Mahidol University
Wisdom of the Land

PET FOOD Edition

Food Focus Thailand 2026 ROADMAP SPECIAL

Prescription Diet Opportunity

1 July 2026 (13.30 – 14.30)
Novotel Bangkok Future Park Rangsit

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Outline

- Introduction
- Evidence-Based Clinical Nutrition
- Prescription diet formulation
  - CKD
  - Food allergy
  - GI diseases
- Take home message

PET FOOD Edition | Introduction

Disease	Puppy (<1yr) N = 591	Adolescent (1 to <3yr) N = 4622	Young Adult (3 to <7yr) N = 8249	Older Adult (7 to <11yr) N = 7666	Senior (≥11yr) N = 6413	Overall N = 27541
Skin	40 (7%)	796 (17%)	2181 (26%)	2556 (33%)	2342 (37%)	7915 (29%)
Infection/Parasites	147 (25%)	1269 (27%)	2291 (28%)	2009 (26%)	1623 (25%)	7339 (27%)
Bone/Orthopedic	7 (1%)	239 (5%)	849 (10%)	1699 (22%)	2493 (39%)	5287 (19%)
Gastrointestinal	39 (7%)	488 (11%)	1059 (13%)	1158 (15%)	1170 (18%)	3914 (14%)
Ocular	31 (5%)	283 (6%)	586 (7%)	906 (12%)	1819 (28%)	3625 (13%)
Ear/Nose/Throat	19 (3%)	302 (7%)	745 (9%)	916 (12%)	1587 (25%)	3569 (13%)
Kidney/Urinary	14 (2%)	153 (3%)	406 (5%)	591 (8%)	957 (15%)	2121 (8%)
Cancer/Tumors	1 (<1%)	21 (<1%)	177 (2%)	586 (8%)	966 (15%)	1751 (6%)
Cardiac	3 (<1%)	45 (<1%)	167 (2%)	440 (6%)	912 (14%)	1567 (6%)
Brain/Neurologic	2 (<1%)	25 (<1%)	188 (2%)	359 (5%)	750 (12%)	1324 (5%)
Liver/Pancreas	2 (<1%)	24 (<1%)	125 (2%)	277 (4%)	542 (8%)	970 (4%)
Respiratory	4 (<1%)	53 (1%)	132 (2%)	242 (3%)	519 (8%)	950 (3%)
Endocrine	0 (<1%)	8 (<1%)	77 (<1%)	310 (4%)	518 (8%)	913 (3%)

Nam et al., 2024

PET FOOD Edition

Introduction

Precise-level disorder term	n (%)	95% CI	F (%)	M (%)	F:M RR	*P* value (sex)	Younger (%)	Older (%)	Younger:older RR	*P* value (age)	Median age (years)
Periodontal disease	2780 (15.2)	14.72–15.76	14.7	15.8	0.93	0.045	9.6	25.3	0.38	<0.001	9.47
Obesity	2114 (11.6)	11.12–12.06	10.8	12.4	0.87	0.001	10.9	13.1	0.84	<0.001	6.83
Dental disease	1502 (8.2)	7.84–8.64	8.2	8.3	0.98	0.741	5.8	12.7	0.46	<0.001	8.64
Overgrown nail(s)	954 (5.2)	4.91–5.56	5.9	4.6	1.27	<0.001	4.6	6.4	0.73	<0.001	6.79
Flea infestation	926 (5.1)	4.76–5.40	4.9	5.3	0.93	0.26	5.76	4.0	1.45	<0.001	3.62
Heart murmur	811 (4.4)	4.15–4.75	4.1	4.8	0.84	0.01	2.2	8.5	0.26	<0.001	11.67
Weight loss	699 (3.8)	3.56–4.12	4.0	3.6	1.12	0.148	1.2	8.5	0.14	<0.001	13.43
Vomiting	589 (3.2)	2.98–3.49	3.4	3.1	1.11	0.184	2.5	4.5	0.55	<0.001	8.26
Abscess	573 (3.1)	2.89–3.40	1.8	4.5	0.39	<0.001	2.9	3.6	0.81	0.011	6.74
Diarrhoea	522 (2.9)	2.62–3.11	2.8	3.0	0.93	0.406	3.0	2.7	1.12	0.206	3.14
Haircoat disorder	477 (2.6)	2.39–2.86	2.5	2.8	0.91	0.262	1.7	4.3	0.42	<0.001	9.24
Thin/underweight	397 (2.2)	1.97–2.40	2.3	2.1	1.11	0.315	0.9	4.3	0.22	<0.001	13.25
Wound	378 (2.1)	1.87–2.29	1.6	2.6	0.63	<0.001	2.2	1.9	1.18	0.119	5.55
Hyperthyroidism	350 (1.9)	1.72–2.13	2.4	1.5	1.64	<0.001	0.0	5.2	0.01	<0.001	15.37
Chronic kidney disease	333 (1.8)	1.64–2.03	2.0	1.6	1.21	0.082	0.2	4.6	0.05	<0.001	15.57
Anorexia	318 (1.7)	1.56–1.94	1.9	1.6	1.14	0.245	1.0	3.1	0.33	<0.001	10.72
Conjunctivitis	302 (1.6)	1.47–1.85	1.5	1.8	0.87	0.216	1.8	1.4	1.26	0.059	4.23
Disorder not diagnosed	286 (1.6)	1.39–1.76	1.4	1.7	0.81	0.081	0.7	2.9	0.26	<0.001	12.36
Flea bite hypersensitivity	266 (1.5)	1.29–1.64	1.7	1.2	1.44	0.003	1.2	1.9	0.60	<0.001	7.84
Osteoarthritis	252 (1.4)	1.22–1.56	1.5	1.3	1.14	0.301	0.1	3.7	0.02	<0.001	15.70
Cat bite injury	222 (1.2)	1.06–1.39	0.7	1.7	0.41	<0.001	1.4	1.0	1.33	0.047	5.64
Cystitis	202 (1.1)	0.96–1.27	1.1	1.1	1.08	0.578	0.9	1.5	0.64	0.001	7.71
Lameness	195 (1.1)	0.92–1.23	0.8	1.3	0.65	0.004	0.9	1.3	0.72	0.026	7.25
Postoperative wound complication	185 (1.0)	0.87–1.17	1.2	0.8	1.40	0.021	1.3	0.5	2.33	<0.001	1.67
Cardiac dysrhythmia	183 (1.0)	0.86–1.16	1.1	0.9	1.23	0.158	0.3	2.3	0.12	<0.001	13.69
Otitis externa	170 (0.9)	0.80–1.08	0.8	1.0	0.82	0.193	0.7	1.4	0.50	<0.001	8.83
Overgrooming	167 (0.9)	0.78–1.06	1.1	0.7	1.53	0.006	0.7	1.2	0.61	0.001	7.57
Constipation	153 (0.8)	0.71–0.98	0.8	0.9	0.93	0.645	0.5	1.5	0.34	<0.001	10.45
Poor quality of life	153 (0.8)	0.71–0.98	1.0	0.7	1.41	0.037	0.1	2.1	0.03	<0.001	16.78
Road traffic accident	148 (0.8)	0.69–0.95	0.7	0.9	0.71	0.033	1.0	0.4	2.30	<0.001	4.16

