

# CAUSES, DIAGNOSTICS AND TREATMENT FOR FELINE THYROID DISEASES

HEMOPET

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## Overview

Thyroid dysfunction is the second most common endocrine disorder in the older cat after diabetes. Although thyroid dysfunction is the most frequently recognized endocrine disorder of pet animals, it is often difficult to make a definitive diagnosis. As the thyroid gland regulates metabolism of all body cellular functions, reduced thyroid function can produce a wide range of clinical manifestations. Many clinical signs mimic those of other causes and so recognition of the condition and interpretation of thyroid function tests can be problematic.

## Dietary-Induced Hyperthyroidism in Cats

The rising incidence of hyperthyroidism (symptoms: insatiable hunger, dramatic weight loss, howling and constant panting) in older cats – since first identified in the mid-1970s – led to much speculation about the true cause(s). Eventually, research focused on the commercial diets fed to the affected cats; most were found to eat foods containing more than the NRC recommended amounts of iodine. Once the iodine content of the foods was lowered, and even fed in less than the recommended amounts to affected cats, their hyperthyroidism resolved. A prescription diet was produced that contained less iodine for feeding affected cats. Today, a properly balanced amount of iodine is present in commercial pet foods, treats and snacks for both cats and dogs.

Regarding the iodine content of commercial pet foods, iodine excess causes alterations in thyroid activity, blocking both its characteristic functions and cell proliferation. Feeding excessive amounts of iodine in foods and supplements (kelp, seaweed) reduces thyroid function in dogs and increases thyroid activity in older cats. This contributes to the rising prevalence of hypothyroidism in young dogs, and hyperthyroidism in older cats. Iodine also increases auto-antigenic potency of thyroglobulin leading to induction of autoimmune thyroiditis.

## PBDE's

Another issue of concern for cats is the use of PBDEs, the flame-retardant chemicals that have been used in clothing, furniture and electronics since the 1970s. PBDEs are especially prevalent in foam products, such as mattresses, pillows, upholstered products and carpet padding, as well as in electronics, such as cell phones, computers, printers, scanners, copiers, hair dryers, toner cartridges, TVs, TV remote controls and video equipment. PBDEs can leak into the environment and are known disruptors of endocrine function, especially of the thyroid gland. Foam products sold in 2005 or later should be free of PBDEs, but they are still found in some new TVs and computer monitors.

Residues from PBDEs have been found in serum, foods and house dust of cats and dogs. PBDE levels in cats were 20 to 100 times those seen in humans, while the levels in dogs were 5-10 times higher. (The levels were lower in dogs because dogs can metabolize these chemicals faster than cats, and are thought to have an enzyme that helps break them down.

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## Associated Endocrine Disorders

Endocrine disorders of companion animals, especially those of dogs and cats, have long been recognized as being similar to their human counterparts in terms of presenting clinical signs as well as genetic, physiological and endocrinological features. As pointed out in a landmark review from 2003, "Over several millennia, humans have created hundreds of dog and cat breeds by selective breeding, including fixation of mutant genes. Endocrine diseases of humans are also known to occur as similar entities in dogs and cats. With some variations, this is true for conditions such as diabetes mellitus and the hypofunction syndromes of the thyroid and adrenal cortex. Also, the hyperfunction syndromes of hypercortisolism and hyperparathyroidism in dogs and cats have many similarities with their human counterparts."

Thus, as in humans, thyroid dysfunction (both hyper- and hypothyroidism), Addison's disease, immune-mediated adrenocortical insufficiency, hyperadrenocorticism, and diabetes occur in genetically predisposed dog and cat families.

