Nutritional management of a jack russel terrier puppy affected by urate urolith: a homecooked-diet approach

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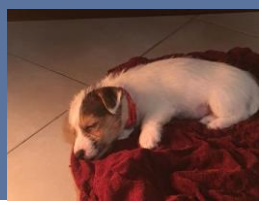
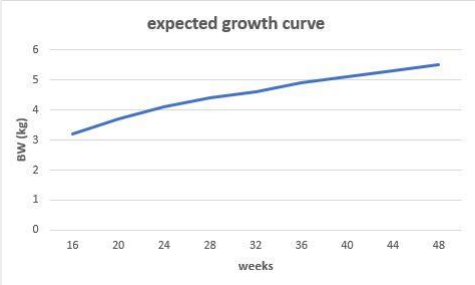


Case description

Teo, a 3.1 kg, 4-months-old, jack russel terrier (JRT) puppy was evaluated because of turbid white (cloudy) urine flow and dysuria.

On presentation → the puppy was bright, alert, responsive and with a BCS score 5/9*.
[*evaluated by the general practitioner].



(Equations for growth curves from Klein et al. 2019)

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Physical examination→ unremarkable.
Up-to-date on vaccination protocols (WSAVA Vaccination Guidelines 2016)

Complete blood count | Biochemistry | Urinalyses | Abdominal US

Case description

CBC

- ↓ hemoglobin level [**12.2** g/dL; reference interval (RI): 15.7 to 19.9 g/dL]
- ↓ lymphocyte counts [**5872**/µL; RI: 1200 to 4100/µL]
- ↑ platelet counts [**400** X 10^3/µL; RI: 103 to 395 10^3/µL]

Biochemistry

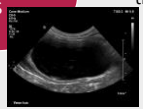
- ↑ CPK level [**313** IU/L; RI: 20 to 150 IU/L]
- ↑ ALP level [**166** IU/L; RI: 20 to 120 IU/L]
- ↓ creatinine level [**0.49** mg/dL; RI: 0.7 to 1.3 mg/dL]
- ↑ phosphorus level [**8.4** mg/dL; RI: 2.5 to 5.5 mg/dL]

Urinalyses [spontaneous urination]

- aspect: cloudy
- specific gravity [USG **1054;** RI: 1025 to 1045]
- pH = 6
- urine sediment: ammonium urate crystals ++++
- bacteria: few

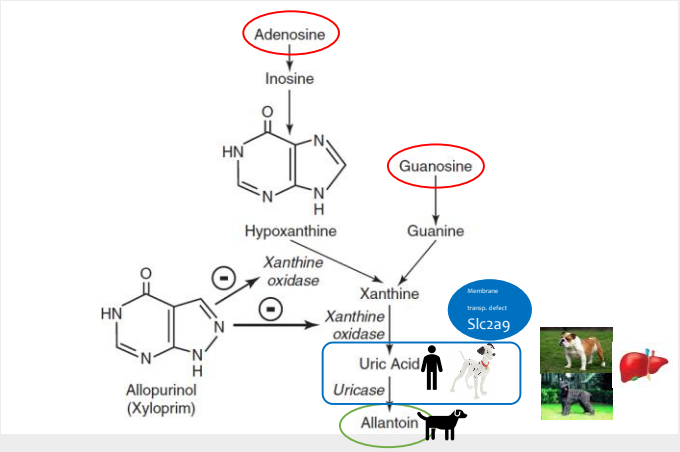
Abdominal US

- bladder: one 23mm round radiopaque calculus close to ureterovesicular junction
- the remainder was unremarkable.



