Canine Nutrition NEWSLETTER

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In this Issue

The "hypoglycemic effect of fat and protein" is a well documented phenomenon in nutrition. When a dog eats a meal that is predominantly fat and protein, blood glucose levels drop rather than rising as per the standard glucose curve. Dogs that perform intense physical activity during the dip in blood glucose are at risk of becoming hypoglycemic. Because raw starch is indigestible to dogs, all-raw diets derive almost all of their calories from fat and protein. These diets will therefore induce the "hypoglycemic effect". Dogs that compete in events that involve multiple intense heats of short-duration should be fed meals that provide some calories from digestible carbohydrate. For more information see:

Two of the most important molecules in your dog's body, glucose and glycogen, are carbohydrates. Glucose is the preferred fuel of the cells in a dog's body, including brain cells. Glycogen is the emergency fuel used to power muscles when adrenaline is pumping (fight, fright, flight). Glycogen is similar in structure to plant starch and starch, like glycogen, provides readily available energy to dogs. For more information, see:

Iodine is converted into thyroid hormone in the dog's thyroid gland. The symptoms of iodine deficiency therefore mimic those of hypothyroidism. AAFCO and NRC have defined minimum requirements for iodine in dogs. Foods that have an AAFCO claim on the packaging are providing sufficient iodine to support normal thyroid function. Foods that do not have an AAFCO claim on the packaging may not be providing sufficient iodine to meet a dog's needs. Assessing iodine intake is an important part of the diagnostic work-up for any dog that tests positive for hypothyroidism. For more information, see:

In humans, folate deficiency during pregnancy has been shown to cause brain and spinal cord defects in the fetus. In the late 1990s, in order to reduce the incidence of birth defects in children, the governments in both Canada and the US instituted a national mandatory cereal folate-fortification program. This program mandated that 140 ug of folic acid be added to every 100g of all cereal grains sold in North America. Despite significant improvements in folate status as a result of this program, a January 2010 study shows that 15-20% of reproductive-age women in America are still folate-deficient. For more information, see:

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Hypoglycemia in Agility Dogs

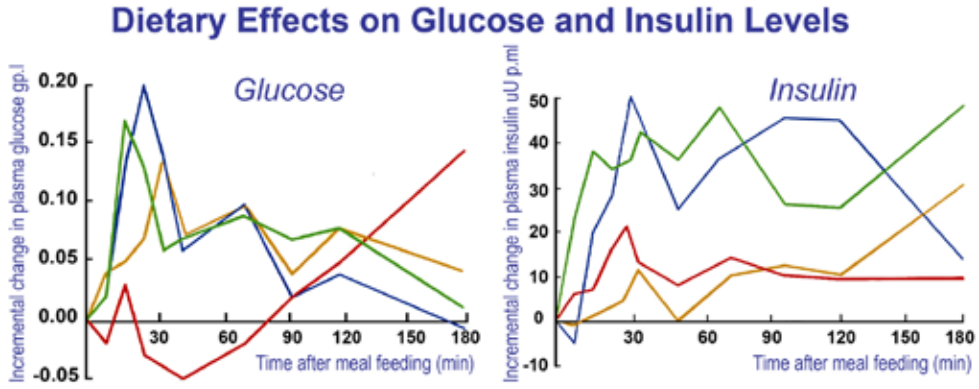
By Hilary Watson BSc

Sports nutrition should support your working dog and enhance his performance. A meal that leaves a competing athlete hypoglycemic is not an appropriate choice for that athlete. For reasons that this article will explain, working dogs fed all-raw are at higher risk of developing hypoglycemia.

After your dog eats a meal his blood glucose level rises. The pancreas produces the hormone insulin in response to the meal, so your dog's blood insulin level also rises after he eats. Insulin's job is to move glucose from the blood into your dog's cells and tissues where it can be burned for energy. Once the glucose has been moved into the cells, blood glucose drops and so does blood insulin.

Glucose and insulin curves depend on the type of meal the dog eats. The charts below are from a study in dogs (Nguyen, 1994). At time=0, a group of dogs is fed one of 4 foods. Blood samples are taken at 5, 10, 15, 20, 30, 45, 60, 90, 120 and 180 minutes after the meal is finished. The blood samples are analyzed for glucose and insulin. The glucose levels are plotted on the left-hand chart and the insulin values are plotted on the right-hand chart. Days later, the same group of dogs is fed the second of the 4 foods, and the blood is sampled again. This is repeated 4 times until all 4 foods have been fed and their glucose and insulin curves have been plotted.

You'll notice that three of the glucose curves (green, blue and yellow) are reasonably similar, whereas the red curve is quite different. To understand what is going on, it's necessary to look at the composition of these four foods.



