CFDC

Health Seminar

NUTRITION & NUTRIGENOMICS

April 14, 2019
Acton, CA

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Hemopet
The Picture of Optimal Health
Impact of Diet on Genome & Metabolism

• **GOAL** – holistically understand how dietary components interact with/within cells & organisms to develop new strategies/ products that are nutritious & safe

• **Nutrition is the most important factor for human and animal health**

• Health is achieved by understanding molecular individualized, functional nutrition
Nutrigenomics

**Goal:** Optimize gene expression for good health – Functional Foods
Functional Nutrition, Foods & Superfoods

- **Functional foods** include certain botanicals, amino acids, vitamins and phytochemicals that activate disease-fighting genes and suppress genes that promote disease.

- Since each individual has an unique genome, a food benefitting one might not create the same effect for another -- and could even prove harmful.

- Commercial prescription diets might work for certain subsets of animals, but they are too generalized to meet the individual needs of every animal.

- Commercial foods can send unhealthy messages to the cells as the functional effect of a food is only as good as the sum total of ingredients.
Dietary-Induced Hyperthyroidism

- In humans, excessive consumption of meat contaminated with thyroid tissue has resulted in exogenous hyperthyroidism.
- Throat/gullet in raw meat fed to dogs & cats causes hyperthyroidism; first recognized in 2012.
- Dietary hyperthyroidism can be seen in dogs or cats fed red raw meat diet or fresh or dried gullets (which include thyroid tissue). High circulating T4 concentration in a dog or cat, with or without signs of hyperthyroidism, should prompt a review of the dietary history.
- Clinical signs are readily reversed upon removing the thyroid-contaminated food or treats.
Grain-Free Pet Foods, Taurine and CHD

❖ The US FDA stated on July 12, 2018 it is investigating a possible connection between grain-free pet diets, taurine, and dilated cardiomyopathy (DCM), also called canine heart disease (CHD)

❖ However, much is still unknown, and various factors impact heart health: Genetics, diet, scientific research to date, taurine needs for dogs vs cats, interaction between foods when passing through and within the body

❖ What do we know about taurine?

• Taurine is an amino acid found in animal-based protein and plant sources like soy in amounts that vary with the type of meat or plant

• Taurine deficiency can lead to CHD in humans, cats and dogs

• **Not** an essential, food-sourced amino acid for dogs, but still present in pet foods

• **Cats do** need food-sourced taurine to prevent CHD; minimum standards by AAFCO
Even More on Taurine

- No effect of age, sex, body weight, body size, or diet was seen on plasma and whole blood taurine concentrations.
- Mean whole blood taurine concentrations were lower in dogs fed diets containing whole grain rice, rice bran or barley.
- The lowest whole blood concentrations were seen in dogs fed lamb or lamb meal and rice diets.
- Plasma methionine and cysteine concentrations were lower in dogs fed diets with animal meals or turkey, and whole grain rice, rice bran or barley.

- No research has established that grain-free diets can cause heart disease in dogs.
Measuring Taurine in Pets

• Need diagnostic laboratory experienced with the appropriate reference ranges for circulating taurine (see below). Special sample preparation, storage and shipping is required using sodium or lithium heparin anticoagulated tubes. If plasma taurine level is equivocal, whole blood taurine is measured to substantiate the diagnosis of deficiency

• Amino Acid Laboratory, University of California, Davis, 1020 Vet Med 3B, 1089 Veterinary Medicine Drive, Davis, CA 95616; 530-752-5058; Fax 530-752-4698. http://www.vetmed.ucdavis.edu/vmb/aal/aal.html

<table>
<thead>
<tr>
<th></th>
<th>Plasma (nmol/ml)</th>
<th>Whole Blood (nmol/ml)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Normal Range</td>
<td>No Known Risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>for Taurine Deficiency</td>
</tr>
<tr>
<td>Cat</td>
<td>80-120</td>
<td>&gt; 40</td>
</tr>
<tr>
<td>Dog</td>
<td>60-120</td>
<td>&gt; 40</td>
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Confounding Factors

❖ Confluence (merging) foods


❖ Homemade versus commercial

❖ Raw (freeze dried, dehydrated, high-pressure pasteurization)

❖ Contamination
  • bacterial, fungal and parasite contamination, metals, thyroid hormone, etc
  • Residual pesticides and herbicides
    • glyphosate (Roundup ®); chlorpyrifos, dicamba

❖ Aflatoxins and mycotoxins
More Confounding Factors

❖ Undeclared ingredients not on the label

• Critically assessed published discrepancies between ingredients and labeling in commercial pet foods, including those with “novel” or “limited” ingredients and containing micronized hydrolysates.