In his review of endocrine disorders in 2010, Peterson categorized these conditions as those of hormone excess and hormone deficiency:

### Hormone excess ("Hyper") disorders

- Pituitary tumors (excess GH, or ACTH)
- Hyperthyroidism
- Hypercalcemia
- Hyperparathyroidism
- Pancreatic insulin-secreting tumor, insulinoma
- Hyperadrenocorticism, Cushing's syndrome
- Hyperaldosteronism, Conn's syndrome
- Pheochromocytoma (excess adrenaline)
- Hypertension

### Hormone deficiency ("Hypo") disorders

- Pituitary dwarfism (reduced GH in young animals)
- Diabetes insipidus (low antidiuretic hormone/vasopressin)
- Hypothyroidism
- Hypocalcemia

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- Hypoparathyroidism
- Diabetes mellitus
- Hypoadrenocorticism, Addison's disease (low cortisol and/or aldosterone)
- Hypotension

## Diagnostic Procedures

Three diagnostic procedures – biopsy, scintigraphy, and serum – are currently available to diagnose thyroid disease in dogs and cats. Biopsies have extremely high predictive values but are invasive, high risk and simply not practical. The thyroid is so tiny that removing even a miniscule portion could induce scarring and prove detrimental to a cat's health.

Scintigraphy is very precise and can readily detect disease at an earlier stage than anatomical imaging procedures can. It requires a radioactive agent (radionuclide, radiotracer, or radiopharmaceutical) to be administered. Scintigraphy is available in large referral clinics and universities. It is costly, which may not be feasible for many clients.

Serum testing is the most practical and cost-effective, but has received a bad reputation for inaccuracies compared to other diagnostic tests. The problem lies with veterinarians who are unwittingly running incomplete assays. A complete baseline thyroid profile for cats typically includes total T4, total T3, free T4, free T3 and cTSH. Complete tests can provide highly accurate diagnoses of hyperthyroidism and hypothyroidism in cats, and proper interpretation is as much an "art" as it is a science.

Confusion over the diagnostic utility of the free T4 concentration as measured by ED (equilibrium dialysis) had led to misdiagnosis of hyperthyroidism in the cat. Use of FT4 ED alone as a diagnostic aid (without evaluating a concurrent T4), or as a screening test in healthy cats, has led to more cats being diagnosed as hyperthyroid rather than actually have the disorder.

Free T4 is the non-protein bound, physiologically active form of T4 and therefore should be the best marker of thyroid status in dogs and cats. Indeed, in cats with overt hyperthyroidism (consistent clinical signs and high T4), FT4 ED values are elevated. In cats with early or mild hyperthyroidism (more mild signs of disease and T4 in the upper 1/2 of normal reference range), the FT4 ED is also usually elevated.

However in 5-10% of cats with non-thyroidal illness (e.g., chronic renal failure, inflammatory bowel disease, liver disease, neoplasia), the FT4 ED can be elevated for reasons that are unclear. These cats may have signs consistent with hyperthyroidism, (e.g., weight loss, vomiting) but there is typically no palpable thyroid nodule(s), and T4 values are typically within normal limits.

Since a commercial feline TSH assay does not exist at this time, we substitute and use the cTSH instead (4). Hyperthyroid cats predictably have very low cTSH concentrations, whereas high cTSH values have been reported in cats with naturally occurring hypothyroidism, as well as cats with iatrogenic hypothyroidism, i.e., secondary to methimazole or radioiodine-131 treatment.

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Normal cats, and cats with non-thyroidal illness, generally maintain normal cTSH values. Therefore, finding a low total T4 or free T4 in combination with a high cTSH concentration greatly improves the diagnostic sensitivity and precision for identifying hypothyroidism in cats.

## Testing Older Cats

- Basal thyroid levels in older cats should be lower than in adults
- Other illnesses often lower T4, masking hyperthyroidism
- Minimum testing needed is T4, freeT4 and cTSH
- FT4 ED is usually high in hyperthyroidism but can be high in IBD, renal and liver disease, and neoplasia

## **Management & Therapy**

Hyperthyroid cats after diagnosis are typically treated with oral (tablet or compounded liquid) or transdermal ear tip application of methimazole (Felimazole, Dechra Veterinary, Overland Park, KS.), radioactive iodine-131 therapy to ablate the thyroid acinar cells, or surgical removal of the thyroid adenoma(s). Radioactive iodine-131 can render a cat hypothyroid so thyroid medication would be administered to abate this new condition.

Cats who have renal disease may function better as slightly hyperthyroid. Regular blood draws and monitoring are of the utmost importance.

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