



# Canine Nutrition NEWSLETTER

May 2010



## In this Issue

Diarrhea and constipation are symptoms, not diseases. Both these symptoms can be due to a wide variety of underlying problems. Correctly diagnosing the underlying problem is critical to resolving the symptoms. This article will discuss the various types of diarrheas, characteristics that can help to distinguish between small intestinal and large intestinal diarrhea, as well as provide some direction on dietary management strategies based on the underlying problem. For more information, see:

### ***Diarrhea, Constipation and their Dietary Management***

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Inflammatory bowel disease is one of the most frustrating problems for owners and veterinarians. Seemingly opposite dietary management strategies (ie high fibre vs low fibre) can work in different cases and it is difficult to predict which approach will work best for any given dog. This article provides a detailed overview of IBD, including its dietary management. For more information, see:

### ***Nutritional Management of Inflammatory Bowel Disease in Dogs***

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Total dietary fibre vs crude fibre; soluble fibre vs insoluble fibre; fermentable fibre vs non-fermentable fibre; dietary fibre vs prebiotic fibre – this article will explain these terms and how different types of fibre can be used to manage various medical conditions in dogs. For more information, see:

### ***Dietary and Prebiotic Fibre***

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# Diarrhea, Constipation & their Dietary Management

By Hilary Watson BSc

The main purpose of this article is to explain why your veterinarian needs to be involved in diagnosing and managing diarrhea or constipation in your dog.

## The Digestive Tract

The digestive tract has both a small intestine and a large intestine (also called the colon). The two main functions of the small intestine are:

- 1) **to produce digestive enzymes that break down food in the digestive tract and**
- 2) **to absorb small digested nutrients into the dog's body**

The two main functions of the colon are:

- 1) **to provide a storage vat for bacterial fermentation and**
- 2) **to retrieve water and electrolytes from the digestive tract and return them to the dog's body**

Consider that every day the average person produces:

- **one litre of saliva**
- **one litre of stomach acid**
- **one litre of pancreatic juices**
- **almost a half litre of bile**
- **2.5 litres of intestinal fluid**

That's six litres of fluid being pumped into your digestive tract each day. About 4.7 litres of these juices move back into your body in the small intestines along with nutrients that are absorbed from the digestive tract. However that still leaves a surplus of more than a litre of fluid still remaining in your digestive tract. It is the job of the colon to retrieve that fluid and return it to your body. Of the 6 litres pumped into your digestive tract each day, only 0.1 litres are lost from the body in stool.

## Stool quality

Stool quality is directly tied to the stool's moisture content. Diarrhea is feces that contain too much moisture. Constipation causes stools that are overly dry. Diarrhea and constipation are symptoms, not diseases. Diarrhea and constipation are telling you that some underlying problem is changing the normal movement of fluids into or out of the digestive tract of your dog.

## Intestinal Motility and Transit Time

Intestinal motility and intestinal transit both refer to the speed with which food travels through the digestive tract. Hyper-motility, which causes a decreased transit time, means that food is moving too quickly through the intestines. Hypo-motility, which causes an increased transit time, means that food is moving too slowly through the intestines. Motility has a direct effect on stool moisture because transit speed determines how long stool sits in the colon where water is reabsorbed into the dog's body.

If you eat tainted meat, your body will rush that food through your digestive tract to get rid of the bacteria and toxins as quickly as possible. Hyper-motility is the body's natural response to consuming tainted food. Because the food's time in the colon is very limited, there is little time

for water to be reabsorbed into the body. The result is liquid stools.

Hypothyroidism can cause hypo-motility. Because thyroid hormone regulates metabolic rate, a deficiency in this hormone can slow the speed with which food passes through the digestive tract. When stool moves too slowly through the colon, there is more time for water to be re-absorbed into the body. In this way, hypothyroidism can cause constipation.

In both the above cases, diarrhea/constipation are symptoms of an underlying problem. Diagnosing the underlying problem is therefore key to finding the appropriate solution.

## Diarrhea

Although there are dozens of causes of diarrhea, there are 4 main *types* of diarrhea.

**Osmotic diarrhea** is the most common type of diarrhea in dogs. It is caused by the presence of unabsorbed nutrients in the digestive tract. Unabsorbed nutrients draw water by passive diffusion into the digestive tract which leads to large watery stools. This type of diarrhea is generally caused by impaired digestion or malabsorption in the small intestines, or by the dog binge eating. Osmotic diarrhea generally resolves when food is withheld for 24-48 hours.

**Exudative diarrhea** is also relatively common in dogs. This type of diarrhea is caused by changes in the permeability of the mucosal lining of the digestive tract. Any disease that causes inflammation or ulceration of the small or large intestine can lead to exudative diarrhea. Food allergies, inflammatory bowel disease (colitis), and protein-losing enteropathy are examples of conditions that can lead to exudative diarrhea. With exudative diarrhea there is often blood in the stool and the diarrhea typically does not resolve when food is withheld.

