

How Dogs Digest Different Foods

By Sy Guth
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The focus of this article is to explain how the dog's digestive system is designed to work. It also discusses some notes on supplements in the dog's diet – advantages and possible dangerous side effects.

In 2007, I did a mini study with Golden Retriever puppies that was published in the December / January 2009 issue of NZ Dog World. These puppies were on different diets and all except two of the puppies were given added supplements as part of their diets. The study used a combination of diets mainly composed of dry dog food, with one puppy on a raw / home-cooked diet and one on a raw diet to 7 months and then dry dog food. The puppies that did the best in terms of hip score results at a year old were: Best – raw / home-cooked diet with no supplements / hip results 1:1; Second best – dry dog food combination with supplements / hip results 1:2; Third best – dry dog food combination with supplements / hip results 4:1. The digestive action on the different diets is important to the results achieved.

DOG'S DIGESTIVE SYSTEM

To understand how dogs digest different foods, one needs to understand how the dog's digestive system works. Once understood, one can then determine what steps can be taken to compensate for any short-comings in diet, particularly in the first 18 months of a puppy's life to ensure their bones, teeth, and tissues get a good start to life.

Dogs are carnivorous animals. They have sharp, blade-like molars designed for slicing, rather than grinding food. This design "is very effective for shearing meat off bone."ⁱ Their jaws are single hinged and designed to open wide to swallow chunks of meat whole.

"The saliva of carnivorous animals does not contain digestive enzymes. When eating, a mammalian carnivore gorges itself rapidly and does not chew its food. Since proteolytic (protein-digesting) enzymes cannot be liberated in the mouth due to the danger of autodigestion (damaging the oral cavity), carnivores do not need to mix their food with saliva; they simply bite off huge chunks of meat and swallow them whole."ⁱⁱ

They have a short small intestinal tract about 3 to 6 times the body length. The stomach capacity is comparatively large, 60% to 70% of the total volume of the digestive tract. The digestive enzymes are in the stomach and effective in digesting animal protein and fat. The colon is short, simple, and smooth. The liver can detoxify vitamin A and produce vitamin C.

"The ability of the carnivore stomach to secrete hydrochloric acid is exceptional. Carnivores are able to keep their gastric pH down around 1-2 even with food present. This is necessary to facilitate protein breakdown and to kill the abundant dangerous bacteria often found in decaying flesh foods."ⁱⁱⁱ Humans, on the other hand, have a pH of around 4 to 5. Quite simply, dogs are carnivorous, with digestive systems designed to process protein and fat. A digestibility chart for dogs would go something like this: Egg white 100%; muscle meats, fish, and chicken, 92%; Organ meats, such as kidney and liver, 90%; milk and cheese 89%; wheat 64% and corn 54%.^{iv}

For this reason, dogs have a difficult time digesting grains and other complex carbohydrates and most carbohydrates pass through their system undigested. High prolonged temperature processing creates molecular bonds between protein and carbohydrates that interfere with the dog's ability to digest proteins, specifically lysine. High temperature cooking destroys amino acids methionine and histidine as well as vitamins B complex and C. In 1946, a study on cooking pork at high temperatures using autoclave showed that the amino acid cystine was reduced to 56% of its raw nutritional state but that other amino acids present were not severely affected.^v

Dr David Kronfeld has written, "no carbohydrates need be provided in the diet for pups after weaning or adult dogs, not even for those subjected to hard work. The liver is easily able to synthesize sufficient glucose (from amino acids derived from protein and glycerol derived from fats) for transport in the blood and utilization in other tissues."^{vi}

Fruits and vegetables supply natural protector nutrients like B-vitamins, essential minerals and enzymes that enhance immunity and digestive motility. This explains why so many dogs eat grass when they have an upset stomach, or just as part of their normal daily intake. Animals naturally seek out and consume the plants that their bodies need. Plants (botanicals) serve as tonics that strengthen organs, glands, and tissues. Biotanicals are also natural antioxidants that promote natural health.

