

# **ORIJEN WHITE PAPER**

The Biologically Appropriate Food Concept and the Dietary Needs of Dogs and Cats

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# 1 | THE ANATOMY OF EATING

*As a faithful companion to humans for some 10,000 years, the trend to humanize our companion dogs comes as no surprise.*

Yet despite his long and close association with humans, the dog remains closest genetically to the gray wolf, with whom he shares over 99% of his mitochondrial DNA.

The close genetic relationship between dog and wolf led the Smithsonian Institution to reclassify the dog from its previous separate species designation of *Canis familiaris* to *Canis lupus familiaris*.

In other words, the Timber wolf, the Tundra wolf, and our beloved companion dog, all fall under the genetic umbrella of the gray wolf: *Canis lupus*.<sup>1</sup>

Just like wolves, all dogs are evolved as carnivores, with anatomical features that clearly adapt them for meat-based diets.

Understanding the anatomical differences between carnivores, omnivores and herbivores helps understand why dogs and cats are classified as carnivores, and what foods best match their anatomy.

## THE ANATOMICAL DIFFERENCES OF HERBIVORES, OMNIVORES & CARNIVORES

*To understand the nutritional needs of dogs and cats, it is useful to begin with a basic understanding of their anatomical features, and how*

*they differ from herbivores and omnivores.*

Milton's "Comparative Anatomy" (Milton R. Mills, M.D.) illustrated how all animals are anatomically and physiologically adapted to find and eat particular kinds of foods.

By understanding which anatomical features are associated with each kind of diet, we are able to classify an animal as:

1. CARNIVORE (meat eaters),
2. HERBIVORE (plant-eaters), or
3. OMNIVORE (both meat and plant eaters) a

This classification helps understand which foods the animal is actually adapted to eat.

### HERBIVORES (cows, sheep)

Herbivores eat plants, not meat. So it's no surprise that their anatomical features are adapted to process carbohydrates and other nutrients produced by plants.

Anatomical features common to herbivores confirm their adaption for a plant-based diet.

1. LONG DIGESTIVE TRACTS up to 10 times their body length are needed due to the relative difficulty with which plant foods are broken down. Herbivores have significantly longer and much more elaborate guts than do carnivores.<sup>2</sup>
2. SQUARE & FLAT MOLARS provide an ideal grinding surface to crush and grind plants (but not meats). A lower jaw with a pronounced sideways motion facilitates the grinding motion needed to chew plants.

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<sup>1</sup> Robert K. Wayne, Ph.D. , "Molecular evolution of the dog family" , Theoretical and Applied Genetics

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<sup>2</sup> The Comparative Anatomy of Eating, Milton R. Mills, M.D.

3. **CARBOHYDRATE-DIGESTING ENZYMES IN SALIVA.** AMYLASE is a digestive enzyme in saliva that helps in digesting carbohydrates. Herbivores methodically chew their food to ensure the thorough mixing with amylase.

### **OMNIVORES (pigs, bears, humans)**

Omnivores (from Latin: omne all, everything; vorare to devour) are evolved to eat both plants and animals.

As general feeders, omnivores are not specifically adapted to eat meat or plant material exclusively.

Anatomical features common to omnivores include:

1. **MEDIUM LENGTH DIGESTIVE TRACTS** that provide the flexibility to digest both vegetation and animal proteins.
2. **FLAT MOLARS AND SHARP TEETH** developed for some grinding and some tearing.
3. **SALIVA CONTAINS CARBOHYDRATE-DIGESTING ENZYME AMYLASE** which is responsible for the majority of starch digestion.

### **CARNIVORES (wolves, dogs, cats)**

Carnivore means 'meat eater' (Latin carne meaning 'flesh' and vorare meaning 'to devour') and classifies animals whose diets consist mainly of meat – such as dogs and cats.

The anatomical features of carnivores are:

1. **SHORT, SIMPLE & ACIDIC DIGESTIVE TRACTS.** Protein and fat from animal source are quickly and easily digested – hence the short digestive system of dogs and cats.

The ability of dogs and cats to secrete hydrochloric acid is also exceptional. To facilitate protein breakdown and kill the bacteria found in decaying meats, dogs and cats are able to keep their gastric pH around 1-2.

2. **SHARP TEETH** (designed for slicing meat, not grinding plants). Carnivores have elongated teeth designed for tearing and killing prey.

Their molars are triangular with jagged edges that function like serrated-edged blades that give a smooth cutting motion like the blades on a pair of shears.

3. **JAWS MOVE VERTICALLY** unlike herbivores and omnivores that grind their food by side to side chewing, the jaws of dogs and cats operate vertically to provide a smooth cutting motion, and open widely to swallow large chunks of meat.
4. **NO AMYLASE IN SALIVA.** Amylase in saliva is something omnivorous and herbivorous animals possess, but not carnivorous animals like dogs or cats.

As amylase is not present in saliva, the burden is entirely on the pancreas to produce the amylase needed to digest carbohydrates.

Feeding dogs as though they were omnivores or herbivores makes the pancreas work harder in order to digest the carbohydrate-filled foods (instead of just producing normal amounts of the enzymes needed to digest proteins and fats).<sup>3</sup>

## **CONCLUSIONS | CATS & DOGS ARE DESIGNED FOR AN ALMOST EXCLUSIVELY MEAT-BASED DIET**

Several key anatomical features separate dogs and cats from omnivores and herbivores, while clearly classifying them as carnivores with an adaptation for an almost exclusively meat based diet.

### **STOMACH TYPE & LENGTH**

- Dogs & cats possess a short, simple gastro-intestinal tract. Because meat is easily digested (relative to plants) their small intestines are short.

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<sup>3</sup> The Comparative Anatomy of Eating, Milton R. Mills, M.D.

- A high concentration of stomach acid helps quickly break down proteins (Carnivores have a stomach acidity of about pH 1 - compared to humans at pH 4 to 5).

## **TEETH & JAWS**

- A large mouth opening with a single hinge joint adapted for swallowing whole chunks of meat.
- Short and pointed teeth designed for grasping, ripping and shredding meat (not grinding grains).
- Teeth and jaws designed to swallow food whole (not for chewing or crushing plants).

## **DIGESTIVE ENZYMES**

- Adapted to break down protein and fat from meat (not plants or grains), the

saliva of dogs and cats does not contain the digestive enzyme amylase.

- Carnivores don't chew their food. Unlike carbohydrate-digesting enzymes, protein-digesting enzymes cannot be released in the mouth due to the potential of damaging the oral cavity (auto digestion).
- Therefore, carnivores do not mix their food with saliva—they simply bite off huge chunks of meat and swallow them whole.

## 2 | THE DIETARY NEEDS OF DOGS AND CATS

*The dog is, by all scientific standards and by evolutionary history, a domesticated wolf.*

Section 1 illustrated the anatomical features of dogs and cats that classify them as carnivores, and explained how these features adapt dogs and cats for digesting proteins and fats from animal flesh, – not carbohydrates from plants.

**This raises the question of which foods are appropriate for their carnivorous anatomy, and which are not?**

As the dog's internal physiology does not differ from the wolf, dogs have the same physiological and nutritional needs as their wild predator cousins, whose diets are almost exclusively proteins and fats.

Modern dogs of all breeds are not only capable of eating the food of their wild ancestors, but actually require it for maximum health.

This is because their basic physiology has changed very little with domestication—despite the obvious differences in their physical appearances.

### ANIMAL SOURCE PROTEINS

*Protein is the staff of life for dogs and cats – essential to basic body functions, including cellular regeneration, tissue maintenance, hormone and enzyme production, and the provision of energy.*

Although protein is essential, not all proteins function equally, with protein qualities varying enormously between various sources.

Three factors effecting protein quality include:

1. **PROTEIN SOURCE**
2. **AMINO ACID COMPOSITION**
3. **DIGESTIBILITY**

### PROTEIN SOURCE

Due to the different amino acid profiles contained in animal and plant proteins, ANIMAL PROTEINS are considered 'complete proteins' for dogs and cats, while PLANT PROTEINS are considered 'incomplete proteins'.

### AMINO ACID COMPOSITION

ANIMAL PROTEINS contain all of the amino acids essential to dogs and cats in quantities that match the requirements needed for their overall health, maintenance and growth.

PLANT PROTEINS such as corn gluten, soybean meal or plant protein isolates, do not contain all of the amino acids in the right proportions that a dog or cat needs.

Amino acids essential to dogs and cats often missing in plant proteins, include arginine, taurine, methionine, lysine and tryptophan.

### PROTEIN DIGESTIBILITY

Protein digestibility is a key quality measure.

After all, what good is it to have a food made with a higher quality protein if it's not also easy to digest?

A food with high protein digestibility is one that can be broken down into smaller easy-to-absorb components easier and quicker than others.

In the short digestive systems of dogs and cats, plant proteins are far less digestible than meat proteins.