**Secretory diarrhea** is a common form of diarrhea in humans (the classic example being diarrhea from cholera). Certain substances, such as bacterial toxins, hydroxy fatty acids (ie rancid fat) and deconjugated bile acids can cause the intestinal cells to actively secrete large volumes of water into the digestive tract. Food poisoning in dogs is an example of this type of diarrhea. Although relatively rare in dogs, it can be very serious because it can quickly lead to severe dehydration.

Diarrhea from **altered intestinal motility** is uncommon in dogs. In this type of diarrhea, altered intestinal motility is the primary cause of diarrhea. Parvovirus infection can cause hyper-motility leading to diarrhea. Hypo-motility can cause small intestine bacterial overgrowth (SIBO) which can also lead to diarrhea.

Since diarrhea and constipation are symptoms not diseases, it's important for your veterinarian to diagnose the underlying disease in order to manage the symptom. Diarrhea due to food allergies has a completely different management strategy versus diarrhea due to parvovirus infection. The chart on the next page gives some characteristics of small and large intestine diarrheas. These are all broad generalizations – not all symptoms will be present in all dogs, and in some cases symptoms that are predominantly characteristic of small intestinal diarrhea may be present in dogs with large intestinal diarrhea and vice versa. However, in general, these characteristics can help to identify the location of the underlying problem.

To further complicate things, it is also possible for diarrhea and vomiting to be symptoms of diseases that have nothing to do with the digestive tract! Liver disease, pancreatic disease and kidney disease are all diseases that can cause vomiting and/or diarrhea. Fortunately there are blood tests that can help to identify or rule out these diseases.

## Constipation

Constipation is the number one gastrointestinal complaint of humans. Constipation is also relatively common in middle-aged cats, especially males. Although constipation occurs in dogs, it is





Distinguishing between diarrhea caused by problems of the small intestine vs the large intestine		
DESCRIPTION	SMALL INTESTINE	LARGE INTESTINE
Stool appearance	Watery cow-pies	Semi-formed jelly-like
Stool volume	Large	Normal or small
Blood in the stool	Rare. Black/dark blood (melena)	Often. Bright red blood (Hematochezia)
Fat in the stool (steatorrhea)	Common	Rare
Flatulence	Present	Absent
Rumbling, gurgling (borborygmi)	Present	Absent
Vomiting	Present	Absent
Weight loss	Present	Absent
Frequency of defecation	Normal	Increased
Mucus in the stool	Absent	Present
Urgency of defecation	Absent	Present
Straining (tenesmus)	Absent	Present
Difficulty defecating (dyschezia)	Absent	Present

relatively rare. As with diarrhea, constipation is a symptom, not a disease.

Three of the most common causes of constipation in dogs are:

- 1) **dietary indiscretion (ie eating rocks, clay, sand or ground bones, including bones fed as part of an all-raw diet),**
- 2) **dehydration and**
- 3) **electrolyte imbalance**

Remember the colon's job is to retrieve water from the stool and return it to the dog's body. If a dog is dehydrated, the colon will attempt to retrieve as much water as possible from the stool, leaving the stool hard and dry. An electrolyte imbalance can also cause constipation. Hyponatremia (too little sodium in the blood), hypokalemia (too little potassium in the blood), and both hypo- and hypercalcemia (too little or too much calcium in the blood) can all cause constipation. So while constipation may appear to be a mild and insignificant problem, it may be indicating a very serious underlying condition.

## Dietary Management of Diarrhea and Constipation

Again, the most important thing to remember is that diarrhea and constipation are both symptoms, not diseases. The appropriate dietary management strategy will therefore depend on the underlying problem. This is why a correct diagnosis of the underlying disease is so critical to resolving the problem.

Osmotic diarrhea is caused by poor digestion and absorption. Feeding small meals which are highly digestible and low in fat is generally the best approach to take with this type of diarrhea. As well, feeding digestive enzymes with every meal helps to improve food digestion and prevent unabsorbed nutrients from remaining in the digestive tract.

The article by Liz Pask in this newsletter discusses the nutritional management of inflammatory bowel disease (IBD). Exudative diarrhea is often challenging and it is hard to predict which approach will work best for any individual dog. As the testimonials in this issue demonstrate, two dogs who both presented with similar symptoms (soft stools/diarrhea/colitis) may respond to completely opposite dietary strategies (ie increased fibre vs restricted fibre).

The usefulness of fibre in treating diarrhea depends on the underlying cause of the diarrhea. Some cases of exudative diarrhea respond well to increased fibre, but with osmotic diarrhea, feeding extra fibre is the worst thing you can do. Fibre physically interferes with digestion and with osmotic diarrhea digestion and absorption are already impaired. This is why osmotic diarrhea responds best to a highly digestible food that is very low in fibre.

Dietary fibre is widely used to treat constipation in humans. Dietary fibre increases stool volume and speeds the rate of passage of stool through the colon. The faster passage leaves more moisture in the stool and the fibre traps and holds that extra moisture, resulting in larger softer stools.

