




Case Report:

Evaluation and monitoring of a case of nutritionally-associated osteopenia using DEXA imaging

Signalment

4 month old male intact Old English Sheepdog



History

- 1 month history of progressive lameness
 - Initial diagnosis of hip dysplasia by rDVM
- Progressed to hindlimb paresis
- Vomiting
- Muco-haemorrhagic diarrhoea

Presentation

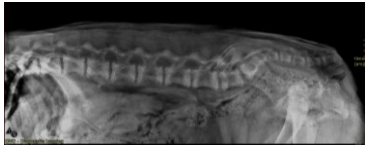
- 10.9kg, subjectively small for age
- Reluctant to ambulate
- Hindlimb paresis
- Generalized muscle fasciculations
- Tachycardia
- Tachypnoea
- Left forelimb lameness, shifting bilateral pelvic lameness
 - Mild effusion in left stifle, painful on palpation
- Spinal pain
 - Kyphotic stance
 - Plantigrade stance



Diagnostics

- Complete blood count
 - No abnormalities detected
- Serum biochemistry
 - Hypocalcaemia (1.36 mmol/L, range 2.50-3.00 mmol/L)
 - No other abnormalities detected
- Idexx SNAP® Parvo - negative
- Idexx SNAP® 4DX® - negative
- Synoviocentesis
 - Normal synovial fluid
 - Mixed populations of cells consistent with inadvertent sampling of bone marrow

Diagnostics
- radiographs



- Diffuse severe osteopenia
- Irregular caudal aspect of right femoral neck
- Sacral kyphosis
 - Suspected vertebral fracture

Dietary history

- Homemade diet since acquisition at 9 weeks of age (5 weeks prior to presentation)

Ingredient	Quantity	Frequency
Raw egg	1	SID
Goat's milk	½ cup	SID
Raw ground beef, or Chicken meat, or Turkey meat, or Lamb meat	½ cup	TID
Chicken liver	½ cup	Q8h
Cottage cheese, or Goat's milk yogurt	½ cup	BID
Cooked white rice, or Cooked sweet potato, or Cooked oatmeal	½ cup	TID
Carrot, or Lettuce, or Alfalfa sprouts, or Broccoli	¼ - ½ cup	BID
Dried alfalfa	2 tsp	SID

Homemade Diet
- computer
analysis

Nutrient	Quantity /Mcal	AAFCO recommendation /Mcal
Calcium (g)	1 0.23	3.0 - 4.5
Phosphorus (g)	1 1.01	2.5 - 4.0
Cu:P	1 4.5	3.2 : 1
Vitamin D (IU)	1 11.1	125 - 750
Magnesium (g)	1 0.13	≥ 0.18
Copper (mg)	1 0.72	≥ 3.1
Iron (mg)	1 10.9	≥ 22
Manganese (mg)	1 1.0	≥ 1.8
Zinc (mg)	1 13	≥ 25
α-linolenic acid (g)	1 0.16	≥ 0.2
Choline (mg)	1 321	≥ 340
Vitamin E (IU)	1 2.7	≥ 12.5

Main nutritional considerations

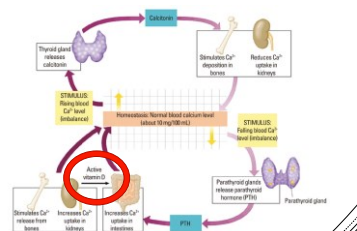
- Growing puppy
- Insufficient dietary calcium
- Insufficient dietary phosphorus
- Insufficient dietary vitamin D


Vitamin D Profile

Parameter	Result	Reference range
Ionized calcium (mmol/L)	1.47	1.28 - 1.48
Parathyroid hormone (pmol/L)	8.70	0.90 - 5.90
25-hydroxyvitamin D (nmol/L)	66	109 - 433

- Performed 36 post hospitalization and being fed a commercial puppy diet during hospitalization
- Initial hypocalcaemia → hypercalcaemia
- High normal PTH
- Low vitamin D
- **Nutritional secondary hyperparathyroidism**



