CALCIUM TO PHOSPHORUS RATIO:

In humans and animals Calcium to Phosphorus balance is essential to the development and maintenance of a strong and healthy skeletal structure. If a living creature is not getting enough Calcium in its diet, its body will seek to obtain it from within - from its bone mass. Too much Calcium, on the other hand, can also cause health issues. It is not difficult to supply this balance.

It is said by most nutritionists and physicians that the optimal balance is a ratio of 1.1:1 – the Calcium slightly higher than the Phosphorus. Other individuals claim that for the carnivore, the Calcium to Phosphorus ratio can be as high as 2:1- twice as much Calcium than Phosphorus. In his article, ***Balancing the Calcium/Phosphorus ratio in a raw diet for dogs*** (2003), Mogens Eliasen, PhD, states that 1.2:1 Calcium to Phosphorus ratio is ideal (about 7% to 10% of the raw meat meal as bone), but leaves room for a slightly higher amount of Calcium in the overall diet as long as it is not in excess.

It is important to have more Calcium than Phosphorus in your pet's *overall* diet. Meat without bone (*boneless meats*) and especially organ meats are much higher in Phosphorus than Calcium. Eggs are also slightly higher in Phosphorus than Calcium.

The following chart lists the Calcium and Phosphorus found in various *boneless* meats and how much Calcium should be added to get the Calcium higher than the Phosphorus and keep within what is considered balanced ranges:

Raw *Boneless* Meat **(16 oz or 1 lb)**	Calcium*	Phosphorus*	Difference	Calcium needed (estimated)
Beef Chuck	81.6mg	798mg	716mg	730 to 760mg
Chicken Breast	49.6mg	781mg	734mg	750 to 780mg
Lamb Ground	59.0mg	762mg	703mg	720 to 750mg

You can clearly see how feeding your pet only *boneless* meats would cause an unhealthy imbalance in this important Calcium to Phosphorus ratio.

Taking into consideration the difference in Calcium to Phosphorus listed in the table above, we feel adding about 800mgs of *elemental* (absorbable) Calcium per pound of *boneless* meat is sufficient. However, organ meat is very high in Phosphorus and would require substantially more Calcium to achieve balance; just one of the reasons it is not recommended to feed organ meats in large quantity at one time.

Raw *Boneless* Meat **(16 oz or 1 lb)**	Calcium*	Phosphorus*	Difference	Calcium needed
Chicken Liver	35.2mg	1329mg	1293mg	1300 to 1350mg

**according to http://nutritiondata.self.com/*

There are three ways people who feed their pets a raw diet accomplish a balance of Calcium to Phosphorus when feeding *boneless* meats or eggs:

1. mixing the raw *boneless* meats with ground Frames (carcass with meat removed). *Our preference because it is the most natural form of Calcium.*
2. adding ground eggshell. Calcium Carbonate – *an antacid. Highly acidic stomach acids allow our pets to safely digest raw meat. Calcium Carbonate reduces stomach acid.* We suggest eggshell with cooked eggs or occasional cooked boneless meats only. *Pure Bone Meal Calcium is the safer choice for raw boneless meats and raw eggs.*
3. adding any other Calcium supplement. *Least favorable because supplements may contain other ingredients that dogs and cats are sensitive to.*

Bone is the most natural source of Calcium for our carnivorous companion animals. According to acu-cell.com, *"Of the approximately 1000g of Calcium in the average 70kg adult body, almost 98% is found in bone."* **The Calcium to Phosphorus ratio in bone is 2.5:1 (two and a half times more Calcium than Phosphorus.)**

Carnivores were biologically designed to eat whole-prey animals; the meat, fat, organs, *and bone*. Our pets can easily digest and absorb the Calcium and other nutrients found in bone. Therefore, we trust that whole-prey supplies a good balance of necessary nutrients; including the proper ratio of Calcium to Phosphorus for our pets to thrive. ***Carnivores* ground *whole-prey* products include the prey's bone in the ratio nature intended for our carnivorous kids.**