Animal source protein is the best choice - it is easily digested and contains the amino acids essential for dogs and cats.

**PLEASE SEE SECTION 5 FOR A MORE INDEPTH DISCUSSION OF PROTEIN QUALITY.**

## ANIMAL SOURCE FATS

*While often viewed negatively by health conscious people, fat is an essential dietary requirement for dogs and cats.*

As many people are concerned with reducing our fat intake, we often fail to realize the essential role that fat plays in the diets of our dogs and cats.

Just as with protein, fats are also not created equally and differ greatly in their component structure and quality.

Dogs and cats don't suffer from cholesterol problems or heart disease caused by higher levels of animal fats, and it comes as no surprise that cats and dogs need fat from animals, rather than plant source.

Two key roles of dietary fat are:

1. Providing a concentrated source of energy.
2. Supplying the Essential Fatty Acids (Omega-3, for example) that dogs and cats cannot produce within their own body.

## FAT AS ENERGY

- Both dogs and cats require a fairly high amount of animal fat in their diets.
- As companion dogs and cats enjoy a more sedentary lifestyle than their wolf relatives, moderation of fat is important, with an optimum range of 15-18% fat.
- While both fats and carbohydrates provide energy, they function very differently in the body of a dog or cat. Fats are essential in the diets of dogs and cats, carbohydrates are not.
- Carbohydrates provide energy more rapidly compared to fats. In humans, a high intake of carbohydrates increases muscle-glycogen, which increases stamina. The same carbohydrate loading in dogs creates an excess accumulation of lactic acid in the muscles, leading to a condition called hypoglycemia, which causes weakness and fatigue.

- Animal fats are clearly the choice of energy for dogs and cats.

## ESSENTIAL FATTY ACID SUPPLY

Essential fatty acids are the fatty acids present in fats that are required by the body.

Because they cannot be produced in the body, Essential Fatty Acids must come from foods.

The most important are linoleic and arachidonic<sup>4</sup> (Omega-6), and DHA and EPA (Omega-3).

An appropriate balance of omega-6 and omega-3 is important as these two fats work together. A ratio of 2:1 to 5:1 is generally accepted as ideal for dogs and cats.

As lack of Omega-6 is extremely rare, most pet foods have too much Omega-6 and not enough Omega-3.

## OMEGA-3 QUALITY

- Omega-3 quality varies dramatically between plant and animal sources.
- Of the 3 kinds of Omega-3: **ALA** (alpha-linolenic acid) is from plants, while **DHA** (docosahexaenoic acid) and **EPA** (epicosapentaenoic acid) are from fish.
- Dogs and cats require DHA and EPA, not ALA.

### ALA | Omega-3 from plants

Plant source Omega-3 is ALA, a short-chain omega-3 found in soy, canola oil and flax.

ALA must be converted to EPA and DHA to be of any nutritional benefit to a dog or cat.

As cats and dogs are not adapted to create this conversion, ALA Omega-3 from plants is considered 'inactive' and not Biologically Appropriate for dogs and cats.

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<sup>4</sup> While dogs are able to produce arachidonic acid from linoleic acid, cats cannot synthesize arachidonic acid and require it in their diet.

### **EPA & DHA | Omega-3 from fish**

Animal Omega-3s (EPA and DHA) are long-chain omega-3s that are absorbed readily and directly within the body.

Naturally present in oily fish such as salmon, herring and lake whitefish, EPA & DHA and are by far the best Omega-3 choice for dogs and cats.

## **CARBOHYDRATES – AS FEW AS POSSIBLE**

*Carbohydrates are usually the first source of energy available to the body. Proteins and fats also provide energy but carbohydrates are called upon first.*

According to the NRC guidelines, "Carbohydrates provide an economical source of energy in the diet of dogs."

Carbohydrates are divided into two broad groups:

- 1). SIMPLE CARBOHYDRATES or sugars, and
- 2). COMPLEX CARBOHYDRATES.

### **SIMPLE CARBOHYDRATES**

Simple carbohydrates are made up of single sugars, or two sugars joined together and are found in grains such as corn, wheat and rice.

- Simple sugars are quickly absorbed into the blood stream, causing a rapid rise in blood sugar levels.
- This rapid rise causes the body to produce a sharp rise in insulin levels and results in the sugars being converted into fat.
- The rapid rise in blood sugar levels is usually followed by a rapid drop, leading to feelings of hunger and weakness.

### **COMPLEX CARBOHYDRATES**

Complex carbohydrates have more than two units of sugar joined together and are found in

potatoes, beans, as well as many other vegetables and fruits.

- Complex carbohydrates can take a long time to break down in the stomach or pass through undigested, creating voluminous stool.

## **ARE CARBOHYDRATES APPROPRIATE FOR CARNIVORES?**

*Dogs and cats have no nutritional need for carbohydrates and are evolved to use protein and fat as energy sources.*

- The natural diet contains almost no carbohydrate at all, and the small predigested grains, fruits & vegetables in the stomach of a prey animal make up a very small fraction of the total diet.
- Today's high carbohydrate pet foods lead to blood sugar fluctuations, insulin resistance, and are widely considered as a leading cause of obesity, diabetes and a host of other health problems in cats and dogs.
- Conventional dry dog foods have a very high carbohydrate content, with most foods exceeding 40-50% in total carbohydrate content.
- Almost half of typical dry dog foods is non-essential, simple sugars! This important fact is often lost on consumers as pet food makers are not required to claim carbohydrate content on their packages.
- Carbohydrate intake above the daily needs of the dog (which regularly occurs with conventional pet foods) prompts internal enzyme factors to store the extra carbohydrate as body fat.
- The Association of American Feed Control Officials' (AAFCO) nutrient profiles show that carbohydrates are not essential for dogs and cats, and that no minimum level of carbohydrate is needed in their diets.
- According to Dr. David S. Kronfeld, carbohydrates need not be supplied to adult dogs, even those working hard as the liver is easily able to synthesize sufficient glucose (from protein and fats).

## FEEDING CATS & DOGS ACCORDING TO THEIR ANATOMY

*“Cats and dogs evolved as hunters and despite a modern lifestyle, their digestive systems and internal anatomical features have remained unchanged for hundreds of years”*

Despite obvious and dramatic changes in their physical appearance, the basic physiology of the modern dog has changed very little with domestication.

Today’s modern dogs are not only capable of eating the food of their wild ancestors, but actually require it for maximum health.

A biologically appropriate diet mirrors the same balance and variety of ingredients that would be consumed in the wild, including muscle meat, bone, fat, organ meat and vegetable materials.

Applied to dry foods, the Biologically Appropriate concept means higher-protein, moderate fat, low carbohydrate foods that contain high and various inclusions of animal ingredients that are processed as little as possible.

Cereal grains are excluded and carbohydrates are reduced.

### SUMMARY

Section 1 found that, despite obvious changes in their physical appearance, the basic physiology of the modern dog and cat has changed very little with domestication.

Section II asked the question of which foods are appropriate for their carnivorous anatomy, as well as which foods are not appropriate?

Conclusions are that dogs and cats are evolved as carnivores, and that despite obvious differences in appearance from their wild cousins, their internal anatomy remains unchanged.

- Dogs are carnivores, not omnivores. Dogs ARE very adaptable, but just because they can survive on an omnivorous diet, does not mean it is the best diet for them.

- With short digestive tracts and gastrointestinal systems, dogs and cats are adapted to metabolize animal flesh and fat, not grains and carbohydrates.
- Today’s modern dogs (of any breed) are not only capable of eating the food of their wild ancestors, but actually require it for maximum health.
- Biologically Appropriate foods are designed to match the digestive capability of dogs and cats. Just like the natural diet, they are high in protein and low in carbohydrates, with a concentration and variety of minimally processed meats and fats from animal source.

Although these findings are well accepted within the scientific community, conventional dry dog and cat foods appear to be created on the premise that the digestive system of the dog and cat is similar to humans - with a heavy emphasis on inappropriate grains and carbohydrates.

This leads to the next question:

**If dogs and cats are carnivores, evolved for an almost exclusively meat-based diet, why do conventional pet foods contain such high levels of cereal grains and carbohydrate?**

Section 3 – the History of Pet Foods attempts to answer.

# 3 | THE BRIEF HISTORY OF COMMERCIAL PET FOODS

*If dogs are cats are carnivores, evolved for an almost exclusively meat-based diet, why then are commercial pet foods made with such high inclusions of cereal grains and carbohydrates?*

Understanding the brief history of commercial dry pet food helps explain why most commercial pet foods were developed with convenience and economy in mind,—rather than peak health of dogs and cats.

Since the emergence of dry pet foods in the 1860s through their mass popularity in the 1970's, most pet food makers have focused on cost and convenience at the expense of nutrition.

