

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet

W. Jean Dodds, DVM

11561 Salinaz Avenue, Garden Grove, CA 92843

## Testing overview for canine thyroid disorder

This publication is extracted from Diana Laverdure's and my book *The Canine Thyroid Epidemic: Answers You Need for Your Dog*. Thyroid disease is complex and diagnosis of hypothyroidism is difficult to achieve. So, I believe everyone in the veterinary community can benefit from understanding why specific diagnostic tests are necessary in order to make an accurate diagnosis of hypothyroidism, and how proper interpretation of those tests is as much an "art" as it is a science.

**Total T4** – This test measures the total amount of T4 [thyroxine] hormone circulating in the blood – both bound and unbound molecules. More than 99 percent of T4 hormone is "bound," meaning that it attaches to proteins in the blood and never reaches the tissues. Therefore, a T4 result by itself is often misleading, since it is affected by anything that changes the amount of binding proteins circulating in the blood, such as occurs with certain drugs. T4 is still the most popular and widely used initial screening test for thyroid disorder in dogs. As explained below in "The T4 Myth," relying on the accuracy and sensitivity of this test alone is at the heart of the rampant misdiagnosis of canine thyroid disorder. T4 alone is not an accurate indicator of thyroid disorder in dogs, and is often affected by moderate to severe **non-thyroidal illness (NTI)** and certain medications (e.g. Phenobarbital, corticosteroids, and sulfonamides).

**FreeT4** – Serum freeT4 represents the tiny fraction (< 0.1%) of thyroxine hormone that is unbound and therefore is biologically active. As the freeT4 molecule circulates in the blood and through the pituitary gland's sensor, the level of free T4 tells the pituitary gland whether or not it needs to make more Thyroid Stimulating Hormone (TSH). Although both the bound and free forms of T4 hormone are in circulation, the pituitary gland only recognizes the free molecule. Since protein levels in the blood do not (or only minimally) affect freeT4, it is considered a more accurate test of true thyroid activity than the total T4. FreeT4 is much less likely to be influenced by NTI or drugs. Both totalT4 and freeT4 are lowered in cases of hypothyroidism.

Endocrinologists may favor the equilibrium dialysis (ED) RIA method for measuring freeT4 because earlier analog methods were less accurate, newer technologies (improved analog RIAs and non-RIA chemiluminescence and other methods) offer alternative and accurate methodology. These new assays are also faster and less costly.

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet

W. Jean Dodds, DVM

11561 Salinaz Avenue, Garden Grove, CA 92843

**Total T3** – As with totalT4, totalT3 represents both the bound and unbound forms of T3 circulating in the blood. Measuring serum T3 alone is not considered an accurate method of diagnosing canine thyroid disorder, as this hormone reflects tissue thyroid activity and is often influenced by concurrent NTI. It is, however, useful as part of a thyroid profile or health screening panel. For example, if levels of totalT4, freeT4, and totalT3 are all low, the patient more likely suffers from an NTI rather than hypothyroidism. If totalT3 levels are high or very high in a dog not receiving thyroid supplementation, the patient most likely has a circulating T3 autoantibody (the most common type), which has **spuriously** [falsely] raised the T3 and/or freeT3 level.

**FreeT3** – As with freeT4, less than 0.1 percent of T3 molecules circulate freely in the blood and are biologically active. The blood's freeT3 level tells the pituitary gland whether or not it needs to produce more TSH. Levels may be elevated slightly in **euthyroid** dogs with increased tissue metabolic demands, and are typically spuriously high or very high in dogs with T3 autoantibodies. Both total T3 and freeT3 are typically normal in cases of hypothyroidism, unless the disease has been present and undiagnosed for some time, or the dog has concurrent NTI.

