenal outcomes while also meeting nutrient requirements.
- Keep in mind that not all patients with CKD require a renal-specific formula. This population requires careful monitoring of fluid, electrolyte, and acid-base balance, and there are many instances in which patients are hypovolemic, hypokalemic, and/or hypophosphatemic. The whole range of plant-based enteral formulas can therefore be appropriate, depending upon clinical status.

### REFERENCES

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