Vitamin D and Calcium homeostasis





DEXA

- Dual-energy x-ray absorptiometry
- Standard for noninvasive body composition evaluation in humans
- Uncommon in veterinary medicine
 - Handful of reports on bone mineral density and bone mineral content in dogs and isolated dog bones (Speakman et al. 2000, Lauten et al. 2001, Schneider et al. 2004)



CaseHealthy

Nutritional correction

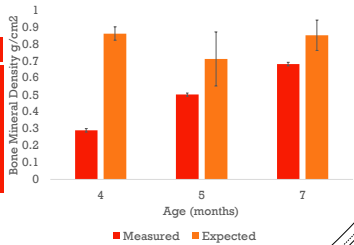
- Commercial puppy diet with AAFCO adequacy statement for large-breed puppies

Nutrient	Quantity /Mcal	AAFCO recommendation /Mcal
Calcium (g)	3.3	3.6 – 4.5
Phosphorus (g)	2.5	2.5 – 4.0
Ca:P	1.3:1	1.2:1
Vitamin D (IU)	298	125 - 250
Magnesium (g)	0.2	≥ 0.15
Copper (mg)	4.3	≥ 3.1
Iron (mg)	59.8	≥ 22
Manganese (mg)	20.0	≥ 1.8
Zinc (mg)	56.5	≥ 25
Choline (mg)	541	≥ 340
Vitamin E (IU)	135	≥ 12.5

Comparison

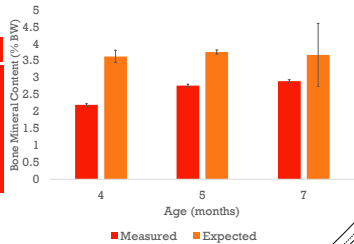
Nutrient	Original diet quantity/Mcal	Prescribed diet quantity/Mcal
Calcium (g)	0.23	3.3
Phosphorus (g)	1.03	2.5
Ca:P	1:4.5	1.3:1
Vitamin D (IU)	11.1	299
Magnesium (g)	0.13	0.2
Copper (mg)	0.12	4.3
Iron (mg)	10.9	89.8
Manganese (mg)	1.0	20.0
Zinc (mg)	13	56.5
Choline (mg)	331	841
Vitamin E (IU)	2.7	135

Bone mineral density

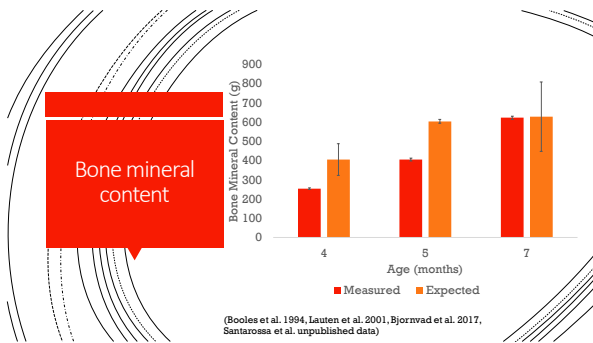


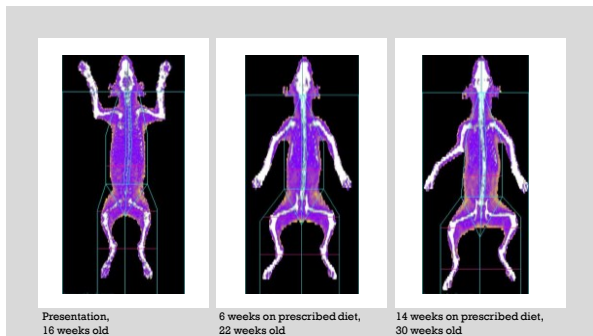
(Booles et al. 1994, Lauten et al. 2001, Bjornvad et al. 2017, Santarossa et al. unpublished data)

Bone mineral content



(Booles et al. 1994, Lauten et al. 2001, Bjornvad et al. 2017, Santarossa et al. unpublished data)





Follow-up

- Discharged after 2 weeks of hospitalisation, supportive care, and a balanced puppy diet
 - Directed to strictly rest for 4 weeks
- Repeat DEXA 4 weeks post discharge showed marked improvements in bone mineralization and bone mineral content, but still below average
 - Directed to slowly re-introduce controlled exercise
- Final DEXA 12 weeks post discharge showed almost complete resolution
 - Directed to gradually return to normal exercise