	PROTEIN	FAT	FIBRE	CHO	PROT.CAL	FAT.CAL	CHO.CAL
FOOD G	29.0	12.7	3.3	48.4	27	28	45
FOOD B	33.0	8.2	2.1	47.1	33	20	47
FOOD Y	35.5	12.2	10.8	35.2	36	29	35
FOOD R	41.1	25.7	2.4	15.5	35	52	13

The composition of the four foods is listed under the graphs. The first four columns give each food's "protein", "fat", "fibre" and carbohydrate "(CHO)" contents as percentages on a dry matter basis. In other words, the Green food is 29.0% protein, 12.7% fat, 3.3% fibre and 48.4% carbohydrate (CHO), all on a dry matter basis.

The last three columns indicate where the food's calories are coming from: the percentage of calories coming from protein, fat and carbohydrate. For example, Green food has 27% of its calories coming from protein, 28% of its calories coming from fat and 45% of its calories coming from carbohydrate.

Knowing the composition of these four diets, we can now look at their glucose and insulin curves. Blue and Green are very similar - they both result in fairly quick and large glucose and insulin responses. Blue spikes a little higher than Green. This is because Blue has more calories coming from carbohydrate (47 versus 45) and protein (33 versus 27), whereas Green has more calories coming from fat (28 versus 20). These differences are not huge, and neither are the differences in their glucose and insulin responses. Both these foods are consistent with typical dry kibble. Dry kibble typically has 35-50% of calories coming from carbohydrate.

Yellow's glucose spike is lower and delayed (the peak is later than Green and Blue). What is most noteworthy about Yellow is its insulin curve (graph on the right). Yellow diet has a "moderated glycemic response". This is due to its increased fibre content. Column 3 lists the fibre content of all four diets. Yellow contains 10.8% fibre, 3-5 times more than the other three foods. Fibre slows the absorption of glucose from the digestive tract which moderates the glycemic response and significantly lowers the dog's insulin requirements. This is why high fibre diets are recommended for dogs with diabetes.

Finally, Red. Red food is composed largely of protein and fat with 35% of calories coming from protein and 52% of calories coming from fat. Red food has only 13% of calories coming from carbohydrate. This composition is typical of all-raw dog foods. Because raw starch is indigestible to dogs, all-raw foods contain very little starch. Fresh fruits and vegetables contribute water and fibre but they do not contribute much starch and they contribute very few calories. (Think of the few calories in low-starch foods like broccoli or carrots as compared to the high calories in starchy foods like pasta or rice). Even if a raw food contains a significant amount of fruits and vegetables, it will still be getting less than 15% of its calories from carbohydrate.

Notice the very distinctive inverted glucose response when dogs are fed a low carbohydrate food. That inverted Red glucose curve is what nutritionists refer to as "the hypoglycemic effect of fat and protein". The latest issue of the *American Journal of Clinical Nutrition* has a research paper titled "The hypoglycemic effect of fat and protein is not attenuated by insulin resistance." I mention this study to make the point that "the hypoglycemic effect of fat and protein" is a well-documented and well-known phenomenon in nutrition. When a food has less than 15% of calories coming from carbohydrates, insulin is produced in response to the meal (see right graph). That insulin moves the glucose from the blood into the dog's cells, however with a low starch meal there is very little glucose in the food to replace the glucose that has moved into the cells and tissues. The level of glucose in the blood drops and only rises again much later, after the dog's body has had time to convert the food's protein and fat into glucose.

If you run your high-drive agility dog 20-90 minutes after feeding an all-raw food, you are asking your dog to work through that glucose dip. Not only are you making him feel crummy, you are asking him to perform when he has little fuel in his blood. Stop for a moment and imagine this: imagine eating half your daily calorie allotment (say 1000 calories) as cheeseburgers (without the buns). Now imagine waiting 30 minutes then running a 90 second sprint. You would not feel great and you would not run your best time. Your dog won't do any better if he's fed the same way. That translates in the ring to lost focus, missed cues, knocked bars, and in severe cases, your dog may start hallucinating right before he drops dead.

What's the solution? There are 3 options.

First, you can choose to feed your all-raw food at least 90 minutes before you work your dog. This will give your dog's body time to convert the protein and fat in the food into glucose which the dog can use to fuel his muscles. Does your dog typically do better on later runs and not so well on the first runs of the day? Your first runs will go much better if they occur after your dog has had time to work through the glucose dip.

Second, you can feed starchy foods like cookies or treats in association with your all-raw food. What you're doing in this case is trying to overlay a Blue/Green curve on top of the Red one, in hopes of offsetting the Red effects. While this generally will work, it plays havoc with insulin production and may cause wide fluctuations in blood glucose and insulin concentrations. Your dog will feel crummy, and his performance may be inconsistent.