O'Neill et al., 2023

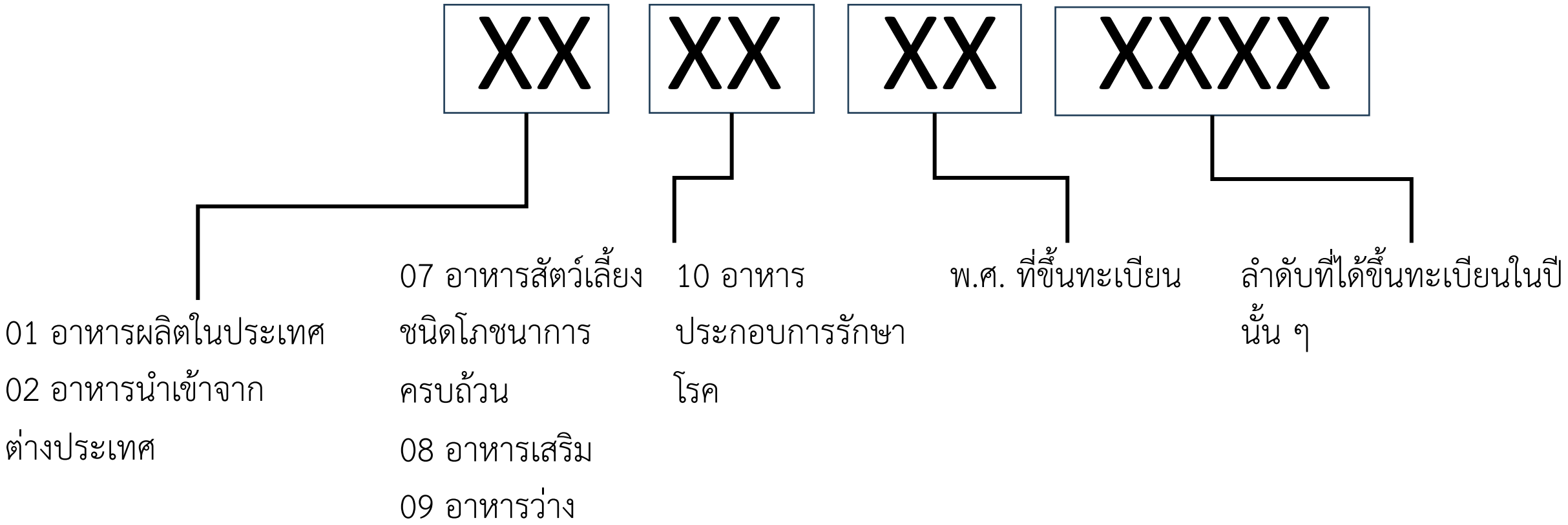
Introduction

- Top 3 Causes of Death in Pets
  - Cancer
  - Kidney disease
  - Heart disease

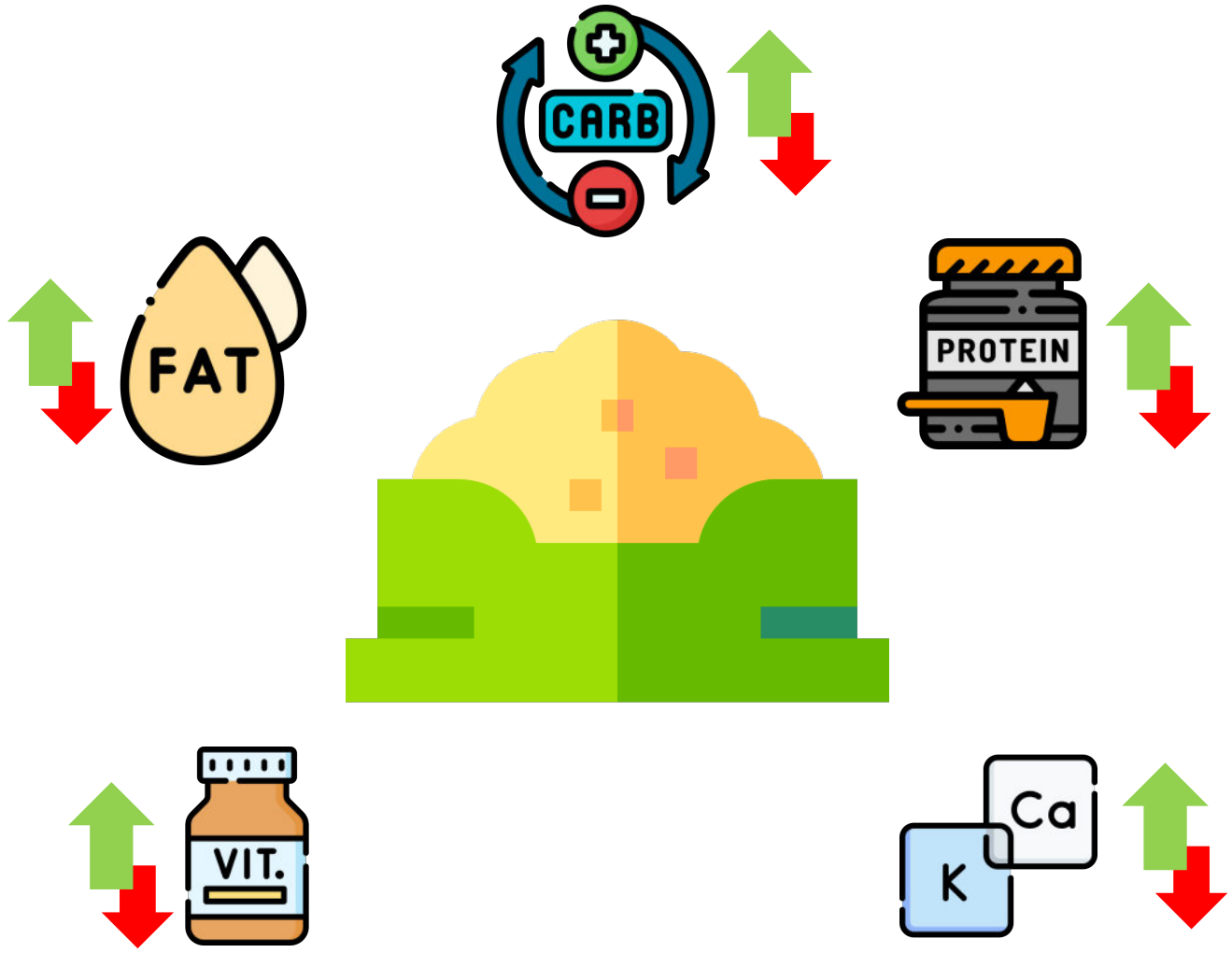
Hand & Lewis, 2010

PET FOOD Edition | Introduction

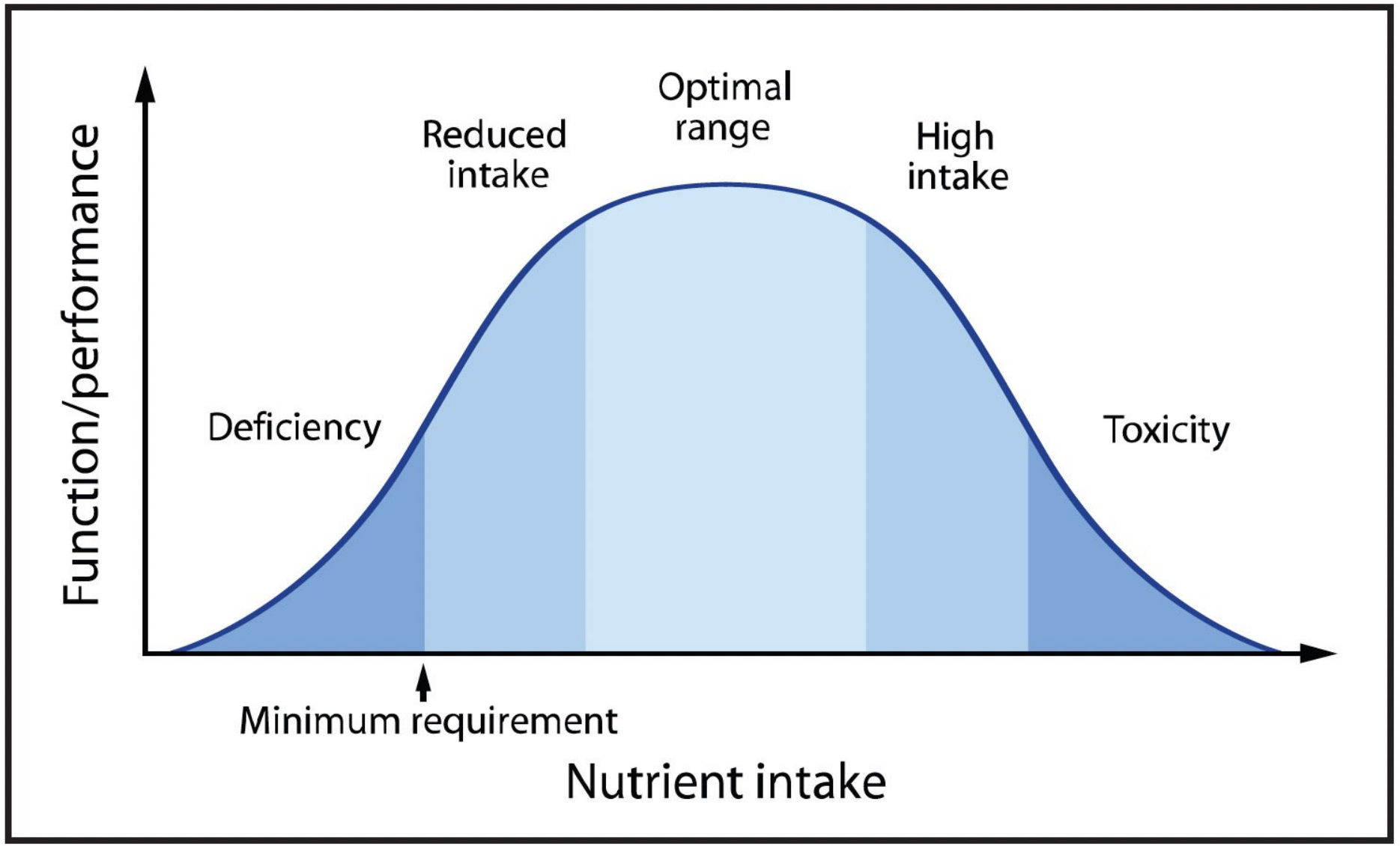
เลขทะเบียนอาหารสัตว์



PET FOOD Edition | Introduction



Introduction



Hand & Lewis, 2010

PET FOOD Edition Introduction

- KNF

Table 37-9. Key nutritional factors for dogs and cats with chronic kidney disease.*