• Found that the median mislabeling was 45% of tested diets with a range of 33-83% for the “novel/limited” ingredients ones that are used for food elimination trials, and one hydrolyzed diet.

# Golden Retriever Nutrition Data (2016-2018)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of Dogs</th>
<th>Comments</th>
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</thead>
<tbody>
<tr>
<td>Total Number with Nutriscan Testing</td>
<td>523</td>
<td>None had cardiac disease or dysfunction; all healthy or had itching and/or bowel issues *</td>
</tr>
<tr>
<td>Raw Diet</td>
<td>133 (25%)</td>
<td>Variety of meats, fowl and fish plus some carbs and vegetables</td>
</tr>
<tr>
<td>Grain-Free Diet</td>
<td>79 (15%)</td>
<td>Same as raw group</td>
</tr>
<tr>
<td>Homemade Diet</td>
<td>38 (7%)</td>
<td>Same as raw group</td>
</tr>
<tr>
<td>Reactive Foods on Nutriscan Testing (24 key foods)</td>
<td>523 (total results) and the combination of Raw, Grain-free and Homemade diet groups (250) yielded the same breakdown of reactive foods</td>
<td>Highest (54-60%) = Turkey &amp; White-Colored Fish. Medium = (44-48%) = Venison &amp; Corn. Lowest (11%) = Lamb &amp; No food reactions</td>
</tr>
<tr>
<td>Total Number in Data Base (all Diagnostics)</td>
<td>22,192</td>
<td>Includes any type of diagnostic test run at Hemopet during the 2-year period</td>
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</tbody>
</table>

* 26 dogs were tested for whole blood taurine levels upon client request. All were mid-normal except 3 were slightly elevated (not supplemented with taurine beyond their diet level)
Raw vs Cooked Diets

Benefits of raw

- Carnivores ancestrally consume raw meat, bones and viscera
- Controlled ingredient selection and sourcing if home prepared; safe food handling needed
- Higher in enzymes, vitamins, minerals and nutrient availability
- Improved skin, coat and breath; increased energy; enhanced immune function
- Reduced or eliminated ear infections; fewer, less bulky, less foul-smelling stools
- Reduced incidences of chronic disease

Benefits of fresh cooked

- Controlled ingredient selection and sourcing; safe food handling needed
- Fresh, whole foods provide higher levels of nutrients than processed commercial foods
- Nutrients more bioavailable, and more species appropriate
- Improved skin, coat and breath; increased energy; enhanced immune function
- Reduced or eliminated ear infections; fewer, less bulky, less foul-smelling stools
- Reduced incidences of chronic disease
Raw vs Cooked Diets (cont’d)

Negatives of raw

- May expose humans to higher bacterial contamination, especially for young, elderly and ill
- Proof needed that raw-fed dogs live healthier, longer lives
- Exposes vulnerable dogs to dangerous bacteria
- Home-prepared raw meat-based diets may be unbalanced, with deficiencies and/or excesses of certain nutrients
- Unbalanced raw diets of concern for growing puppies
- Bones, even raw, pose risk of obstruction and perforation

Negatives of fresh cooked

- Main negative risk if unbalanced of long-term vitamin/mineral deficiencies
- Opponents may be invested in mass-market commercial pet food industry
- Mainstream veterinarians often opposed to home-prepared diets
- Pet Food Recalls (Salmonella, Listeria, Campylobacter, and E. coli). Both human and pet food industries have recently been inundated with food recalls for contamination with microbes including bacteria, viruses and parasites
Summary Raw vs Cooked Foods

- Neither a balanced raw nor cooked diet is inherently “better” than the other.
- As veterinarians, we see many dogs that thrive on raw food diets, while others that do less well on raw food thrive on freshly prepared human-grade cooked foods.
- We should always come back to the fact that every dog (and cat) is an individual, and that individual needs should outweigh a preference to any one way of feeding.
Functional Superfoods

- Functional superfoods include: berries, but not strawberries; coconut oil; curcumin; medicinal mushrooms; milk thistle; omega-3 fatty acids (EPA and DHA); pomegranates; probiotics; raw honey products (not suitable for the very young); and spirulina (pre-biotic)

- Home-prepared diets require separate extra calcium, regardless of the diet’s quality

- Deficient nutrients that often need supplementing are linoleic acid; omega-3 fatty acids; selenium; vitamin B-6 (pyridoxine); vitamin D; vitamin E; and zinc
Emerging science that studies the molecular relationships between nutrition and the response of genes in the genome in promoting health.

