GROWING GOALS A large-breed puppy with renal dysplasia required a custom nutrition plan to satisfy its needs for kidney health while it was still growing.

CASE REPORT: NUTRITION

Nutritional Management of a Puppy With Congenital Renal Dysplasia

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Nutritional management and optimal diet selection for pets with multiple medical conditions or conflicting nutritional goals can prove challenging. Nutritional management is particularly complicated for growing animals with nutritional deficiencies that can result in serious and lifelong consequences (e.g., skeletal malformation resulting from inappropriate calcium or phosphorus intake in growing puppies). For these patients, there is typically not a "one size fits all" solution, and each nutritional plan should be curated on a case-by-case basis. One approach is creating a problem list after a full nutritional assessment, with accompanying nutritional goals, determination of priorities and potential side effects/risks, and comparison of nutrients of concern among various diet options.

The patient in this case report was a 7-month-old intact female mixed breed puppy (her breed and expected adult body weight were unknown) referred to our nutrition service by her primary care veterinarian. The purpose of the referral was to discuss nutritional management for renal dysplasia. The diet options and management discussed in this report illustrate one potential approach for this specific patient and should not be generalized to all dogs with similar conditions.

HISTORY

The patient was originally presented to the primary care veterinarian due to frequent urination and increased drinking since her adoption a few months earlier. Aside from the polyuria and polydipsia, the clients reported no concerns; the patient was up-to-date on all vaccinations and was not receiving any medications. Blood work revealed elevated kidney values, and the veterinarian recommended that the patient be seen by an internal medicine specialist for further diagnostic testing. After additional laboratory work and diagnostic imaging had been performed, the clients consulted our clinical nutrition service to determine optimal dietary management.

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NUTRITION CONSULTATION

A full dietary history indicated that the patient had been eating Weruva Grain Free Funky Chunky Chicken Soup with Pumpkin, Grandma Mae's Country Naturals Puppy Food, Bixbi Pocket Trainers Training Treats (bacon flavor), Happy Howie's Meat Roll (lamb and turkey), peanut butter, frozen banana pieces, baby carrots, and green bean pieces. For daily supplements, she was receiving Nutramax Proviable-DC capsules and Nutramax Welactin Omega-3 Supplement for Dogs.

Considering the patient's young age, the presumptive diagnosis of renal dysplasia, based on blood chemistry and ultrasonography findings, was of highest concern.

Physical Examination

At the time of examination, the patient weighed 20.5 kg and had a body condition score of 5/9 and normal muscle condition. No significant abnormalities were detected.

Diagnostic Tests

The internal medicine service performed the following:

Urinalysis

- **Appearance:** straw colored, clear
- **Specific gravity:** 1.015
- **pH:** 6
- **Protein:** trace
- **White blood cells:** rare
- **Bacteria:** none seen
- **Crystals/glucose/ketones/bilirubin:** negative
- Urine protein:creatinine ratio (UPC) and urine culture not performed

Blood Chemistry

The following figures in parentheses indicate the reference range for laboratory tests. The following figures in brackets indicate the reference range for growing puppies 7 to 12 months of age.[1]

- **Blood urea nitrogen (BUN), mg/dL:** 33 (8 to 30) [9.8 to 37.3]
- **Creatinine, mg/dL:** 0.6 (0.6 to 2) [0.21 to 0.89]
- **Phosphorus, mg/dL:** 6.2 (2.6 to 7.2) [3.5 to 7.8]
- **Calcium, mg/dL:** 11.3 (9.4 to 11.3) [10.4 to 12]
- No other significant abnormalities

Abdominal Ultrasonography

The polydipsia/polyuria, dilute urine, and elevated kidney values in this older puppy prompted ultrasonographic examination. Both kidneys had diffusely altered architecture characterized by lack of corticomedullary distinction and poorly defined hyperechoic outer medulla/inner cortex. No pyelectasia or other abnormalities were seen. The ultrasonography findings supported renal dysplasia.

