



CASE BY CASE: NUTRITION

Nutritional Management of Protein-Losing Enteropathy

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Protein-losing enteropathy (PLE) is a pathologic state with several etiologies. Although many underlying conditions can result in protein loss through the gastrointestinal tract, there are 3 main mechanisms to consider: mucosal injury, infectious disease, and lymphatic disease.¹ Intestinal lymphangiectasia (IL), the pathologic dilation of lymphatic vessels, is a common subset of PLE and affects almost half of dogs with PLE.¹ IL can be congenital or secondary to inflammation and/or hydrostatic pressure changes within intestinal veins.² Intestinal lymphatic vessels are critical for transporting most dietary fats. After digestion and absorption, fat molecules are packaged into chylomicrons within enterocytes. Chylomicrons do not readily enter the portal circulation but are carried through the intestinal lymphatic system before eventually entering the cardiovascular circulation. Nutritional management of IL focuses primarily on

reducing lymphatic pressure by lowering chylomicron formation through reduced fat consumption. Other dietary plans may include feeding novel, hydrolyzed, or amino acid protein sources in case IL is secondary to a food allergy and/or providing a higher protein content to offset intestinal losses. This article describes the nutritional management of PLE for a dog with chronic inflammatory enteropathy (CIE) and presumed IL.

CASE HISTORY

The patient was a 7-year-old neutered male French bulldog presented in early July via a telemedicine appointment to the nutrition service at the University of Tennessee Veterinary Medical Center. He had an approximately 1-year history of unintended weight loss and reduced appetite, loose to watery stool, and occasional vomiting (**FIGURE 1**). Endoscopic biopsies

Abstract

Protein-losing enteropathy (PLE) can result from mucosal injury; infectious disease; or lymphatic disease, most commonly intestinal lymphangiectasia (IL). Nutritional management of IL focuses primarily on reducing lymphatic pressure by decreasing fat consumption via a low-fat diet. This case report describes a patient that was diagnosed with PLE and presumed IL and successfully gained and maintained weight on a homemade ultra-low-fat diet.



Take-Home Points

- Protein-losing enteropathy can result from mucosal injury, infectious disease, or lymphatic disease (most commonly intestinal lymphangiectasia [IL]).
- Commercially available novel, hydrolyzed, or amino acid protein diets that are low in fat may be tried; however, if there is no response, a homemade diet trial is often indicated.
- Secondary to food allergy and/or higher protein content to offset protein loss.
- Dietary management of IL entails reducing lymphatic pressure by decreasing fat consumption.
- The homemade diet can contain novel protein sources if IL may be secondary to food allergy and/or higher protein content to offset protein loss.
- Close communication with clients and follow-up appointments will ensure adjustments can be made and the patient is responding well to dietary management.

performed 9 months before presentation identified a moderate to marked lymphoplasmacytic gastritis and enteritis with intestinal crypt abscesses in the jejunum. The client reported that the patient's serum cobalamin was low, but values were not available at the time of consultation. In addition, the patient had a history of atopy that was controlled with occasional lokivetmab (Cytopoint; Zoetis, zoetis.com) injections.

Relevant physical examination findings from the referring internal medicine specialist 3 weeks before the nutrition consultation reported that the patient weighed 8.8 kg (19.4 lb), had a body condition score (BCS) of 2/9, and exhibited mild muscle wasting. His estimated ideal weight was 12 kg (26.5 lb). Serum chemistry values from the same visit showed hypoproteinemia (4 g/dL), hypoalbuminemia (2 g/dL), hypocalcemia (8.2 mg/dL), and hypocholesterolemia (95 mg/dL). No protein was present in the urine. The diagnosis was PLE, presumably IL secondary to a CIE.



FIGURE 1. The patient approximately 6 weeks before initial nutrition consultation, weighing 8.8 kg (19.4 lb) with a body condition score of 2/9.

Therapies included psyllium powder (½ teaspoon q12h), tylosin (100 mg PO q12h), vitamin B₁₂ (250 µg SC q7d), folic acid (200 µg PO q24h), prednisone (10 mg [1 mg/kg] PO q24h; increased from 5 mg 2 weeks earlier, initially prescribed 6 weeks before presentation to the nutrition service), maropitant (24 mg PO q24h), and ivermectin (unflavored Heartgard; Boehringer Ingelheim, bi-animalhealth.com) monthly.

The patient's diet was 1.5 cans of Royal Canin Selected Protein Adult PW loaf (royalcanin.com) per day (413 kcal/can; 42.5 g fat/1000 kcal), divided into 2 meals. He had not been fed any additional treats in the 6 weeks before presentation. Previously, the patient had consumed a large variety of commercially available diets and treats with known protein content including chicken, turkey, beef, pork, lamb, duck, bison, dairy, chickpeas, alligator, whitefish, pea, soy, and goat's milk. His total calorie intake was 620 calories per day from the canned commercial food, which was about 37% above his calculated resting energy requirements for ideal weight ($70 \times BW_{\text{kg}}^{0.75}$).