Third, and this is my personal recommendation, feed your working dog starch! Usain Bolt runs on pasta. Michael Phelps swims on pasta. Lance Armstrong pedals on pasta. Basketball players, football players, hockey players, track-and-field competitors, swimmers, bikers - human sprinting athletes, especially those performing multiple short heats, run best on digestible carbohydrates. I realize that this may contradict what you've heard elsewhere, but your agility dog runs best on starch too! The graphs above show why that's true.

Many owners like to think of their dogs as carnivores. Many pet food companies encourage that way of thinking. It's romantic and appealing but in fact, dogs are not carnivores. If dogs were carnivores, they would die if fed a strict vegetarian diet. Just like humans, dogs can do perfectly well on a properly-balanced vegetarian diet. Dogs are far closer to humans in terms of their digestive physiology, biochemistry, metabolism and nutritional needs than they are to cats who are true carnivores. Dogs are omnivores. Their digestive physiology is well suited for digesting starch. If dogs did not digest starch extremely well, there would be far fewer overweight dogs.

The most common objection I hear to feeding starch to a dog is that dogs didn't evolve eating cereal grains. While this is true, it's also true of humans. Humans started out as hunter-gathers and originally had a diet of fruits, berries and whatever prey they could kill. Humans developed cereals crops to give themselves a safer

and more predictable food supply. Wheat was the very first crop developed by man in the Fertile Crescent (Middle East) around 8500 BC; rice was the first crop developed in Asia in around 7500 BC; and corn was the first crop developed in Central America in around 3500 BC. It was the cultivation of cereal crops that allowed humans to transition from nomadic hunter-gatherers to stable, organized civilizations. Those cereals weren't just used to feed humans. They also sustained livestock and dogs. Dogs have been eating cereal grains for as long as humans have. Cereals still make up a significant proportion of the diet of most humans and dogs around the world.

Canine sprinting athletes, like their human counterparts, run best on digestible starch. So, what would that meal look like? Here's a recipe from my cookbook that derives calories evenly from protein, fat and carbohydrate.

INGREDIENTS		
APPROX.	INGREDIENT	GRAMS
425 g raw	Beef, ground, cooked	320
1 cup	Broccoli, raw, chopped	91
1 tsp	Cod liver oil	5
½ cup	Peas, thawed from frozen	72
1 tsp	Safflower oil	5
2 cups	Spaghetti, cooked	280
1 leaf	Spinach, raw	10
½ cup	Tomatoes, cherry, raw	75
½ cup	Tomato sauce, canned	122
2 scoops	HILARY'S BLEND™ supplement	20
	Total	1000

Wow - is that really two cups of cooked spaghetti? Yep! Look at the pie at left - calories are evenly split between P (protein), F (fat) and C (carbohydrate). This recipe contains all essential nutrients required by dogs (as defined by NRC and AAFCO), is full of anti-oxidants and yet delivers the proper balance of protein, fat and carbohydrate to enhance rather than inhibit athletic performance.

Here's my personal guarantee - no agility dog will ever become hypoglycemic eating this recipe, no matter how hard he is worked. This is nutrition that will enhance rather than inhibit your dog's athletic performance.

"Crouton" at 16 months

Testimonial

When I got my French bulldog puppy, Crouton, I wanted to feed him a home-prepared diet right from the start. As a veterinary technician of 20 years, I know that when preparing a homemade diet, it's important to provide complete and balanced nutrition. Knowing how critical the initial growth period is and how important it is to get the calcium-to-phosphorus ratio right, I started Crouton on Hilary's Puppy Recipes and HILARY'S BLEND supplement when he was 9 weeks old. Now at 16 months, Crouton is a happy, healthy adult who is enjoying Hilary's Adult recipes. Crouton loves his food and I love knowing exactly what he is eating and that his meals are providing him with complete and balanced nutrition.

Julie Putman-Snider

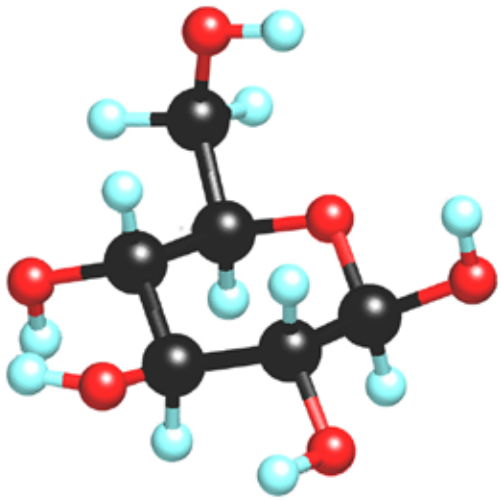
Carbohydrate: Structure, Metabolism, Function.