Factors	Dietary recommendations
Water	Parenteral fluid therapy if dehydration, blood volume contraction or renal hypoperfusion is clinically significant
	Offer water free choice at all times
	Recommend moist foods
Protein	14 to 20% in foods for dogs
	28 to 35% in foods for cats
Phosphorus	0.2 to 0.5% in foods for dogs
	0.3 to 0.6% in foods for cats
Sodium	≤0.3% in foods for dogs
	≤0.4% in foods for cats
Chloride	1.5 x sodium levels in foods for dogs
	1.5 x sodium levels in foods for cats
Potassium	0.4 to 0.8% in foods for dogs
	0.7 to 1.2% in foods for cats
	If patient becomes hyperkalemic, switch to a lower potassium food
Omega-3 fatty acids	0.4 to 2.5% in foods for dogs and cats
	Omega-6:omega-3 fatty acid ratio of 1:1 to 7:1
Antioxidants	
Vitamin E	≥400 IU vitamin E/kg of food for dogs
	≥500 IU vitamin E/kg of food for cats
Vitamin C	≥100 mg vitamin C/kg of food for dogs
	100 to 200 mg vitamin C/kg of food for cats

*All values expressed on a dry matter basis, unless otherwise indicated.

Hand & Lewis, 2010

Introduction

- PARNUTs

REGULATIONS

COMMISSION REGULATION (EU) 2020/354

of 4 March 2020

establishing a list of intended uses of feed intended for particular nutritional purposes and repealing Directive 2008/38/EC

PET FOOD Edition | Introduction

Entry number	Particular nutritional purpose	Essential nutritional characteristics (GP1)	Species or category of animal	Labelling declarations (GP2)	Recommended length of time	Other provisions
	1	2	3	4	5	6
10	Support of renal function in case of chronic renal insufficiency (1)	High quality proteins and phosphorus ≤ 5 g/kg complete feed with a moisture content of 12 % (2) and crude protein ≤ 220 g/kg complete feed with a moisture content of 12 % (2)	Dogs	— Protein source(s) — Calcium — Phosphorus — Potassium — Sodium — Essential fatty acids (if added)	Initially up to 6 months (3)	1. The feed shall be placed on the market as complete feed. 2. Recommended digestibility of proteins: minimum 85 %. 3. Indicate on the labelling: 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.' 4. Indicate in the instructions for proper use: 'Water should be available at all times.'
		Reduced phosphorus absorption by means of incorporation of Lanthanum carbonate octahydrate	Adult dogs	— Protein source(s) — Calcium — Phosphorus — Potassium — Sodium — Essential fatty acids (if added) — Lanthanum carbonate octahydrate	Initially up to 6 months (3)	1. Indicate on the labelling: 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.' 2. Indicate in the instructions for proper use: 'Water should be available at all times.'
		High quality proteins and phosphorus ≤ 6,5 g/kg complete feed with a moisture content of 12 % (2) and crude protein ≤ 320 g/kg complete feed with a moisture content of 12 % (2)	Cats	— Protein source(s) — Calcium — Phosphorus — Potassium — Sodium — Essential fatty acids (if added)	Initially up to 6 months (3)	1. The feed shall be placed on the market as complete feed. 2. Recommended digestibility of proteins: minimum 85 %. 3. Indicate on the labelling: 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.' 4. Indicate in the instructions for proper use: 'Water should be available at all times.'
		Reduced phosphorus absorption by means of incorporation of Lanthanum carbonate octahydrate	Adult cats	— Protein source(s) — Calcium — Phosphorus — Potassium — Sodium	Initially up to 6 months (3)	1. Indicate on the labelling: 'It is recommended that advice from a veterinarian be sought before use and before extending the period of use.' 2. Indicate in the instructions for proper use: 'Water should be available at all times.'

Introduction

- List of diseases and conditions noticed in PARNUTs
  - CKD
  - Oxalate stone
  - Cystine stone
  - Urate stone
  - Struvite stone
  - DM
  - Food intorelance
  - Convalescence
  - Maldigestion

Functional claims should be clearly separated from any particular nutritional purpose diets.

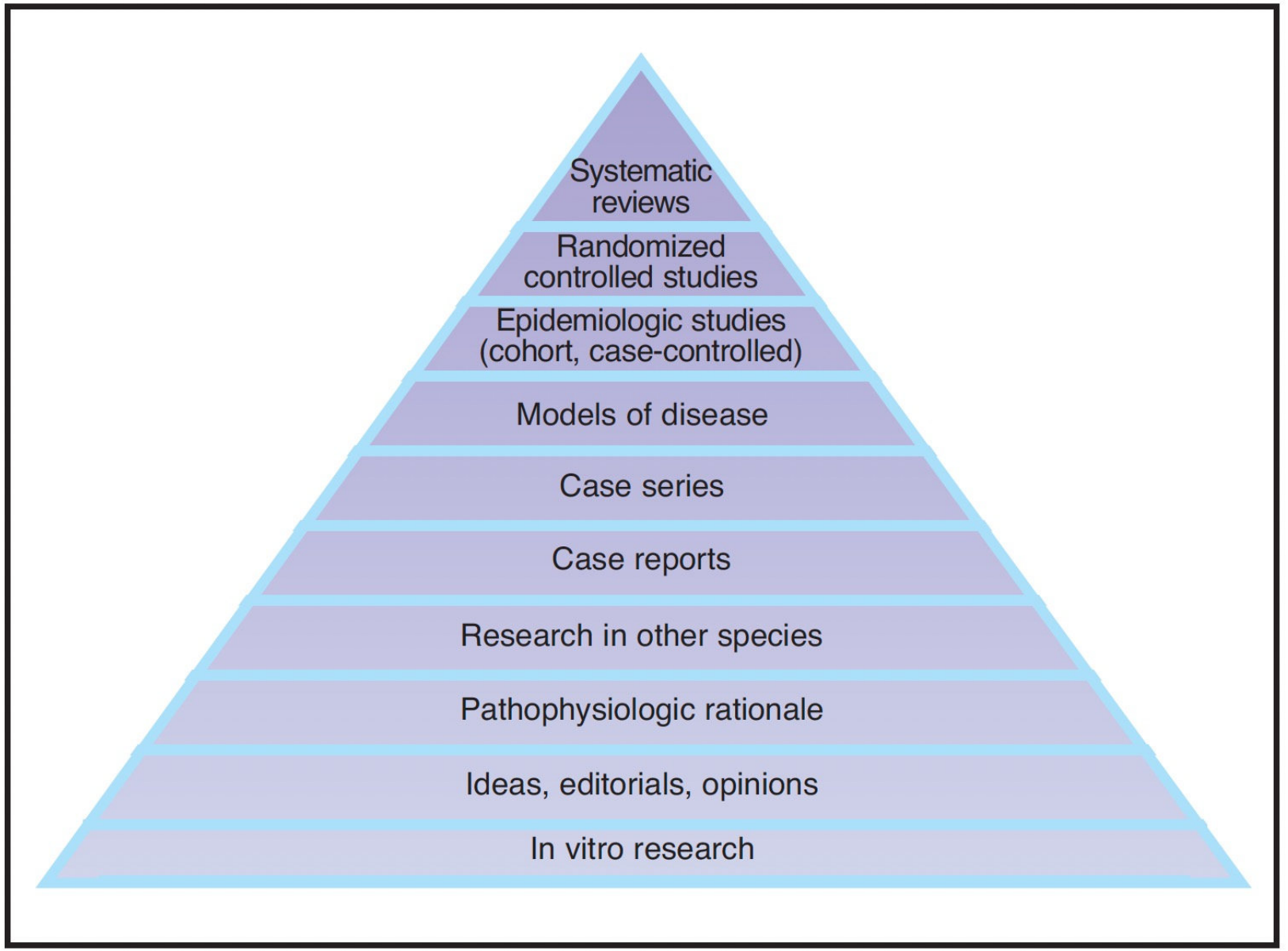
However, this does not prevent PARNUT products from making additional functional claims.