NUTRITION RECOMMENDATIONS

Initial Visit

To minimize dilation of intestinal lymphatic vessels, the authors formulated an ultra-low-fat home-prepared diet with a fat content of 7 g/1000 kcal (5.8% metabolizable energy [ME]). In comparison, the fat content of common commercially available therapeutic low-fat diets ranges from 17 to 26 g/1000 kcal (16% to 22% ME) (**TABLE 1**). Because a possible cause of the patient's CIE with IL was a food allergy, the diet was also formulated with a novel protein source. The ingredients used for the recipe included boiled shrimp, baked sweet potato, and cooked white rice, which were

supplemented with psyllium, vitamins, and minerals. Shrimp was chosen as a low-fat novel protein source that can be readily purchased from most grocery stores. The combination of sweet potato and white rice was used to provide palatability and a relatively low amount of total dietary fiber (14 g/1000 kcal). For comparison, the patient's previous diet contained 27 g of total dietary fiber per 1000 kcal. The new diet was also formulated to be relatively high in protein (84 g/1000 kcal) to offset intestinal losses. With the exception of fatty acids, the remaining nutrients in the diet met the recommended allowances for adult dogs set by the National Research Council.³ The daily caloric goal for the patient was based on his resting energy requirements for an ideal body weight of 12 kg (26.5 lb) multiplied by a life stage factor of 1.8 to promote weight gain, equaling approximately 800 calories per day.

Follow-up Visits

Two weeks after starting the home-prepared diet, the patient was reported to have a ravenous appetite and near perfect stool quality. However, his weight remained static, and he was polyuric and polydipsic from increased prednisone. The calorie content of the diet was increased by 50% to 1200 calories per day. By the end of August, the patient continued to do well and had gained 1 kg (2.2 lb) and the referring veterinarian reported a BCS of 4.5/9. His albumin had increased to 2.6 g/dL, and his prednisone dose was reduced to 5 mg PO q24h. He was no longer receiving maropitant. Four weeks later, his albumin was 2.9 g/dL, and his weight had increased to 12 kg (26.5 lb). Prednisone was further reduced to 2.5 mg PO q24h. By mid-October, the patient weighed 13.2 kg (29.1 lb) and had a BCS of 6/9 and albumin level of 3.2 g/dL. The prednisone dose was tapered to 2.5 mg q48h and eventually discontinued. He was weaned off of tylosin and remained in clinical and biochemical remission.

By December, the patient had reached 13.6 kg (30 lb) and his home-prepared diet was reformulated with fewer total calories and supplemented with a

combination of flaxseed and walnut oil to meet minimal fatty acid requirements while maintaining a very low level of fat (13 g/1000 kcal; 12% ME). A year and a half after starting this homemade diet, the patient remains in remission and is doing well (**FIGURE 2**).

DISCUSSION

This case is an example of an ultra-low-fat, novel-protein diet that induced remission in a dog with CIE and presumed IL. The client never challenged the dog with other protein sources to confirm the presence of a food allergy; therefore, it is difficult to determine whether feeding a novel protein had an effect. In addition, the simplicity of ingredients in a home-prepared diet can also benefit some dogs with CIE and may have influenced this patient's response to dietary therapy. In a retrospective study of dogs with PLE, 85% (23/27) of dogs responded to an ultra-low-fat homemade diet (3.5 g/1000 kcal) with increased albumin and improved clinical severity scores.⁴ The median time until dogs were considered responsive was 15 (range, 6 to 32) days.

Nutritional management of PLE can at times feel frustrating for clients and veterinarians; therefore, approaching the disease with the mindset that several diet trials may be needed is helpful. For some dogs,



FIGURE 2. The patient 18 months after initial nutrition consultation, weighing 13 kg (28.6 lb) with a body condition score of 6/9.

TABLE 1 Categories of Low-Fat Diets

CATEGORY	GRAMS OF FAT/1000 KCAL
Ultra-low-fat	≤15
Conventional low-fat	16-25
Moderate low-fat	>25-30

PLE can be well controlled with commercially available low-fat diets. Moderately low-fat hydrolyzed diets (e.g., Purina HA vegetarian dry, Purina EL Elemental dry [proplanvetdirect.com], Blue Buffalo HF canned [bluebuffalo.com]) and novel protein low-fat diets (e.g., Rayne Low-fat Kangaroo [raynenutrition.com]) are available and often a first-line choice for PLE patients. If a dog with PLE does not have a positive response to commercially available diets, a homemade diet trial is often indicated. For many patients, a good temporary (2 to 4 weeks) diet to test responsiveness contains a lean novel protein such as whitefish (e.g., cod, tilapia) combined with cooked sweet potato and white rice in 3 equal parts by weight. Due to nutrient imbalances of the temporary diet, follow-up with a board-certified veterinary nutritionist (vetspecialists.com) is needed for long-term management.

SUMMARY

Many dogs with PLE will have IL as a primary or secondary etiology, and the best management is a low-fat diet. Using a novel, hydrolyzed, or amino acid diet that is also low in fat is helpful for patients that may also have a food allergy. If a diet trial with commercially available products does not improve clinical signs, the next step may be an ultra-low-fat homemade diet. **TVP**

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