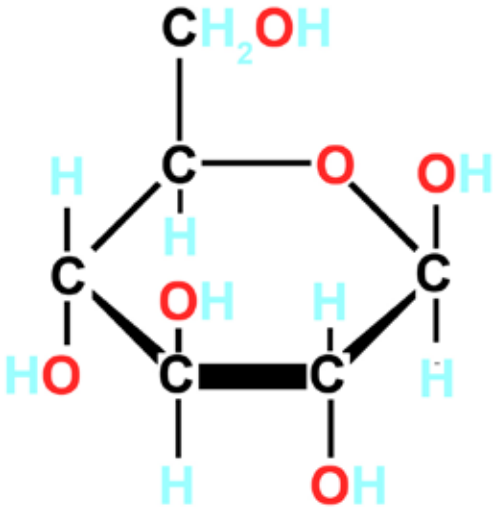
By Hilary Watson BSc

Carbohydrate Structure

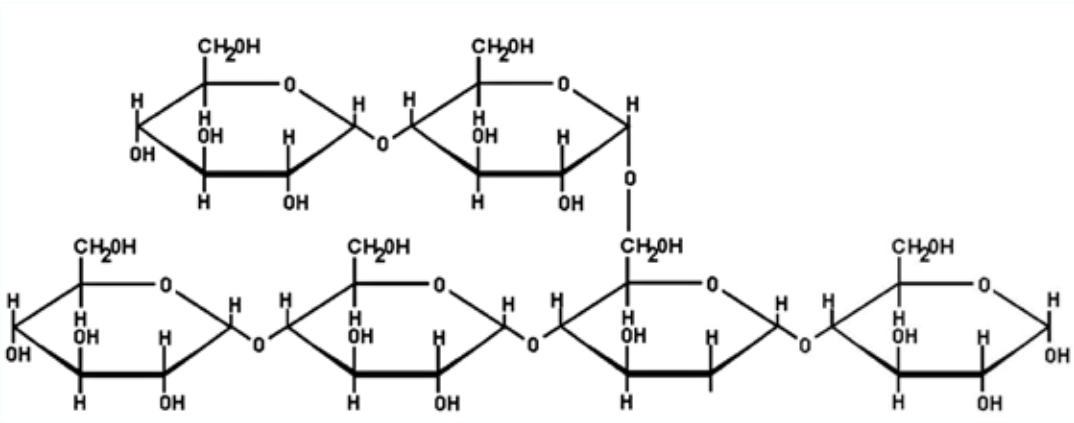
The word carbohydrate is a contraction of the words "carbon" and "hydrate" (ie "hydration"). By definition, carbohydrates contain carbon, hydrogen and oxygen in the ratio of one carbon (C) for every "hydrate" (H2O).

The simplest form of carbohydrate is called a "monosaccharide". One of the most important molecules in your dog's body is the monosaccharide glucose. Glucose is the major fuel for your dog's cells, including brain cells. Hypoglycemia, ie a drop in blood glucose concentration, causes serious neurological symptoms (dizziness, hallucination, collapse and death if unresolved). Glucose is a carbohydrate with 6 "hydrates of carbon" (ie 6 x CH2O) arranged in a ring, as show in the images below.





Stringing together glucose units gives you a "polysaccharide" as shown below.



The only polysaccharide in a dog's body is called glycogen. In the image of glycogen to the left, each black dot is a molecule of glucose. When glycogen is broken down, individual glucose units are released. The high degree of branching is significant – it provides numerous free "ends" from which glucose units can be released. Glycogen is stored in various tissues (primarily muscle and liver) and is used to fuel intense, short bursts of energy. It serves as a readily available emergency energy supply (fright – flight – fight) and is typically exhausted quickly, typically within the first 5-10 minutes of intense activity.

The image on the left is of plant starch. Again, each black dot is a molecule of glucose. The main difference between plant starch and animal glycogen is that plant starch has straighter chains of glucose and not as many free "ends". But the bonds that link the glucose units together in starch are identical to those linking glucose units together in glycogen. Similarly, the enzymes that break down starch into glucose in the digestive tract are identical to the enzymes that break down glycogen into glucose in the dog's body. To the cells and tissues in a dog's body, the glucose units originating from glycogen breakdown are 100% identical to the glucose units originating from starch digestion.