- Different diets alter gene expression, and production of proteins/metabolites.
- Ideal diet contains variety, nutrient-dense, whole foods.
- Specific nutrients affect body responses in a form defined as a “signature.”
- Individual response = “Molecular Dietary Signature.”
BASIC CONCEPTS OF NUTRIGENOMICS

❖ Diet can be a serious risk factor for a number of diseases

❖ Common dietary ingredients act on animal genome directly/indirectly, to alter gene expression/structure

❖ Degree of dietary influence on balance of healthy and disease states depends on individual’s genetic makeup

❖ Certain diet-regulated genes play a role in onset, incidence, progression, and/or severity of chronic diseases

❖ **Dietary intervention** based on animal’s nutritional requirement/status plus genotype used to prevent, mitigate or cure chronic disease
Do all foods suit all dogs?
Thyroid Function, Diet & Behavior

Foods/Supplements important for thyroid function:

- **Soy** – dietary goitrogens, but anti-thyroid effect protected by iodine
- **Iodine** – vital to thyroid function; excess and deficiency can occur
- **Zinc** – critical to immune function, and health of skin
- **Selenium** – protects against oxidative damage; boosts immunity
- **Vitamin E** – neutralizes free radicals; protects against cancer, aging
- **Vitamin B-6 (pyridoxine)** – keeps CNS healthy, aids RBC function
- **Vitamin D** – balances cellular and humoral immunity, regulates insulin and glucose
Vitamin D Toxic Excess in Dry Pet Foods

• Recently, some 9 companies have recalled their dry pet foods for harmful excess levels of Vitamin D

• This vitamin D toxicosis had sickened at least 6 dogs, but to date according to the FDA none have died

• Some products contained about 70 times the intended amount, which could cause kidney failure and death if consumed

• Other signs of vitamin D toxicity include: vomiting, anorexia, increased thirst and urination, excessive drooling and weight loss
Ultra-Trace Minerals in Commercial Dry Kibble

- Major and trace minerals in commercial pet foods are regulated by the NRC and AAFCO. But, ultra-trace minerals (aluminum, mercury, chromium, nickel, molybdenum and silica) are not. These can be cumulative and harmful, causing liver damage, GI inflammation, and brain toxicity.

- Recent study examined 49 OTC dry dog foods.

- **Aluminum** in 46/49 foods was 38 times average human exposure.

- **Chromium** was 30-fold the average human daily intake.

- **Molybdenum** was 15 times more, but **silica** was similar in both.

- **Mercury (thimerosal)** accumulates from vaccines.

[Bohn & Stoessel, American Veterinarian.com Dec 24, 2018]
Factors to Control Aging and Memory

- **Functional foods** that improve cognitive activity in aging dogs include vitamins E and C, and resveratrol (acting as antioxidants) along with a mixture of fruits and vegetables to reduce free radical damage.

- Alpha-lipoic acid + L-carnitine (mitochondrial cofactors)

- **Exercise** in modest amount + tasks to learn & perform

- **Omega-3 fatty acids** help improve brain health and function and slow loss of cognitive function with aging

- Requirement for essential nutrients increases not only during periods of rapid growth or reproduction but also in geriatrics, because immune function and bio-availability of nutrients generally wanes with aging
Future Directions

Nutrigenomics and Canine Health

- Simple tests for rancidity and antioxidant capacity should permit dog owners and breeders to select better foods
  - Monitor for antioxidant levels
  - Evaluate rancidity due to oxidation of foods – especially kibble products – over time

- Development of functional foods, e.g. those containing natural Nrf-2 activators, has great promise
Future Directions

Nutrigenomics for Canine Health (cont’d)

❖ The effects of other dietary variables, including functional foods and saturated vs unsaturated fats need to be evaluated.

❖ Older, less healthy animals more likely to exhibit higher levels of disease-related biomarkers. Also more likely to benefit from induction of antioxidant pathways.