For the carnivorous dog, animal proteins are considered complete and plant proteins are considered incomplete in regards to amino acid profiles. Plant proteins are normally missing arginine, taurine,

methionine, lysine and tryptophan. To take an example, corn does not contain glycine, lysine or tryptophan. Meat, on the other hand, contains all the essential amino acids. Likewise, eggs are considered to have all essential amino acids in sufficient amounts for dogs. If dogs do not absorb enough protein, their bodies will go into a negative nitrogen balance resulting in protein being pulled from muscle to provide the body protein the dog needs. This will result in muscle wasting, loss of body weight, and protein deficiency. Diets below 15% protein are considered at risk to puppies. For this reason, it would be unusual to find a dog food on the market below 18% protein.

The question was asked – why does the raw or fresh meat diet produce good bones and tissue and lower incidents of hip dysplasia? The explanation above goes a long way to explaining how the dog digests good quality protein – raw or fresh to feed the body to provide for sound bones and tissue.

SUPPLEMENTS

Do supplements have a place in the dog's diet? The answer to that question depends on the dog's type of diet. Vitamin C is needed to produce healthy bones, teeth, and tissues. The lack of vitamin C results in scurvy – loose joints and eventually death. My mini study showed remarkable success feeding an 80% dry / 20% lightly cooked fresh meat diet with supplements that included 460 mg daily of a molecularly natural vitamin C. The argument was put to me that meats do not contain vitamin C, so why does the raw or fresh meat diet work in this respect? In looking at normal nutrient charts, vitamin C is not normally listed for meats. This is deceiving in part, because as discussed, the dog digests and utilizes raw or fresh meats differently from humans. Further, meats do contain vitamin C. The Wikipedia entry on Vitamin C contains charts showing the amount of vitamin C that can be found in 100 gram servings: Calf liver raw – 36 mg; beef liver raw – 31 mg; oysters raw – 30 mg; cod roe raw – 30 mg; pork liver raw – 23 mg; lamb brain boiled – 17 mg; chicken liver fried – 13 mg. Whereas, fresh goats milk only has 2 mg of vitamin C per 100 grams. A large breed dog will eat much more than 100 grams a day – about 10 to 14 times more or 1 kg to 1.4 kg a day. Using an average from the above units would provide approximately 25 mg per 100 gram serving and would mean a dog eating 1 kg to 1.4 kg of raw or fresh meat daily would take in 250 mg to 350 mg of vitamin C a day. Add to this the biotanicals that are richer in vitamin C than meats, and one starts to come close to the 460 mg level of vitamin C needed to affect the positive results in my study. This provides the understanding of why raw or fresh meat diets with some biotanicals are able to produce good hip and elbow results.

The Wikipedia offers this study that, although done on humans, helps to explain why dogs derive vitamin C from raw or fresh meats.

“In 1928 the Arctic anthropologist Vilhjalmur Stefansson attempted to prove his theory of how the Eskimos are able to avoid scurvy with almost no plant food in their diet, despite the disease striking European Arctic explorers living on similar high-meat diets. Stefansson theorised that the natives get their vitamin C from fresh meat that is minimally cooked. Starting in February 1928, for one year he and a colleague lived on an exclusively minimally cooked meat diet while under medical supervision; they remained healthy. (Later studies done after vitamin C could be quantified in mostly-raw traditional food diets of the Yukon, Inuit, and Métis of the Northern Canada, showed that their daily intake of vitamin C averaged between 52 and 62 mg/day, an amount approximately the dietary reference intake (DRI), even at times of the year when little plant-based food were eaten.”^{vii}

Vitamin C is found naturally in many raw foods. When I submitted the mini study article for publication, my main concern was that some might start feeding their puppies / dogs commonly found synthetic vitamin C. Let's look at fabricated vitamin C. There are two types – synthetic and wholly natural vitamin C. First a look at the chemically produced synthetic vitamin C commonly found in health food and grocery stores.