**Canine Thyroglobulin Autoantibodies (TgAA)** – Elevated thyroglobulin autoantibodies are present in the serum of dogs with autoimmune thyroiditis, which as much as 90 percent of cases of canine hypothyroidism result from the heritable condition. TgAA is especially important in screening breeding stock for autoimmune thyroiditis, as dogs testing positive for TgAA should not be bred. The commercial TgAA test can give false negative results if the dog has received thyroid supplement within the previous 90 days, thereby allowing unscrupulous breeders to test dogs while on treatment to assert their normalcy, or to obtain certification with health registries such as the OFA Thyroid Registry. False negative TgAA results can also occur in about eight percent of dogs verified to have high T3AA and/or T4AA. Furthermore, false positive TgAA results may be obtained if the dog has been vaccinated within the previous 30 - 45 days for rabies, or very occasionally in cases of NTI. Vaccinating dogs with polyvalent vaccines containing rabies virus or rabies vaccine alone has been shown to induce production of antithyroglobulin autoantibodies. This represents an important finding with implications for the subsequent development of hypothyroidism.

**T3 Autoantibody (T3AA)/T4 Autoantibody (T4AA)** – These autoantibodies affect the ability to measure T4 and T3 accurately with most thyroid assay methods. In the presence of

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet

W. Jean Dodds, DVM

11561 Salinaz Avenue, Garden Grove, CA 92843

high levels of circulating T3AA and/or T4AA, the autoantibody interferes with the ability of the test antibody **reagent** to detect the hormone being measured. The result is a spuriously high reading of T3 and freeT3 or T4 and freeT4. However, if the freeT4 is measured by the ED technique, the T4AA will be removed by the dialysis step and not be detected. Thus, the presence of T4AA may go unnoticed if freeT4 is only measured by the ED method. Fortunately, most circulating antibodies are against T3 (~70%), some affect both T3 and T4 (~25%), and only a few affect T4 alone (~5%).

Most cases of autoimmune thyroiditis exhibit elevated serum TgAA levels, whereas only about 20 – 40 percent of cases have elevated circulating T3 and/or T4AA. Thus, the presence of elevated T3 and/or T4AA confirms a diagnosis of autoimmune thyroiditis but underestimates its prevalence, as negative (non-elevated) autoantibody levels do not rule out thyroiditis.

## **Endogenous Canine TSH (Thyroid Stimulating Hormone)**

In primary hypothyroidism, as freeT4 levels fall, pituitary output of TSH rises. Since about 95 percent of thyroid hormone regulation in humans is controlled by TSH, it is a highly accurate screening for hypothyroidism. However, only about 70 percent of thyroid hormone regulation in dogs is controlled by TSH, so this test shows relatively poor predictability. The remaining 30 percent of a dog's thyroid regulation is controlled by growth hormone, which, like TSH, is manufactured, stored, and secreted by the pituitary gland. For this reason, the TSH test provides a false negative or false positive in approximately 30 percent of canine cases. So, although elevated TSH usually indicates primary thyroid disease, there is 20 – 40 percent discordance observed between expected and actual results in normal dogs as well as in hypothyroid dogs or those with NTI.

## **The T4 myth**

Many of our veterinary colleagues believe that serum T4 alone is adequate as the first screening for a thyroid problem, and that only if T4 is abnormal should further testing be pursued. This misconception, which is still perpetuated today at veterinary schools throughout the country, is a huge obstacle to accurately and efficiently diagnosing canine thyroid disorders. Additionally, current veterinary medical textbooks have stated that if a dog has a T4 level above 2 ug/dl [26 nmol/L), there is no need to perform other thyroid testing because the dog is euthyroid. This statement is false and misleading, as the T4 result fails to identify any cases of thyroiditis in which elevated thyroid autoantibodies are present!

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

The only way that true progress can be made in the diagnosis of canine thyroid disorder is when the veterinary community realizes that serum T4 alone is *not* a reliable method of initial screening, as there are many circumstances in which it can provide misleading results. T4 can over diagnose hypothyroidism in the presence of NTI (such as chronic yeast infections, liver and bowel disorders, and kidney disease – just a few of many examples) or with the use of certain drugs (corticosteroids, Phenobarbital, and sulfonamides); it inaccurately assesses the adequacy of thyroxine therapy; and it fails to detect autoimmune thyroiditis.