❖ Newer biomarkers, including metabolomic analyses, isoprostanes and miRNAs plus provide earlier assessment of diet-related health effects in younger animals.
Some Nrf-2 Activators in Foods

- Turmeric
- Chili peppers
- Ginger
- [6]-Gingerol
- Green tea
- Epigallocatechin-3-gallate
- Soybeans
- Genistein
- Tomatoes
- Lycopene
- Grapes
- Resveratrol
- Caffeic acid phenethyl ester
- Diallyl sulphide
- Indole-3-carbinol
- Broccoli
- Sulforaphane
- Cabbage
10 foods for Brain Health and Memory

- **Leafy greens** (folate, vit. B 9) - kale, spinach, collard and mustard greens
- **Cruciferous vegetables** (folate, carotenoids) - broccoli, cauliflower, bok choy, Brussel sprouts
- **Beans/ legumes** (choline)
- **Whole grains** (gluten-free = quinoa, millet, rice, soy, corn, flax, TEFF, tapioca)
- **Berries/cherries** (anthocyanins, antioxidants, vits. C & E)
Omega 3 fatty acids (anti-oxidant, anti-inflammatory)

Yellow Squash, asparagus, tomatoes, carrots, beets (folate, vit. A, iron)

Nuts (omega fatty acids, vits. E & B6, folate, magnesium)

CAUTION macadamia, walnuts are unsafe for pets

Seeds (zinc, choline, vit. E)

Spices (anti-oxidant, anti-inflammatory)
Brain Health & Memory

Other Superfoods

• **Eggs** - high in quality protein and choline for brain and memory

• **Kiwis** - antioxidant-rich, vit. A, C & E, potassium, high in fiber

• **Quinoa** - high in protein and fiber, iron, zinc, vit. E, selenium

• **Salmon** - high omega-3 and iron, low calorie and low saturated fat

• **Sweet Potatoes** - high in vit. A & C, calcium, potassium
**Brain Health & Memory**

- **Mediterranean type diet** - fish, nuts (for dogs: not macadamia, walnut or hickory nuts; brazil nuts and cashews are high in fat; pistachios, pecans, almonds can be moldy (aflatoxins); some dogs = peanut reactive); whole gluten-free grains; olive oil, fresh produce

- **Avoid Trans Fats & Saturated Fats** - less dairy, red meat, fried foods

- **Heart-Healthy diet** - also good for the brain

- **Plenty of Omega-3 Fatty Acids** – causes 26% less brain lesions

- **Smaller meals throughout the day** – helps digestion

- **Eat Fruits, Vegetables, and Berries** - of various colors

- **Green Tea** - enhances memory and alertness; anti-inflammatory; put on body and sores, in foods
Avoiding Glutens

- Protect brain function in geriatrics and those with gluten intolerance by avoiding wheat, barley, rye, oats unless labeled gluten-free, kamut, spelt, farro, and couscous.
- Linked with impairment of brain function, including learning disabilities, attention-deficit-hyperactivity disorder, and memory problems.
- Gluten sensitivity may manifest exclusively as a neurological disease.
Canine Cognitive Dysfunction

- Incontinence
- Confusion/disorientation in familiar surroundings
- Increased sleeping/insomnia
- Loss of interest in people and events
- Forgetfulness of housetraining habits
- Failure to recognize familiar people and animals
- Wandering aimlessly/pacing
- Loss of appetite/forgetting to eat
- Staring into space
- Decreased activity level
- Lack of response to name/commands
- Failure to pay attention
Nutrients of benefit include:

- Milk thistle and SAMe (S-adenosylmethionine)
- Phosphatidylserine & Phosphatidylcholine
- Medium-chain triglycerides (MCTs)
- DHA and EPA omega-3 fatty acids
- Anthocyanins (pigmented foods)
- Avoiding Glutens
- Avoiding carbs with high Glycemic Index
Silibinin (milk thistle extract) prevents impairment of both short-term memory and recognition memory
- prevention for cancer as well
- works as antioxidant, protects brain from oxidative damage

SAMe (S-adenosyl methionine) improves neuron membrane fluidity
- increases serotonin and dopamine metabolites
- reduces effects of depression in people
- may help Alzheimer’s patients

Milk Thistle and SAMe
Phosphatidylserine (PS)

• Phospholipid primarily from soy lecithin
• Beneficial effects for dementia and cognitive dysfunction
• Commercial animal products combine PS with gingko biloba, vit. E, pyridoxine (vit. B6) and grape-skin extract
• Improves canine cognitive function, decreases sleeping problems, apathy and disorientation
• Increases playful behavior and response to commands
Phosphatidylcholine