This focus explains the predominance of inexpensive commodity grains and by-products that, while less than ideal for feeding dogs and cats, are easily made into shelf stable, lower priced pet foods.

While some would argue that dogs and cats have adapted since kibble foods were introduced, Sections 1 and 2 of this document have made it clear their digestive systems remain unchanged.

Were they to occur, such evolutionary adaptations require much more time than a mere hundred years or so, and the evolutionary change—from gross anatomy down to the molecular level—that would be required for the development of such different digestive capabilities would take MUCH longer than the time that dogs have been living with humans.<sup>5</sup>

## 1860s | THE FIRST DRY DOG FOOD

- The first food made specifically for dogs was created by American electrician, James Spratt who concocted the 'dog

cake' - made of wheat, vegetables and beef blood.

- Other companies followed and dog foods baked with grains entered the pet food market, which was previously dominated by the butcher.

## 1930s | THE GREAT DEPRESSION, INEXPENSIVE PET FOODS

- The 1930's saw the introduction of dry meat-meal dog food by the Gaines Food Company.
- For companies such as Nabisco, Quaker Oats and General Foods, the emerging pet food market represented an opportunity to market otherwise unusable by-products as a profitable source of income.
- Sold with the primary benefit of convenience, high inclusions of grain ingredients created a longer shelf life, while carbohydrates provided a cheap source of energy.

## 1960s | PRODUCER CLAIMS THAT THEIR FOODS WERE SUPERIOR AS THEY UTILIZED WASTE GRAINS AND MEATS UNFIT FOR PEOPLE.

- In the 1960s, new debates were developing as pet food makers claimed their products offered good value because they utilized cereal waste products and meat otherwise unusable for human consumption.
- While acknowledging that fresh meat and vegetables were excellent foods, pet food makers argued that dogs and cats could be fed economically with factory waste products and still be healthy.
- Mill operators continued to have a good market for their grain by-products, while slaughterhouses enjoyed a market for their meat by-products that were otherwise unusable.

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<sup>5</sup> The Many Myths of Raw Feeding, G. Cowan

## 1970s | 'COMPLETE & CONVENIENT' AS THE PRIMARY BENEFIT

- In the 1970s, convenience was the first selling point for packaged dog foods. Scooping dry pieces of food into the bowl was more time saving than cooking or preparing their pet's dinner.
- Dog food companies began labeling their dog foods as complete, with no additional foods or supplements being necessary, with producers warning consumers that table scraps could be dangerous to the dog's health.

## 1970s | SPECIALTY DIETS ARE INTRODUCED

- Formulated for specific diseases or disorders in pets - specialty diets were (and still are) often little more than the same foods in a different package.
- The introduction of specialty diets portrayed pet nutrition as complex and implied people should rely more on their veterinarian's advice than their own common sense.
- Shopping for pet food expanded from the supermarkets to the veterinarian's office<sup>6</sup>.

## 1980s | THE ARRIVAL OF "SUPER PREMIUM"

- Sold as more nutritional and offering different formulas for all stages of life, the vast majority of "Premium" foods still used the old standards – high grain, high carbohydrate, low meat content and low protein.

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<sup>6</sup> While veterinarians perform much-needed services for our pets, these services should not include a) selling pet food, and b) administering nutritional advice. Veterinarians receive very little nutritional training. The training they do receive is often advocated by or even administered by the same multinational pet food companies whose foods they sell. Their nutritional training comes from the incorrect view that dogs are omnivores and can safely be maintained on a high carbohydrate & grain-based diets - even when scientific research has proven that canines and felines have no evolved need for carbohydrates and fiber.

## 1990s | CONSUMERS BECOME MORE EDUCATED (sort of)

- As consumers recognized the role of nutrition in their own lives, they began reading pet food labels more closely.
- This led to the so-called "Holistic" foods, and producers began to promote specific ingredients (such as organic grains) that appealed to people, rather than nourishing their dogs.
- Almost all 'holistic' foods remain grain and carbohydrate based, and are anything BUT holistic from a dog or cat's point of view.

## 2000 | THE PAST, REVISITED

The more things change, the more they stay the same! While pet food marketing evolves, the pet foods themselves continue to rely upon heavily processed ingredients, with the vast majority of today's conventional pet foods still containing more than 50% grain and almost as much carbohydrate.

- Yet with all of the allergies and chronic illnesses afflicting our companion dogs and cats today, are today's pets really healthier?
- Although consumers today are better educated and increasingly aware of the ingredients in their pet's food – most people are not aware of important food quality measures such as the amount of carbohydrate in their pet foods, and do not know how to determine the protein or fat quality.
- Grains are widely considered as healthy foods for humans, and dried pet foods have always been made with grain –two primary reasons why consumers accept grains as part of their pet's diet. Grains have always been there, so they're often not questioned.
- When asked if to consider whether grain and carbohydrate are appropriate for their dogs or cats, most consumers come to the realization that these are not part of the natural canine or feline diet.

- Despite advances in marketing – from Premium, Super-premium, “vet recommended” and “holistic diets” – the foods really haven’t changed that much in the last 40 years. Conventional pet foods are still made by the same companies and remain low in protein, high in carbohydrate, and are made with high percentages of grains (this is especially true of the vet diets).
- As history has shown, pet food makers will produce foods designed primarily for their appeal to consumers. This generally occurs at the lowest cost and highest convenience, rather than

making a food most appropriate to for the dogs and cats themselves.

**If conventional pet foods are focused on price and convenience, what foods focus more on the biological requirements of dogs and cats?**

Section 4 – BIOLOGICALLY APPROPRIATE DOG & CAT FOOD attempts to answer this question.

## 4 | BIOLOGICALLY APPROPRIATE DOG & CAT FOOD

*The Biologically Appropriate concept is simple to understand yet very difficult to achieve within the limits of a dry dog or cat food.*

Stated simply, 'Biologically Appropriate' means mimicking the foods that Mother Nature evolved the animal to eat.

Herbivores, like cows and sheep for example, evolved flat molars to grind plants, long digestive tracts to ferment plants and amylase in the saliva to break down the carbohydrates found in plants.

For herbivores, a Biologically Appropriate food would include a variety of plants in a low-protein and high-carbohydrate diet.

Carnivores, like dogs and cats, have a large mouth with a single hinge designed for swallowing large chunks of meats, pointed teeth for tearing and shredding meats, and a short, acidic digestive tract designed for the quick digestion of meats.

For dogs and cats, a Biologically Appropriate food would include a variety of fresh meats in a high-protein, moderate fat and low-carbohydrate diet.

It should be clear by now that large quantities of grains and carbohydrates are certainly NOT biologically appropriate for dogs and cats.

Biologically Appropriate diets are instead concentrated in fresh animal ingredients that supply the correct proteins, fats, carbohydrates, vitamins and minerals in species-specific ratios (focus on matching food to the anatomical capacity).

### KEY FEATURES OF A BIOLOGICALLY APPROPRIATE DIET

Put simply, a Biologically Appropriate food is designed to match the digestive anatomy of the target animal.

In its dry form, Biologically Appropriate dog or cat foods feature:

1. RICH IN ANIMAL PROTEIN from meat concentrated formulations (70%+).<sup>7</sup>
2. HIGH & VARIOUS FRESH MEAT INCLUSIONS from a variety of animal sources.
3. LOW IN CARBOHYDRATES with no high-glycemic cereal grains present.
4. ESSENTIAL FATS FROM ANIMALS (meats and fish) – not plants<sup>8</sup>
5. FRUITS, VEGETABLES & BOTANICALS.
6. NOTHING IN EXCESS and not over supplied in calcium and phosphorus<sup>9</sup>

#### i. RICH IN ANIMAL PROTEINS & MEAT CONCENTRATED

*As carnivores, dogs and cats are adapted for a diet high in meat proteins.*

*The ideal diet for a dog or cat is almost exclusively from animal source, with minimal plant material and no grains at all.*

- Just like their wild cousins, dogs and cats are carnivores—equipped with sharp teeth,

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<sup>7</sup> Many grain-free pet foods contain potato or pea protein isolates which are not Biologically Appropriate.

<sup>8</sup> In most dry pet foods, Omega-3 and 6 is of plant rather than animal source, including flax, sunflower, canola or coconut oils. As plants do not provide essential oils in a form useable by dogs and cats, plant oils are not considered as Biologically Appropriate.

<sup>9</sup> Most high-protein dry pet foods contain calcium and phosphorus in excessive amounts and are not Biologically Appropriate

a short, acidic digestive tract, and a body that is highly efficient at metabolizing meat-based protein as an energy source.