However, if constipation is caused by dehydration, fibre will exacerbate the problem. If dehydration is causing the dog to take more water from the stool, then using fibre to trap moisture in the stool will exacerbate the dehydration. In cats, constipation is often caused by dehydration. Many cats don't like drinking and these cats get the bulk of their water from the moisture in their food. Non-drinking cats that are fed kibble may not consume enough water. If they become dehydrated, they can become constipated. In cats and dogs that are constipated due to dehydration, the best way to correct the problem is to fully re-hydrate the animal. In cats, feeding a wet food (ie canned or home-made) and feeding normal daily calories but of a very low calorie food can often resolve constipation. By feeding an increased volume of a low calorie wet food, the moisture intake of the cat is greatly increased, and the increase in food volume results in faster passage of stool through the colon, giving less time for moisture to be drawn from the stool. In dogs that are constipated, always verify that the dog is well hydrated before increasing fibre intake.

The most important message from this article is that diarrhea and constipation are both symptoms, not diseases. Many, many diseases can all cause the same symptoms. Correctly diagnosing the underlying cause is critical to resolving the underlying problem. Often a dietary strategy that works well for one animal may be the worst approach for an animal with the same symptoms, but a different underlying problem. Your veterinarian should always be involved in diagnosing and treating diarrhea and constipation in your dog.



Siberian Husky "Maelo"

## Testimonial

*How lucky to have heard of Hilary Watson and her supplement, and especially what a gift to communicate with her. I have a Husky 3 1/2 years called Maelo. He was suffering from IBD for 7-8 months and couldn't tolerate any food. Historically, he has always been difficult with his food. He would suddenly stop eating. He was placed on medication (prednisone). Maelo's system is very, very sensitive. The medication helped his diarrhea but it caused many problems with digestion. He drank constantly. He always had his heart in his throat. We had to give antacids. So I decided to stop the prednisone treatment under the medical supervision of the internal medicine specialists at the Faculté de Médecine Vétérinaire at St Hyacinthe. Eventually I managed to control his bowel movements with digestive enzymes, but the digestive prob-*

*lems were still present and so was the inflammation, according to blood tests.*

*That's when I heard about Hilary Watson. I contacted her about my Maelo and she formulated a low fibre, limited antigen recipe based on ground beef and boiled potatoes, along with HILARY'S BLEND supplement. The change was almost instantaneous. He is happy to eat and all the digestive problems have disappeared. Recent blood tests done at the end of March are perfect and show no more inflammation. Regarding his coat, he is simply gorgeous. The vet told me he had never seen a Husky with a coat as beautiful.*

*Thank you Hilary for creating this recipe and for the supplement but also, thank you for your helpfulness and for your immense generosity.*

*On my own behalf, and on behalf of Maelo, thanks!*

*Joanne Goupil, Longueil, QC*



# Nutritional Management of Inflammatory Bowel Disease in Dogs

By Elizabeth Pask, Ph.D. (candidate)

Inflammatory Bowel Disease (IBD) in dogs is a challenging and often frustrating condition that an increasing number of owners are coping with. Owners of dogs diagnosed with IBD are often faced with conflicting information on nutritional management. Nutritional management of this disease is not meant to replace the need for medical treatment rather it should support the medical intervention by supplying the nutrients required to repair the damaged intestines. In last months article we discussed how intestinal health can be linked to chronic conditions such as food allergies. It is important to understand that the dog's body is only as healthy as his gut. The intestinal tract is the only way our dogs absorb the nutrients required for survival. If the gut fails then our dog's health begins to fail.

## What is IBD?

IBD is often confused with Irritable Bowel Syndrome (IBS) because the clinical signs can be almost identical. However these conditions are not the same. IBD refers to a chronic inflammatory disease of the bowel which can only be diagnosed by intestinal biopsy. IBD is a disorder involving inflammatory cells and multiple types of immune cells, where areas of the gastrointestinal tract spasm causing pain. There are multiple types of IBD. The area of the bowel affected and the type of immune cell involved will determine the type of IBD.

Most cases of IBD involve the large intestine and not the small intestine. The most common form of IBD is lymphocytic-plasmacytic where the lymphocytes and plasma cells line the tissues of the intestine. Other types of IBD include eosinophilic gastroenteritis, granulomatous enteritis, and a Boxer specific form called chronic histiocytic ulcerative colitis.

There is no known single cause of IBD. However, it has been suggested that it is the result of an abnormal gastrointestinal immune response to either a dietary, parasitic or other environmental irritant. Another possible cause is a loss of immune tolerance coupled with an increase in gastrointestinal mucosal surface permeability. Genetic susceptibility is also thought to play a role in the onset of IBD. Any of these causes can initiate the primary inflammatory response that when sustained or left untreated can result in a more chronic inflammation. Once chronic inflammation in the small and/or large intestine takes hold it can persist after the initial cause has been resolved. In addition once IBD has been resolved the same animal can begin to suffer from IBS.

Clinical signs of IBD include and increased frequency, tenesmus (difficulty during bowel movement), bloody or mucous covered diarrhea and steatorrhea (excess fat in feces). If IBD is affecting the small intestine then it is common to see large bulky stools or diarrhea, weight loss and vomiting.