The bottom line: We **veterinarians should not use the T4 alone** as the first screening test for hypothyroidism. If the T4 is low, you will not know whether the values are accurate without performing additional tests. If it's normal you may miss the diagnosis altogether, because there could be an antibody preventing you from even seeing it.

## Case Study

Pretty Girl, a seven year old, intact female Shetland Sheepdog, exhibited all the classic symptoms of hypothyroidism (slight weight gain, extensive hair loss on the neck and lower torso near her underbelly, skin discoloration and irritation with yeasty odor, thin and rough hair, and a dull coat). Pretty Girl's guardians requested a thyroid profile because their research on her symptoms explained that hypothyroidism was a fairly common problem in Shelties. Also, other breeders told them that Shelties tend to have much higher normal levels of thyroid hormones than many other breeds, so it is often difficult to get a correct diagnosis in this breed. (This is not so, as their thyroid levels are similar to those of other small breed dogs.)

Pretty Girl's veterinarian ran a "complete thyroid profile" and told her guardians that it was normal. He then referred them to a dermatologist. However, when they received a copy of the lab results, they discovered that only two tests had actually been performed – a freeT4 by equilibrium dialysis (ED) and TSH.

The freeT4ED result was clearly normal, but the TSH was quite high. These results were confusing because a high TSH level is classically seen in most cases of primary hypothyroidism, whereas the mid-range freeT4 didn't fit.

So, what was wrong with this diagnosis? It's simple: Shelties frequently have autoimmune thyroiditis with elevated thyroid autoantibodies. However, none of these values were measured.

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

For example, if Pretty Girl had shown elevated T4 autoantibodies (T4AA), these would have been removed and not detected by the dialysis step in the freeT4ED method used. If she had shown elevated T3 autoantibodies (T3AA), these would not have been detected either, as no T3 or FreeT3 assays were run. Finally, her TgAA also was not measured. Pretty Girl needed more thyroid testing to confirm the clinical impression that she was indeed hypothyroid.

Follow up results: Pretty Girl's serum was sent to Hemopet's Hemolife Diagnostics Laboratory. Pretty Girl was found to have elevated T4AA and T3AA, as well as very high TgAA. These results confirmed that Pretty Girl indeed had heritable autoimmune thyroiditis that had progressed to hypothyroidism, which was already manifested with her clinical signs.

My recommendation was to immediately begin thyroxine therapy twice daily and, after she was clinically improved, to spay her during her next anestrus period in between heats.

After beginning therapy for thyroiditis, Pretty Girl improved dramatically and was spayed. Her guardians were thrilled with her progress and were so happy that they had "their little dog" back.

## **What really constitutes a "complete" baseline thyroid profile?**

The initial thyroid profile should be comprehensive enough to accurately identify or rule out thyroid disorder, and to determine whether or not the condition is heritable autoimmune thyroiditis. As emphasized above, serum T4 alone is not sufficient for this purpose.

A complete baseline thyroid screening (referred to at the Hemopet lab as the "Thyroid 5" panel) typically includes:

- T4
- T3
- freeT4
- freeT3
- TgAA

If a dog is brought in for a general wellness exam or with signs of an illness, the Hemopet Thyroid 5 panel (or an equivalent profile conducted at a lab such as Michigan State University) should be combined with a CBC, Super-Chemistry, urinalysis, and a comprehensive physical

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

examination. However, if the dog is simply coming in for genetic screening or a thyroid profile, only the Thyroid 5 is necessary.

There are several options for follow-up testing, based on the results of the initial Thyroid 5 panel. The goal is always to balance affordability with accuracy.

For example, if the dog's TgAA autoantibodies are negative on the initial screening and he is diagnosed as hypothyroid based on a low T4 and freeT4, with normal T3 and freeT3, a Thyroid 4 panel (T4, T3, FreeT4, FreeT3) is sufficient for retesting (as long as the dog has been placed on thyroid hormone replacement therapy).