Evidence-Based Clinical Nutrition

Evidence Grade	Guideline
1	Randomized controlled study
2	Randomized controlled study in lab setting
3	Observational study, Non-radomized study
4	Expert opinion, Study in other species, In vitro study

Adapted from Hand & Lewis, 2010

Evidence-Based Clinical Nutrition



Hand & Lewis, 2010

Prescription diet formulation

Box 2.1 List of Essential Nutrients for Dogs and Cats by Group

Protein

- Amino acids
  - Arginine
  - Histidine
  - Isoleucine
  - Leucine
  - Lysine
  - Methionine (spared by cystine)
  - Phenylalanine (spared by tyrosine)
  - Threonine
  - Tryptophan
  - Valine
  - Taurine (cat, not dog)

Fat

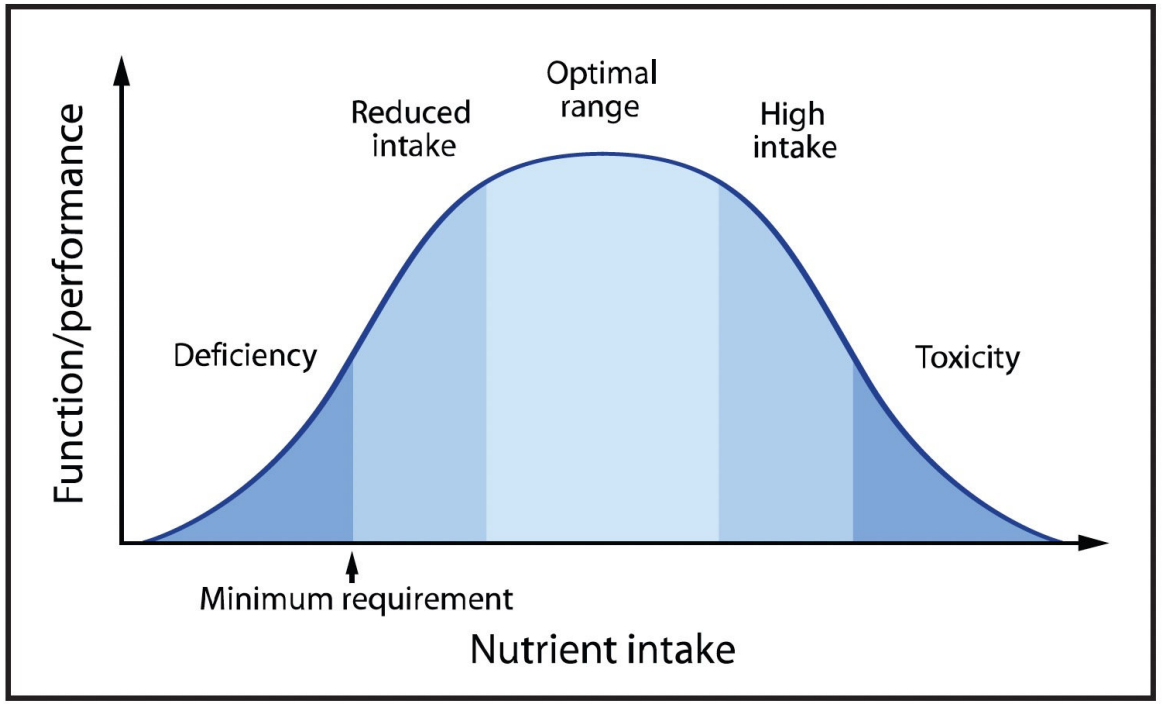
- Linoleic acid
- Arachidonic acid (cat, not dog)
- +/− Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)

Minerals

- Macrominerals (required at ≥100 mg/Mcal, or approx. ≥400 ppm)
  - Calcium (Ca)
  - Phosphorus (P)
  - Magnesium (Mg)
  - Sodium (Na)
  - Potassium (K)
  - Chloride (Cl)
- Trace minerals or microminerals (required at <100 mg/Mcal, or approx. <400 ppm)
  - Iron (Fe)
  - Copper (Cu)
  - Zinc (Zn)
  - Manganese (Mn)
  - Selenium (Se)
  - Iodine (I)

Vitamins

- Fat-soluble vitamins
  - Vitamin A, retinol
  - Vitamin D3, cholecalciferol
  - Vitamin E, α-tocopherol
  - +/− Vitamin K3, menadione (also vitamin K1, phylloquinone) (cat, not dog)
- Water-soluble vitamins
  - Thiamin, vitamin B1
  - Riboflavin, vitamin B2
  - Pyridoxine, vitamin B6
  - Niacin, vitamin B3
  - Pantothenic acid, vitamin B5
  - Cobalamin, vitamin B12
  - Folic acid, vitamin B9
  - Biotin, vitamin H or B7
  - Choline



PET FOOD Edition | Prescription diet formulation

scientific reports

antioxidants

Article

Evaluation of Antioxidant Capacity and Gut Microbiota Modulatory Effects of Different Kinds of Berries

Jiebiao Chen [1], Yichen Shu [1], Yanhong Chen [2], Zhiwei Ge [3], Changfeng Zhang [4,5], Jinping Cao [1], Xian Li Yue Wang [1,*] and Chongde Sun [1]

Check for updates

OPEN

Effect of a weight loss diet with or without Spirulina supplementation on serum lipids and antioxidant capacity of overweight dogs

Davide Stefanutti[1]✉, Lorenzo Serva[1], Michele Berlanda[1], Federico Bonsembiante[2], Gianfranco Gabai[2], Erica Franceschinis[3], Marco Cavazzoni[4], Giada Morelli[1] & Rebecca Ricci[1,5]

REVIEW ARTICLE OPEN ACCESS

Effectiveness of Cranberry Supplementation for Prevention and Treatment of Infectious Urinary Tract Disease in Dogs and Cats: A Systematic Review

J. Scott Weese[1] | Heather E. Weese[2]

[1]Department of Pathobiology, Ontario Vete
Ontario, Canada

Dietary supplementation with medium-chain TAG has long-lasting cognition-enhancing effects in aged dogs

Yuanlong Pan[1]*, Brian Larson[1], Joseph A. Araujo[2,3], Winnie Lau[2], Christina de Rivera[2,3], Ruben Santana[1], Asa Gore[1] and Norton W. Milgram[2,3,4]

[1]*Nestlé Purina Research, One Checkerboard Square, 2RS, St Louis, MO 63164, USA*
ıla
ity of Toronto, Toronto, Canada
of Toronto at Scarborough, Toronto, Canada

r 2009 – Accepted 4 January 2010 – First published online 9 February 2010)

International Journal of *Molecular Sciences*

MDPI

Review

Turmeric and Curcumin—Health-Promoting Properties in Humans versus Dogs

Jagoda Kępińska-Pacelik * and Wioletta Biel *

Prescription diet formulation

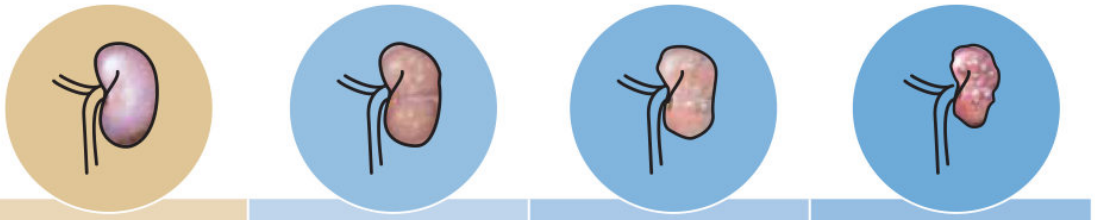
Depend on Animals

- Unit/head/day
- Unit/kg BW

Depend on Diet

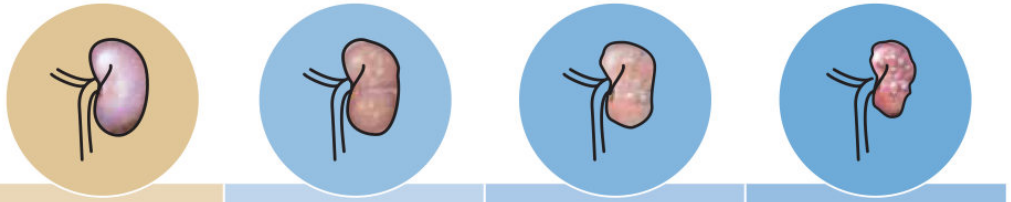
- % in Diet DM
- % in Diet FM
- Unit/kg Diet
- Unit/1,000 kcal
- % Energy