## Structure & Function of the Large Intestine

Before we can examine the effect of nutritional management on IBD we first need to explore the role of the large intestine. The main function of the large intestine is to reabsorb water and sodium from intestinal contents. During the process of digestion and absorption, which takes place in the small intestine, there is a large volume of fluid that is drawn into the intestine to facilitate

digestion. This fluid is reabsorbed by the large intestine. The large intestine houses huge population of bacteria that provide a number of symbiotic functions for their host. These bacteria can break down some fiber that was indigestible in the small intestine; they can then ferment this fiber to produce short chain fatty acids (SCFA) which are important to large intestine cell health. The bacteria can also make some vitamins which are absorbed and used by the dog's body.

## **Nutritional Management of IBD Dogs**

### **Fasting**

Traditionally acute diarrhea is treated with short term fasting lasting 12-48 hours followed by re-feeding with a bland diet. The initial fast does aid in resting the intestine however for more chronic conditions like IBD this strategy may not be effective.

### **Elimination & Hypoallergenic Diets**

Elimination diets are highly digestible diets. In the past these diets were home made containing one protein source and one simple carbohydrate source (usually boiled rice). However, more recently it has become more popular to use commercially available completely hydrolyzed diets where the dietary protein has been enzymatically broken down so that it will not stimulate the immune system. In some IBD cases exposure to a dietary allergen has been implicated in initiating the inflammatory condition in the intestine. In elimination diets the diet is fed to the dog for 4-6 weeks to the exclusion of all other food. Once the symptoms of IBD have subsided single foods are reintroduced one at a time to determine which of the foods is causing the inflammatory response.

Alternatively a hypoallergenic diet can be used in the same manner. Hypoallergenic diets contain one novel protein source (e.g. buffalo, venison, kangaroo, etc.) and a digestible carbohydrate source (e.g. rice or potato). As with the elimination diet this diet should be fed to the exclusion of all other diets for at least 4-6 weeks. However, unlike elimination diets you may need to change to a 2nd novel protein based diet after 4 weeks because of the increased intestinal permeability in IBD cases leading to a sensitivity forming to the first novel protein based diet. For dogs that are suffering from IBD caused by an allergen or dietary irritant this can be a successful method for resolving IBD.

Researchers investigated the efficacy of hypoallergenic diets against a low fat diet and against a high insoluble fiber diet to determine if type of diet could influence the duration whether type of diet could influence IBD remission. Dogs with chronic lymphocytic plasmacytic IBD were selected and placed on one of the 3 diets. Dogs were monitored for clinical symptoms (tenesmus as well as fecal consistency, and characteristics (mucus or blood)) for 4 months. Any medical intervention required to maintain remission was recorded. Of the low fat group 82% of the dogs required both medical and dietary intervention over the course of the trial. 50% of the high fiber dietary group required medical and dietary intervention over the first 3 months of the trial but as the trial continued the dogs continued to improve. At the end of the 4 month trial 25% of the dogs in the high fiber group required medical and dietary intervention for IBD symptoms. In the hypoallergenic diet group, 15% of the dogs required medical or dietary intervention over the course of the 4 month trial. The dogs in the hypoallergenic and low fat dietary groups showed improvement in clinical signs of IBD, however a similar improvement was not seen in the high fiber diet.

### **Dietary Fiber & IBD**

It should be noted that in the study mentioned in the previous section the researchers chose to use a diet high in insoluble fiber which has fewer large intestine health benefits when compared to soluble fiber. Not all fiber is created equal. Insoluble fiber tends to provide bulk to the feces,