Findings were consistent with a supposed diagnosis of congenital disorder of purine metabolism (hyperuricosuria) → mutation in the Slc2a9 gene NOT tested

Purine metabolic pathway



Modified from: Canine and feline nephrology and urology (Chew-Dibartola-Schenck, II edition)

Case description

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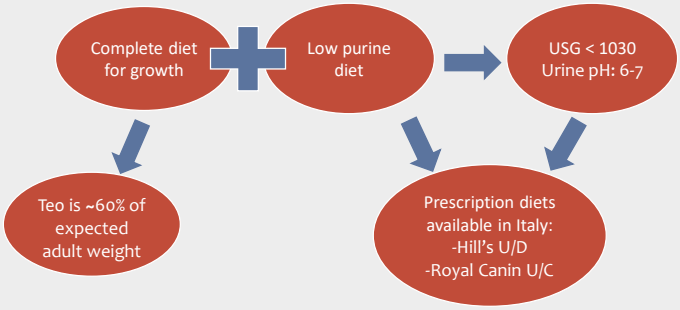
The JRT puppy was referred to DIMEVET for nutrition consultation & diet evaluation



Nutritional management

Determination of Teo's daily energy requirements (~60% of expected adult weight)

ME requirement (MJ/d) = (1.063 - 0.565 x [actual BW/expected mature BW]) x actual BW$^{0.75}$) =

2 MJ/d → 216 kcal/d

Current diet: Royal Canin Puppy Mini 1-10 kg → EM /kcal/1000g) = 3870

Daily amount (feeding recommendations according to manufacturer) = 110 g/d

Dietary risk factors

In predisposed dogs:
- High protein content of diet → >20% DM
- High in purines/purines precursors ingredients

(Bartges et al., 1999)

Nutrient	Unit/1000kcal/
Protein (g)	80
Fat (g)	52
Ca (g)	3.6
P (g)	2.8
Vit. A (IU)	5555
Vit. D (IU)	258

CP ~35% DM

(Equations for ME intake from Klein et al. 2019)

Nutritional management

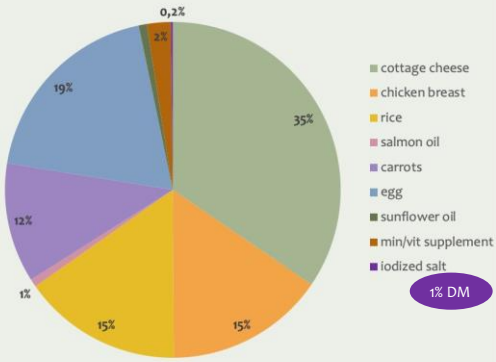
Comparison between Hill's U/D, Royal Canin U/C and FEDIAF nutrient levels for puppies (unit per 1000 kcal/ME)

Nutrient	Fediaf (late growth)	U/D Hill's	U/C R.C.
Protein (g)	50	25	46
Fat (g)	21.25	47	39
Ca (g)	2.00	0.68	2.06
P (g)	1.75	0.45	1.54
K (g)	1.1	1.43	2.3
Na (g)	0.55	0.55	1.43
Vit. A (IU)	1250	3200	6527
Vit. D (IU)	125	160	208
		ME (kcal/1000g) = 4000	ME (kcal/1000g) = 3830

From: FEDIAF Nutritional Guidelines 2019

Nutritional management

Homecooked diet composition (HCD) and nutrient levels (unit per 1000 kcal/ME)



Nutrient	Unit/1000kcal/ME
Protein (g)	68
Fat (g)	39
Ca (g)	2.9
P (g)	2.6
K (g)	1.5
Na (g)	2.2
Vit. A (IU)	4398
Vit. D (IU)	287

ME (kcal/1000g as fed) = 1384
Moisture (% as fed) = 74%

Nutritional management

Comparison between Hill's U/D, Royal Canin U/C, the HCD and FEDIAF nutrient levels for puppies (unit per 1000 kcal/ME)

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Teo's choice

From: FEDIAF Nutritional Guidelines 2019

Nutritional management

Determination of Teo's daily energy requirements (-60% of expected adult weight)

ME requirement (MJ/d) = (1.063 - 0.565 x [actual BW/expected mature BW]) x actual BW$^{0.75}$) =