If budget is a serious concern and the dog is on thyroid replacement therapy, a Thyroid 2 panel (T4 and freeT4) could suffice for a routine follow-up. However, the Thyroid 4 is preferable, since we ideally also want to look at T3 and freeT3 to see if any non-thyroidal issues are occurring in the dog's system.

In contrast, if the TgAA is elevated on the initial screening, a Thyroid 5 (or its equivalent) must be conducted at every recheck to monitor whether the dog's autoantibody level is progressively being lowered based on the therapy. If it isn't, the therapy is not working and needs to be re-evaluated, or the dose adjusted.

If the dog's T4, T3, freeT4, and freeT3 values are normal but his TgAA is high, you still must treat the patient in order to stop the progression of the disease. This is true even if the dog is a prize-winning show dog with no outward signs of a thyroid condition. If his TgAA level is high, he should not be used for breeding and should be placed on hormone replacement therapy immediately.

Many of my veterinary colleagues believe that it makes clinical sense to wait for the animal to "get sick" before treating him. This "ticking time bomb" approach makes no sense at all. The fact is that the dog *is* sick, and in the vast majority of cases will only become sicker, if left untreated. Only with the proper therapy can he regain his health.

Several in the veterinary community also see no value in measuring the free, unbound hormones as part of a complete thyroid profile. However, this could not be further from the truth. As discussed above, freeT4 and freeT3 are the sensing hormones the body uses to

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

determine whether or not it will produce more TSH. It is the circulating levels of free T4 and freeT3 that the pituitary gland senses and which determine how much TSH the gland needs to put out in order to stimulate or inhibit thyroid hormone output from the thyroid gland.

Measuring freeT3 in combination with T3 is especially important, as these two hormones combined tell us what is happening in the tissues. When the T3 and freeT3 are very low together, it tells us that there is a non-thyroidal problem occurring in the body. Alternately, if the T3 and freeT3 are very high and the dog is not taking an overdose of thyroid hormone, it is usually spuriously high, indicating the presence of an antibody against T3 in the blood that's blocking the correct measurement. Those spuriously high levels are a flag for autoimmune thyroiditis.

To help control overall costs of testing, the Hemopet lab does not include the T3AA and T4AA tests as part of the baseline Thyroid 5 profile, but instead adds them on later, if appropriate. This is a simple matter of weighing the advantages of including the tests initially with the cost to the client, the additional time it takes, and the additional reagent required. The Thyroid 5 profile identifies about 92 percent of autoimmune thyroiditis cases based on the elevated TgAA levels. In the remaining eight percent of dogs that are TgAA negative but still suffer from thyroiditis, the T4, freeT4, and/or T3 and freeT3 levels will be high, providing a "red flag" that further testing is required.

Although the Thyroid 5 (or equivalent) panel is extremely accurate, there is still a small percentage of dogs who do not test positive for autoantibodies but will show lymphocytic thyroiditis if you biopsy their thyroid gland. Routine biopsies simply are not practical, however. This butterfly shaped organ is so tiny that removing even a miniscule portion could induce scarring and prove detrimental to the dog's health.

## Analyzing the thyroid panel

Conducting the proper tests, as described above, is half of the thyroid diagnostic puzzle: The other half is understanding how to accurately interpret these tests. Analyzing thyroid panel results is as much an art as it is a science. You cannot judge whether or not a dog's thyroid is functioning optimally based solely on the laboratory's "normal" reference range. Many other factors must also be considered.

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

Firstly, optimal reference ranges for canine thyroid analytes need to be defined by age, breed, and size. Young animals are growing and need more thyroid activity, whereas geriatrics require less energy. Further, the metabolism of large breeds is different from that of small breeds, and sight hounds differ metabolically from all other breed types. Other issues, such as lifestyle, weight, and sex must also be considered. In other words, no two dogs are alike. Each animal's individual situation must be taken into account and balanced against the laboratory's normal reference range in order to determine an accurate diagnosis.

In addition, every lab has a slightly different range, so what's normal for one could be abnormal for another. If a dog's blood sample is sent to "Lab A" for one screening and "Lab B" for a follow-up, these numbers could vary significantly. Many people memorize a "normal" number and compare that number for the same dog taken from different labs, not realizing that there can be a variation from lab to lab.