The Wikipedia informs us that synthetic Vitamin C supplement “is produced from glucose by two main routes. The Reichstein process, developed in the 1930s, uses a single pre-fermentation followed by a purely chemical route. The modern two-step fermentation process, originally developed in China in the 1960s, uses additional fermentation to replace part of the later chemical stages. Both processes yield approximately 60% vitamin C from the glucose feed.”

The manufacturers of synthetic vitamin C use chemicals in their process and most do not add any other beneficial ingredients to the ascorbic acid to make it synthesis as needed by the body. Ascorbic acid produced in this manner can often lead to upset in the stomach and to solve this side affect buffered products have been introduced such as Ester-C. I recently reviewed the label on a bottle of synthetic vitamin C at one of New Zealand's leading grocery store chains. This vitamin C is made in New Zealand by a leading supplier of supplements. It was the ONLY solely vitamin C product available in this store. The ingredients

read as follows: Vitamin C (buffered) 500 mg, tableting aids, colour- natural, flavour – nature identical. Contains sulfur dioxide, aspartame (phenylketonurics – contains phenylalanine.) This list contains two chemicals that need to be understood – sulfur dioxide and aspartame.

The Wikipedia writes, “Sulfur dioxide is the chemical compound with the formula SO₂. It is produced by volcanoes and in various industrial processes. Since coal and petroleum often contain sulfur compounds, their combustion generates sulfur dioxide. Sulfur dioxide is toxic in large amounts. It or its conjugate base bisulfite is produced biologically as an intermediate in both sulfate-reducing organisms and in sulfur oxidizing bacteria as well. Sulfur dioxide has no role in mammalian biology. Sulfur dioxide blocks nerve signals from the pulmonary stretch receptors (PSR's) and abolishes the Hering-Breuer inflation reflex”^{viii}

Aspartame is a chemical used as a sweetener most commonly in diet soft drinks. It breaks down and goes into the blood stream. Dr Janet Starr Hull has a website naming and discussing some 94 side effects that can be caused by aspartame. She writes in part: “Aspartame may trigger, mimic, or cause the following illnesses: Chronic Fatigue Syndrome, Epstein-Barr, Post-Polio Syndrome, Lyme Disease, Grave’s Disease, Meniere’s Disease, Alzheimer’s Disease, ALS, Epilepsy, Multiple Sclerosis (MS), EMS, Hypothyroidism, Mercury sensitivity from Amalgam fillings, Fibromyalgia, Lupus, non-Hodgkins, Lymphoma, Attention Deficit Disorder (ADD). These are not allergies or sensitivities, but diseases and disease syndromes. Aspartame poisoning is commonly misdiagnosed because aspartame symptoms mock textbook ‘disease’ symptoms, such as Grave’s Disease.”^{ix}

Most important, is the fact that nearly all synthetic vitamin C is made with chemicals and lacks added ingredients to make the ascorbic acid supplement molecularly natural so that proper synthesis in the body can aid in the healthy formation of bones, teeth, and tissues.

In my study with puppies, **I used a totally natural vitamin C made from fruits and vegetables with NO added chemicals.** The GNLD Scientific Advisory Board states that using a molecularly natural Vitamin C, causes the vitamin C to work in the body longer and more affectively. They have determined that the following is what they classify as molecularly natural – equal to 4 small whole oranges. It took 2 of these tablets with a total of 460 mg to get the positive results in my study – hence 8 small whole oranges daily.

GNLD Neo-C Vitamin C	
Ascorbic Acid (Vitamin C)	230 mg
Neo-Plex Concentrate:	
- Citrus sinensis fruit juice dry	90 mg
- Citrus sinensis fruit peri dry	620 mg
- Citrus bioflavonoids extract (orange)	410 mg
Malpignia punicifolia (Acerola cherry)	
Extract – EQIV to fresh fruit	8 mg
Rosa canina (Rose hips) fruit powder	2 mg
Rutin	5 mg
Hesperidin	5 mg
Citrus Bioflavonoids extract (lemon)	5 mg

I used only 460 mg daily of the GNLD Vitamin C and achieved good results. The fact that this brand of vitamin C is made wholly from fruits and vegetables with no chemicals and contains all the ingredients of whole oranges, means the dogs are better able to digest and utilize it. It also means that it stays in the body longer. Most synthetic vitamin C goes through the body in 2 hours. Because vitamin C goes through the body, it needs to be replenished daily. I am not in favour of feeding dogs large doses of synthetic vitamin C and I worry about the side effects that might be caused from the use of chemicals.