- Phospholipid choline is critical for cell membrane structure and function
- Increases production of acetylcholine
- Helps reverse signs of cognitive and other neurological disorders of aging pets
Medium-Chain Triglycerides (MCTs)

- MCTs, like coconut oil, break down and absorb rapidly, unlike fats; quick source of non-carbohydrate energy
- Readily cross blood-brain barrier, supplying 20% of brain energy requirement
- Important for ketone production
- Help body use omega-3 fatty acids more efficiently
- Helps age-related cognitive decline by providing alternative source of brain energy
DHA & EPA Omega-3 Fatty Acids

• Fight obesity, decrease inflammation, combat arthritis and cancer, and promote overall health

• Benefit neurotransmission and cognition, plus brain health and structure, since the brain contains up to 60% fat

• Used together to benefit mood

• EPA from marine sources such as fish oil decrease the cytokines of depression

• Individuals reactive to white fish (including sardines and herring) or salmon oils can use krill oil, anchovy oil, and plant oils (olive, moringa, sunflower, safflower, hemp)
Anthocyanins (pigmented foods)

- Give berries their rich pigment; antioxidants; also benefit cognitive health of senior dogs
- Most potent is *aronia*, the chokeberry. Greater antioxidant than all other berries; anti-cancer; anti-bacterial, anti-viral and even anti-diabetic; and anti-inflammatory
Avoiding Carbs
With High Glycemic Index (GI)

• Impaired glucose metabolism caused by sugary foods can promote brain starvation, leading to memory problems, like canine cognitive dysfunction

• Foods with high GI can also lead to hunger-related behavioral problems

• Simple carbohydrates digest and absorb quickly (hence rapid rise and fall in blood sugar concentrations), so pets feel hungry again quickly
DIETARY DIAGNOSTICS

Food Sensitivity -- Newer Testing

- Newer tests can use serum, **saliva** or feces
- ELISA or other immunoassay platforms
- Identify IgG, IgA, or immune complexes to foods in **serum** (poorly correlated to clinical signs)
- IgA or IgM antibodies to foods in **saliva** (**excellent clinical correlation**)
- Antibodies to foods appear in saliva before GI tract clinical/biopsy diagnosis of IBD or “leaky gut syndrome.” Saliva testing can thus reveal the latent or pre-clinical form of food sensitivity

[Dodds, WJ JAHVMA, 49, Winter Issue, 32-43, 2017/2018; patented worldwide]
Leaky Gut Affects the Whole Body

Brain
- Depression
- Anxiety
- ADHD

Skin
- Acne
- Rosacea
- Eczema
- Psoriasis

Thyroid
- Hashimotos
- Hypothyroidism
- Graves

Joints
- Rheumatoid Arthritis
- Fibromyalgia
- Headaches

Adrenals
- Fatigue

Colon
- Constipation
- Diarrhea
- IBD
NUTRISCAN SUCCESS CASE

Darby, 9 yr, S/F, 68 pounds, Old English Sheepdog

- Hypothyroid on thyroxine therapy; antihistamine
- Orange staining on head, ears; black skin eruptions
- Eating chicken & turkey, plus some fish & corn, veggies
- Removed these 4 foods, and head, ear & skin improved
NUTRISCAN SUCCESS CASE (cont’d)

Before Ear
Before Head
Before Skin

WRONG FOOD
NUTRISCAN SUCCESS CASE (cont’d)

After Ear
After Head
After Skin

RIGHT FOOD
After Thyroid Therapy + Nutriscan
Before -- Face Lesions -- Before
Before

After
Does your dog or cat:
- have itchy skin?
- have stomach discomfort?
- belch or have gas?

Do you suspect your dog or cat has a food intolerance?

Food intolerance or sensitivity is actually quite common whereas food allergy is rare. In fact, food intolerance is the third most common sensitivity condition in cats and dogs and often can be easily remedied with a change in diet. For years, though, the difficulty lay in figuring out what foods were problematic – until now.

Developed by world renowned veterinarian, Dr. Jean Dodds, NutriScan tests for the twenty four most commonly ingested foods by dogs and cats to provide you with specific results as to your dog’s or cat’s food intolerances or sensitivities. Since it is a salivary test, you have the convenience to complete the test at home or at your veterinarian’s office. Best of all, you can have the results in approximately ten days to help you put your companion animal on the right diet.

NutriScan®
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By Dr. Jean Dodds
Nutriscan is a division of Hemopet

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Isoprostane Biomarker Assay
“Let food be thy medicine and medicine be thy food.”

Hippocrates