Even the Most Meticulous Pet Parent Can Be Misled by This Trend

It all looks fine and good — till you look under the hood to discover the truth of the matter. The last thing you want to do is sacrifice your pet's health on the altar of convenience. But follow this seemingly terrific trend, and you may be doing exactly that — to the detriment of your pet.

Reviewed by Dr. Becker

STORY AT-A-GLANCE

- Pet food manufacturers are finding it challenging to produce dry pet food with high meat content — something more and more pet parents are demanding
- The manufacture of kibble requires extrusion, which is a process better suited to lesser ingredients than whole cuts of fresh lean meat
- Extrusion results in the denaturation of proteins, which changes their structure, and destroys essential vitamins
- Pet food processing also creates toxic reactions including advanced glycation end products and heterocyclic amines
- The extrusion process doesn't completely eliminate the activity of toxic substances

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High meat content is described as a "growing pet food trend" in the pet food "specialty market."

Pet food industry insiders won't even blink reading those words, but many pet parents would be quite surprised to learn that meat in pet food is considered a "trend" and a specialty product rather than a staple of diets formulated for carnivorous cats and dogs.

This leads to the topic of extrusion, which is the process used by pet food manufacturers to turn ingredient mixes into kibble.

About 95% of dry pet diets are manufactured using the extrusion process. The fact that extruding high meat pet food is considered a challenge by manufacturers gives you a peek behind the curtain of the processed pet food industry.

Extrusion Primer

Batches of dog or cat food ingredients are mixed, sheared and heated under high pressure, forced through a spiral shaped screw (either a single screw or a twin-screw) and then through the die of the extruder machine. The result is called extrudate, which is a ribbon-like product that is subsequently knife-cut and dried.

The extrusion process involves extremely high temperatures. Research shows that drying pet food at 160 degrees C (320 degrees F) to 180 degrees C (356 degrees F) can significantly reduce its nutritional value.[1]

In small-sized kibble (4 mm or about 0.16 inch), a drying temperature of 200 degrees C (392 degrees F) lowered concentrations of the amino acids proline, total lysine and reactive lysine.

It also decreased concentrations of the linolenic (omega-3) and linoleic (omega-6) essential fatty acids, and increased the concentration of oleic acid (omega-9 monounsaturated).

The increase in oleic acid may point to lipid oxidation of the smaller kibbles during the drying process. Lipid oxidation can create off-flavors and aromas, as well as toxic compounds.

The high temperature used in extrusion and the short timeframe to process (under five minutes) creates continuous chemical and physical alterations to the ingredient mixture. These changes include:

- Starch gelatinization
- Inactivation of nutritionally active factors
- Protein denaturation
- Vitamin loss

When it comes to the ingredients used in dry dog foods, which are often of low quality to begin with, the first two items on the list, despite what you might assume, are actually desirable changes. These changes are necessary to form the physical characteristics of kibble and make it more digestible.

The other two items, vitamin loss and certain types of protein denaturation, are undesirable results of the extrusion process.

Starch Gelatinization

It's important to keep in mind that all dry pet food, including grain-free formulas, contains starch, because starch is essential to the formation of kibble.

When the raw ingredients are exposed to heat and moisture during extrusion, the starch in the mixture gelatinizes (melts). This helps bind the kibble and also causes expansion of the product after it travels through the die.

A high starch content of 30% to 40% of the ingredient mixture decreases the density and therefore the weight of the end product, which is a benefit to the manufacturer. Dry cat and puppy foods normally contain around 30% starch, and 40% is about average in dog foods.

However, some dry pet food formulas can contain twice that amount, which is derived primarily from cereal grains, which like all grains are biologically inappropriate for dogs and cats. Interestingly, the extrusion process is thought to lessen the biological inappropriateness of the grain content in dry pet food formulas.

According to a 2008 report by the Animal Nutrition Group at Wageningen University in the Netherlands:

> *"One of the challenges when using cereals in canine diets is the presence of anti-nutritional factors that are harmful for dogs.*
>
> *Study on NAF [nutritionally active factors] in canine diets show that extrusion cooking inactivates NAF activity especially those of a proteinaceous structure (Purushotham et al., 2007)."*[2]

Another starch-related fact mentioned in the report is that extrusion conditions and the type of starch used can affect glucose and insulin response in dogs after a meal of dry food.

Extruded rice, which many pet parents mistakenly assume is a healthier starch, causes a higher glucose and insulin response than other extruded starches like barley, corn, wheat and sorghum.