Prescription diet formulation



	Stage 1 No azotemia (Normal creatinine)	Stage 2 Mild azotemia (Normal or mildly elevated creatinine)	Stage 3 Moderate azotemia	Stage 4 Severe azotemia
Creatinine in mg/dL Stage based on stable creatinine — Canine	Less than 1.4 (125 µmol/L)	1.4–2.8 (125–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
Feline	Less than 1.6 (140 µmol/L)	1.6–2.8 (140–250 µmol/L)	2.9–5.0 (251–440 µmol/L)	Greater than 5.0 (440 µmol/L)
SDMA* in µg/dL Stage based on stable SDMA — Canine	Less than 18	18–35	36–54	Greater than 54
Feline	Less than 18	18–25	26–38	Greater than 38
UPC ratio Substage based on proteinuria — Canine	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.5**	Proteinuric **>0.5**	
Feline	Nonproteinuric **<0.2**	Borderline proteinuric **0.2–0.4**	Proteinuric **>0.4**	
Systolic blood pressure in mm Hg Substage based on blood pressure	Normotensive **<140**	Prehypertensive **140–159**	Hypertensive **160–179**	Severely hypertensive **≥180**

Prescription diet formulation



Treatment recommendations	Stage 1	Stage 2	Stage 3	Stage 4
	Use nephrotoxic drugs with caution	Same as Stage 1	Same as Stage 2	Same as Stage 3
	Correct prerenal and postrenal abnormalities	Renal therapeutic diet	Keep phosphorus <5.0 mg/dL (<1.6 mmol/L)	Keep phosphorus <6.0 mg/dL (<1.9 mmol/L)
	Fresh water available at all times	Treat hypokalemia in cats	Treat metabolic acidosis	Consider feeding tube for nutritional and hydration support and ease of medicating
	Monitor trends in creatinine and SDMA to document stability or progression	**Treat inappetence and nausea if present**	Consider treatment of anemia	
	Investigate for and treat underlying disease and/or complications		Treat vomiting, inappetence, and nausea	
	Treat hypertension if systolic blood pressure persistently >160 or evidence of end-organ damage		Increased enteral or subcutaneous fluids may be required to maintain hydration	
	Treat persistent proteinuria with renal therapeutic diet and medication (UPC >0.5 in dogs; UPC >0.4 in cats)			
	Keep phosphorus <4.6 mg/dL (<1.5 mmol/L)			
	If required, use renal therapeutic diet plus phosphate binder			

IRIS International Renal Interest Society

See www.iris-kidney.com for more detailed staging, therapeutic, and management guidelines.

Prescription diet formulation

Table 37-9. Key nutritional factors for dogs and cats with chronic kidney disease.*

Factors	Dietary recommendations
Water	Parenteral fluid therapy if dehydration, blood volume contraction or renal hypoperfusion is clinically significant
	Offer water free choice at all times
	Recommend moist foods
Protein	14 to 20% in foods for dogs
	28 to 35% in foods for cats
Phosphorus	0.2 to 0.5% in foods for dogs
	0.3 to 0.6% in foods for cats
Sodium	≤0.3% in foods for dogs
	≤0.4% in foods for cats
Chloride	1.5 x sodium levels in foods for dogs
	1.5 x sodium levels in foods for cats
Potassium	0.4 to 0.8% in foods for dogs
	0.7 to 1.2% in foods for cats
	If patient becomes hyperkalemic, switch to a lower potassium food
Omega-3 fatty acids	0.4 to 2.5% in foods for dogs and cats
	Omega-6:omega-3 fatty acid ratio of 1:1 to 7:1
Antioxidants	
Vitamin E	≥400 IU vitamin E/kg of food for dogs
	≥500 IU vitamin E/kg of food for cats
Vitamin C	≥100 mg vitamin C/kg of food for dogs
	100 to 200 mg vitamin C/kg of food for cats

*All values expressed on a dry matter basis, unless otherwise indicated.

Prescription diet formulation

Diet	CP % DM	EE % DM	ME kcal/100g as DM	Protein intake g/day
A	18.0	21.4	434.9	
B	15.5	25.9	445.9	
C	15.5	5.7	368.0	

Prescription diet formulation

RESEARCH ARTICLE

Feeding cats with chronic kidney disease food supplemented with betaine and prebiotics increases total body mass and reduces uremic toxins

Jean A. Hall[1]*, Dennis E. Jewell[2], Eden Ephraim[3]

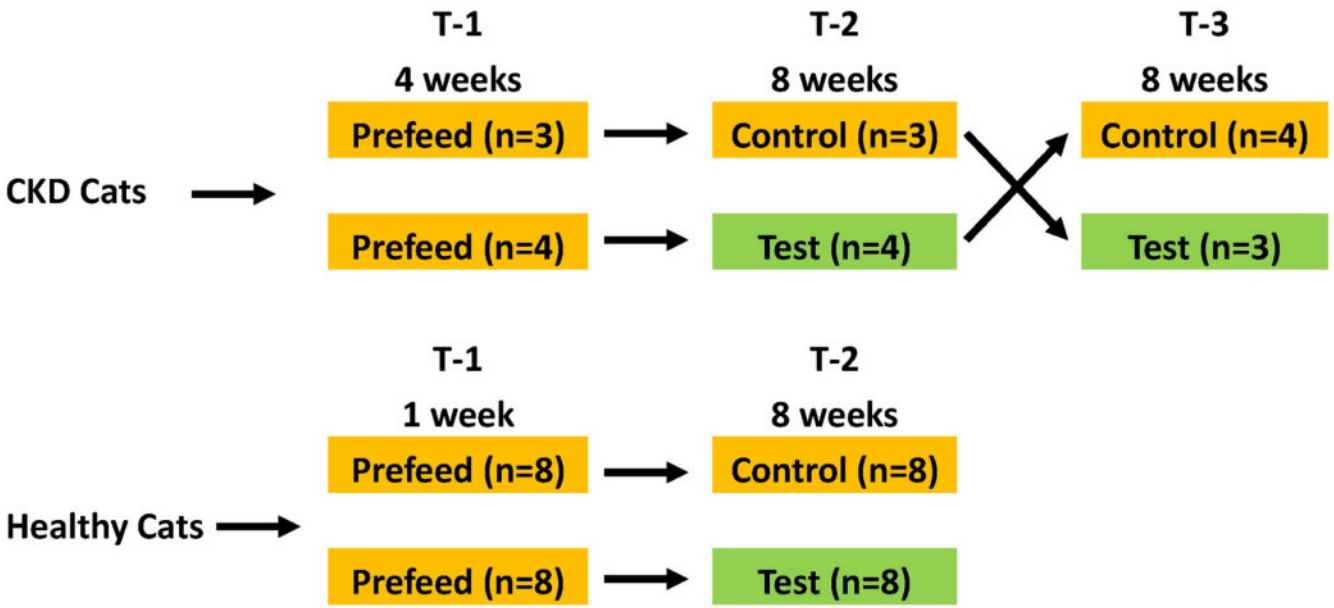


Fig 1. Study design. Pre-trial food and control food were the same. Test food was the pre-trial food supplemented with betaine (0.500%) and prebiotics: oat beta-glucan (0.586%) and scFOS (0.407%).

Hall et al., 2022

Prescription diet formulation

What if ?