> *"How much [Calcium] is "plenty"? A good guide would be to use a natural prey animal as standard - about 7-10% of its total weight will be bone, so anything in excess of 10% of the total diet would be "plenty". You should not exceed 25% - because you do need to leave room for other nutrients also..."* Mogens Eliasen, PhD, Balancing the Calcium/Phosphorus ratio in a raw diet for dogs (2003)

When you feed primarily *whole-prey* products, you will only need to consider giving your pet added Calcium when you are serving them *boneless* meats, organ meats, or egg.

Tripe is a *boneless* meat, but it is naturally balanced in Calcium and Phosphorus and therefore does not require additional Calcium. Tripe supplies excellent protein and unadulterated enzymes and probiotics to your pet's diet.

Gullet is also a *boneless* meat, but is said to be only slightly higher in Phosphorus than Calcium. Beef Gullet is bovine cartilage surrounded by muscle meat. It is a good natural source of Chondroitin Sulfate; a beneficial food because of its anti-inflammatory properties. A weekly meal or several weekly snacks of Gullet is fine without the concern of added Calcium because if you also include raw Poultry Necks (1.6:1 Cal:Phos ratio) in the diet and offer Recreational Bones, these foods have more than enough extra Calcium to offset the little excess Phosphorus found in Gullet.

Poultry and Other Frames (animal carcass with meat removed):

"Frames" is the term used to describe the animal carcass once it's been de-boned. It is the bone structure of the animal with the choice meats removed. Like with a bone-in chicken breast that you remove the breast meat off of the bone to cook only the breast meat of the chicken. A frame is what is left. It is generally 50% to 60% or more bone with little meat and naturally higher in Calcium than Phosphorus.

Because we use ground carcass-"Frames" to balance *boneless* meals we work in percentages of raw *boneless* meat to bone instead of milligrams of Calcium to ounces of raw *boneless* meat. When we feed *boneless* meats, like our ***Carnivores Boneless* Lamb or Venison,** we simply add about 10% organ meats and enough ground carcass-Frames as a bone Calcium source to mimic whole-prey.

You don't have to be exact with every meal. About seven to thirteen percent (7% to13%) bone in the *overall* diet is the range we strive for. **With a variety of food, a balance within range, over time is fine.** Keep in mind: the minerals found in processed pet food are part of a large mix of overly processed synthetic minerals. Some commercial pet foods contain far too much Calcium causing growth spurts in growing puppies and resulting in life-long joint issues. With all the pet food recalls with supplement potencies too high in this and too low in that we feel 100% more comfortable with using natural sources of Calcium like bone to balance wholesome raw *boneless* meats.

Extra Bones = Extra Calcium:

To supply added Calcium as well as enjoyment and other health benefits, we also feed our mastiffs **Poultry Necks** and **Recreational Bones** which are both on the higher end of Cal:Phos ratio (significantly more Calcium than Phosphorus.)

Necks, however, are *not* suitable for bringing the lack of Calcium in *boneless* raw meats into balance with the Phosphorus level found in meat alone. **Chicken Necks** are about a 1.6:1 ratio. Turkey and **Duck Necks** slightly higher in Calcium at a ratio of about 1.75:1. Necks have a decent balance of Calcium to Phosphorus on their own, but not enough Calcium to do the job of balancing out the high Phosphorus in added *boneless* meat. They are above the ideal of the 1.1:1 ratio and therefore not recommended as a staple in the diet - for everyday meals. Remember, variety is the key with raw feeding. **We feed Poultry Necks as a snack 2-3 times a week**. Our dogs love the crunchy goodness and it increases their Calcium intake when they enjoy them. If your dog or cat can tolerate the high bone content in Necks without uncomfortable constipation, Poultry Necks can be alternatively served as a meal once a week.