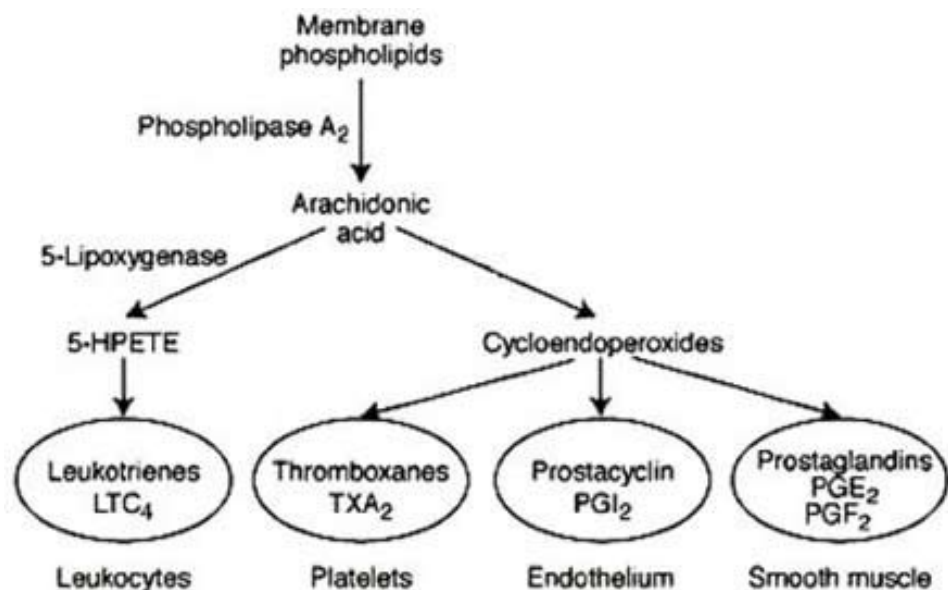




which increases the speed at which the contents move through the intestine and promotes peristalsis. Types of insoluble fiber include wheat bran or cellulose (plant fiber). Soluble fiber also provides bulk to feces but it has other benefits as well. Soluble fiber (such as pectin, Guar gum, Yucca, beet pulp) is highly fermentable which allows the large intestine bacteria to use this as a substrate for making SCFA. It is estimated that SCFA meets approximately 70% of the large intestine cell energy requirement. Specifically the SCFA butyrate has been shown to be anti-inflammatory to intestinal cells. However, dietary butyrate is completely absorbed in the small intestine so supplementing with butyrate is ineffective. The addition of soluble fiber helps in the production of butyrate in the large intestine. In addition, soluble fiber has been shown to protect against pathogenic bacteria colonization of the large intestine. Soluble fiber also increases large intestinal mucosal mass and blood flow which would aid in the repair and maintenance of the intestine. It increases the production of mucin and mucous which provides protection and lubrication for the large intestine. Soluble fiber has been shown to reduce severity of colitis. Furthermore, in normal dogs both the small and large intestine have a population of bacteria. The number of bacteria in the large intestine hugely outweighs the number of bacteria in the small intestine. However, the small intestine normally contains some bacteria. Current research has indicated that dogs with IBD have an altered profile of small intestinal bacteria. This altered profile of bacteria is thought to trigger the immune response that results in chronic inflammation. It is unclear whether the altered profile causes the IBD or is caused by the disease. But either way the lack of a normal intestinal microbial profile may be prevented or corrected by the addition of a blend of soluble and insoluble fiber.

## Omega 3 fat & IBD

It has been well documented by research that a diet high in omega 3 fatty acids can be beneficial in preventing a variety of health conditions. Cell membranes are made up of fat. Depending on the type of fat in our diet we can over time influence the type of fat in our cell's membranes. Most dog diets are very high in omega 6 fats and by comparison have low levels of omega 3 fats. In chronic inflammatory diseases such as IBD cell membranes containing high levels of omega 6 fats break down resulting in an enzyme called phospholipase A producing pro-inflammatory substances in the body (i.e. arachidonic acid, prostaglandin<sub>3</sub>, thromboxane<sub>3</sub>, leukotriene<sub>4</sub>). If Omega 3 fats are substituted with omega 6 the result is less inflammatory products of phospholipase A (i.e. prostaglandin<sub>2</sub>, thromboxane<sub>2</sub> and leukotriene<sub>5</sub>).



Omega 3 and omega 6 fats use the same enzyme pathway and therefore we can influence the amount of inflammation present in the large intestine mucosal cells by altering the ratio of omega 6:omega 3 fats in the diet. The optimal ratio of omega 6: omega 3 in the diet should be



5:1 to 10:1. One of the most effective ways to increase the amount of omega 3 fats is to include fish oil in your dog's diet. Research conducted in humans found that supplementation of fish oil in diet resulted in a reduction in large intestine inflammation. Further research has shown that the addition of fish oil to the diet results in a reduction in severity of IBD by 56%. As with many dietary changes it may take up to 6-8 weeks to see the full effect of the dietary change.

## Other dietary factors & IBD

Recent research conducted in humans has found that diets high in sucrose (table sugar) were positively correlated with the incidence of IBD while diets high in fructose (sugar found in fruit) were negatively correlated with the incidence of IBD. Diets in dogs do not have a lot of highly refined sugar but they also don't have a lot of fruit. Consequently increasing fruit consumption in dogs may be beneficial in reducing the incidence of IBD.

Research conducted in humans found that diets low in fat but contain medium chain fatty acids (from coconut oil) were effective in initiating and maintaining remission of IBD.

As well, vitamin D may play a role. A recent study in humans with IBD concluded: "Vitamin D deficiency may compromise the mucosal barrier, leading to increased susceptibility to mucosal damage and increased risk of IBD."

## Summary

One of the frustrating aspects of IBD is that we really don't know what causes it. So far we have identified 5 possible causes of this disease. The dietary management of IBD cases is complex and the amount of omega 3 fat, total fat and amount and type of fiber may have to be adjusted to optimize the effects of dietary management.



Belgian Malinois "Traveler"

## Testimonial

*I have always been interested in nutrition and I love Hilary's Complete & Balanced cook book because it has so many healthy recipes.*

*My boy Traveler is 6 years old and has had terrible stools ranging from gravy to mashed potato consistency all his life. He had multiple fecal exams and I tried every good grade dog food on the market. Nothing worked. After two days on one of the high fiber recipes in Hilary's book, a miracle happened. I couldn't believe the wonderful stools I was picking up! Besides that, he's crazy about the food and looks so much better after a month of eating it.*

*The book is full of nutritional information and every recipe has a complete listing of vitamin, mineral, protein, fat, calories and fiber, so you know what your dog is getting. HILARY'S BLEND supplement covers any missing elements, especially minerals that the food lacks, making it a complete and balanced meal.*