- Animals also allergic to some ingredients
- Animals also suffer from other diseases
- Animals rejecting therapeutic diet
- Owner want to give some snack

Prescription diet formulation

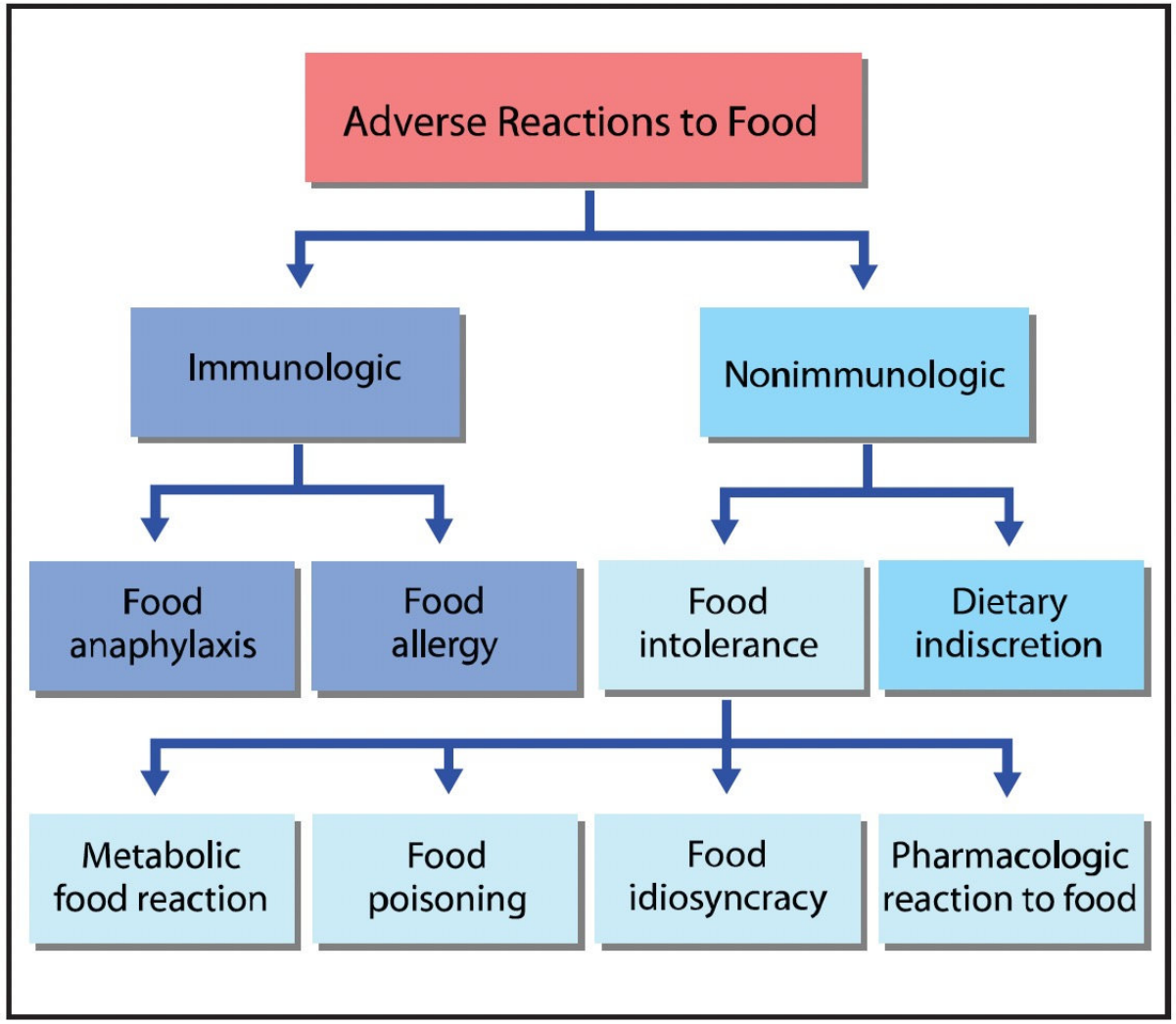
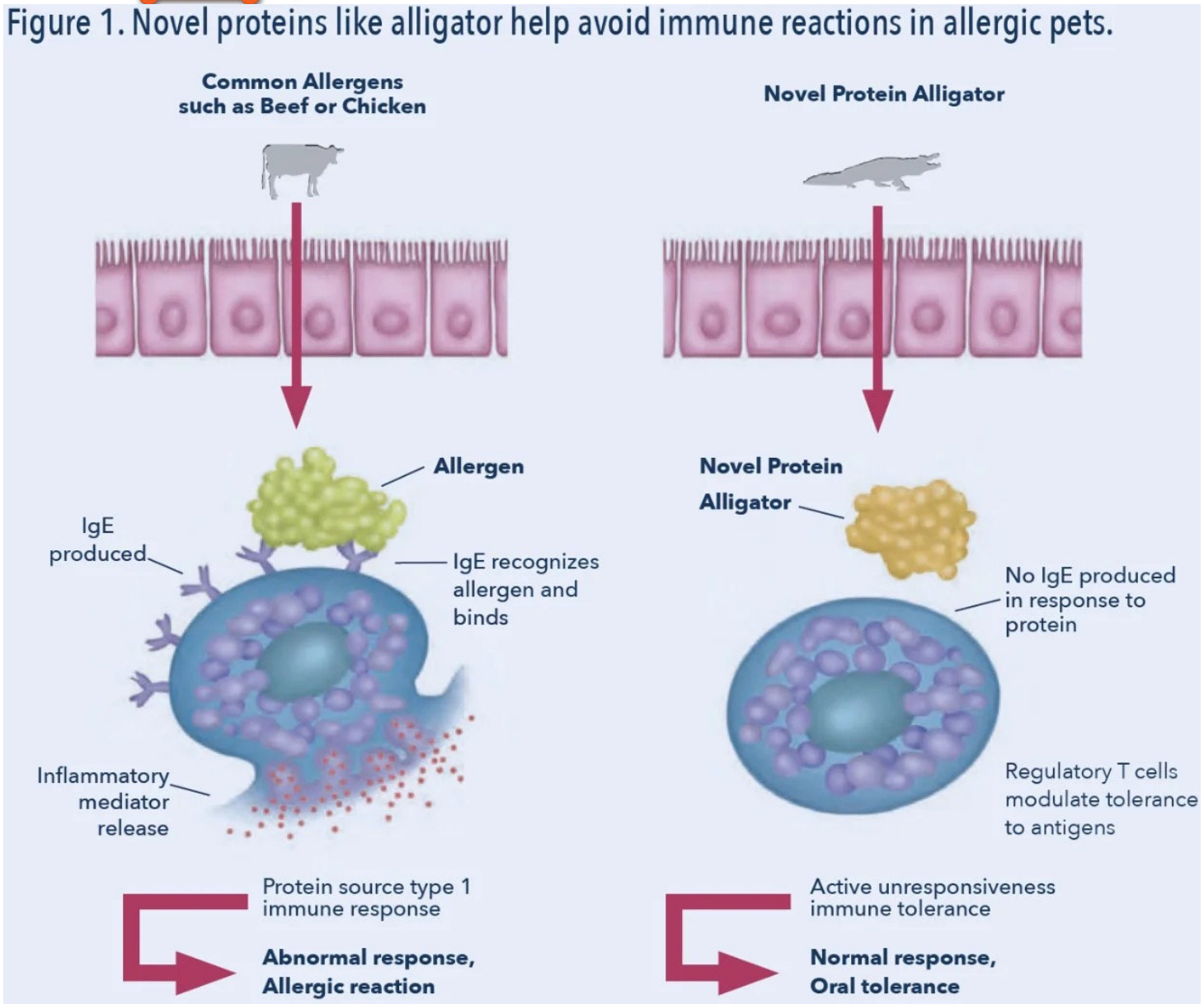


Figure 31-1. Classification of adverse reactions to food.

Prescription diet formulation

Figure 1. Novel proteins like alligator help avoid immune reactions in allergic pets.



Prescription diet formulation

Table 1. Foods or food ingredients reported to cause adverse reactions in dogs (330 cases)

Beef	107
Dairy	59
Chicken	50
Wheat	42
Chicken egg	24
Soy	18
Lamb	16
Pork	14
Fish	12
Corn	10
Turkey	6
Rice	5
Duck	2

Table 2. Foods or food ingredients reported to cause adverse reactions in cats (56 cases)

Beef	16
Dairy	16
Fish	13
Chicken	4
Corn gluten/corn	4
Lamb	4
Wheat	3
Chicken egg	2

Roudebush P. Ingredients and foods associated with adverse reactions in dogs and cats. Vet Dermatol. 2013 Apr;24(2):293-4. doi: 10.1111/vde.12014. Epub 2013 Feb 18. PMID: 23413825.