Recreational Bones: Beef or Buffalo Knuckle Bones - Knuckle bones are hard, but not brittle. The animal will usually gnaw at the knuckle with its back molars wearing off small shavings at a time. Knuckle bones supply good extra source of natural Calcium. In addition, they provide our pet's great psychological

pleasure, strengthen the neck and jaw muscles, and naturally keep their teeth and gums in good health.

Do Not Feed Frames (carcasses with little meat) or Necks as a Regular Diet:

Some people feed poultry Frames and Necks or other meat Frames as a regular diet to their companion animal. In our opinion this is not a good practice. Let me explain why we are not comfortable making Frames and Necks the primary food source for our loved ones.

Frames can be similar to a chicken back which also has little meat on it. The Calcium to Phosphorus ratio of a chicken back is a little more than 2:1 (more than double the Calcium than Phosphorus). This ratio on a daily basis may be tolerable to your carnivorous dog or cat, but I am not convinced it is healthy. In the wild, carnivores instinctively go for the muscle and organ meat of the prey-animal first! Meats supply all of the essential amino acids that are vital to our pet carnivore's health. Meats also provide our four-legged loved ones with a wide spectrum of other essential vitamins and minerals. Feeding Frames and Necks as a regular daily diet would supply an excessive, unnatural amount of bone; disrupting the balance nature intended. In our opinion, consistently limiting the many essential nutrients found only in the raw meat and organ of the prey animal would be detrimental to the dog's or cat's long term health.

We feed our pets primarily *Carnivores whole-prey* products because we believe the bone content is naturally within the average healthy range. *Carnivores whole-prey* ground products have *approximately* 80% meat, 10% bone and 10% organ meat.

As noted above, Frames do have their place in our pet's weekly menu. They serve as an excellent source of Calcium for balancing out the excess Phosphorus in *boneless* meat meals. See Guild to Balancing Boneless Meats below.

Ground Eggshell:

Eggshells are said to have healthy, balanced Calcium because of the trace amount of other minerals found in them and because they are also easily digested and absorbed. Naturally the most beneficial eggshells are those that come from cage-free, organically raised chickens. According to Bee Wilder, a health researcher for more than 20 years, *"Dutch researchers reported recently a highly positive effect of eggshell Calcium (with added Magnesium and vitamin D) on bone mineral density in a scientific study… The eggshell supplement group had measurable increases in bone density in their hips after one year."* See full article, **http://www.healingnaturallybybee.com/articles/supp2.php**

Eggshells are approximately 95% Calcium Carbonate; the balance is mostly Magnesium, and Phosphorus. Eggshells also contain micro-elements, i.e., trace amounts of sodium, potassium, manganese, zinc, iron, copper and boron. The composition of an eggshell is quite *similar* to yours and your pet's bones and

teeth. Ground Eggshell contains about 1900 mg of Calcium per teaspoon. Further research indicates this 1 teaspoon of ground eggshell actually contains only 800mgs of *elemental* Calcium [*meaning the amount actually absorbed*].

We do, however, have concerns about adding ground eggshell to our dog's and cat's raw *boneless* meat meals because of the fact that **Calcium Carbonate is essentially an antacid**. The very high acidity in the carnivore's gut is what allows them to eat and digest raw proteins without ill effects. If we add eggshell to raw meat are we not at the same time reducing the natural and essential acidity in our pet's stomach? For this reason we would only use eggshell as a Calcium source when feeding that occasional *cooked boneless* meat meal or *cooked* eggs where the importance of extremely high levels of stomach acid is not as necessary to safely digest.