**Barb Choo**  
Guelph ON



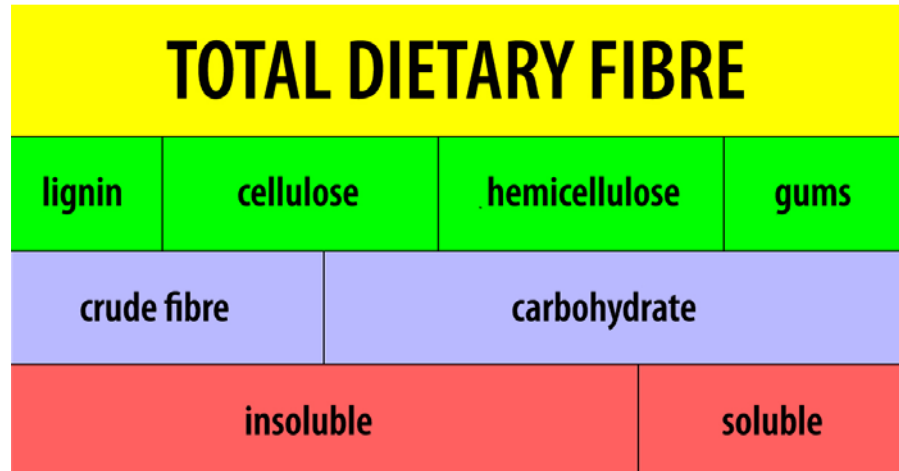
# Dietary & Pre-Biotic Fibre

By Hilary Watson BSc

Fibre is defined as plant material that cannot be digested by the enzymes in the small intestines of a dog. Prebiotics are fibres that provide a beneficial physiological effect on the host by selectively stimulating the growth or activity of beneficial bacteria.

## Dietary Fibre

The chart below illustrates 3 different ways of defining total dietary fibre (yellow): by its constituents (green), by crude fibre analysis (blue) or by its solubility in water (pink).



Note that a diet's total dietary fibre, as shown at the very top of this chart, is composed of lignin, cellulose, hemicellulose, gums and pectin. A diet's "crude fibre" is comprised only of lignin and part of the cellulose of that diet. In other words, a diet's "crude fibre" greatly underestimates its total dietary fibre. A diet's true fibre content may be more than ten times greater than its crude fibre content. This is particularly true if the diet contains high levels of soluble fibre.

Ingredients such as guar and vegetable gums contain relatively high levels of soluble fibre. Cellulose (wood pulp), peanut hulls and rice hulls are largely insoluble fibre. Cereal brans (wheat bran, oat bran etc) and vegetable fibre (ie pea fibre) contain a mixture of both types of fibre. The distinction between soluble and insoluble fibre is an important one. These two types of fibre behave quite differently in the digestive tract.

Soluble fibres make viscous gels when they mix with the digestive secretions in the intestinal tract. Pectin is an example of a soluble fibre. Pectin is used in making jams and jellies. It is the gel forming properties of this fibre that give jams and preserves their characteristic jelly texture. Insoluble fibres on the other hand, do not mix or interact with water and do not form gels. Insoluble fibre is relatively inert in the digestive tract but it does add bulk to the feces.

Dietary fibre, particularly soluble fibre, is said to "modulate the glycemic response". Fibre alters the viscosity of the stomach contents which in turn affects the rate at which food components leave the stomach and enter the small intestines. As well, a viscous nature of this mixture inhibits contact between the food and the enzymes in the digestive tract. In this way, fibre slows the digestion of the diet, allowing for a more gradual release of nutrients into the blood stream. An appropriate combination of both soluble and insoluble fibre slow the absorption of nutrients, spreading the rise in blood glucose and the secretion of insulin over a longer period of time. This results in a more efficient uptake of nutrients by body tissues and in many cases, lowers the dog's insulin requirements. This is why high fibre diets are recommended for diabetic dogs.

The same gel forming properties of soluble fibre which make high fibre diets suitable for diabetic dogs, make them unsuitable for dogs with impaired digestive capacity. High fibre diets should never be fed to dogs with pancreatic insufficiency, malabsorption syndrome or any disease which interferes with nutrient digestion in the small intestines. In dogs with these conditions, fibre will further interfere with the digestive and absorptive processes and exacerbate the dog's condition.

There is another important distinction between soluble and insoluble fibres and that relates to their potential to act as substrates for microbial fermentation. Since fibre cannot be digested by the enzymes of the small intestines, it is carried into the large intestines where large populations of microbes reside. Soluble fibre provides an excellent source of fuel for these microbes.

## The Role of Bacteria in the Digestive Tract

Because we can't see bacteria, we tend to underestimate their importance in our lives. To put things in perspective, your body is composed of about 10 quadrillion cells, but is host to about 100 quadrillion bacterial cells. (A quadrillion is 1,000,000,000,000,000). About a trillion bacteria live on your skin – more than 100,000 for every square centimeter of surface area. Your digestive tract is home to more than 100 trillion bacteria, representing over 400 different species.

The acidic conditions of the stomach and the digestive secretions in the small intestine create unfavorable environments for most types of bacteria. Bacterial concentrations are therefore low in these early segments of the digestive tract but their numbers increase towards the lower end of the small intestine. Microbial populations are very high in the dog's colon.