Below are Hemopet's reference ranges for various segments of the canine population:

## **Puppy/Adolescent**

As anyone who has watched their tiny puppy sprout into a mammoth adult can attest, puppies' bodies grow at an astounding rate. This rapid level of development requires quite a fast metabolism and, with it, higher thyroid hormone output. For optimal health, young dogs under 15 - 18 months of age should have thyroid baseline levels in the upper half of the adult normal ranges. This is because puppies and adolescent dogs require higher levels of thyroid hormones as they are still growing and maturing.

Below are Hemopet's general reference ranges for puppy and adolescent dogs:

<b>Expected Levels Category</b>	<b>T4 µg/dL</b>	<b>FT4 ng/dL</b>	<b>T3 ng/dL</b>	<b>FT3 pg/mL</b>
<b>Puppy/ Adolescent</b>	1.60 – 3.80	0.85 - 2.30	35 – 70	1.6 - 3.5

\* Reference ranges from Hemopet/Hemolife using non-RIA methods



# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

## Adult

Adult dogs require less metabolic energy than puppies. Their bones, tissues, and organs are fully developed, and that frenzied energy of puppy-hood has transitioned into a calmer, “grown up” temperament.

The normal reference ranges for thyroid analytes of healthy adult dogs is similar for most breeds, although differences do exist based on size and breed. Giant breeds have lower basal thyroid levels, while sight hounds have the lowest of any category (see charts below).

Lifestyle also plays an important role in determining optimum thyroid levels. Many adult canines are working dogs or enjoy participating in agility competitions. These highly active animals have higher metabolic testing profiles than a “couch potato.” Case in point: In Alaska, during the training season for the Iditarod, the dogs exhibit quite different thyroid values than when they are not training. During the off-season, their metabolic needs lessen with their reduced levels of activity. Even the changing diurnal rhythms and the light/dark cycle fluctuations affect the dogs’ metabolic profiles, and their corresponding optimal thyroid output.

It isn’t just Alaskan race dogs that illustrate this point, however. Even two dogs of the same size and breed can vary dramatically if one runs several miles each day and the other sleeps in! The lesson is that dogs cannot be “stereotyped” or classified. Just like people, they are individuals and their metabolic needs are in large part determined by their specific circumstance. This is why we say that interpreting thyroid profiles is as much an art as it is a science.

Below are Hemopet’s general reference ranges for adult dogs:

Optimal Levels Category	T4 µg/dL	FT4 ng/dL	T3 ng/dL	FT3 pg/mL
Adult	1.40 – 3.50	0.85 - 2.30	35 – 70	1.6 - 3.5

\* Reference ranges from Hemopet/Hemolife using non-RIA methods

## Geriatric

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

Since older animals beyond eight or nine years of age have slower metabolisms, baseline thyroid levels of euthyroid dogs may be slightly below midrange.

You must be careful not to prescribe too much thyroxine per pound of body weight to a senior dog.

Below are Hemopet's reference ranges for geriatric dogs:

<b>Optimal Levels Category</b>	<b>T4 <math>\mu\text{g/dL}</math></b>	<b>FT4 ng/dL</b>	<b>T3 ng/dL</b>	<b>FT3 pg/mL</b>
<b>Geriatric</b>	1.20 – 3.00	0.70 – 1.75	30 – 70	1.6 - 3.5

\* Reference ranges from Hemopet/Hemolife using non-RIA methods

## Large Breed

Since large and giant breed dogs have slower metabolisms than smaller breeds, don't expect the optimum basal thyroid levels of a St. Bernard to be the same as a Yorkie. As you'll see in the chart below, the normal reference range for large breed dogs is actually the same as for geriatric dogs. Optimum thyroid levels of healthy giant breeds fall between the lower end and midpoint of these ranges. This is very important to take into account when prescribing thyroid medication.