> *"Healthy cats & dogs can eat just about any meat and survive, if not thrive. Their stomachs contain high concentrations of hydrochloric acid and digestive juices & their digestive tracts host an abundance of beneficial bacteria, making it difficult for harmful bacteria to survive."* C.J. Puotinen, The Encyclopedia of Natural Pet Care

We understand that some raw feeders do use ground eggshell to balance the Calcium to Phosphorus ratio in raw *boneless* meats, but we feel it is not worth the risk of reducing the dog or cat's naturally high concentrations of hydrochloric acid (stomach acid). We believe bone is the natural source of Calcium for our four-legged kids and it is just as easy to add **ground carcass** to achieve this balance when needed.

We suggest if your dog or cat has a compromised digestive system, many times the case as a result of eating biologically inappropriate food for long periods of time, you should stay away from using eggshell or any Calcium Carbonate supplement as a Calcium source for balancing *boneless raw* meats or *raw* egg. Stick with adding some ground Frames or Bone Meal instead.

To prepare Eggshell for Calcium supplementation (for that occasional cooked boneless meat meal):

- Wash the outer shell and gently rinse the inner shell.
  Don't remove the membrane inside the egg shell because it is very beneficial to joint health. There is an expensive, patented joint and bone health supplement on the market today that is exactly this: the inner membrane of the eggshell
- Set eggshells on a paper towel to dry
- If the shell has a dye stamp on it, remove this small piece of shell
- Place the eggshells on a cookie sheet and bake at 200ºF for 2 to 3 minutes
  (Salmonella bacteria are killed at temperatures above 160ºF)
- Remove from oven and place egg shells in a *clean* coffee grinder
  (It's best to have a separate one just for this purpose)
- Grind shells into a fine powder
- Place ground shells in a glass food container and store in cool dry place or refrigerate

If you are short on time, Eggshellent Calcium is a convenient alternative source of ground eggshell for boneless cooked meats or cooked egg meals only.

About Calcium Absorption:

To function correctly Calcium requires Phosphorus (which is abundant in the boneless meats and present in bones as well). Experts also agree that Magnesium and Vitamin D, as well as Vitamin A and C should be consumed with Calcium for best absorption. Unlike humans, dogs and cats synthesize Vitamin C internally. Magnesium is present in bones, eggshell, animal muscle meat, green leafy vegetables and chlorophyll, which is found highest in **Chlorella**. Vitamin A and Vitamin D are found in organ meat. **Organ Meats supply a high level natural source of Vitamin D as well as Vitamin A, healthy amounts of Iron and all of the B Vitamins. http://www.truthaboutabs.com/weird-nutrient-dense-meat.html.** Of course, the very best source of Vitamin D for you and your pets is the sun. Depending on the sun's intensity, twenty minutes to an hour of sunshine each day will provide maximum benefit. This can be accomplished by taking your dog for a healthy walk and taking the time to sit outside with your pet or allowing them to do so.

All of these Calcium absorption enhancing vitamins are available as natural sources within a species-appropriate diet. They are better absorbed and safer than synthetic vitamins. Processed pet food has been recalled for excessive vitamin levels, one as recently as October 2010 involving excess quantities of Vitamin D. In addition, foods high in oxalic acid reduce Calcium uptake (e.g. spinach, beets, whole grains, and fiber-rich foods). Beet pulp, grains, and fiber fillers are some of the main ingredients in many processed pet foods.

Calcium Supplements:

We believe whole real foods supply the most bio-available form of nutrients. Therefore, we do not give our pets many supplements, but the need for Calcium to Phosphorus balance is important and if you are feeding *boneless* meats weekly, Calcium should be added to these meals. As an alternative to the more natural form of Calcium- ground carcass/Frames or eggshell, some people use a Calcium supplement to increase the Calcium level in *boneless* meat meals.

We have already established that about 800 mg of *elemental* Calcium per one pound of raw *boneless* muscle meat (not considering organ meat) should bring the Calcium above the Phosphorus. Most supplements list the amount of *elemental* Calcium on the label, but you should verify with the manufacturer.