The microbes in the colon have a very important function. They complete the digestion process, breaking down nutrients that were not digested and absorbed in the dog's small intestine. All dietary fibre bypasses digestion in the upper gastrointestinal tract and is therefore available for fermentation by bacteria in the colon. Although high quality proteins, fats and digestible carbohydrates are generally broken down and absorbed in the small intestine, there may be times when impairment of the digestive or absorptive processes allows these nutrients to pass unabsorbed into the colon. Poor quality diets may also contain nutrients which cannot be digested or absorbed in the dog's small intestines. Bacterial fermentation of undigested protein leads to the production of several odoriferous intestinal gases: indole, skatole, volatile amines, hydrogen sulfide and ammonia.

## Good Versus Bad Bacteria

The bacteria in the gut can be helpful, harmful or neutral.

Some of the harmful species are likely familiar to you. Seven people died and more than a thousand were taken ill when the drinking water in Walkerton, Ontario became contaminated with *Escherichia coli* in 2000. The botulism toxins produced by *Clostridium botulinum* are among the most poisonous natural substances known to man. Other Clostridial species, including *Clostridium perfringens* and *Clostridium difficile*, cause severe diarrhea, intestinal cramps and colitis. "Salmonella poisoning" is a term well understood by most people. Many different species of Salmonella can cause food poisoning. However the most common bacterial cause of food poisoning in humans is *Campylobacter* spp. These are the most common species of "bad" bacteria.

On the list of "good" bacteria are *Bifidobacteria*, *Lactobacillus acidophilus* and other *Lactobacilli* strains. These bacteria exert many beneficial effects on health, both by their direct interaction with the cells lining the intestinal tract, as well as by producing beneficial products through metabolism. For example, when these bacteria digest dietary fibre, they produce short chain fatty acids which are crucial to gut integrity, immune function and mineral absorption. These short chain fatty acids are a primary source of nutrition for the cells lining the dog's colon.





## Prebiotics – Foods that Preferentially Promote “Good” Bacteria

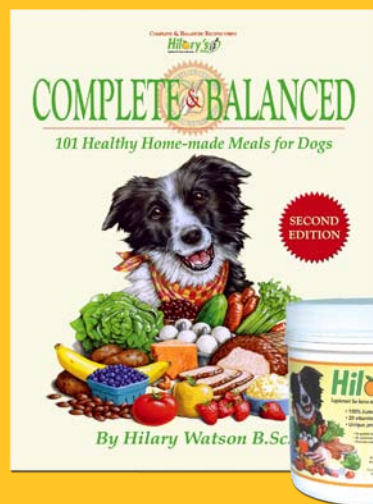
Prebiotics are foods that promote the growth of healthy bacteria in the gut, at the expense of harmful bacteria. There are three major types of prebiotics: fructo-oligosaccharides (FOS), inulin and oligofructose. Fructo-oligosaccharide literally means small (oligo) sugar (saccharide) that contains fructose (fructo). FOS is commercially produced from the natural fermentation of sugar cane. Inulin is a second type of prebiotic. (Note: inulin should not be confused with the hormone insulin). Inulin is found naturally in foods such as chicory root, garlic and onions. Garlic and onions are not recommended for dogs (they can cause anaemia). However chicory root is a safe prebiotic for dogs. Oligofructose is a third type of prebiotic which is derived from the enzymatic breakdown of inulin. It is not commonly used in pet foods.

Studies show that both FOS and inulin support the growth of a wide variety of Bifidobacteria and Lactobacilli strains but do not support the growth of harmful bacteria. By providing a substrate that only healthy bacteria can use, prebiotics allow good bacteria to thrive, crowding out the bad species. This is known as competitive exclusion.

Furthermore, the bacterial fermentation of prebiotics leads to the production of short chain fatty acids: acetic, butyric and propionic acids. Butyric acid can be used as a fuel by the cells of the colon and is thought to promote the integrity of the colon's mucosal lining. In this way, butyric acid may be beneficial to dogs with colitis and inflammatory bowel disease. Acetic and propionic acids are absorbed into the blood and can be used for energy. The presence of these acids in the colon lowers the pH inside the colon which makes the gut more unfavorable to harmful bacteria.

The first ingredient in HILARY'S BLEND™ supplement for home-made meals is chicory root extract. This high quality extract promotes the growth of good bacteria at the expense of harmful bacteria. Dogs eating the recipes in the *Complete & Balanced* cookbook will get a healthy dose of prebiotic fibre with every meal. Chicory root feeds intestinal cells, strengthens the gut barrier and protects the dog from harmful bacteria. Chicory root extract is the exclusive carrier in this supplement (all other ingredients are vitamins or minerals).

## Dogs in Canada Contest!



***Dogs in Canada magazine is running a contest this month in which 2 owners will win a free copy of my Complete & Balanced cookbook plus a 350g jar of HILARY'S BLEND supplement (value \$65).***

***To enter click the link below:  
<http://www.dogsincanada.com/hilary-watson-contest>***

***Contest closes May 31, 2010.***

Each month, we'll review one nutrition research study published within the last 2 months. These reviews won't be limited to canine nutrition. We may review human, equine, livestock and zoo animal nutrition research if we find it interesting and relevant. The common denominator is that each study will be recently published in a peer-reviewed scientific journal and they will all provide new insight into some concept of nutrition.