Carbohydrates in plants			
Classification	# of monosaccharide units	subcategories	examples
Monosaccharides	one		Glucose
Oligosaccharides	two - ten	Disaccharides	Table sugar (sucrose), milk sugar (lactose)
		Fructose-containing	Fructo-oligosaccharides (pre-biotic fibre)
Polysaccharides	Over 10, typically 100s to 1000s	Digestible	Starch
		Non-digestible	Fibre

Carbohydrates in a dog's body			
Classification	# of monosaccharide units	Example	Importance
Monosaccharides	one	Glucose	Primary fuel for all cells
Oligosaccharides	two	Lactose	Carbohydrate in milk, major source of energy for newborns
Polysaccharides	100s to 1000s	Glycogen	The only carbohydrate stored in body tissues (liver and muscle)

Carbohydrate Function

Carbohydrate is not an essential nutrient for dogs. The sole function of dietary carbohydrate is to provide the dog with energy. Digestible carbohydrate supplies 3.5 kcal of metabolizable energy (ME) for every gram consumed by the dog. This is similar to the ME in protein (protein also supplies 3.5 kcal of ME per gram), but because carbohydrate metabolism produces no waste products, carbohydrate delivers 30% more net energy (NE) than protein (3.2 kcal NE per gram of carbohydrate versus 2.2 kcal NE per gram of protein). Net energy is energy that is available to the dog to do work.

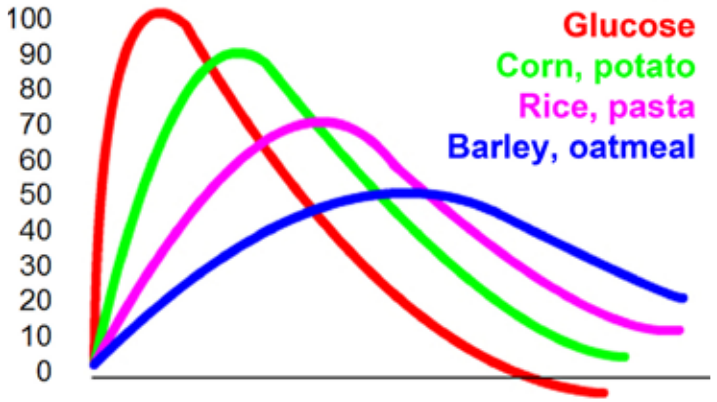
Since carbohydrate is used exclusively for energy, its quality is defined by how easily it is broken down and converted to energy in the dog's body. This in turn is dependent on the carbohydrate's digestibility and the absence of anti-nutritional factors such as molds and mycotoxins.

Carbohydrate Digestion – "Glycemic Index"

Carbohydrate digestibility refers to how easily the starch is broken down into glucose units by enzymes in the digestive tract. Traditional digestibility trials determine digestibility by measuring the level of a nutrient in the food and the level of the nutrient in the stool and calculating digestibility by subtraction (ie the amount of a nutrient that was present in the food but not in the stool represents the amount of that nutrient that was absorbed into the dog's body). For carbohydrate, this type of measurement is not useful. Large amounts of carbohydrate can escape digestion in the dog's small intestines, but can then be fermented by bacteria in the colon, in which case it doesn't appear in the stool.

A more useful way of assessing carbohydrate utilization is by measuring glycemic index. Glycemic index measures how quickly glucose appears in a dog's blood after the dog eats a specific quantity of digestible carbohydrate (starch). A group of fasting subjects are fed a specific amount of pure glucose, then a series of blood samples are taken at specific time intervals. Blood glucose concentration is measured for each blood sample and plotted against time. Then on subsequent days, the same fasting subjects are fed the same amount of a test starch. Blood samples are again taken on the same time schedule. The peak blood glucose concentration is given a value of 100 and all other blood glucose values are converted to percentages of this peak value. In this way, other starches are always compared to the glycemic curve of pure glucose. If a starch is found to have a glycemic index of 90, that means that its peak blood glucose value was 90% the peak blood glucose value after eating pure glucose.

When different starches are consumed by a dog, the appearance of glucose in the dog's blood will roughly follow the curves on the right.



Blood glucose concentrations after feeding different starches, as a percentage of blood glucose concentration after feeding pure glucose

These are broad strokes. There are many subtlies not shown in this graph. For example, baked potatoes have a glycemic index around 85, but mashed potatoes have a glycemic index of 100 (eating mashed potatoes is like eating pure glucose!). White rice has a higher glycemic index than brown rice, and instant (parboiled) rice is higher than white rice. Boiling spaghetti for 7 minutes lowers its glycemic index by almost 10% versus boiling for 5 minutes. All of which is to say that these are not exact values but rather are generalizations.

Note that the above graph doesn't show any fruits or vegetables. The glycemic indices of fruits and vegetables are equally variable. For example, watermelons have a glycemic index over 70, whereas the glycemic indices of bananas and carrots are around 50, of apples and pears around 40, of beans and chickpeas around 30, of broccoli and alfalfa sprouts around 15.

