PAEDIATRIC NUTRITION: BUILDING FOR THE FUTURE

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We all know that when we want to build something that will last, we must first ensure that the foundations are strong. This is a simple principle that all architects, designers and engineers follow strictly to ensure success and stability of their creation. As veterinarians, when an owner of a new puppy or kitten comes to us, they are seeking our professional advice not only on vaccination and deworming, but on ensuring that their new family member will survive the critical danger period and continue to grow and develop correctly.

Of all the advice we can give at this most important lifestage, there is nothing more important than providing the best nutrition advice. After weaning, development of the immune system, the skeletal system, the neural system and the vital organs are all directly affected by nutrition. Any deficiency, excess or imbalance at this critical stage will have profound and long-lasting effects on development, behaviour and disease susceptibility.

This lecture will cover the important aspects of paediatric nutrition that we need to know before providing advice to our clients; highlight some disturbing myths about puppy and kitten nutrition that our clients may be exposed to from other sources of information; and cover clinically relevant information about developmental paediatric neurology, mobility and immunity that explains how certain diets are designed and clinically proven to ensure the best nutrition for your younger patients.

When a new puppy or kitten owner walks into your clinic or seeks your advice on their newest family member, they want to know the following:

- How can I protect my pet from all the dangerous diseases that he or she may be exposed to?
- What do I need to do to ensure my new pet grows properly and is able to enjoy an active lifestyle?
- Is there anything I can do to enhance the learning ability of my new pet, so he or she is easier to

train?

- How can I make sure my new pet eats well, but does not get fat?
- I know that some pets get liver and kidney disease ? is there anything I can do to prevent this?
- There are so many different diets all claiming to be better than each other ? how do I choose the right one?

We can summarise these concerns into the following sections:

- Enhanced Immunity
- Improved Mobility ? healthy bone/joint development
- Neurological development and cognition
- Ideal body weight
- Healthy vital organ development
- Precisely balanced and clinically proven nutrition

Enhanced Immunity

Between two and six months of age, a puppy or kitten will be receiving its primary vaccination course from you. This is our only chance to develop a healthy immune system. The vaccinations given stimulate the existing immune system to build antibodies against diseases such as canine parvovirus, canine distemper, rabies and feline enteritis. Without a healthy immune system, these animals may not be protected against these diseases, even if they are vaccinated. So how can we ensure that the vaccinations we administer are going to be effective?

Two published studies (Jewell at al, 2000; Khoo et al, 2005) substantiate claims that allow one particular brand to state that its puppy and kitten diets ¡°has a clinically proven antioxidant formula to build a healthier immune system within 90 days¡±.

The claim itself is based on a couple of things:

- –Vitamin E concentrations in blood, which can be measured.
- – ↓biomarkers of oxidative stress. Biomarkers are indicators of a particular disease state or a particular state of an organism, and they can also be measured in the blood. (An example of a biomarker would be cholesterol, which can be a risk factor or indicator for heart disease).

So we know that when the Vitamin E concentrations become high enough in the blood, the biomarkers of oxidative stress, which are known as alkenals, actually decrease. Alkenals are the by–products of oxidative damage in cells.

Compared to the competitive products used in this claim, Hill¡¦?s Science Diet pet foods contained higher levels of Vitamin E levels vs. other leading brands, which is reflected in the higher Vit. E levels in the blood. This is what causes the by-products of oxidation to be decreased in the Science Diet puppies and kittens.

Vitamin E Study

1) Canine:

Adult dogs were fed four different test foods (10 dogs in each group) for 6 weeks: control food (153 IU vitamin E/kg food) or control food plus increasing levels of vitamin E (293, 445 or 598 IU vitamin E/kg food). Vitamin C and ¥a-carotene were also added to the foods. Dogs were fed to maintain body weight.

2) Feline:

Adult cats were fed four different test foods (10 cats in each group) for 6 weeks: control food (98 IU vitamin E/kg food) or control food plus increasing levels of vitamin E (248, 384 or 540 IU vitamin E/kgfood). Vitamin C and ¥a-carotene were also added to the foods. Cats were fed to maintain body weight.

- Blood samples were obtained from each animal at the beginning and end of the 6-week study
- Serum was analyzed for vitamin E and alkenal (biomarker of lipid peroxidation and generalized free radical damage) concentrations
- Serum vitamin E concentrations increased significantly in all groups receiving increased dietary supplementation of vitamin E but only the canine groups receiving 445 and 598 IU vitamin E/kg food and only the feline group receiving 540 IU vitamin E/kg food had significantly reduced serum alkenal concentrations.

Reference : Jewell DE, Toll PW, Wedekind KJ, et al. Effect of increasing dietary antioxidants on concentrations of vitamin E and total alkenals in serum of dogs and cats. Vet Therapeutics 2000;1:264-272.