# Research Study of the Month

By Laura Scott MSc

**Title of study:** *Fiber-related digestive processes in three different breeds of pigs*

**Authors:** *E. von Heimendahl, G. Breves and Hj. Abel*

**Journal:** *Journal of Animal Science*

**Issue:** *Volume 88, Number 3, pages 972-981, March 2010*

**Species:** *Pigs*

**Link:** <http://jas.fass.org/cgi/content/full/88/3/972>

## Background information

Dietary fibre comes from the indigestible parts of plants and has two main components; soluble and insoluble fibre. Soluble fibre is fermented (digested) in the large intestine and produces volatile fatty acids which can be used for energy. Insoluble fibre helps to increase the bulk of the material moving through the gastrointestinal tract, softens feces and can shorten intestinal tract transit time.

Fibre is an important component of diets for pigs. The digestibility of fibre is dependent on many factors, including; the level of feeding, fibre source, age of the animals, and individual adaptation to the source. Digestibility can vary between 0 and 97 percent. Fibre can also have an effect on the digestibility of nutrients. The majority of fibre digestion occurs in the large intestine, however the energy derived from this is used less efficiently than energy from digestion in the small intestine.

## Purpose of this study and study design

Modern breeds of pigs have been selected to have greater daily body weight gain and feed efficiency and the authors hypothesize that they may have lost the ability to adapt to high fibre diets. Previous studies have shown that there is a significant interaction between diet and genotype with regards to nutrient digestibility. The authors also hypothesize that older breeds of pig that traditionally consume less concentrated feeds will show differences in efficiency of fibre utilization when compared to modern cross breeds.

The study used three different breeds of pigs, two local German breeds (Schwaebisch Haellisches Landschwein (SH) and Buntess Bentheimer (BB)) and a modern crossbreed (German Landrace x Large White). Growing pigs were adapted to the experimental diet and then housed individually in metabolism crates. Sugar beet pulp was used as the source of fibre in the experimental diet and pigs were analyzed for performance, anatomy, digestibility and microbial hindgut fermentation.

## Study results

Pigs consumed more of the test diet (with sugar beet pulp) than the control diet and subsequently had greater body weight gains. The test diet resulted in lower digestibility of organic matter, crude protein and ether extract, and increased NDF and ADF digestibility. The nitrogen balances showed increased fecal nitrogen excretion with the test diet.

There were no interactions between pig breeds or diets in intestinal morphology and digestive function. However, the test diet did result in reduced total intestinal length and increased colon length. The SH pigs did have significant differences from the other two breeds with regards to body weight gain, NDF digestion, nitrogen retention, feed intake, cecum and colon lengths. The SH pigs appear to have a smaller capacity for microbial hindgut fermentation which causes reduced fibre digestion. Overall, there were no differences in efficiency of fibre utilization between the old pig breeds and the modern pig breed.





## My thoughts

Fibre is often neglected when evaluating the diets for dogs. Fibre does play an important role in ensuring good movement through the gut and quality of feces. Growing pigs adapted to a higher fibre diet with changes in their gut morphology and it can be assumed that similar results would be seen in dogs, although it is important to note that these results were only seen in growing pigs, and not in adult animals. The lack of difference in fibre utilization between old pig breeds and the new cross breeds that have been intensively selected for performance on concentrated diets is very interesting and indicates that if the diet is altered in young animals the gut is able to adequately adapt for optimal utilization of the nutrients. Pet nutritionists can ensure that the diet formulated for your dog contains adequate fibre.

# Ask the Pet Nutritionist

Do you have a question that you'd like to see answered in this newsletter?  
Submit your question to [hwatson@completeandbalanced.com](mailto:hwatson@completeandbalanced.com)

## Coming Next Month

- Calcium/phosphorus balance for growing puppies
- Calcium/phosphorus balance for dogs with renal disease
- Vitamin D and hyperparathyroidism in dogs with renal disease

## Did You Miss Previous Issues?

April 2010

Link: <http://www.completeandbalanced.com/Complete & Balanced Canine Nutrition Newsletter Apr 2010.pdf>

- Food allergies in dogs.
- Limited antigen recipes for the management of atopy (inhalant allergies) in dogs
- Limited antigen recipes for the diagnosis and management of food allergies in dogs
- Limited antigen recipes for the management of gastroenteritis in dogs
- Animal models for protein allergenicity

March 2010

Link: <http://www.completeandbalanced.com/Complete & Balanced Canine Nutrition Newsletter Mar 2010.pdf>

- Nutritional Management of Cachexia in Dogs with Kidney Disease
- Nutritional Management of Cachexia in Dogs with Cancer
- Successful Nutritional Management of Canine Lymphoma - A Case Report
- Strengthening the Skin Barrier with B-Vitamins

February 2010

Link: <http://www.completeandbalanced.com/Complete & Balanced Canine Nutrition Newsletter Feb 2010.pdf>

- Hypoglycemia in Agility Dogs
- Carbohydrate: Structure, Metabolism, Function
- Your Hypothyroid Dog may be Iodine Deficient



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