SMALL ANIMALS

Prevalence of serum thyroid hormone autoantibodies in dogs with clinical signs of hypothyroidism

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Objective—To determine prevalence of thyroid hormone autoantibodies (THAA) in serum of dogs with clinical signs of hypothyroidism.

Design—Cohort study.

Sample Population—287,948 serum samples from dogs with clinical signs consistent with hypothyroidism.

Procedure—Serum THAA were detected by use of a radiometric assay. Correlation and χ^2 analyses were used to determine whether prevalence varied with breed, age, sex, or body weight. Only breeds for which ≥ 50 samples had been submitted were used for analysis of breed prevalence.

Results—Thyroid hormone autoantibodies were detected in 18,135 (6.3%) samples. The 10 breeds with the highest prevalence of THAA were the Pointer, English Setter, English Pointer, Skye Terrier, German Wirehaired Pointer, Old English Sheepdog, Boxer, Maltese, Kuvasz, and Petit Basset Griffon Vendeen. Prevalence was significantly correlated with body weight and was highest in dogs between 2 and 4 years old. Females were significantly more likely to have THAA than were males.

Conclusions and Clinical Relevance—Thyroid hormone autoantibodies may falsely increase measured triiodothyronine (T_3) and thyroxine (T_4) concentrations in dogs; results suggest that T_3 concentration may be falsely increased in approximately 57 of 1,000 dogs with hypothyroidism and that T_4 concentration may be falsely increased in approximately 17 of 1,000 dogs with hypothyroidism. Results also suggested that dogs of certain breeds were significantly more or less likely to have THAA than were dogs in general. (*J Am Vet Med Assoc* 2002;220:466–471)

Autoimmune thyroid disease is a common cause of hypothyroidism in dogs. **Autoantibodies (AA)** predominantly develop against **thyroglobulin (Tg)** and not against thyroperoxidase, a major difference between canine and human autoimmune thyroid disease.[1] There also have been a number of reports[2-5] of dogs having AA to **thyroxine (T_4)** and **triiodothyronine (T_3)**. Thyroxine and T_3 are haptens and not antigenic by themselves. Therefore, it appears that Tg is the protein that provides the antigenic stimulus, and because T_4 and T_3 are attached to the Tg molecule, AA develop against them as well.[4] These AA are often found in serum from dogs with various clinical signs that can be associated with hypothyroidism. The presence of AA to T_4 and T_3 plays havoc with the corresponding radioimmunoassays designed to measure T_4 and T_3 concentrations, as the assay's radioactive tracer interacts with the AA as well as with the target antibodies.[2,3] As a result, reported concentrations may be falsely elevated or lowered depending on the type of radioimmunoassay that is used. Reported hormone concentrations have actually been in the hyperthyroid range when, in fact, dogs were hypothyroid. These reported concentrations are not the true T_4 and T_3 concentrations but artifacts resulting from the presence of **thyroid hormone AA (THAA)**.

The Michigan State University Animal Health Diagnostic Laboratory has developed an assay for detecting THAA in serum from dogs. The purposes of the study reported here were to determine the prevalence of THAA in serum from dogs with clinical signs of hypothyroidism and to determine whether prevalence varied with breed, age, sex, or body weight.

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Materials and Methods

In 1987, the Michigan State University Animal Health Diagnostic Laboratory developed a radiometric assay to detect AA to T_4 and T_3 in serum samples from dogs. The assay was based on the procedure described by Young et al.[2] As described, 8-anilino-1-naphthalene sulfonic acid was used in the buffer to decrease natural thyroid hormone binding to serum proteins, leaving any additional and abnormal binding to γ-globulins.[4] The percentage of ^{125}I-labeled T_4 and ^{125}I-labeled T_3 bound to AA in 100 µl of serum was compared with the amount of T_4 or T_3 radioligand (^{125}I) taken up by cold (4 C) dextran-coated charcoal from a control tube with only buffer (500 µl), defined as 100%. When the tracer was bound to AA, the amount adsorbed by the activated charcoal was reduced. The percentage reduction from 100% was defined as the percentage of AA binding.