- Substantially higher in meat protein than conventional pet foods, ORIJEN mimics the variety and balance of animal ingredients for which their anatomy is designed.
- ORIJEN's high-protein formulas eliminate the need for grains as inexpensive and inappropriate energy source.
- As the body cannot store amino acids (other nutrients such as fat and carbohydrates can be stored by the body), the daily diet must provide sufficient protein of proper quality to fulfill the need of the body.
- The protein needs of cats and dogs cannot be properly met by plants. Essential amino acids missing from plants include arginine, taurine, methionine, tryptophan and lysine.
- Unlike carbohydrates (which adversely affect blood sugars and are easily stored in the body as fat), once the body's demand for protein is met, protein is either metabolized for energy or removed from the body through natural functions. Protein is seldom converted to body fat.
- As high-protein diets are more satiating, dogs and cats naturally consume less ORIJEN than they would of any conventional dry pet food

## HOW MUCH IS TOO MUCH?

*While it was once thought that too much protein could lead to health problems, this myth has for many years been roundly debunked by the scientific community.*

Studies have proven that protein does not cause orthopedic problems in puppies, nor lead to kidney disease in older dogs.

In fact, high protein is extremely beneficial: it supports the immune system and the central nervous system, contributes to wound healing, helps build lean muscle, and is required for skin and coat health.

Any concept of reducing protein in today's pet foods is clearly tied to reducing ingredient costs,

rather than to any concern for the health of dogs and cats.

- While high protein diets were once believed to be associated with kidney disorders, clinical studies have time and again demonstrated that no association exists between high protein diets and kidney disease.
- The myth that high protein diets are harmful to kidneys probably started because, in the past, patients with kidney disease were commonly placed on low protein (and thus low nitrogen) diets.
- Science has since shown that for patients with kidney disease the concern is rather protein *quality*, not protein *quantity*.
- The ability of excess dietary protein to induce kidney failure has been studied in both dogs already with chronic kidney failure, dogs with only one kidney, and older dogs. All studies conclude that high protein does not adversely affect the kidneys.
- Dietary protein consumed in excess of daily requirements is not stored, but is deaminated<sup>10</sup> followed by oxidation of the carbon skeleton through pathways of glucose or fat metabolism. The nitrogen waste generated is excreted in the urine as either urea or ammonia.
- There is also no direct link between high protein and skeletal development of puppies and growing dogs of any size or breed. It is calorie intake and mineral intake - NOT PROTEIN INTAKE - that directly correlates with orthopedic problems in growing dogs.
- Protein restriction for healthy older dogs is not only unnecessary, it can be detrimental. Protein requirements actually increase by about 50% in older

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<sup>10</sup> Deamination is the process by which amino acids are broken down when too much protein has been taken in. The amino group is removed from the amino acid and converted to ammonia. The rest of the amino acid is made up of mostly carbon and hydrogen, and is recycled or oxidized for energy. Ammonia is converted to urea or uric acid which can safely diffuse into the blood and then be excreted in urine.

dogs, while their energy requirements tend to decrease. When insufficient protein is provided, it can aggravate the age-associated loss of lean body mass and may contribute to earlier mortality,

## PROTEIN vs. CARBOHYDRATES, AN UP & DOWN RELATIONSHIP

*Most people are unaware of the relationship between protein and carbohydrate in their pet's food. It's actually quite simple: if one goes up, the other MUST go down.*

In other words, the more protein in the food the less room there is for carbohydrate.

That's good for your dog or cat, because while protein is essential and cannot be oversupplied, your dog or cat has absolutely no requirement for carbohydrate.

- Protein and carbohydrates contain exactly the same number of calories per gram, so reducing protein in favor of carbohydrates simply provides less nutrition without changing the calories.
- The Dog Food Nutrient Profiles published by Association of American Feed Control Officials (AAFCO, 2008) show that dogs have absolutely no requirement for carbohydrate.
- According to the National Research Council's Committee on Animal Nutrition (2006), "there appears to be no requirement for carbohydrate provided enough protein is given".

## ii. HIGH & VARIOUS IN FRESH ANIMAL INGREDIENTS

*Consider the dramatic variation of a wolf's diet.*

From day-to-day, week-to-week, the foods eaten will vary widely from a nest of pheasant eggs to a deer or moose carcass, a duck, a spent salmon...

This natural variety is lost in conventional dog or cat foods, which typically focus on a single source of protein such as chicken or lamb.

The truth is that a wider variety of animal ingredients better matches the natural diet — providing dogs and cats with a natural diversity of protein and fats.

- Formulated to mimic the natural diet, ORIJEN is made with the highest inclusions (30%) of FRESH (never frozen) animal ingredients.
- ORIJEN introduces protein variety through a diverse selection of FRESH animal ingredients including,
  - **POULTRY** (free-run chicken, turkey, duck & whole eggs).
  - **FISH** (a wide variety of wild-caught saltwater and freshwater fish).
  - **MEATS** (free-range bison, lamb, wild boar and heritage pork).
- FRESH meats have a higher protein and amino acid quality than the previously frozen (raw) or rendered meats.
- Rendered animal meals generally have lower protein quality than fresh meats.<sup>11</sup>
- Experiments conducted to evaluate the protein quality of fresh versus rendered animal by-product meals found that total essential Amino Acid (AA) digestibility ranged from 93.6 to 96.7 for fresh animal meals and 79.2 to 84.8% for rendered animal meals.
- ORIJEN's unique low temperature processing (90c/195F) helps maintain the nutritional integrity of fresh meat ingredients.

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<sup>11</sup> Protein quality of various raw and rendered by-product meals commonly incorporated into companion animal diets. K. R. Cramer\*,2, M. W. Greenwood\*,3, J. S. Moritz\*,4, R. S. Beyer\*,5 and C. M. Parsons

\* Department of Animal Science and Industry, Kansas State University, Manhattan 66506; and Department of Agricultural, Consumer, and Environmental Sciences, University of Illinois, Urbana 61801

### iii. LESS CARBOHYDRATES, NO GRAIN

*If dogs and cats are not evolved to eat grains or metabolize carbohydrates, and have no nutritional need for carbohydrates; then why include them in their foods?*

Most consumers would be shocked to learn their “super premium or “holistic” pet food contains over 40% grain and 40-50% carbohydrate – a nutrient for which their dog (or cat) has absolutely no nutritional requirement.

#### **So exactly why are conventional pet foods so high in carbohydrates and grains?**

Grains and carbohydrates are used as an inexpensive source of calories, as well as for their ready availability, easy transport, easy processing, and easy storage.

- Grains first appeared in pet foods about 70 years ago when consumers wanted the convenience of pet food in a bag, and manufacturers wanted to reduce costs with inexpensive calories from grains.
- Although grains such as rice or wheat do provide low-cost calories, their high carbohydrate content contributes to insulin resistance, obesity, diabetes and a host of other health problems.
- "There is no known minimum dietary carbohydrate requirement for either the dog or the cat. Based on investigations in the dog and with other species it is likely that dogs and cats can be maintained without carbohydrates if the diet supplies enough fat or protein from which the metabolic requirement for glucose is derived."<sup>12</sup>
- Of the three sources of available energy (protein, fat and carbohydrates), carbohydrates are converted to energy first, before protein and fats because they are easier to use.

For this reason, carbohydrates actually regulate how much fat will be utilized. If there is an abundance of carbohydrates, fat

will be stored instead of used. If there are not enough carbohydrates to meet energy needs, then fat and protein are used to fill energy needs.

- PROTEIN, not carbohydrate, is the building block for hair and skin and all other parts of the body.
- Carbohydrates do nothing for building and maintaining the body structures except provide easy glucose to fuel the rebuilding process.
- Cats and dogs are simply not evolved to eat processed cereal grains. Most commercial pet foods feature two or more grain ingredients and exceed 40% in total dietary carbohydrate.

### iv. FATS FROM ANIMALS, NOT PLANTS

*Most people are conditioned to believe that fat is bad.*

And while it's easy to conclude that the same goes for your dog...that's simply not true.

A dogs' metabolism is much more effective than the human metabolism when it comes to dealing with fat.

- As illustrated in Section I, dogs are classified as carnivores, and while we humans are omnivores.
- What is good for you could be very bad for your dog and (as we've learned with carbohydrates) vice versa!
- Unlike us humans, dogs and cats don't suffer from cholesterol problems or heart disease caused by high levels of animal fats.
- Fat is a very important part of dog and cat nutrition, providing a concentrated source of energy and supplying essential fatty acids (EFAs) not otherwise synthesized in the body.
- Dogs and cats require a fairly high amount of fat in their diets.

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<sup>12</sup> Waltham Book of Dog and Cat Nutrition (2nd edition, 1988)

## **FATS OR CARBOHYDRATES? AN ENERGY PERSPECTIVE.**

*While both fats and carbohydrates provide energy, they function very differently in the body of a dog or cat.*

Fats are essential in the diets of dogs and cats, carbohydrates are not.

- Carbohydrates enter into the oxidation process much more quickly and provide energy more rapidly compared to fats, which make energy available at a slower pace.