Below are Hemopet's general reference ranges for large breed dogs:

<b>Optimal Levels Category</b>	<b>T4 <math>\mu\text{g/dL}</math></b>	<b>FT4 ng/dL</b>	<b>T3 ng/dL</b>	<b>FT3 pg/mL</b>
<b>Large Breed</b>	1.20 – 3.00	0.70 – 1.80	30 – 70	1.6 - 3.5

\* Reference ranges from Hemopet/Hemolife using non-RIA methods

## Sight Hound

Sight hounds have the lowest basal thyroid levels of any canine group. The typical thyroid levels for healthy sight hounds fall at or just below the established laboratory reference ranges.

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

## Sight hound breeds include:

- Afghan Hound
- Azawakh
- Basenji
- Borzoi
- Chart Polski (Polish Greyhound)
- Greyhound
- Ibizan Hound
- Irish Wolfhound
- Italian Greyhound
- Peruvian Inca Orchid
- Podengo Portugueso (Portuguese Hound; Grande and Mediabig and medium)
- Silken Windhound
- Pharaoh Hound
- Rhodesian Ridgeback
- Saluki
- Scottish Deerhound
- Sloughi
- Thai Ridgeback
- Whippet

## Below are Hemopet's reference ranges for sight hounds:

<b>Optimal Levels Category</b>	<b>T4 <math>\mu\text{g/dL}</math></b>	<b>FT4 ng/dL</b>	<b>T3 ng/dL</b>	<b>FT3 pg/mL</b>
<b>Sight Hound</b>	0.90 – 2.00	0.50 - 1.20	30 – 70	1.6 - 3.5

\* Reference ranges from Hemopet/Hemolife using non-RIA methods

Remember that none of these reference ranges is cut in stone, and no dog falls into an absolute stereotype. A major mistake made by veterinarians is to believe that if a dog's numbers fall inside the reference ranges than they are normal and if they fall outside of the reference ranges, they are abnormal. This is absolutely false. The ranges are merely a guideline and are

# **CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING**

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

not meant to serve as absolute numbers for individual dogs. Each dog's "normal" will depend on a variety of factors, including his age, breed, size, and lifestyle.

## **Genetic Screening for Thyroid Disease**

Complete baseline thyroid panels and thyroid antibody tests are effective tools used for genetic screening to evaluate apparently healthy animals for breeding. As discussed above, tests for TgAA and circulating thyroid autoantibodies (T3AA and T4AA) are especially important for this purpose. A bitch with antithyroid antibodies (TAAs) in her blood may pass these along to her puppies in her colostrum milk. Also, any dog with elevated TAAs can eventually develop clinical symptoms of thyroid disease or become susceptible to other autoimmune diseases because his immune system is impaired. Therefore, TAA prescreening can be very important for ruling out heritable autoimmune thyroiditis in potential breeding stock.

Thyroid testing for genetic screening purposes is unlikely to be meaningful before puberty. Screening is initiated, therefore, once healthy dogs and bitches have reached sexual maturity (between 10 – 14 months in males and during the first anestrus period for females following their maiden heat). The interpretation of results from baseline thyroid profiles in intact females is more reliable when they are tested in anestrus. Thus, testing for health screening is best performed at 12 -16 weeks following the onset of the previous heat. Screening of intact females for other parameters like vWD (von Willebrand disease), hip dysplasia, inherited eye diseases, and wellness or reproductive checkups should also be scheduled when the dog is in anestrus.

Once the initial thyroid profiles are obtained, dogs and bitches should be rechecked on an annual basis to assess their thyroid and overall health. Annual results provide comparisons for early recognition of developing thyroid dysfunction. This permits treatment intervention, where indicated, to avoid the appearance or advancement of clinical signs associated with hypothyroidism.

For optimum thyroid function of breeding stock, levels should be close to the midpoint of the laboratory normal ranges, because lower levels may be indicative of the early stages of thyroiditis among relatives of dog families previously documented to have thyroid disease.