Differential Diagnoses

Considering the patient's young age, the presumptive diagnosis of renal dysplasia, based on blood chemistry and ultrasonography findings, was of highest concern. However, chronic nephritis could not be excluded.

Treatment

The internal medicine service determined the patient's medical management. Our nutrition service determined her nutritional management, which began with lists of nutritional goals and nutrients of concern.

Nutritional Goals

- Provide a complete and balanced diet to maintain ideal body weight and condition throughout growth.
- Provide adequate protein to meet growth, but avoid excessive protein because of renal disease.
- Avoid high phosphorus because of renal disease, but meet needs for growth.
- Avoid high calcium because of renal disease, but meet needs for growth.
- Avoid high sodium because of renal disease.
- Ensure appropriate calcium:phosphorus ratios for growing large-breed puppies (1:1 to 2:1).
- Consider diets that meet the Association of American Feed Control Officials (AAFCO) nutritional guidelines for growing large-breed puppies.
- Consider omega-3 fatty acid supplementation for anti-inflammatory effects in patients with renal disease.[2-4]

- Consider diets formulated with higher B vitamin concentration because of losses associated with water-soluble vitamins and diets that are nonacidifying (i.e., that promote alkaline urine).

Nutrients of Concern

- **Calorie density**
- **Protein:** Consider diets near AAFCO minimum of 5.6 g/100 kcal initially, then modify according to response.
- **Calcium:** Consider diets near AAFCO minimum of 300 mg/100 kcal initially, then modify according to response.
- **Phosphorus:** Consider diets near AAFCO minimum of 250 mg/100 kcal initially, then modify according to response.
- **Sodium:** Meet AAFCO minimum of 20 mg/100 kcal, but avoid excessive sodium (<150 mg/100 kcal).
- **Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA):** Give at recommended dose for renal disease, 140 mg/(kg body weight$^{0.75}$).[2-4]
- **Nonacidifying diets:** These diets produce an alkaline urine, although many companies do not regularly analyze this for nontherapeutic diets.

Potential Diet Options

We compared nutrients of concern among the patient's previous diets and additional potential diet options (**TABLE 1**). All diets listed in **TABLE 1** (with exception of the previous diets listed for comparison) met AAFCO guidelines for growth of large-breed puppies either by being formulated to meet AAFCO guidelines or by undergoing AAFCO feeding trials. We discussed with the clients the diet options as well as potential risks of excess protein, phosphorus, calcium, and sodium possibly worsening renal disease and the competing risks of restricted protein possibly leading to muscle loss and restricted calcium and phosphorus possibly leading to skeletal malformation. Given the early stage of the renal disease and most likely very high intake of protein and phosphorus in the patient's previous diet, we prioritized the essential nutrient needs for a growing large-breed puppy. We recommended that the patient be seen by her primary care veterinarian in 4 to 6 weeks to reassess her blood work. The clients elected to try the Purina Pro Plan Puppy Chicken & Rice Formula (dry) (purina.com) initially until her recheck.

Treats for Training and Mental Enrichment

We recommended a treat allowance such that no more than 10% of calories would come from unbalanced foods (i.e., any foods other than the main diet). To provide expanded options for training, in lieu of the patient's protein-based treats (e.g., meat rolls, bacon treats, peanut butter), we recommended that the clients take a portion of the dry food, make it into a slush with water, and freeze it into a rubber KONG toy (kongcompany.com) for chewing (which would not