The problem with most conventional pet foods is not that they contain any carbohydrate, but that they contain TOO MUCH carbohydrate – typically between 40 and 50%.

- In humans, a high intake of carbohydrates increases muscle-glycogen, which increases stamina. However the same carbohydrate loading in dogs leads to an excess accumulation of lactic acid in the muscles.

In other words, dogs metabolize fat the way humans metabolize carbohydrates. Fat is their fuel – not carbohydrate, and fat, not carbohydrates, provides them the ability to function at their greatest peak of health.

## **ESSENTIAL FATTY ACIDS**

Dogs and cats can produce some of the fatty acids they need, but not all of them.

Those fatty acids which they cannot produce must be obtained through their diet. These are called 'essential' fatty acids.

- What is 'essential' for one species of animal is not necessarily essential for another species. For example, the fatty acid, arachidonic acid is essential for cats but not for dogs.<sup>13</sup>

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<sup>13</sup> Omega Fatty Acids: Sources, Effects, and Therapeutic Uses in Dogs , Veterinary Services Department, Drs. Foster & Smith, Inc., Holly Nash, DVM, MS

- The two essential fatty acids that are most commonly discussed for nutrition are Omega 6 fatty acids, and Omega 3 fatty acids.
- Omega 3 fatty acids are less common and are found in fish oil, flax seed oil and marine sources, such as spirulina and blue green algae.

## **OMEGA-6 FATTY ACIDS**

A lack of Omega-6 is extremely rare. Most pet foods have too much Omega-6 and not enough Omega-3. Omega-6 fatty acids include:

- Linoleic acid (LA)
- Gamma linolenic acid (GLA)
- Dihomo-gamma-linolenic acid (DGLA)
- Arachidonic acid (AA)

LA can be converted into GLA, but not in the body. However, DGLA can be made from GLA in the body.

## **OMEGA-3 FATTY ACIDS**

Omega-3 quality varies dramatically between plant and animal source. Omega-3 fatty acids include:

- Alpha-linolenic acid (ALA)
- Eicosapentaenoic acid (EPA)
- Docosahexaenoic acid (DHA)

ALA can be converted into EPA, however, this conversion does not occur in the body. EPA is the workhorse of the omega-3 fatty acids and is incorporated into the cell membrane.

## **OMEGA-3 SOURCE, PLANT or FISH?**

As noted above, there are three main types of fatty acids. EPA, DHA and ALA.

The question of plant versus fish is as simple as EPA and DHA vs. ALA.

For dogs and cats EPA and DHA are essential, ALA is not.

- The Omega 3 fatty acids in fish are EPA and DHA fatty acids.
- The Omega 3 fatty acids in flax (or other plants) are ALA fatty acids.

- While the three types of Omega 3 (ALA, EPA & DHA) appear similar, they are in fact very different.
- According to Debra Palmer Keenan, a nutrition professor at New Jersey's Rutgers University, "They are not the same thing ... we have to stop talking about omega-3s and talk about DHA and EPA [marine omega-3s] and ALA [the main vegetable omega-3] as separate fatty acids."
- **FISH OMEGA-3 (EPA AND DHA).**  
These long-chain Omega-3s are absorbed readily within the body and are by far the best choice for dogs and cats.
- **PLANT OMEGA-3 (ALA).**  
ALA is a short-chain Omega-3 found in plants. ALA must be converted to EPA and DHA to be of any nutritional benefit.  
As cats and dogs are not adapted to create this conversion, Omega-3 from plants is considered 'inactive' and not readily bioavailable.
- Although the American Journal of Clinical Nutrition reports Omega-3 from plants is of little nutritional use for dogs and cats, conventional pet foods still include vegetable or plant oils as they cost less than animal or fish oils and (due to their short-chain structure), are more stable which in turn produces a longer shelf life.

## OMEGA 3 & OMEGA 6 RATIOS

Most pet foods contain far more omega-6 fatty acids than omega-3's.

- It is important to realize that although the ratios may be a guideline, the actual concentration of EPA in the omega-3's is what is most important.
- Researcher Doug Bibus of the University of Minnesota recently completed a study with dogs. He suggests a lower ratio: between 2 to 1 and 4 to 1 – a ratio to which ORIJEN subscribes.

## V. FRUITS, VEGETABLES & BOTANICALS

### FRUITS & VEGETABLES

In order to form the kibble and provide the structure to hold together meats and fats, all dry pet foods require some form of carbohydrate.

The trick is to keep total carbohydrates at a minimum, and to choose the most appropriate sources.

- Instead of high-glycemic grains such as rice, wheat and corn, Biologically Appropriate pet foods use fruits & vegetables.

While providing the limited carbohydrates needed to form a kibble, fruits & vegetables contain health-boosting vitamins, minerals, fibers and other substances called phytochemicals, in natural, bio-available form.

### BOTANICALS

Botanicals have been used to provide remedies for ailments for thousands of years and their health properties are written about in journals dating back to 3000 BC.

Botanicals are usually provided in combination to enhance their individual properties and actions.

Botanicals help the body eliminate toxins by stimulating processes, like physiological processes like the cleansing of the liver.

They also serve as tonics and builders to strengthen organs, glands and tissues in specific parts of the body — such as strengthening the heart and aiding digestion.

Botanicals put the body in tune with nature.

- Herbs are considered as food, rather than medicine, because they're complete, natural and pure.
- Bridging the gap between nutrition and peak health, herbs are loaded with vitamins, minerals and phytochemicals.
- Herbs assist the organ networks in the performance of their functions, and particular herbs enter specific channels and

enhance the capacity of the pertaining organ.

- Herbs have always been a natural and integral part of the feline and canine diet. In the wild, animals instinctively seek out healing herbs to help them when they are ill or undernourished.
- ORIEN'S botanicals are selected by holistic veterinarians for their broad supportive role in promoting daily health, and for their efficacy in helping solve common health problems of allergic dermatitis, inflammatory bowel disease and chronic hepatitis.

## vi. **BALANCED MINERALS, MODERATE IN CALCIUM AND PHOSPHORUS**

*Over nutrition is a condition of excess nutrient or energy intake.*

*Over time, over nutrition can be just as problematic as under nutrition,*

### **THE RELATIONSHIP BETWEEN PROTEIN, CALCIUM & PHOSPHORUS**

High-protein diets typically contain large inclusions of chicken meal, fish meal or turkey meal.

These meals are made of flesh, bones and cartilage, with bones providing a very rich & natural source of minerals.

This leads to the potential of most high-protein dog and cat foods to oversupply minerals - especially calcium and phosphorus.

As pet food makers either claim only *minimum* (not *maximum*) amounts of calcium or phosphorus, or make no mineral claim at all on their packaging, consumers are unaware they may be feeding excessive minerals.

Most high-protein dog foods contain the highest allowable limit of calcium (2.5%) and phosphorus (1.6%)<sup>14</sup>.

In this case, the very ingredients that supply health-lifting proteins also cause increases in unfavorable mineral levels.

- Although chicken, turkey or fish meals supply high quality animal proteins, they are concentrated in minerals.
- As high-protein diets typically contain large inclusions of 'animal meal ingredients', their mineral levels are substantially increased.
- Most high-protein dog foods contain the highest allowable limit of calcium (2.5%) and phosphorus (1.6%)<sup>15</sup>.
- According to the American Feed Control Officials' 2008 Dog and Cat Food Nutrient Profiles:

*"In light of the concerns for the possible detrimental effects of over nutrition, the Subcommittee deemed that maximum limits for calcium and phosphorus were warranted.*

*A maximum level of 2.5% calcium was regarded as a safe upper limit. The maximum limit for phosphorus was set at twice the growth minimum or 1.6%.<sup>16</sup>*

- Excess intake of calcium can result in growth retardation and severe bone and joint abnormalities, while excess phosphorus can have deleterious effects on the kidney.
- As a Biologically Appropriate food, ORIEN is mineral-balanced and does not oversupply calcium or phosphorus.

Rather than relying solely on conventional meat meals as the source of animal protein, ORIEN incorporates a wide variety of deboned fresh meats (that are low in mineral content), as well as specially prepared 'low ash' chicken & fish meals that have bones removed prior to processing.