The biggest challenge with using supplements is identifying one that does not contain other ingredients that cause allergic reactions (such as itching, chewing, and ear issues) or ingredients that are not suitable for our companion animals. Some examples:

Many Calcium supplements also contain Vitamin D for its enhanced Calcium absorbency qualities. Dogs can take the Vitamin D3 – as Cholecalciferol which is naturally occurring in the body. Cholecalciferol comes from the purified fat of lamb/sheep's wool and is considered a pre-hormone. Once ingested it converts in the body in part to the hormone calcidiol and in part to a very potent anti-cancer steroid called Calcitriol.

Another form of Vitamin D is D2 (or Calciferol) as Ergocalciferol, which is a drug, not a vitamin. **You want to avoid the D2 form of Vitamin D, Ergocalciferol**. It is derived from plant fungus via a radiating process and is not detectable (naturally occurring) in the human body. Unlike humans, **dogs and cats are not capable of converting Ergocalciferol (D2) into usable Vitamin D.**

Stick with Calcium supplements that contain *only* the biologically active form of Vitamin D; the D3 as Cholecalciferol.

Calcium Citrate is said to be one of the most absorbable forms of the Calcium. The problem with Calcium Citrate is that it is made from Citric Acid which in most cases is **derived from corn**; **posing an allergy issue for most pets.**

Other ingredients - Corn and soy derivatives as well as MSG (an excitotoxin- disguised under various name) are added to many supplement products, including microcrystalline cellulous, Vitamin E as mixed tocopherols, lecithin, maltodextrin, and in some pet supplements (the powder, liquid, and chewable forms) carrageenan, natural flavors, and brewers yeast, etc.

Early on in the practice of raw feeding dogs and cats, experts recommended **Bone Meal Calcium** as the best supplement to use for balancing the Calcium to Phosphorus ratio *boneless* meats. Phosphorus is naturally found in Bone Meal as is Magnesium, Protein and many other minerals. The concern of mad cow disease and the possibility of ingesting too much aluminum and lead deter some people from considering Bone Meal as a Calcium source. Mad cow disease has been controlled by the discontinuation of feeding cattle rendered slaughterhouse waste (animal tissue). In 1997 they banned feeding protein source from ruminants to another ruminant. Aluminum is a *trace* nutrient element that can be toxic at certain levels. Dr. Gloria Dodd, DVM has proven processed pet foods pose a great concern over aluminum toxicity. Aluminum is also administered each time our pets receive a vaccination. Heavy metals such as lead are a problem in our environment, especially in dust. Lead, once added to gasoline as an engine lubricant was emitted in automobile exhaust and today still contaminates American soil. Livestock do suffer lead toxicity; many cases are reportedly due to cattle accidentally ingesting discarded car battery parts or licking old crankcase oil. Lead is also unfortunately a reality; found in processed pet food (lead soldered cans), water (where lead soldered copper pipes exist), ceramic bowls, and in vegetables grown in lead contaminated soil.

We do not use synthetic Calcium supplements. We count on the natural source of bone in our ***Carnivores whole-prey products***, Frames/ground carcasses, Poultry Necks, Recreational Bones, and Bone Meal with eggs to assure our furry kids are getting enough Calcium. We have been feeding our pets an average of

10% of their diet as bone for nine years. Recently we had a hair analysis done on our older dog and he tested negative for aluminum and lead as well as other heavy metals.

The good thing about Bone Meal compared to other Supplements is that it is pure Bone Meal, no other ingredients of concern. We only use a minimal amount in eggs once a week. **The best you can do if you choose to use Bone Meal, is select one that is sterilized and tested for heavy metals to assure the lowest possible aluminum and lead levels.**

We have already looked at the concerns related to supplementing with Calcium Carbonate in the section on Eggshells. **The acid reducing effect is a concern with any Calcium Carbonate vitamin supplement taken with raw animal protein.** Calcium Carbonates from oyster shell also contain aluminum.

Note: A brisk 30 minute walk daily will reduce the risk of your furry friend losing bone mass. Also true for us humans.