Inactivation of Nutritionally Active Factors

The ingredients used in dry pet food mixtures, in particular grain legumes, contain undesirable nutritionally active factors (NAFs) that interfere with digestion and absorption of nutrients.

An example of nutritionally active factors is trypsin inhibitors, also called protease inhibitors. These toxins are most often associated with soy products. Trypsin inhibitors are chemicals that reduce the availability of trypsin, an enzyme crucial for digestion.

The extrusion process used in the manufacture of dry pet food inactivates undesirable NAFs in the ingredient mixture. It also reduces the activity of naturally occurring toxins like allergens, glycoalkaloids and mycotoxins present in grains prior to extrusion.

However, the extrusion process doesn't entirely eliminate the activity of these toxic substances. Mycotoxins are still a big risk in dry pet foods even after the manufacturing process is complete.

Protein Denaturation

The protein sources used in dry pet food formulas are often a combination of animal and plant. Less costly plant proteins don't contain amino acids sufficient for the nutritional needs of carnivorous dogs and cats, which is why there must be some type of animal protein in any processed pet food labeled "complete and balanced" per AAFCO standards. Amino acids don't fare well during extrusion. A study cited in the Animal Nutrition Group report:

> *"... [O]bserved a large overestimation of the available lysine content such that the amino acid pattern relative to lysine in these diets may not be optimal to promote health.*

> *In addition to lysine, other amino acids such as arginine, tryptophan, cysteine and histidine can also be affected by the extrusion process. Of particular importance may be the sulphur amino acids (cysteine and methionine) which are often limiting in diets for cats as these amino acids are susceptible to oxidation."*

With regards to protein denaturation, according to the Animal Nutrition Group report:

> *"Mild denaturation of proteins can make them more susceptible to digestive enzymes and, therefore, improve the digestibility of these proteins (Hendriks and Sritharan, 2002)."*

Denaturation takes place during the extrusion process, and often prior in the case of animal proteins, which are heated after grinding to a target temperature before being added to the ingredient mixture.

Denaturation modifies the structure of protein. In the case of plant-based proteins like soy and corn, denaturation makes these biologically inappropriate foods easier for pets to digest. However, denaturation is only beneficial to meat-based proteins if the protein sources are substandard, which is the case in the vast majority of popular dry dog and cat food diets.

Rendered meat by-products are a common protein source in dry pet food, and they are indeed difficult for dogs and cats to digest and assimilate.

Unfortunately, denaturation of high-quality, lean, whole cuts of meat used in superior quality dry pet foods also occurs. Denaturation of biologically appropriate protein has the opposite effect of what is achieved with grain-based and low-grade animal meat. Denaturation makes these once healthy proteins more difficult for your dog or cat to digest and assimilate.

The change in the structure of healthy protein that occurs during exposure to high heat is a possible trigger for food allergies. Research shows the immune system may not recognize the altered protein structure and treats it as a foreign invader.

This may explain why pets allergic to a particular meat-based dry food often have no problem eating that same meat in whole, raw form. According to the Animal Nutrition Group report, "Protein digestibility of extrudates was increased compared to nonextruded samples (Peri et al., 1983; Bhattacharya and Hanna, 1985; Fapojuwo et al., 1987)." These studies were, however, conducted on feeds composed from vegetable sources only.

Enzymes like lipoxygenase and peroxidase present in pet food ingredient mixes are inactivated during extrusion cooking. Since these enzymes can cause deterioration of product and shorten shelf life, their destruction is considered by pet food manufacturers to be a beneficial effect of the extrusion process.

Vitamin Loss

According to the Animal Nutrition Group report, the extrusion process primarily destroys vitamin A, vitamin E and the B-group vitamins in dry food ingredient mixtures. No data on vitamins D or K was available for the report.

The percentage of vitamin loss during extrusion varies widely, from a low of 4% loss of thiamin to a high of 65% loss of vitamin A. Keep in mind that B-group vitamins are water soluble, meaning your pet's body can't store them — they must be provided daily through diet.

Time to Dump That Dry Diet?

So, now you have the scoop on just a few of the problems with dry pet food. There's also the potential for cancer-causing chemicals in kibble, as well as advanced glycation end products (AGE), which in humans have been shown to exacerbate diabetes and interfere with kidney function, and are linked to aging, Alzheimer's disease, neurologic disease and cancer.

If you're still feeding your pet kibble, it’s highly recommended to upgrade your furry family member's diet.

Sources and References

Petfoodindustry, March 9, 2016

[1] Petfoodindustry.com, April 14, 2011

[2] Q.D. Tran, 2008. Extrusion Processing: Effects on Dry Canine Diets