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<sup>14</sup> American Feed Control Officials, Official Publication, Dog and Cat Food Nutrient Profiles, 2008

<sup>15</sup> AAFCO, Dog Food Nutrient Profiles, 2008

<sup>16</sup> AAFCO, Dog Food Nutrient Profiles, 2008

# 5 | PROTEIN QUALITY

## INTRODUCTION TO PROTEIN

*Protein provides the structure for all living things. Every living organism, from the largest animal to the tiniest microbe, is composed of protein. And in its various forms, protein participates in the vital chemical processes that sustain life.*

- In dogs and cats, proteins are vital to basic cellular and body functions, including cellular regeneration and repair, tissue maintenance and regulation, hormone and enzyme production, fluid balance and the provision of energy.
- Diets that are high in carbohydrates can become protein deficient.  
If the diet doesn't supply adequate protein, the body draws on its own tissue proteins.
- Because the body can't store amino acids, it will break down its own protein structure, including healthy muscle, to meet its amino acids.
- Protein is important for dogs in all stages of life, and the quality of the protein is equally important.
- It is important to insure that a wide spectrum of amino acids is being provided from fish, poultry and eggs.
- Protein needs cannot be met by feeding grains, starches and vegetables.
- While plants may lend fiber, some minerals and vitamins - only animal based proteins supply a complete balance of amino acids needed for good health and longevity.

## ALL PROTEINS ARE NOT EQUAL

Proteins are not alike or equal, and vary dramatically according to their:

1. *SOURCE (animal vs. plant)*

2. *AMINO ACIDS*
3. *DIGESTIBILITY*

Good quality proteins are almost always of animal source, as animal proteins are readily digestible and contain essential amino acids in quantities that correspond to the requirements needed by dogs and cats.

## PROTEIN SOURCE | ANIMAL, OR VEGETABLE?

**ANIMAL PROTEINS** such as eggs, meat, and fish are considered high-quality, or 'complete, proteins' because they provide sufficient amounts of essential amino acids.

- Animal-derived tissues are more easily digestible.
- Animal proteins contain all the amino acids essential to dogs and cats.
- Meat, poultry and fish are rich sources of high biological value protein.
- The measure for assessing protein quality is based on the egg, which is considered to have all essential amino acids in perfect amounts and balance.

**PLANT PROTEINS** such as grain, corn, and vegetables are classified as 'incomplete, proteins' as they lack both essential amino acids, and a proper overall balance of amino acids.

- Given that dogs and cats are evolved as carnivores, it's no surprise that plant proteins do not measure up in supplying the amino acids they need to thrive.
- Plant proteins are typically missing essential amino acids arginine, taurine, methionine, lysine and tryptophan.  
Corn, for example, does not contain glycine, lysine or tryptophan. The lack of these essential amino acids reduces the overall protein quality of the food.
- Corn has a crude protein content of approximately 9%. However, of this, less than half (4.5%) is made up of Essential Amino Acids.

In other words, it takes more plant proteins than animal proteins to give the adequate protein percentages, and even then, essential amino acids will be lacking.

## AMINO ACIDS

Proteins are made from a chain of connected chemical building blocks, known as amino acids.

All in all, there are 22 different amino acids required by dogs.

Of the 22 amino acids, 12 can be produced within the dog's body (internally in the liver).

The other ten amino acids cannot be produced in the body and therefore must come from food – these amino acids are termed “essential” amino acids.

1. **NON ESSENTIAL AMINO ACIDS** – these amino acids **can** be produced in the body. Since the body is able to manufacture these amino acids, they do not need to be present in the diet.
2. **ESSENTIAL AMINO ACIDS** - these amino acids **cannot** be produced in the body and therefore must come from food.

The following are the ten\* amino acids essential to meet a dog's dietary requirements (\*includes Taurine) and a brief description of their function.

**ARGININE:** stimulates the immune system, induces growth hormone release, and supports the liver by detoxifying ammonia.

**HISTIDINE:** releases histamines, is associated with pain control, and widens small blood vessels to stimulate stomach acid secretion.

**ISOLEUCINE** and **LEUCINE:** see **VALINE**

**LYSINE:** promotes bone growth in puppies and stimulates secretion of gastric juices.

**METHIONINE:** assists gall bladder functions, helps prevent fats deposits in the liver, balances the urinary tract pH, and gives rise to Taurine.

**PHENYALANINE:** related to appetite control, increases blood pressure in hypotension, works with minerals in skin and hair pigmentation, and produces adrenalin and noreadrenalin.

**THREONINE:** regulates energy draw, works in mood elevation or depression, manufactures adrenalin, and precurses Thyroid hormone.

**TRYPTOPHAN:** produces Serotonin that induces sleep.

**VALINE,** (**ISOLEUCINE** AND **LEUCINE**):

These essential amino acids work together to regulate the protein turnover and energy metabolism.

**TAURINE\*** involved in a large number of metabolic processes and can become **essential under certain circumstances.**

Taurine effects the visual pathways, brain and nervous system, cardiac function, and it is a conjugator of bile acids.

*IT IS THE PRESENCE, BALANCE AND QUALITY OF ESSENTIAL AMINO ACIDS THAT DETERMINES THE OVERALL QUALITY OF DIETARY PROTEIN.*

## PROTEIN DIGESTIBILITY

Protein digestibility is a key quality measure.

After all, what good is it to have a food made with a higher quality protein if it's not also easy to digest?

Meat protein is the best choice - it is easily digested and contains the amino acids essential for dogs and cats.

To better understand protein digestibility, it's important to recall that digestion itself is the gradual breaking down of food into components small enough to pass through the walls of the intestines and into the bloodstream.

- A food with high protein digestibility is one that can be broken down into smaller easy-to-absorb components easier and quicker than others.
- Protein ingredients that meet both amino acid requirements and high digestibility, almost always come from animal sources.
- In the short digestive systems of dogs and cats, plant proteins are far less digestible than meat proteins.
- High levels of trypsin inhibitors grain legumes can cause substantial reductions in protein and amino acid digestibilities (up to 50%) in rats and pigs.

Similarly, the presence of high levels of tannins in cereals, such as sorghum, and grain legumes can result in

significantly reduced protein and amino acid digestibilities (up to 23%) in rats, poultry, and pigs.<sup>17</sup>

## PROTEIN BIOLOGICAL VALUE (BV)

Certain protein sources are simply better than others by providing a richer blend of amino acids. Better proteins have what's referred to as a high Biological Value (BV).

The Biological Value (BV) is a scale of measurement used to determine what percentage of a given nutrient source is utilized by the body. In short - BV refers to how well the body can actually use the protein. The theoretical highest BV of any food source is 100%.

**TABLE 1, PROTEIN RATINGS BY BIOLOGICAL VALUE (BV)**

FOOD	PROTEIN RATING
Eggs (whole)	100
Eggs (whites)	88
Chicken / Turkey	79
Fish	70
Lean Beef	69
Unpolished Rice	59
Brown Rice	57
White Rice	56
Peas	55
Whole Wheat	49
Soy beans	47
Whole-grain Wheat	44
Corn	36
Dry Beans	34

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<sup>17</sup> Effects of antinutritional factors on protein digestibility and amino acid availability in foods, 2005, GILANI G. Sarwar<sup>(1)</sup>; COCKELL Kevin A.<sup>(1)</sup>; SEPEHR Estatira<sup>(1)</sup>; Author(s) Affiliation(s),<sup>(1)</sup> Health Canada, Nutrition Research Division, Bureau of Nutritional Sciences, Banting Research Centre (AL: 2203 C), Tunney's Pasture, Ottawa, ON, K1A 0L2, CANADA

## WHY YOU MUST NEVER TRUST STATED PROTEIN PERCENTAGES TO COMPARE DOG FOODS<sup>18</sup>

*Think you can't be easily fooled? Well, think again.*

You see... when shopping for dog food, you just can't trust the stated protein percentage printed right there on the label.

No, you really can't. And here's why...

Say you've got a pair of old leather boots... some used motor oil... and a scoop of sawdust. Now, grind them all up... blend them together... and send that whole concoction to a food testing laboratory... for analysis.

And the results? This toxic medley of rubbish contains...

Protein 32%

Fat 18%

Fiber 3%

Now, if you look *only* at the "raw data"... the numbers make this funky brew look pretty good... in fact, just as good as any quality dog food.

The leather provides the protein. The motor oil supplies the fat. And the sawdust contributes the fiber.

Not exactly something you'd ever want to feed your dog. See how easy it is to be fooled?<sup>19</sup>

## TEMPERATURE AND PROTEIN QUALITY

High temperatures and long exposure to heat alters amino acid chains and therefore lowers

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<sup>18</sup> Choosing Healthy Dog Food Made Easy, Why You Must Never Trust Stated Protein Percentages to Compare Dog Foods, by Mike Sagman on March 28, 2009

<sup>19</sup> The Dog Food Advisor

the overall quality of protein. High temperature cooking also destroys amino acids methionine and histidine.

- High temperatures create bonds between protein and carbohydrates, which interferes with protein digestibility.
- To preserve protein quality and amino acid integrity, ORIJEN combines high fresh meat inclusions with low temperature cooking (90C for 3 – 5 minutes). This heat exposure is substantially less than at what most people would cook their dinner.

Several experiments have been conducted to evaluate the protein quality of various raw (uncooked) and rendered (cooked) animal by-product meals commonly used in companion animal diets.