TABLE 1 Nutrients of Concern in Previously Fed Diets and Potential Diet Options*

PRODUCT AND AAFCO COMPARISON	KCAL/CAN OR CUP	PROTEIN, G/100 KCAL	CALCIUM, MG/100 KCAL	PHOSPHORUS, MG/100 KCAL	SODIUM, MG/100 KCAL
PREVIOUS DIET FOR COMPARISON					
Weruva Grain Free Funky Chunky Chicken Soup with Pumpkin Adult	259	13.4	230	200	80
Grandma Mae's Country Naturals Puppy	465	7	320	220	90
OTHER DIET OPTIONS					
Hill's Science Diet Puppy Large Breed (dry)	394	6.8	278	231	132
Purina Pro Plan Puppy Shredded Blend Chicken & Rice Formula (dry)	406	7	339	240	125
Purina Pro Plan Puppy Chicken & Rice Formula (dry)	456	6.9	303	244	132
Royal Canin Size Health Nutrition Small Indoor Puppy (dry)	325	6.8	325	250	100
Royal Canin Canine Shih Tzu Puppy (dry)	354	7	330	250	100
AAFCO Minimum for Healthy Puppies	—	5.6	300	250	80

**Nutrient information obtained from 2020 company product guides or by calling companies in 2020 to obtain typical nutrient analysis.*

have to come out of the 10% treat allowance because it was complete and balanced). In addition, we recommended that a portion of the daily kibble be used for treats and training options. Last, we recommended fresh fruits for treats, which could comprise the treat allowance (e.g., blueberries = 1 kcal each), and food-dispensing toys for enrichment.

Medication Administration

Although medications were deemed not necessary at that time, we recommended that if needed in the future, medication could be dispensed in small pieces of fruit or in cheese-flavored Greenies Pill Pockets (greenies.com; 9 kcal, 2.6 g/100 kcal protein, 30 mg/100 kcal phosphorus, 130 mg/100 kcal calcium, 100 mg/100 kcal sodium).

Supplements

Because the patient had not exhibited any gastrointestinal signs, probiotics were discontinued. Fish oil supplementation was continued, but the dose was adjusted to the recommended amount of total EPA and DHA for renal disease (140 mg/[kg of body weight$^{0.75}$]), which was 1346 mg EPA and DHA daily. Welactin Omega-3 Supplement for Dogs (liquid) (welactin.com) was continued at 1 scoop (6 mL) per day, which provided 870 mg EPA and 570 mg DHA.

OUTCOME

Due to family circumstances and the coronavirus pandemic, the patient was presented to her primary care veterinarian for a recheck visit at 12 months of age (5 months after the initial consultation). Her body weight had increased to 31 kg and had remained stable for the previous month (indicating that she had probably reached full skeletal maturity). Her ideal body condition score of 5/9 and normal muscle condition persisted. She had been consuming the Purina Pro Plan Puppy Chicken & Rice Formula (dry) along with varied fruits and vegetables for treats (cucumber slices, blueberries, baby carrots, and bananas). She was also still receiving 1 scoop (6 mL) of Welactin Omega-3 Supplement for Dogs. The clients reported that she was doing very well, although she had been starting to act more hungry in the past month and was scheduled to be spayed in the upcoming weeks. Her primary care veterinarian performed recheck blood work before the spay procedure, and our nutrition service continued to provide recommendations after reviewing the medical records from her primary care visit.

Recheck Diagnostics

The primary care veterinarian performed the following tests:

Urinalysis

- **Specific gravity:** 1.015
- **pH:** 5
- **Protein:** negative
- **Bacteria**: none seen
- **Glucose/ketones/bilirubin:** negative

Blood Chemistry

The numbers in parentheses indicate the reference range.