I believe because the GNLD vitamin C products are made wholly from fruits and vegetables and involve no chemical processes and contain the added ingredients that you find in a whole orange, that I needed less per day of the vitamin C than most vitamin C recommendations for dogs – in fact, 50% to 85% less. Joanne Carson, founder of Epi Guardian Angels, recommends 1,000 to 1,500 mg daily for large dogs with home cooked meals. Dr Belfield in 1981 recommended 500 to 1,000 mg for large breed puppies up to 4 months and then 1,000 to 3,000 mg daily from 4 months to 18 months, increasing gradually. For adult dogs he recommends 3,000 to 6,000 mg daily.^x Dr Billinghamurst in his book, The BARF Diet, recommends supplementing vitamin C with 200 mg per KG of the weight of the dog.

By no means am I the first to suggest supplements are good for dogs. Dr Wendell Belfield, D.V.M and Martin Zucker first published their book, *How To Have A Healthier Dog, The Benefits of Vitamins and Minerals for Your Dog's Life Cycles*, in 1981. The book was published after 15 years of testing megadoses of injectable liquid vitamin C on dogs diagnosed with acute cases of distemper, which was, at the time, a fatal disease prior to the invention of the distemper vaccine. Dr Belfield initially doubted his theory of administering megadoses of liquid vitamin C to these doomed dogs would be of any help, but the dogs were doomed to die so he reasoned there was nothing to lose. To his surprise, all the dogs treated survived and he went on to test vitamin C on other ailments. The forward to the book is by Dr Linus Pauling who is credited with his research into vitamin C on a human level. In the forward, Dr Pauling states, "An indication of the amount of vitamin C that is needed for good health is provided by determining the amount of this substance made by various animal species. It is found that the amount made is approximately proportional to the body weight. The average animal weighing 16 pounds makes between 200 and 2,000 milligrams of vitamin C per day, with animals of some species synthesizing the smaller amount and those of other species synthesizing the larger amount. Dogs and cats are in the first group, in that they synthesize only about 200 milligrams of vitamin C per day (for a 16-pound animal), only about 1/5 as much as animals of most other species synthesize. It is probably for this reason that a large amount of supplementary vitamin C is important for the preservation of the best of health in dogs." ^{xi}

Going back to the commercial diet, I think it is important here to emphasize that the diet I cited in the December / January issue of NZ Dog World, was not a dry food only diet. The step-down protein diet only reduced the protein in the dry food part of the diet which was stepped down from 24% to 20% by using 1/3 puppy food and 2/3 senior food. My diet also contains 20% fresh meat / vegetable dog roll that is roughly 85% meat, 8% vegetables, and 2% rice. It is lightly cooked for 15 minutes at a temperature between 80C and 95C. Cooking at this temperature for a short duration preserves the natural amino acids, vitamins, and other nutrients. Added to this is 1 teaspoon daily of Dr Kruger Joint and Muscle formula that contains 4 digestive enzymes, 64 amino acids, and probiotics plus some other nutrients. And last, but not least was 460 mg of molecularly natural GNLD Vitamin C. So my puppies and adult dogs are receiving fresh meat and vegetables, digestive enzymes, amino acids, probiotics and vitamin C in addition to the dry dog food.