- The biological value (BV) of raw beef tested on rats was found to be greater than that of the same meat cooked in three different ways.
- The biological value for the raw beef is 67. For raw beef boiled at ordinary pressure, 60, boiled for 7 minutes 62, boiled for 1 hour at 15 pounds' pressure, 56.

A heat injury appears to occur to the protein increasing in severity with the length of exposure and the height of the temperature reached.<sup>20</sup>

Another study tested raw versus rendered animal ingredients.

- Six (freeze-dried) raw animal meals (beef, pork, sheep, pork livers, oceanfish, chicken necks) and 3 rendered animal meals (lamb meal, regular ash poultry by-product meal, and low ash poultry by-product meal) were fed to determine bioavailability, protein efficiency ratio (PER), and net protein ratio (NPR).
- Lysine bio-availabilities ranged from 86 to 107% and 70 to 99% for raw and rendered animal meals, respectively.
- Bio-availability of amino acids ranged from 64 to 99% and 61 to 78% for raw and rendered animal meals, respectively.

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<sup>20</sup> The Effect of Heat Upon the Biological Value of Meat Protein, Agnes Fay Morgan and Grace E. Kern, Laboratory of Household Science, University of California, Berkeley

- PER values ranged from 2.83 to 4.03 and 2.01 to 3.34 for raw and rendered animal meals, respectively. The NPR values ranged from 3.83 to 4.8 and 3.05 to 4.12 for raw and rendered animal meals, respectively.
- Despite a numeric increase in NPR vs. PER values, the overall ranking of animal meals remained similar. Lamb meal had the poorest PER and NPR values, and pork had the greatest values.
- Total essential AA digestibility and total AA digestibility ranged from 93.6 to 96.7 and 90.3 to 95.5%, respectively, for raw animal meals and 84.0 to 87.7 and 79.2 to 84.8%, respectively, for rendered animal meals.
- Rendered animal meals generally had lower protein quality than raw animal meals, with lamb meal consistently having the poorest protein quality and pork livers having the greatest protein quality.<sup>21</sup>

## ASH AND PROTEIN QUALITY

The effect of ash concentration on amino acid (AA) composition, true AA digestibility, and protein efficiency ratio (PER; weight gain per unit of protein intake) of meat and bone meal (MBM) was evaluated.

- Commercially rendered MBM samples containing 16 to 44% ash were obtained from two sources.
- Protein quality of selected MBM samples was assessed by determining true AA digestibility using the precision-fed cecectomized rooster assay and by a PER chick growth assay wherein chicks were fed 10% crude protein (CP) diets containing a MBM as the only

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<sup>21</sup> Protein quality of various raw and rendered by-product meals commonly incorporated into companion animal diets. K. R. Cramer\*,<sup>2</sup>, M. W. Greenwood\*,<sup>3</sup>, J. S. Moritz\*,<sup>4</sup>, R. S. Beyer\*,<sup>5</sup> and C. M. Parsons. \* Department of Animal Science and Industry, Kansas State University, Manhattan 66506; and Department of Agricultural, Consumer, and Environmental Sciences, University of Illinois, Urbana 61801

source of dietary protein from 8 to 18 days of age.

- Increases in Ala, Pro, Gly, and Arg as a percentage of CP were observed in all MBM samples as ash percentage increased, with Pro and Gly accounting for most of the increase. In contrast, the levels (% of CP) of all essential AA, other than Arg, decreased as ash level increased.
- For example, Lys concentrations per unit of CP decreased from 5.7 to 4.0% as ash increased from 9 to 63%.
- There was little or no effect of ash content on AA digestibility of MBM varying in ash from 9 to 44%. The PER of MBM markedly decreased from 3.34 to 0.72 as ash increased from 16 to 44%, and most of the effects of ash on PER were not due to differences in dietary Ca and P levels.
- The results indicate that the reduction in protein quality of MBM as ash content increases is almost entirely due to a decrease in analyzed essential AA per unit of CP, not a decrease in digestibility of AA.<sup>22</sup>

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<sup>22</sup> Effect of ash content on protein quality of meat and bone meal. **Shirley RB, Parsons CM.**, Department of Animal Sciences, University of Illinois, Urbana 61801, USA.

# 6 | PROTEIN QUANTITY

*There has been much anecdotal argument about the ideal amount of protein in the diet of dogs and cats.*

And while a decade ago it was thought that too much protein could lead to health problems, this myth has been roundly dismissed by the scientific community.

Contrary to myths and popular beliefs, feeding a high-protein diet is healthy for dogs of any age, including puppies of all breeds and sizes, seniors, and overweight dogs.

Studies have proven that protein does not cause orthopedic problems in puppies, nor does it lead to kidney disease in older dogs.

In fact, protein is extremely beneficial: it supports the immune system and the central nervous system, contributes to wound healing, helps build lean muscle, and is required for skin and coat health.

Dogs and cats thrive on protein, the more the better. There is absolutely no reason to limit the amount of protein you feed your dog.

Let's review a few of the most commonly held protein myths.

## MYTH #1. PROTEIN EFFECTS THE KIDNEYS

***There is no association between high protein diets and kidney disease in dogs.***

A number of **false assumptions** about the need for reduced protein intake in regard to renal disease have been perpetuated in the literature for many years, including:

- Increased urea load causes increased workload for the kidneys.
- High dietary protein intake injures kidneys.
- High dietary protein intake causes hyperkalemia.
- High dietary protein intake causes acidosis.

- Protein intake results in uremic toxins
- Reduced protein intake slows the progression of renal disease.<sup>23</sup>

Research on dietary protein and the kidney has shown that protein does not cause renal failure and that dietary protein does not appear to be involved in the progression of chronic renal failure.

- The ability of excess dietary protein to induce renal pathology was studied in both dogs with chronic kidney failure and older dogs without kidney failure. Numerous studies have confirmed that protein does not adversely affect the kidneys.<sup>24</sup>
- The same research also found that the *restriction* of dietary protein may actually have an adverse effect on the kidney.

The University of Pennsylvania conducted a study to determine whether large amounts of dietary protein leads to sustained kidney damage in dogs.

- Dogs were fed diets varying between 19, 27 and 56% protein over the 4 year study period.
- The study concluded that high protein feeding did not adversely effect the kidney function of dogs.<sup>25</sup>

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<sup>23</sup> Mythology of Protein Restriction for Dogs with Reduced Renal Function, Kenneth C. Bovée, DVM, MMedSc Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, Proceedings, 1998 Purina Nutrition Forum

<sup>24</sup> Pet Food Safety: Dietary Protein, D.P. Laflamme DVM, PhD, Dipl ACVN, Nestlé Purina PetCare Research, St. Louis, MO. Available online 23 July 2008.

<sup>25</sup> Long-term renal responses to high dietary protein in dogs with 75% nephrectomy, John L Robertson, Michael Goldschmidt, David S Kronfeld, John E Tomaszewski, Gary S Hill and Kenneth C Bovee, School of Veterinary Medicine and School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, and Baltimore City Hospitals, Baltimore, Maryland, USA, Revised 23 May 1985.

From the Veterinary Services Department of Drs. Foster & Smith, Inc.

- *“High protein pet foods are NOT harmful to a normal animal's kidneys.*

*As an animal's body digests and metabolizes protein, nitrogen is released as a by-product.*

*The excess nitrogen is excreted by the kidneys. A high protein diet produces more nitrogen by-products and the kidneys simply excrete the nitrogen in the urine.*

*While you may think this would 'overwork' the kidneys and lead to possible kidney damage, this is not true.*

*The kidney's filtering capabilities are so great that even one kidney is sufficient to sustain a normal life. There are many pets - and humans - living perfectly healthy lives with just one kidney”.*

*Unless your veterinarian has told you your pet has a kidney problem and it is severe enough to adjust the protein intake, you can feed your pet a high protein diet without worrying about 'damaging' or 'stressing' your pet's kidneys.*

*Also, you are not 'saving' your pet's kidneys by feeding a low protein diet.*

Additionally, documented research on dogs indicates that **reducing** dietary protein levels in older dogs may be unwise. "...restriction of protein intake does not alter the development of renal lesions nor does it preserve renal function." (See KIRKS VETERINARY THERAPY XIII, Small Animal Practice, W. B. Saunders, page 861).

## **MYTH #2. PROTEIN MAKES PUPPIES GROW TOO FAST**

***There is no direct link between high protein and skeletal development of puppies and growing dogs of any size or breed.***

It is calorie intake - not protein - that directly correlates with orthopedic problems in growing dogs.

Overfeeding encourages puppies to grow too fast, resulting in most of the bone and joint problems common in large breeds.

Keeping large breed puppies lean is key to their healthy skeletal development.

- A balanced diet with high protein content has NOT proved to have negative effects on skeletal development in carnivores.

Excessive energy intake, even as part of a balanced diet, increases both the incidence of osteoarthritis (OA), its severity, and the degree of lameness it will cause.