Other sources of Calcium:

Dark green Leafy Vegetables – Collard greens in the **Veggie Puree** provides a significant amount of Calcium (Cal:Phos Ratio of 14.5:1) as do some of the other vegetables in the Puree. Leafy Greens also contain a good amount of Magnesium and some Phosphorus. Phosphorus in vegetables is reduced if steamed or cooked.

Sesame seeds – high in Calcium and Magnesium, but also very high in iron. We use ground sesame seeds in our homemade treat recipes, but **not as a Calcium supplement in the raw *boneless* meats.** We feel the organ meats in the meal supply plenty of iron. Iron is a trace mineral and necessary for good health, but too much iron can be detrimental.

Balancing the Calcium in *Boneless* Meat Meals – A handy guide:

The following is how we *balance boneless meats* like our ***Carnivores Boneless* Ground Lamb** and **Venison**, the **Beef Trim Meat Chunks** or the ***Boneless* Bison (Buffalo)**. This is just a guideline; again, there is no exact science here.

Option 1 - preferred method
Using **Frames/ground carcass** - the goal is a bone content in the 10% range:

1 lb. (16 oz.)	***Carnivores*** *Boneless* Ground Lamb or Venison, or Beef Trim or *Boneless* Bison (Buffalo), (100% meat – no bones or organs) Higher in Phosphorus than Calcium
1/8 to 1/4 lb. (2 oz. to 4 oz.)	Primal Grind (heart - a muscle meat, bone, liver) Available in Lamb, Buffalo, or Beef These Primal Grinds are balanced with a Calcium to Phosphorus ratio of 1.33:1 and 1:1

	Carnivores Chicken, Beef or Rabbit Organ Meat can be substituted for Primal Grinds. Just add additional Frames to increase the Calcium because they do not contain bone
1/3 lb. (5.3 oz.)	Ground Lamb and Bone or Quail Frames (Frames/carcass) approximately 50% meat and 50% bone (2.65 oz. of each) Higher in Calcium than Phosphorus
1/2 to 1 Tbsp	Optional – Veggie-Puree, or select pureed vegetables

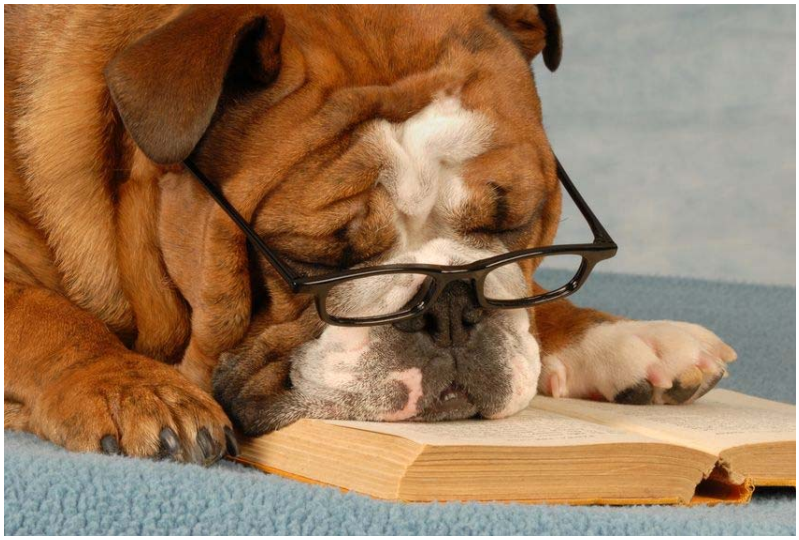
We feel this mix mimics the bone (and organ) content found in the whole-prey model. Make adjustments accordingly when feeding a smaller quantity to a smaller animal.