Puppy Immune Response Study

- Clinical study evaluated puppies fed four different test foods (10 puppies in each group) for 6 weeks: control food, control food plus antioxidants, control food plus antioxidants and 1% whey protein, and a grocery brand food
- The antioxidant combination consisted of vitamin E, vitamin C, ¥a-carotene and selenium

- A standard vaccine product, which included canine distemper and parvovirus antigens was given on day 14 and a booster was given on day 28 of the study
- Blood samples were obtained weekly from day 14 to day 42 of the study for vaccination titers and immune cell response (lymphocyte proliferation and natural killer cell activity)
- Puppies consuming the antioxidant enhanced foods had significantly higher serum vitamin E concentrations compared with the control and grocery brand groups
- Puppies consuming the control food supplemented with antioxidants had significantly higher canine distemper virus and parvovirus titers than puppies receiving the control food alone, and had significantly increased levels of memory CD4+ lymphocytes compared with the control and grocery brand groups
- Dietary antioxidants are thought to improve immune health by protecting immune and other cells from oxidative (free radical) damage. The combination of antioxidants used in this study improved response to standard vaccination and increased the number of memory immune cells, which may help provide longer lived protection against infections.

Reference : Khoo C, Cunnick J, Friesen K, et al. The role of supplementary dietary antioxidants on immune response in puppies. Vet Therapeutics 2005;6:43-56. This is also featured in Clinical Evidence Report TD-836.

Improved Mobility

The next claim is a mobility claim, which is ¡°Tested nutrition to promote healthy joint development and enhance mobility by 30% in 90 days.¡± Substantiation for this claim was based on:

- Serum EPA concentrations
- Agility testing

A clinical study evaluated a total of 16 dogs fed Puppy Healthy Development compared to a similar number of dogs fed a grocery brand food or a premium brand food.

- Puppies were started on the foods at 2 months of age and were evaluated at 3 & 6 months of age
- Puppies were fed according to published feeding guides and amounts adjusted to achieve a Body Condition Score = 3/5
- HSD Puppy formula contained high levels of total omega-3 fatty acids including DHA and EPA. This resulted in significantly higher serum DHA and EPA concentrations in puppies eating HSD

Puppy compared to puppies eating the other two foods. In other studies, omega-3 fatty acids including EPA have been shown to be important nutrients to help maintain joint health.

The following markers of bone and cartilage metabolism were measured:

- Osteocalcin
- Bone alkaline phosphatase
- Cartilage oligomeric matrix protein [COMP, indirect marker for cartilage protein (collagen) degradation]
- Carboxy-terminal telopeptide of type II collagen [CTX-II, marker for cartilage protein (collagen) degradation]
- C-propeptide of type II collagen synthesis [CPII, marker for cartilage protein (collagen) synthesis rate]

CPII was higher in dogs fed HSD Puppy and the other premium brand compared to puppies fed the grocery brand. This indicates that puppies fed HSD Puppy had better joint development compared to puppies eating a grocery brand food.

Agility motor tasks were assessed - tested each dog's ability to run through a T-maze with obstacles ("hoops and weaves").
Changes in time to complete the "weave" task were evaluated 43 days after starting the growth foods (100 days of age)

Grocery brand	+0.9 seconds (+9.9%)
Premium brand	+1.6 seconds (+18.6%)
HSD Puppy	-2.6 seconds (-34%)

A shorter time to complete the "weave" agility task shows improved mobility

Healthy Brain Development

A clinical study evaluated a total of 16 dogs fed HSD Puppy Healthy Development compared to a similar number of dogs fed a grocery brand food or a premium brand food

- Puppies started on the food at 2 months of age and evaluated at 3, 4, 6, 9 and 12 months of age
- Puppies fed according to published feeding guides and amounts adjusted to achieve BCS = 3/5
- Science Diet Puppy formula contained high levels of total omega-3 fatty acids including DHA.

This resulted in significantly higher serum DHA concentrations in puppies eating HSD Puppy formula compared to puppies eating the grocery or premium brand formulas. In other studies, DHA has been shown to be an important nutrient in brain, eye and nervous system development

- Electoretinograms (ERGs) provide a noninvasive and objective evaluation of retinal function in the eye. ERGs record the bioelectrical potential produced when the eye is stimulated by light. It does not test vision directly. This was also conducted in kittens.
- ERG activity was significantly better for puppies consuming HSD Puppy and the other premium brand formulas compared with puppies fedthe grocery brand. Both these foods are significantly higher in DHA, which may have led to the improved retinal response.
- Cognitive function tests were performed (This was the first time such a battery of tests had ever been done, as well as testing done during their entire growth period).

Learning ability (T-maze)	Simple object discrimination
Oddity discrimination	Contrast discrimination
Landmark discrimination	Spatial memory

Compared to puppies eating the grocery brand, puppies eating HSD Puppy formula had improved reversal learning in the T-maze.

Compared to puppies eating the other premium brand, puppies eating HSD Puppy formula had improved landmark discrimination.

Increased levels of serum DHA, improvements in ERG measurements and improvements in cognitive function tests for puppies and kittens consuming HSD Puppy and kitten formula respectively support the claim of optimal eye and brain development.