# **CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING**

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

The difficulty in accurately diagnosing early thyroid disease is compounded by the fact that some patients with typical clinical signs of hypothyroidism have blood thyroid levels within the normal range. A significant number of these patients will improve clinically when given thyroid medication. In such cases, blood levels of the hormones can be normal but tissue levels are inadequate to maintain health, and so the patient shows clinical signs of hypothyroidism. This situation applies in a selenium deficiency, for example. While animals in this category should respond well to thyroid medication, only experienced clinicians are likely to recognize the need to place these dogs on a 6 – 8 week clinical trial of thyroid supplementation. This approach is safe and clinically appropriate, but it requires rechecking blood levels of thyroid hormones towards the end of the 6 – 8 week period to assure that the patient is receiving the correct dose of medication.

In order to reduce the incidences of heritable autoimmune thyroiditis being passed to future generations, it's important to remove dogs with circulating AAs from the breeding pool. Dogs that are symptomatic of low thyroid function without the presence of TAAs can be treated with hormone therapy, but should only be bred with a mate that has completely normal thyroid levels and does not require therapy.

## **Understanding thyroxine dosing**

The typical thyroxine dosage is 0.1 mg per 12 - 15 pounds of a dog's *optimum* body weight. Since large and giant breeds have slower metabolisms, their requirements are less (0.1 mg per 20 pounds of optimum body weight). Sight hounds are also different metabolically, and require only as much thyroxine dosage as the large breeds. Bear in mind that these doses are significantly greater – as much as 10 times greater – than human doses.

The half-life of both T3 and T4 hormone is much faster in dogs than in people (every 12 – 16 hours in a dog versus every 5 - 7 days in a person). It's critical to recognize this difference in metabolic functioning in order to understand canine thyroxine dosing. Through the years, dog guardians have called the Hemopet lab astounded by the prescribed hormone dose, unable to understand why it is so much greater than a typical human dose. We have even seen instances where pharmacists take it upon themselves to lower the dose prescribed by the dog's veterinarian (i.e. – from 0.5 mg to 0.05 mg), assuming that the veterinarian misplaced the decimal point! In such cases, the poor dogs took the thyroxine for months without any improvement – and the poor guardians were pulling their hair out wondering why the

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

medication wasn't working. Once the decimal point debacles were straightened out and the correct doses administered, the dogs improved, of course.

## Sub-clinical hypothyroidism

Some dogs with suppressed thyroid functioning still test within the laboratory's "normal" references ranges. These dogs are said to suffer from sub-clinical hypothyroidism. Sub-clinical hypothyroidism is a controversial topic within the veterinary community, since dogs with borderline-low hypothyroidism often display none of the typical clinical symptoms of full-blown hypothyroidism (weight gain, skin and coat problems, and lethargy, for example). However, there is substantial empirical evidence that animals with borderline-low hypothyroidism experience increased issues of aberrant behavioral, especially aggression, and also commonly suffer from inflammatory bowel disease.

Understanding how to diagnose sub-clinical hypothyroidism is critical, especially when many veterinarians simply dismiss borderline readings as normal because they fall within the laboratory's reference ranges.

A dog is generally considered to suffer from sub-clinical hypothyroidism if his hormone levels fall within the lowest 50 percentile of the normal range. To calculate the 50 percent point, simply add the lowest and highest values of the range and divide by two.

For example, in an adult dog, the 50 percent point is calculated as follows:

### **T4**

Normal range = 1.40 – 3.50 ug/dL

$$1.40 + 3.50 = 4.9$$

$$4.9 / 2 = 2.43$$

2.43 = 50 percent of the normal range for adult T4

### **freeT4**

Normal range = 0.85 – 2.30 ng/dL

$$0.85 + 2.30 = 3.15$$

$$3.15 / 2 = 1.58$$

1.58 = 50 percent of the normal range for adult freeT4

# CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING

Hemopet  
W. Jean Dodds, DVM  
11561 Salinaz Avenue, Garden Grove, CA 92843

## **T3**

Normal range = 35 – 70 ng/dL

$$35 + 70 = 105$$

$$105 / 2 = 52.5$$

52.5 = 50 percent of the normal range for adult T3

## **freeT3**

Normal range = 1.6 – 3.5 pg/mL

$$1.6 + 3.5 = 5.1$$

$$5.1 / 2 = 2.55$$

2.55 = 50 percent of the normal range for adult freeT3

If a dog's thyroid levels fall in the lower 50 percent of the reference range and he exhibits aberrant behavior or other signs related to hypothyroidism, he may benefit from hormone supplementation. If you notice positive changes in the dog's behavior or other clinical issues once he's on the medication and follow-up testing shows an improvement in his thyroid levels, it's certainly worth continuing to administer the medication for the long term.