Option 2 – alternative method (if ground carcass is unavailable)
Using **Bone Meal Calcium**:

1 lb. (16 oz.)	***Carnivores*** *Boneless* Ground Lamb, Venison, or Beef Trim, or *Boneless* Bison (Buffalo), (100% meat – no bones or organs) Higher in Phosphorus than Calcium
1/4 lb. (4 oz.)	Primal Grind (heart- a muscle meat, bone, liver) Available in Lamb, Buffalo, or Beef These Primal Grinds are balanced with a Calcium to Phosphorus at a ratio of 1.33:1 and 1:1 *Carnivores* Chicken, Beef or Rabbit Organ Meat can be substituted for Primal Grinds. Just add a little additional Bone Meal to increase the Calcium because they do not contain bone
1 tsp	Pure Bone Meal (3000 mg) - 900mg elemental Calcium
1/2 to 1 Tbsp	Optional - Veggie-Puree, or select pureed vegetables

Balancing the Calcium in Eggs:

Eggs are slightly higher in Phosphorus than Calcium. Each egg (white and yolk) has approximately 78mgs more Phosphorus than Calcium. This can add up if you are feeding eggs twice a week. Feeding foods with higher Calcium levels, such as Poultry Necks and Recreational Bones on a weekly basis would likely offset this minimal difference. To be on the safe side, for each egg you can add about 85mgs of elemental Calcium (just shy of 1/8th of a teaspoon of pure Bone Meal). **Eggnog Recipe**



I'm gonna sleep on it,
but I think the best Calcium for me is in bones.....

Reference Links:

Nutrient Composition Of Whole Vertebrate Prey (excluding fish) Fed In Zoos, by E. Dierenfeld, PhD, H. Alcorn, BS, and K. Jacobsen, MS.
(See pages 12 and 13 for mineral content of whole-prey.)
http://www.nal.usda.gov/awic/zoo/WholePreyFinal02May29.pdf

Balancing the Calcium/Phosphorus ratio in a raw diet for dogs (2003), by Mogens Eliasen, PhD

Self Nutritional Data – Reference tool for nutrients found in foods
http://nutritiondata.self.com/

The "Weird" Types of Meat with the Highest Nutrient Density,
by Catherine Ebeling – RN, BSN & Mike Geary, Certified Nutrition Specialists
http://www.truthaboutabs.com/weird-nutrient-dense-meat.html

Egg yolks, organ meat, milk, and sea fish are rich in Vitamin D, by Dr. Shagufta Feroz **http://www.facebook.com/note.php?note_id=396296180937**

Calcium to Phosphorus Ratio Chart for Vegetables
http://www.lowchensaustralia.com/health/calphos.htm

Vitamin D Pharmacology
http://www.vitamindcouncil.org/vitaminDPharmacology.shtml

Heavy Metal Toxicity – sources of heavy metals
http://tuberose.com/Heavy_Metal_Toxicity.html

Gloria Dodd, DVM on aluminum found in processed pet food
http://www.byregion.net/articles-healers/HeavyMetal_Pets.html.

Recall excess Quantities of Vitamin D
http://thenewsoftoday.com/dog-food-recall-initiated-from-blue-buffalo-pet-food-producer/3588/

Disclaimer: By utilizing this website you express your consent to our Disclaimer. Unless otherwise noted, the contents of our website and marketing materials are based upon the research and opinions of Grateful Pet, our business partners and reference materials. We are not licensed veterinarians, physicians, or nutritionists. The information is not intended to diagnose or prescribe or to replace a relationship with a qualified health care professional and it is not intended as medical or nutritional advice. It is intended as a sharing of knowledge and information from the research and experience of the Grateful Pet team. We encourage you to make your own health care decisions for your pet based upon your own research and your personal knowledge concerning your pet. If you use the information on this website to make decisions for your pet's health or your own health, Grateful Pet assumes no responsibility for such decisions. We provide insight, high quality food, supplements, and gentle remedies and recommend seeking advice from a qualified, nutritionally oriented health care provider who has thoroughly researched your pet's health.