But there is another more significant difference between cereals and fruits/vegetables: their moisture

content. All of the cereals are relatively low in moisture, and their starch contents are significantly higher as a result. This brings us to another term: "glycemic load". Glycemic load equals the grams of carbohydrate in a food multiplied by the food's glycemic index. The glycemic load of fruits and vegetables is low due to their high moisture, low starch content. For example, even though the glycemic index of carrots is around 50, the glycemic load of a serving of carrots is only 3. This is because a serving of carrots contains a lot of water. Long grain brown rice has a glycemic index similar to carrots, but because of the high starch content of rice, a serving of rice has a glycemic load more than 6 times higher than carrots. Although fruits and vegetables offer many, many health benefits, they are not good sources of digestible starch nor do they provide significant energy for work.

Starches do need to be cooked for them to be digestible. You wouldn't eat raw rice or raw spaghetti and neither should your dog. However, cooked starch is virtually 100% digestible to your dog and like the glycogen stored in your dog's muscles, it provides an excellent source of available energy especially for dogs doing work that involves short bursts of intense activity.

Digestible Carbohydrates – Practical Applications

If you have a dog with impaired digestive function (pancreatic insufficiency, gastrointestinal disease, malabsorption syndrome, inflammation due to food allergies etc), starches with high glycemic index will be easier for the dog to digest. For dogs with big appetites who tend to gain weight, low glycemic index starches are better because they are digested more slowly and leave a dog (or human!) feeling satiated longer. Diabetic dogs benefit from low glycemic index foods as well because these foods moderate the glycemic curve and lower insulin requirements. For canine athletes, a combination of high and low glycemic index starches is best, especially for dogs competing in events that entail repeated heats of relatively short intense activity.

2 year old Kuvasz-cross "Bear" with 1 1/2 year old German Shepherd-cross "Spencer"

3 year old Lab/Greyhound-cross "Ziggy", with 3 year old Border Collie "Anky"

Testimonial

I decided to feed my four dogs HILARY'S BLEND supplement with the Complete & Balanced recipes after starting to learn more about nutrition in university. I had been feeding a home cooked food developed by another company for a couple of years, but realized I might not be meeting all of my dogs' nutritional needs. Having a few dogs means affordability is also important. I find HILARY'S BLEND supplement and recipes to be comparable or better in terms of expense compared to other high quality feeds. My dogs love the recipes, their coats are shiny, and their weights are stable. They have enough energy to compete in disc dog competitions and skijor for fun in the winter. I am very happy feeding HILARY'S BLEND supplement and Hilary's Complete & Balanced recipes.

Denise Lukacs

Your Hypothyroid Dog May be Iodine Deficient

By Elizabeth Pask, PhD (candidate)

Iodine is a micronutrient required for normal function of the thyroid gland. It is an element that is naturally found in the soil and water. However in parts of North America the soil has low levels of iodine. Crops grown on this soil will have low levels of iodine. To prevent iodine deficiency in humans, table salt has been "iodized" for many years. Regular salt is sodium chloride. Table salt sold for human consumption has iodine added to it, making it sodium iodide. This has reduced the incidence of iodine deficiency in humans to about 6% of the North American population. The incidence of iodine deficiency in dogs is unknown.

For more than 30 years, commercial dry and canned dog foods have been fortified with added iodine thus eliminating the risk of iodine deficiency in dogs. The US Department of Agriculture's Association of American Feed Control Official (AAFCO) requires that any American dog food sold as "complete and balanced" for dogs must contain at least 1.5 mg of iodine per kilogram (dry matter basis). In Canada, there is no government equivalent to AAFCO. However, companies that are members of the Pet Food Association of Canada (PFAC) voluntarily agree to adhere to AAFCO guidelines. Not all Canadian pet food companies are members of the PFAC nor do all pet food companies in Canada follow AAFCO guidelines.

Pet foods that have not been fortified with iodine may be iodine deficient. Many natural pet food companies rely on the vitamins and minerals contained in the ingredients of their food and do not fortify with extra vitamins and minerals. Often these pet foods are not tested to insure sufficient amounts of iodine are present. Many home-made diets are not properly formulated to provide complete and balanced nutrition and do not include sufficient sources of iodine. Long term feeding of these recipes will result in iodine deficiency which typically manifests as hypothyroidism. There is some suggestion that the incidence of hypothyroidism in dogs is increasing. The possibility that this may in part be due to an increased incidence of iodine deficiency has understandably caused concern amongst dog nutrition specialists and veterinarians alike.

Sources of Iodine

Sources of iodine (listed in order of iodine level) include: kelp, salt water sea food, sunflower seeds, mushrooms, eggs, beef, liver, peanuts, spinach, pumpkin, and broccoli. With the exception of kelp, these foods are not very concentrated sources of iodine, hence the decision by human health officials to add iodine to table salt. As well, some foods contain a naturally occurring compound called Goitrin. Goitrin interferes with iodide metabolism thus reducing the amount of iodide that is can be taken up by the thyroid. Goitrin is present in cabbage, kale, cauliflower, broccoli, rutabaga, turnips and brussel sprouts. Feeding excessive amounts of these foods could induce iodine deficiency even if there appears to be enough iodine in the food.