## Case Study

Miso, a four year old, intact female red Akita, was a show champion and working agility dog who kept gaining weight even though her experienced guardian didn't overfeed her, and her skin and coat quality were excellent. She gradually got so heavy that her shoulders were bearing too much weight to allow her to safely clear the agility course jumps. Her frantic guardian requested a thyroid profile because she was convinced that Miso must have hypothyroidism as the underlying reason for the weight gain.

Miso's veterinarian ran a "complete thyroid profile" and told her guardian that it was low-normal, but not really low enough to account for the weight issue. In discussing the results, the client asked the veterinarian if he would contact me to get my opinion. After reviewing the situation and the sub-optimal thyroid profile results, it was mutually decided to put Miso on a moderate dose of thyroxine supplement give twice daily for six weeks. But, in those days prior to the 2000s, we were unaware of the importance of giving the thyroid medication apart from meals in order for it to be fully absorbed. This was further complicated because Miso ate a raw diet, which contained lots of calcium in the raw meaty bones to interfere with absorption of the thyroxine.

# **CANINE THYROID DIAGNOSTIC TESTING, INTERPRETATION AND DOSING**

Hemopet

W. Jean Dodds, DVM

11561 Salinaz Avenue, Garden Grove, CA 92843

As expected, the trial course of thyroxine did little to help Miso lose weight. Her veterinarian elected to increase the thyroxine dose by 25 percent, and lo and behold, Miso started to lose weight. After 4 months of thyroid supplementation she had lost 15 of her 20 excess pounds, and was looking svelte and muscled once again. The rest of the story is unremarkable, as Miso returned to top form in agility trials and lived to be 14 years of age, still taking the appropriate dose of thyroxine for her age and weight at the time – given, of course, apart from her meals.

Again, this case study emphasizes that the laboratory references ranges are merely guidelines for diagnosing hypothyroidism. They are not cut in stone.



This is the medical term for an underactive thyroid gland. One of the many things the thyroid gland is responsible for is to regulate metabolism. When not enough thyroid hormone is secreted, the metabolism slows; secreting too much results in hyperthyroidism and a too-rapid metabolism. The thyroid gland is actually controlled by another gland, the pituitary gland. It signals the thyroid to produce its hormone and is responsible for the amount of thyroid hormone in the blood. Canine and feline thyroid disorders are commonly encountered by small animal practitioners. Their diagnosis, however, is not always straightforward. In addition, some patients with thyroid disease can be challenging to manage. This Archived Webinar will provide an overview of the available diagnostic tests for canine hypothyroidism and feline hyperthyroidism, highlighting recent advances in thyroid diagnostics available from IDEXX Laboratories. Current treatment recommendations including therapeutic monitoring protocols will be reviewed. Thyroid testing should be carried out only when patients are suspected of having thyroid disease. Measurement of T4 concentration is helpful to rule out hypothyroidism but should not be solely relied on to confirm the diagnosis. Combined testing that includes the serum T4 concentration along with fT4 and/or TSH levels is needed for definitive diagnosis and will help decrease the possibility for misdiagnosis of hypothyroidism.Â Influence of acetylsalicylic acid and ketoprofen on canine thyroid function tests. *Vet J* 2003;166(3):224-232. Gulikers KP, Panceria DL. Evaluation of the effects of clomipramine on canine thyroid function tests. *J Vet Intern Med* 2003;17(1):44-49. Kantrowitz LB, Peterson ME, Melian C, et al.