Prescription diet formulation

- Novel protein sources

Prescription diet formulation

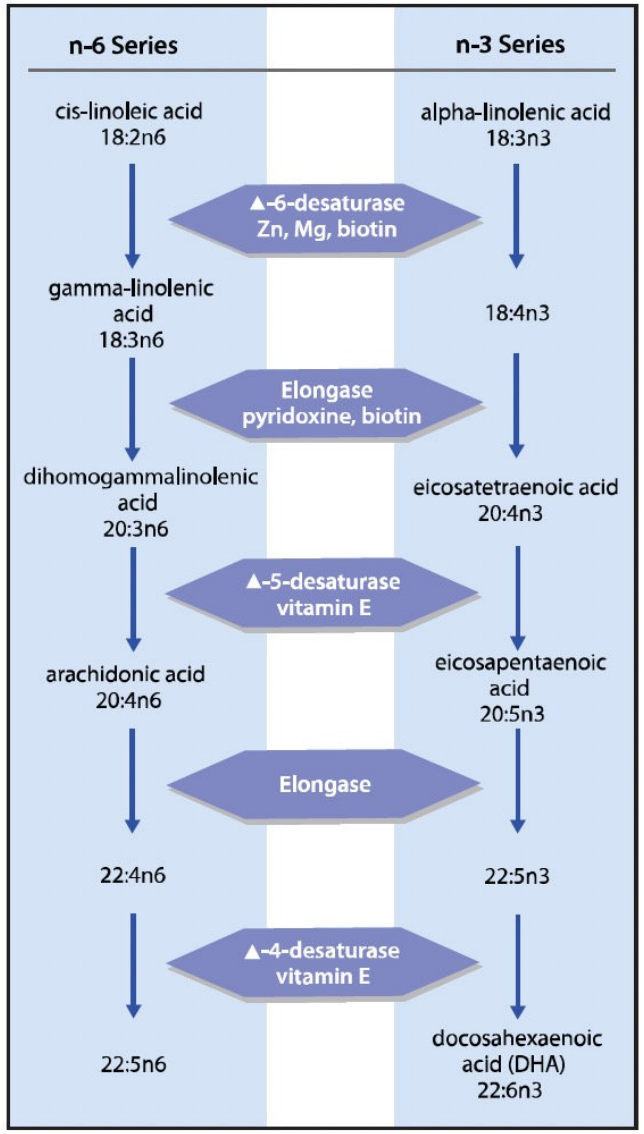


Figure 32-1. Diagram of metabolic pathways for essential fatty acids.

Prescription diet formulation

Example of GI diseases

- ✓Gastroenteritis
- ✓Gastrointestinal adverse reaction to food
- ✓Chronic enteropathy
- ✓Intestinal lymphagiectasia
- ✓Constipation and obstipation
- ✓Pancreatitis
- ✓Exocrine pancreatic insufficiency (EPI)

Prescription diet formulation

- We can separate type of diet for GI diseases as follow
  - ✓Highly digested food
  - ✓Fiber-enhanced food
  - ✓Restricted and moderated fat food

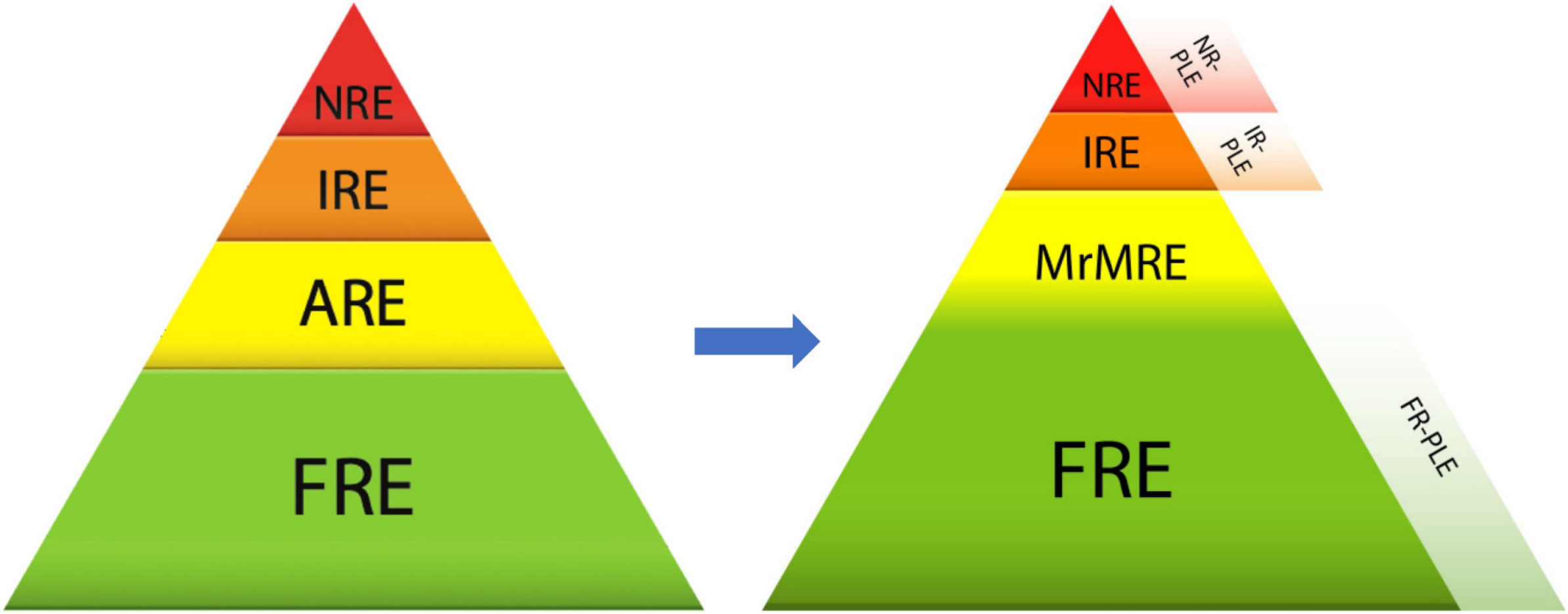
Prescription diet formulation

Nutients	Highly digested food	Fiber-enhanced food	Restricted fat food
Na	0.3 - 0.5 % as DM	0.3 - 0.5 % as DM	-
Cl	0.5 - 1.3 % as DM	0.5 - 1.3 % as DM	-
K	0.8 - 1.1 % as DM	0.8 - 1.1 % as DM	-
Energy density	400 to 450 kcal/100 g	320 kcal/100 g for dogs 340 kcal/100 g for cats	-
Fat	12 to 15% for dogs 15 to 25% for cats	8 to 12% for dogs 9 to 18% for cats	10 - 15 % for dogs 15 - 25 % for cats
Fiber	5 % as DM	7 - 15 % as DM	Less than 5 %
Protein	25 % as DM for dog 35 % as DM for cat	25 % as DM for dog 35 % as DM for cat	15 – 30 % as DM for dogs 30 – 40 % as DM for cats
Digestibility	87% for protein and 90% for fat and carbohydrate	80% for protein and fat and 90% for carbohydrate	87% for protein and 90% for fat and carbohydrate