Would this be my choice of dog diets if I were not a breeder looking for a commercially available diet to keep dogs healthy? In a word – no. I would be feeding a raw or fresh mostly meat with some vegetable diet because I believe that is the best diet for dogs and will achieve the best results in regards to healthy bones, tissue, and longer life. However, getting puppy owners to feed a raw or fresh meat diet has proved unsuccessful for me. Since the first year to 18 months of a puppy's life is important to how sound that puppy will be throughout the rest of its life, I endeavor to seek answers outside the traditional "box."

A further question has been put to me - do you reduce the protein in a raw or fresh meat diet? I suspect that you would not reduce the protein level in a natural food high protein diet. The only way you could do that is to increase the amount of vegetables. Some types of vegetables, overfed, can cause problems for dogs in the form of hypothyroidism. As a side note, it is worth remembering that raw root vegetables are toxic to dogs and must be cooked.

Would feeding the puppies a raw or fresh meat / high protein diet result in growth spurts? Because their bodies would be utilizing the food better and achieving better health in their bones and tissues, the growth spurts may not be a problem. A breeder in Italy has sent me photographs of a litter of 6-month-old puppies and all looked in proportion. These puppies have been reared on Orijen food manufactured in Canada that contains no grain. It is 75% fresh fish/meat protein and 25% sea vegetable food. It's not that dissimilar from what is produced locally here in New Zealand by Butch in their Black Label dog roll.

In conclusion, over the past 6 years, I have trialed three different dry dog foods on puppies and they all resulted in growth spurts when the protein was not reduced, even when adding 20% fresh meat dog roll. I do not believe that one can mix a dry dog food diet and fresh meat diet and get consistently good results without reducing the level of protein to stem the growth spurts. Nor can one only use a "normal" dry dog food without reducing the protein. By normal, I mean one that contains the normal meats (proteins) and grains (carbohydrates). Nearly all dry dog foods on the market today contain around 40% carbohydrates in the form of grains. The fusion of carbohydrates and proteins make the protein difficult for dogs to digest. Dogs are not able to digest the protein in dry foods the same as raw / fresh foods. Adding a supplement that contains digestive enzymes that act in the dog's stomach will aid the breakdown of the dry food and adding probiotics will clean the intestinal walls and enable the dog to absorb more of the nutrients from dry dog foods. Adding a molecularly natural vitamin C to a dry dog food diet will restore the vitamin C naturally found in raw / fresh food diet.

- ⁱ The Comparative Anatomy of Eating, Milton R Mills, MD
- ⁱⁱ The Comparative Anatomy of Eating, Milton R Mills, MD
- ⁱⁱⁱ The Comparative Anatomy of Eating, Milton R Mills, MD
- ^{iv} Orijen – Biological Food for Cats and Dogs. White Paper.
- ^v The Effect of Severe Heat Treatment upon the Amino Acids of Fresh and Cured Pork, by J F Beuk, F W Chornock, and E E Rice, Research Laboratories, Swift and Co., Chicago, March 15, 1948.
- ^{vi} Kronfeld, DE Ph.D. Dsc MVSc: Home Cooking For Dogs: Pure-Bred Dogs American Kennel Gazette, July, 1978.
- Kronfeld, DS Ph.D. Dsc, MVSc: Protein Quality and Amino Acid Profiles of Commercial Dog Foods: Journal of the American Animal Hospital Association, July/August 1982.Vol 18
- ^{vii} http://en.wikipedia.org/wiki/Vitamin_C
- ^{viii} Molecular make up of Sulphur Dioxide, http://en.wikipedia.org/wiki/Sulfur_dioxide
- ^{ix} Aspartame Side Affects. By Dr Janet Starr Hull, <http://www.sweetpoison.com/aspartame-side-effects.html>. 2002.
- ^x How To Have A Healthier Dog, The Benefits of Vitamins and Minerals for Your Dog's Life Cycles, by Wendell O Belfield DVM, Martin Zucker. Doubleday and Co, 1981.
- ^{xi} How To Have A Healthier Dog, The Benefits of Vitamins and Minerals for Your Dog's Life Cycles, by Wendell O Belfield DVM, Martin Zucker. Doubleday and Co, 1981.

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