Iodine Metabolism & Thyroid Function

Iodine in the food is converted into iodide in the digestive tract, which is readily absorbed across the surface of the stomach, small intestine and large intestine. Once in the blood stream, iodide is distributed throughout the entire body. The thyroid gland actively takes up about 80% of the body's iodide. The remaining iodide can be found in salivary and gastric glands and to a lesser extent in the mammary gland, ovaries, placenta and skin.

The thyroid gland is located at the base of the neck. In the thyroid gland, iodide is incorporated into two different forms of thyroid hormone: thyroxine (T4) and tri-iodothyronine (T3). Thyroid hormones have a variety of effects on metabolism. These hormones are responsible for normal basal metabolic rate, oxygen consumption and body heat regulation. They are also required for growth and normal development of the nervous system. Basal metabolic rate (BMR) is the amount of energy expended when the animal is resting. Thyroid hormones help regulate this rate within fairly tight parameters.

Deficiency

Because iodine is required for the production of thyroid hormone, symptoms of iodine deficiency mimic those of hypothyroidism. This is why it is important to consider the diet history of any dog that tests positive for hypothyroidism. Iodine deficiency symptoms in dogs include lethargy, enlargement of the thyroid gland, dull dry and sparse hair coat, weight gain (unrelated to dietary intake), excessive tearing and salivation.

In 1975 researchers found that the minimum daily requirement of iodide for an adult beagle was 0.14 mg/day (approximately 0.015 mg per kilogram of body weight). When this level of iodide was reduced to below 0.05 mg/day there was a significant reduction in T4 levels and a slight reduction in T3 levels. A reduction in T4 and T3 results in the anterior pituitary trying to stimulate the increase of T4 and T3 by releasing thyroid stimulating hormone (TSH). During the normal course of events TSH released from the anterior pituitary into the blood stream would stimulate the release of T4 and T3 from the thyroid. Once the thyroid responds by increasing production and release of T4 the production and release of TSH is stopped. Under deficiency conditions there is not enough iodide to make T4 or T3 and therefore TSH does not get turned off. Over time high blood levels of TSH results in the thyroid enlarging as it struggles to make T4 and T3.

An additional symptom of thyroid deficiency is lethargy. Dogs with a normal amount of iodide and thus a normal level of T4 and T3 will have normal BMR. Dogs that do not have enough T4 and T3 will have lower BMR which results in a lower resting heart rate. These dogs will be lethargic and they will often seek warm nesting places.

Iodine deficiency in pregnant animals results in deficiency in the fetus. Fetal deficiency usually manifests as mental deficiency, hearing loss, and motor disorders. A recent article in the New York Times reported that children born with iodine deficiency had a permanent reduction of around 15 IQ points when compared to non deficient children. Although there is no research examining what happens to the intelligence of a puppy when a bitch is deprived of iodine, it is plausible to assume that the mental ability of the puppy would be affected.

Toxicity

In humans there are no reported adverse effects from iodine intake of up to 2 mg/day. With the soil in North American being deficient in iodine it is unlikely that a toxic intake would occur. However iodine toxicity may occur in dogs fed an improperly balanced diet. A recent experiment in Argentina examined several commercial dog foods. These dog foods contained a range of iodide from 0.5 to 5.6 mg of potassium iodide/Kg of diet (dry matter). In this experiment 6 week old puppies were fed one of 3 diets: home prepared diet containing the recommended level of iodide, a commercial dog food containing 5.6 mg potassium iodide/kg of food (dry matter), or a home prepared diet containing 5.6 mg potassium iodide/kg of food (dry matter). The puppies consumed between 600 and 750 grams of food/day over the course of 90 days. This resulted in the puppies consuming between 2.5 mg and 3.75 mg of potassium iodide/day. This is between 18 and 25 times the recommended level of iodide intake. The puppies consuming the excessively high iodide had significantly lower levels of T4 and higher levels of TSH than the puppies consuming the recommended amount of iodide. This indicates that feeding excessive amounts of iodide can result in the clinical signs of hypothyroidism. This phenomenon is called the Wolff-Chaikoff effect and it is the body's mechanism to prevent excessive iodine leading to excessive T4 and T3 production which would result in HYPERthyroidism. This effect will last up to 10 days following a single feeding of excessively high level of iodide. This effect can be renewed when high iodide intake is continued resulting in a chronic hypothyroidism.