Weight reduction is both a part of the prevention as of the OA-programme.<sup>26</sup>

The same study concluded that excessive intake of protein or fat per se has no proven influence on skeletal development **as long as it does not go together with adipositas** and is part of a balanced diet covering the required nutrients.

- Excessive **energy intake** causes excessive body weight gain with negative influences on hip joint development in those dogs which are prone to hip displacement (HD).

The Faculty of Veterinary Medicine at the University of Utrecht in The Netherlands conducted a study to determine the role of dietary protein, especially with regard to calcium metabolism and skeletal development, in large breed-dogs.

- Seventeen Great Dane pups, 7 wk of age, were divided into three groups. During 18 wk each group received dry food containing 32%, 23% or 15% protein on dry matter basis.
- No differences were found among the high protein (HPr), normal protein (N-Pr) and low protein (L-Pr) groups for the height at the shoulder. Significant differences were found between the H-Pr and L-Pr groups for body weight and plasma albumin and among all three groups for plasma urea.

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<sup>26</sup> Nutritional Influences on Hip Dysplasia, Herman A.W. Hazewinkel, DVM, PhD, DECVS, DECVGN, Dept. Clinical Sciences of Companion Animals, Utrecht University, The Netherlands

- The study concluded that the differences in protein intake did not affect the occurrence of disturbed skeletal development in young Great Danes, and that an etiologic role for dietary protein in the development of osteochondrosis in dogs is unlikely.<sup>27</sup>

### MYTH #3. PROTEIN SHOULD BE RESTRICTED FOR OLDER DOGS

*Conventional pet food makers claim that senior dogs are better fed lower protein, higher carbohydrate foods.*

The belief that senior dogs need less protein is false.

Senior dogs should be fed a diet that is high in protein, with low carbohydrates and moderate amounts of fat (too little fat leaves your dog feeling hungry all the time, which can make it harder for them to lose weight).

- Diets formulated on a low protein premise are full of fiber, have higher levels of carbohydrates and reduced amounts of protein and fat.

This results in dogs that are less satisfied causing them to appear hungry and beg for more food. These ingredients lead to the loss of coat and skin quality and they do not lead to any weight loss.

More recent studies show that it is harmful to restrict protein in senior dogs, and that high quality proteins are needed for our older pets.

- Protein restriction for healthy older dogs is not only unnecessary, it can be detrimental.
- Protein requirements actually increase by about 50% in older dogs, while their energy requirements tend to decrease.

When insufficient protein is provided, it can aggravate the age-associated loss of lean

body mass and may contribute to earlier mortality.<sup>28</sup>

### MYTH #4. PROTEIN IS NOT HEALTHY FOR OVERWEIGHT DOGS

*Another popular myth is that overweight dogs are best fed a lower protein (and therefore high carbohydrate) diet.*

Several studies showed the potential benefits of a high-protein, low-carbohydrate diet on reducing body weight in humans.

These diets are also associated with decreases in serum TG as compared to diets high in carbohydrates. The results of the study reported here suggest that these same benefits can also be obtained in dogs fed high-protein, low-carbohydrate diets.

Despite claims that subjects consuming high-protein, low-carbohydrate diets lose weight with no reduction in calories, recent evidence indicates that the ad libitum consumption of low-carbohydrate diets compared to high-carbohydrate diets is associated with increases in satiety and an overall decrease in total caloric intake.

In a review of the efficacy of low-carbohydrate diets, weight was associated with decreased caloric intake and increased diet duration and not simply with a change in the macronutrient profile of the diet.

Low-carbohydrate diets also help stabilize blood glucose levels throughout the day, preventing the hypoglycemia after a high-carbohydrate meal that causes hunger.

Substituting carbohydrates for protein in a weight-loss diet induces a greater metabolism of fat than a high-carbohydrate diet.

This study evaluated the benefits of high-protein, low-carbohydrate diets on reducing body weight in dogs.

<sup>27</sup> Growth and Skeletal Development in Great Dane Pups Fed Different Levels of Protein Intake, "Department of Clinical Sciences of Companion Animals, Faculty of Veterinary Medicine, University of Utrecht, The Netherlands

<sup>28</sup> Pet Food Safety: Dietary Protein, D.P. Laflamme DVM, PhD, Dipl ACVN, Nestlé Purina PetCare Research, St. Louis, MO. Available online 23 July 2008.

Changing the macronutrient profile of a canine weight-loss diet from a high-carbohydrate level to one primarily based on protein can promote greater weight loss without further reductions in caloric intake. This weight loss is driven primarily from an increased loss of fat mass while maintaining lean muscle mass.<sup>29</sup>

In a study with high protein diets and cats, cats fed higher-protein diets lost more body fat while reducing their loss of lean body mass by 50%.

These findings are consistent with those reported in other species undergoing weight loss.

Likewise, the composition of weight loss in cats fed the High Protein diet in this study was similar to that reported for another group of cats fed a similar protein level for weight loss.<sup>30</sup>

## WHY SO MANY MYTHS?

*In recent years, 10 experimental studies using dogs have been published that clarify the controversy of protein restriction.*

In 1999, the University of Pennsylvania's School of Veterinary Medicine set out to determine why the practice of reduced protein persisted in face of the lack of supportive scientific evidence.

The study found false assumptions about the need for reduced protein intake in regard to kidney health have been perpetuated for many years.

These myths include:

- Increased urea load causes increased workload for the kidneys.
- High dietary protein intake injures kidneys.
- High dietary protein intake causes hyperkalemia.
- High dietary protein intake causes acidosis.
- Protein intake results in uremic toxins
- Reduced protein intake slows the progression of renal disease.<sup>31</sup>

The following excerpts from the study help expose the reasons why the myths surrounding high protein exist. The study conclusions were less than flattering toward to practicing veterinarians.

*“Evidence that high protein diets enhance renal function in normal dogs has led to confusion among veterinarians who have been told for decades that low protein diets may be beneficial for kidney function”.*<sup>32</sup>

## Why Have Vets Chosen to Keep the Reduced Protein Myth?

The myth (regarding high protein) has been maintained even in the past decade despite negative scientific evidence because the dogma has persisted about its value for the past 40 years.

If we as professional (veterinarians) are uncertain about the facts concerning a controversy, we are likely to put ourselves in

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<sup>29</sup> Supplement: WALTHAM International Science Symposium: Nature, Nurture, and the Case for Nutrition, High-Protein Low-Carbohydrate Diets Enhance Weight Loss in Dog, Tiffany Linn Bierer<sup>3</sup> and Linh M. Bui, Masterfoods USA, Vernon, CA 90058

<sup>30</sup> Increased Dietary Protein Promotes Fat Loss and Reduces Loss of Lean Body Mass During Weight Loss in Cats, Dorothy P. Laflamme, DVM, PhD, Steven S. Hannah, PhD, Nestlé Purina PetCare Global Resources, St. Louis, MO

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<sup>31</sup> Mythology of Protein Restriction for Dogs with Reduced Renal Function, Kenneth C. Bovée, DVM, MMedSc Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, Proceedings, 1998 Purina Nutrition Forum

<sup>32</sup> Mythology of Protein Restriction for Dogs with Reduced Renal Function, Kenneth C. Bovée, DVM, MMedSc Department of Clinical Studies, School of Veterinary Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, Proceedings, 1998 Purina Nutrition Forum

someone else's hands who appears to have authority.

Power to command this authority is in the hands of commercial advertisements that promote these special products with misleading messages.

Marketing is aggressively aimed at veterinarians and owners alike. There is a profit motive for veterinarians to sell these diets. The public has a nutritional mania and preoccupation with diet in our society.

Dietary change has assumed the status of medical treatment using such terms as intervention, maintenance, and correction.

The profession and the public do not appreciate that advertising claims come without proof in the case of diets.

Owners can easily be enrolled to accept such diet change because they feel they are involved in doing something constructive.

Professional responsibility has been lost in this case. The situation can remind us that we are part of an uncritical profession with little review or standards.

**When scientific proof fails to justify a practice, a false myth may likely live on.**

In conclusion, the continued existence of this false myth about dietary protein is an uncomfortable reminder of the lack of sophistication, lack of critical thought, and reliance on oversimplified and attractive dogma that persists in our profession.

This is only one example of many false myths, misinformation, and partial truths that are repeated from decade to decade.

Until a more critical approach with standards and oversight are brought to bear in our profession, we will likely continue to be ensnared in false myths despite the presence of sound science.<sup>33</sup>

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<sup>33</sup> Mythology of Protein Restriction  
for Dogs with Reduced Renal Function  
Kenneth C. Bovée, DVM, MMedSc  
Department of Clinical Studies  
School of Veterinary Medicine

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University of Pennsylvania  
Philadelphia, Pennsylvania, Proceedings, 1998  
Purina Nutrition Forum