TABLE 2 Nutrients of Concern in Recommended Diet and Other Diet Options*

PRODUCT AND AAFCO COMPARISON	KCAL/ CAN OR CUP	KCAL/ KG	PROTEIN, G/100 KCAL	PHOSPHORUS, MG/100 KCAL	SODIUM, MG/100 KCAL
CURRENT DIET (FOR COMPARISON)					
Purina Pro Plan Puppy Chicken & Rice Formula (dry)	456	4188	6.9	244	132
OTHER DIET OPTIONS					
Hill's Science Diet Adult 6+ Large Breed (dry)	353	3558	4.8	176	83
Hill's Bioactive Recipe Adult 7+ Thrive + Vigor (dry)	354	3567	5.2	152	70
Hill's Science Diet Adult 7+ Beef & Barley Entrée (13 oz)	376	1016	5.2	164	78
Royal Canin Canine West Highland White Terrier Adult (dry)	339	3730	5.3	170	100
Royal Canin Canine Dalmatian Adult (dry)	375	3823	5.5	150	150
AAFCO Minimum for Healthy Adult Dogs	—	—	4.5	100	80

**Nutrient information obtained from 2020 company product guides or by calling companies in 2020 to obtain typical nutrient analysis.*

- **BUN, mg/dL:** 38 (9 to 31)
- **Creatinine, mg/dL:** 1.1 (0.5 to 1.5)
- **Phosphorus, mg/dL:** 3.9 (2.5 to 6.1)
- No other abnormalities were noted.

Revised Nutrients of Concern (TABLE 2)

- **Calorie density:** Consider less calorie-dense diets due to the upcoming spay.
- **Protein:** Adjust intake to meet adult AAFCO minimum of 4.5 g/100 kcal.
- **Phosphorus:** Adjust intake to meet adult AAFCO minimum of 100 mg/100 kcal.
- **Sodium:** Continue to avoid excessive sodium.
- **EPA and DHA:** Provide at 140 mg/(kg body weight$^{0.75}$), the recommended dose for patients with renal disease.[2-4]

CONCLUSIONS

Because the patient had reached full skeletal maturity and was 1 year of age, revised nutritional goals were discussed with the clients and involved adjusting protein and phosphorus intake to meet minimum values for an adult dog instead of a growing puppy while considering a less calorie-dense diet and increased enrichment. Because gonadectomy can reduce energy requirements by up to 30% in dogs[5] and the patient was showing increased hunger at meals, the clients elected to try the lowest calorie food of the options discussed, the Royal Canin Canine West Highland White Terrier Adult Dry (royalcanin.com). Hunger-seeking versus attention-seeking behavior was also discussed with the clients because it can sometimes be challenging to differentiate between them, and additional strategies for mental and physical enrichment were recommended. The dog still maintained an ideal body condition and was not eating less than that recommended on the product label, so an initial 10% reduction in calories was recommended after spay, followed by biweekly weighing until the calorie intake that would enable the dog's weight to remain stable could be confirmed. To ensure no potential for nutrient deficiency, the clients were counseled that if their dog required dietary restriction less than the amounts recommended for her weight on the product label, we would need to revisit our nutritional goals to include calorie density, nutrient density, protein, and fiber. Treats were continued as before, and her fish oil dose was adjusted for her new weight (1800 mg of EPA and DHA = 1.25 scoops [7.5 mL] of Welactin Omega-3 Supplement for Dogs [liquid] per day). Two months later, the dog's renal values were stable (creatinine 1.1 mg/dL, BUN 30 mg/dL, phosphorus 4.2 mg/dL), and urinalysis indicated inactive sediment and unremarkable results. The clients noted that the dog needed a 20% reduction in calories to maintain her weight, but food-seeking behaviors had stopped when they switched to the lower calorie food and increased enrichment. The dog continued to do well, and recheck diagnostics every 3 to 6 months were recommended; the intent was to reduce protein and phosphorus as needed, based on kidney disease progression. TVP

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Dr. Linder is a board-certified veterinary nutritionist at the Cummings School of Veterinary Medicine at Tufts University, where she also earned her DVM degree. Dr. Linder's interests include obesity management, effective client education, and human–animal interaction. Her research has focused on safe and effective weight-loss strategies for pets as well as the effect of obesity on pet and human wellbeing. She is also co-director of the Tufts Institute for Human-Animal Interaction and co-founder of the pet nutrition website petfoodology.org.