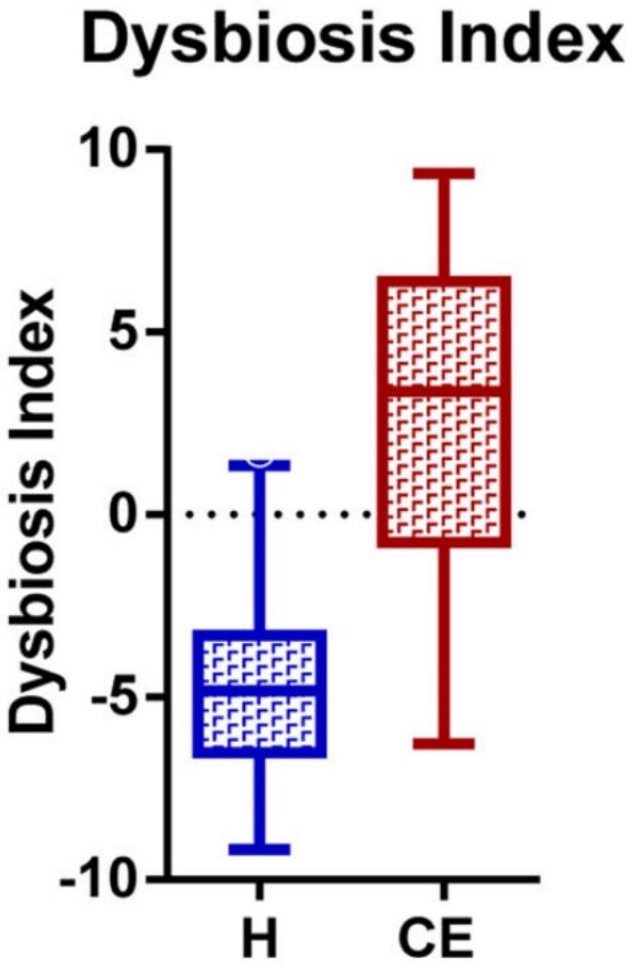
Prescription diet formulation

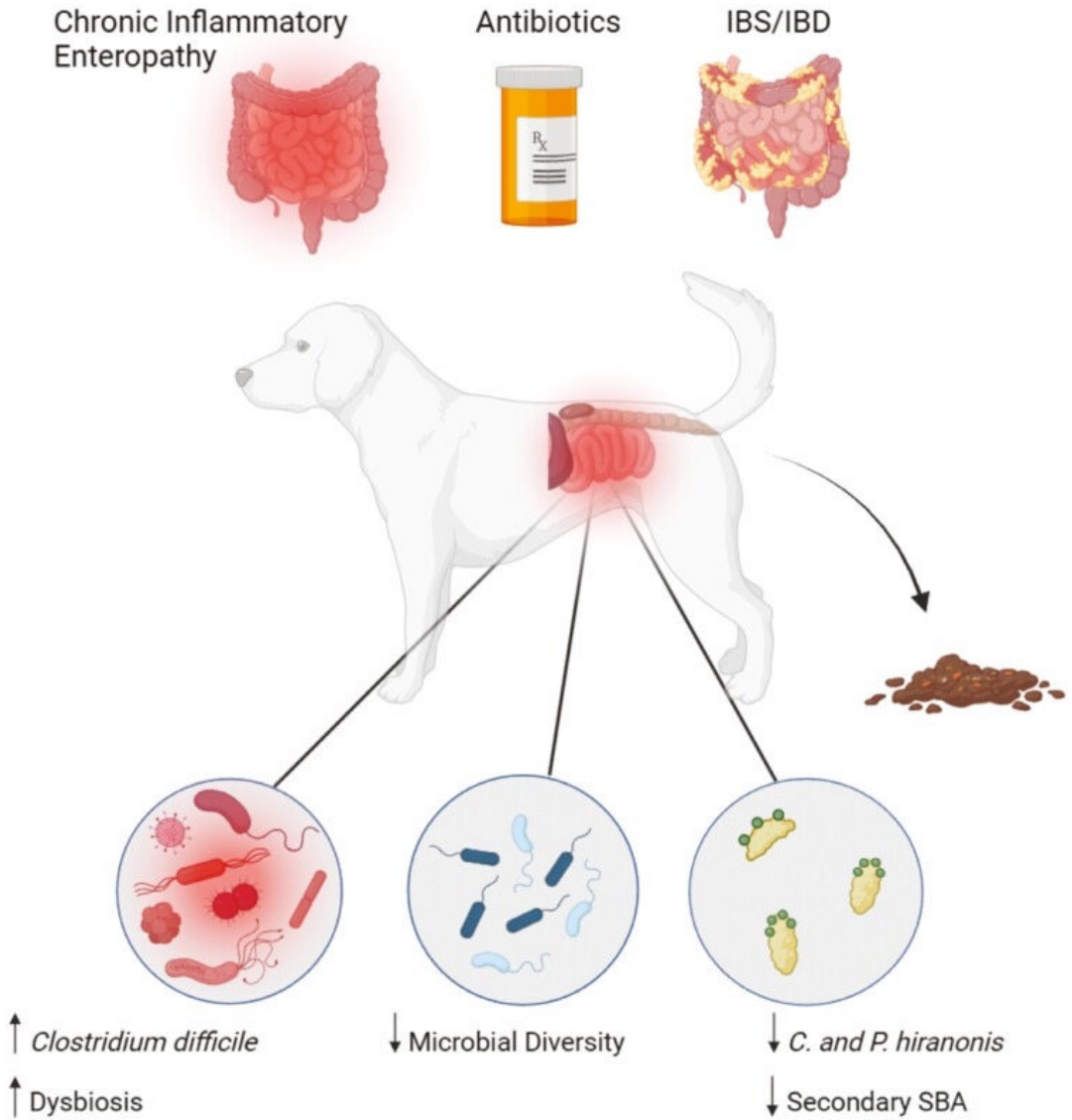
	Highly digested food	Fiber-enhanced food	Restricted fat food
Recommended for	- Acute and chronic diarrhea - Inflammatory bowel disease - Maldigestion and malabsorption - Gastritis - Enteritis - Colitis - Exocrine pancreatic insufficiency	- Constipation - Acute and chronic diarrhea - Inflammatory bowel disease - Gastritis - Enteritis - Colitis	- Acute and chronic pancreatitis - Exocrine pancreatic insufficiency - Acute and chronic diarrhea

Prescription diet formulation



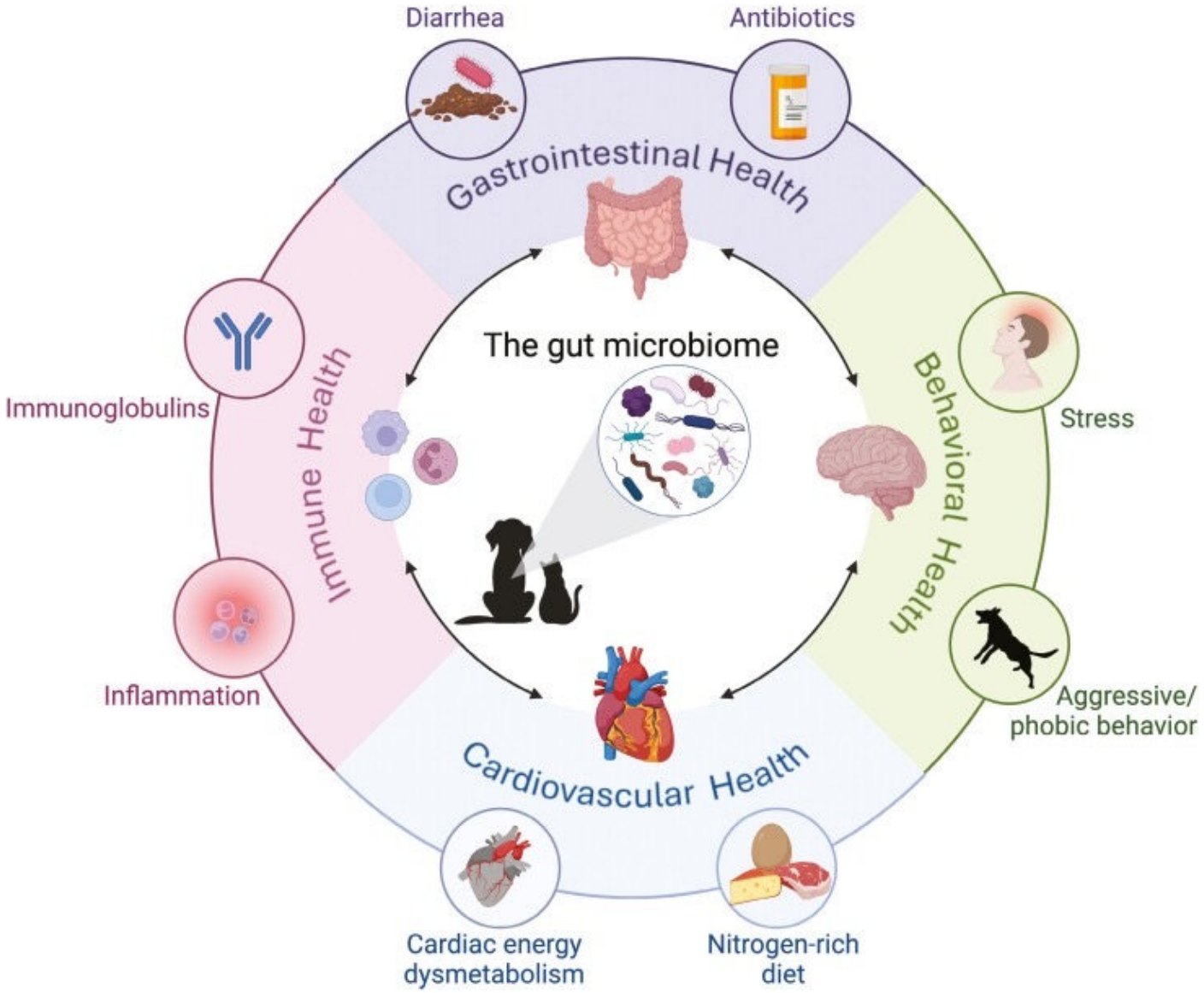
Prescription diet formulation





(AlShawaqfeh et al., 2017; Rindels & Loman, 2024)

Prescription diet formulation



(Rindels & Loman, 2024)

Take home message

1. Always evaluate the scientific validity and strength of the available evidence before applying it in practice.
2. Unit conversions should be performed carefully to avoid calculation errors.
3. Each animal has its own specific nutritional requirements; however, developing commercial products that meet the needs of the majority of animals remains a significant challenge.

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Acknowledge

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Thank you