2 MJ/d→ 216 kcal/d

5% ME snacks

95% ME HCD diet

290 g HCD/ day

Treats list	Mg uric acid/100g	Kcal/100g	g/d
Strawberry	21	32	**65**
Raspberry	18	52	**40**
Pineapple	19	50	**42**
Apple (w/o skin)	14	48	**44**
Pear	12	58	**36**
Peach	21	39	**54**
Carrot	17	41	**52**
Banana	57	89	**24**

Westropp et al. BMC Veterinary Research (2017) 13:45 DOI 10.1186/s12917-017-0958-y

Follow-up → daily diet amount has been adapted according to growth phase

1-month follow-up 3.8 kg BW
- aspect: clear
- specific gravity [USG **1028**; RI: 1025 to 1045]
- pH = 6
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 222 mg/100 kcal

2-month follow-up 4.2 kg BW
- aspect: clear
- specific gravity [USG **1024**]
- pH = 6
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 240 mg/100 kcal

3-month follow-up 4.5 kg BW
- aspect: clear
- specific gravity [USG **1030**]
- pH = 6
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 250 mg/100 kcal
+ Oral potassium citrate 100mg/kg BW

4-month follow-up 4.8 kg BW
- aspect: clear
- specific gravity [USG **1036**]
- pH = 6.5
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 250 mg/100 kcal
+ Oral potassium citrate 100mg/kg BW

Follow-up → daily diet amount has been adapted according to growth phase

5-month follow-up 4.9 kg BW

- aspect: clear
- specific gravity [USG **1045**]
- pH = 6.5
- urine sediment: **sodium urate crystals ++**
- bacteria: neg.

→ **> Na intake = >375 mg/100 kcal***
+ Oral potassium citrate 100mg/kg BW

6-month follow-up 5.0 kg BW

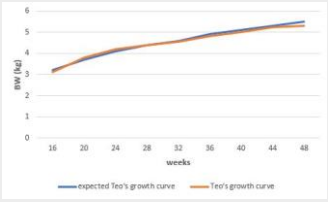
- aspect: clear
- specific gravity [USG **1022**]
- pH = **7**
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 450 mg/100 kcal
+ Oral potassium citrate 100mg/kg BW

1 year follow-up 5.2 kg BW

- aspect: clear
- specific gravity [USG **1023**]
- pH = 6
- urine sediment: neg.
- bacteria: neg.

→ Na intake = 450 mg/100 kcal



* Lulich et al., ACVIM Consensus Statement 2016

Discussion → matching diet to disease

- **Growing dogs** have more demanding nutritional requirements than adults.
- Inappropriate diets can lead to nutritional deficiencies/excesses during growth phase → health consequences (e.g. developmental orthopedic disease and dilatative cardiomyopathy)

- **Urate uroliths** occur when [urinary uric acid] is high
- Cause: portovascular anomalies or congenital hyperuricosuria in Dalmatians and non-dalmatian dogs (e.g. English Bullodg, Shi-tzu, Parson/Jack RT)

- **Medical treatment: above all, consider dietary calculi dissolution!**
- low protein and purine restricted diet (35-50g/1000kcal) → inappropriate for growing dogs!
- monitor urine monthly
- XO inibithor (allopurinol) →safe for puppies?
- **To minimize recurrence**
  - < urine concentration (high-moisture foods >75%) → USG </= 1020 in dogs
  - promote alkcaline urine (pH >/= 7)
  - limit purine intake (see next table)

Discussion → Purine content of various food

Foods to avoid	Foods to use sparingly	Very low purine foods
Anchovies/ Herrings/ Mackarel/ Salmon/Sardines/ Tuna	Fish (except those listed In the first column)	Breads (whole grain cereals product)
Brains/ Heart/ Kidney/ Liver/	Asparagus/ Cauliflower	Cheese
Goose	Legumes (Beans/ Peas/ Lentils)	Eggs
Shrimps	Meats	Fruits
Crustaceans	Spinach	Vegetables (except those listed In the first column)
Meat Extracts, Including Buoillon	Mushrooms	Water

Modified from: «Canine urate urolithiasis» in veterinary clinics of North America: small animal practice (Bartges et al. 1999)

References

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