Given the evidence outlined above it is clear that there is both a safe minimum and safe maximum iodine intake for dogs. The National Research Council's Nutrient Requirements for Dogs and Cats recommends that **a dog** be fed at least 0.015 mg of iodine, and no more than 4 mg of iodine, per kilogram of body weight each day. AAFCO states that **a dog food** should contain at least 1.5 mg of iodine, and no more than 50 mg of iodine, per kilogram of food (dry matter basis). If the dog food you are feeding has an AAFCO adult maintenance or puppy growth claim on the label, then it contains sufficient iodine to meet your dog's needs. If the food you are feeding is produced by a Canadian company that is a member of the PFAC, then your food also contains sufficient iodine.

If the food you are feeding meets neither of the above criteria, it is up to you, the owner, to ask the company for proof that the food has been tested and shown to be adequate in iodine. If you are feeding home-made and are not sure if your recipe is complete and balanced, you can have your food tested by a laboratory. Maxxam Laboratories (maxxam.ca) is a human food laboratory that can test for iodide (by subcontracting

out to a US laboratory). Owners should send in a 200g sample to this laboratory. Iodine testing costs about $250 with a turnaround time of 3 weeks.

Because most dogs are being fed complete and balanced diets, most cases of hypothyroidism are not caused by iodine deficiency. However with the increasing number of home-made and natural diets being fed, we should be checking the nutritional status of all hypothyroid dogs to ensure that health related issues are not being caused by diet.

Each month, we'll feature 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 to canine nutrition. The common denominator is that each study will be very 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:	*Total folate and folic acid intake from foods and dietary supplements in the United States 2003–2006*
Authors:	*Regan L Bailey, Kevin W Dodd, Jaime J Gahche, Johanna T Dwyer, Margaret A McDowell, Elizabeth A Yetley, Christopher A Sempos, Vicki L Burt, Kathy L Radimer and Mary Frances Picciano*
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Background information

Folic acid or folate is an essential B-vitamin. Folate is the name used for the form of the vitamin found naturally in foods such as lettuce, spinach, cabbage, and beans. Folic acid is the name given to the form of the vitamin used in supplements and in fortified cereal products, such as enriched breads, pasta, baked goods and breakfast cereals.

In humans, folate deficiency during pregnancy has been shown to cause brain and spinal cord defects in the fetus. In the late 1990s, in order to reduce the incidence of birth defects in children, the governments in both Canada and the US instituted a national mandatory cereal folate-fortification program. This program required that 140 ug of folic acid be added to every 100g of flour sold in North America. The average blood folate concentrations for all segments of the US population more than doubled in the decade after this program was initiated.

Purpose of this study and study design

Folic acid supplementation not only reduces the incidence of birth defects, it is also believed to lower the risk of some cancers and cardiovascular disease. However, excessively high folic acid intake may increase the risk of colorectal cancer and cognitive impairment. The authors of this research paper wanted to evaluate the current intake of both food folate and total dietary folate in American adults. They used data collected from 5552 women and 5910 men between 2003 and 2006 as part of the National Health and Nutritional Examination Survey (NHANES). The researchers compared food folate and total dietary folate intake of these individuals to the recommended minimum and maximum folate intakes for adults.

Study results

34.5% of the people surveyed used dietary supplements that contained folic acid. Use of dietary supplements lowered the incidence of folate deficiency, but even with supplementation, folate deficiency still existed in a significant percentage of the population. The original goal of folate fortification was to increase

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folate consumption in pregnant women to prevent birth defects. In this study, 22% of reproductive-age women did not consume the minimum folate intake through diet alone. When food and dietary supplements were examined together (ie total folate intake), 19% of 14-18 year olds, 17% of 19-30 year olds and 15% of 31-50 year olds did not consume adequate levels of folate to meet their minimum requirements.

The researchers also found that while reproductive-age women were more likely to be folate-deficient, other groups were at risk of excessive intake. Approximately 5% of American men and women over the age of 50 had total folic acid intakes above the recommended daily maximum.

My thoughts

Despite considerable documentation linking folate deficiency during pregnancy to birth defects in children, and despite a national program that mandates the addition of folic acid to virtually all cereal-based products in North America, 15-20% of reproductive-age women in America are still folate-deficient.

Human nutritionists have defined a minimum recommended intake for all essential nutrients, yet nutritional deficiencies, and in some cases toxicities, are still not uncommon. Dogs have a distinct advantage over humans. Pet nutritionists can use formulation software to create complete and balanced recipes that ensure that nutrient deficiencies and excesses are avoided.

Seminar Announcement

In February and March 2010, Hilary Watson will be doing a series of evening nutrition seminars across Ontario. Below are the cities and dates.

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Barrie	Tuesday February 16	Monday February 15
Sarnia	Tuesday February 23	Monday February 22
Windsor	Wednesday February 24	Thursday February 25
Oshawa	Tuesday March 2	Monday March 1
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London	Tuesday March 9	Monday March 8
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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

Coming Next Month

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- **Muscle wasting in cancer and heart disease**
- **B-complex vitamins and skin health**