A graph was used to determine the point of visual divergence between nonspecific binding to serum proteins and specific binding to THAA (**Fig 1**). This graph was based on

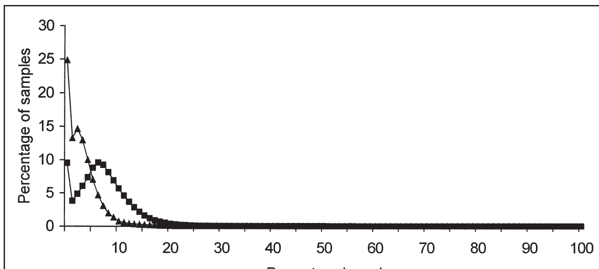

Figure 1—Distribution of 562,060 serum samples from clinically normal dogs and dogs suspected to have hypothyroidism on the basis of percentage of radiolabeled thyroxine (T_4; squares) and triiodothyronine (T_3; triangles) bound to serum proteins.

data for 562,060 serum samples from clinically normal dogs and dogs suspected to have hypothyroidism. To avoid overestimating the prevalence of THAA, serum samples for which percentage reduction in tracer binding was > 10% for T_3 AA and 20% for T_4 AA were considered to be positive for AA. For purposes of the present study, dogs were considered to have THAA if they were positive for T_4 AA, T_3 AA, or both.

A total of 1,081,536 canine serum samples were submitted to the Michigan State University Animal Health Diagnostic Laboratory between January 1987 and December 2000. Samples from dogs receiving thyroid hormone replacements, glucocorticoids, or any other medication were excluded from the study, along with samples from dogs that were clinically normal, that did not have any clinical signs consistent with hypothyroidism, or that had been tested previously. Results for the remaining 287,948 dogs were used in the study. Data were sorted according to age, sex, body weight, and breed, and prevalence of THAA was determined for each group. There were 237 breeds represented; for calculation of prevalence within breeds, only those breeds with 50 or more dogs were used (141 breeds). Correlation and χ^2 analyses were used to determine whether prevalence of THAA varied with age, sex, body weight, or breed.

Results

Thyroid hormone AA were detected in 18,135 (6.30%) samples. Triiodothyronine AA alone were detected in 13,359 (4.64%), T_4 AA alone were detected in 1,815 (0.63%), and T_4 AA and T_3 AA were detected in 2,961 (1.03%). There was a significant (r = –0.85; $P < 0.05$) inverse correlation between prevalence of THAA and age of the dogs, indicating that older dogs were less often positive for THAA **(Fig 2)**. Females had significantly higher odds of being positive for THAA than did males (odds ratio, 1.07; $P < 0.001$; **Fig 3**). Also, neutered males and females had a significantly ($P < 0.001$) higher prevalence of THAA than did sexually intact dogs. There was a significant (r = 0.93; $P < 0.05$) correlation between prevalence of THAA and body weight, indicating that heavier dogs (ie, dogs of larger breeds) were more likely to be positive for THAA **(Fig 4)**.

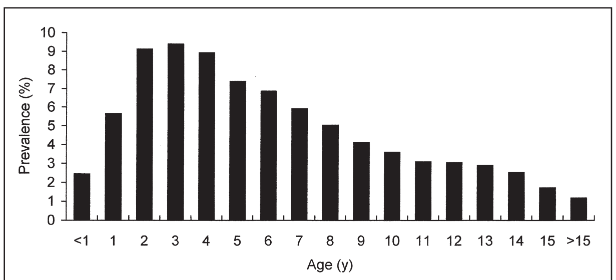

Figure 2—Prevalence of serum thyroid hormone autoantibodies (THAA) as a function of age at the time of sample collection for 287,948 dogs with clinical signs consistent with hypothyroidism.

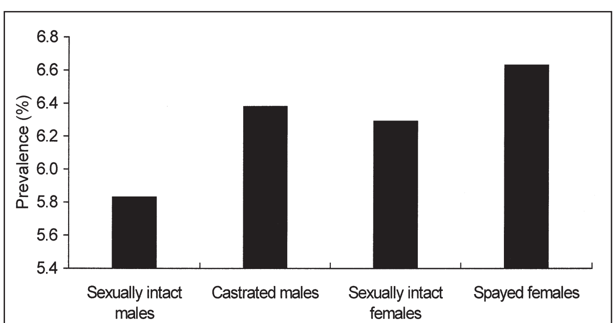

Figure 3—Prevalence of serum THAA as a function of sex for 287,948 dogs with clinical signs consistent with hypothyroidism.

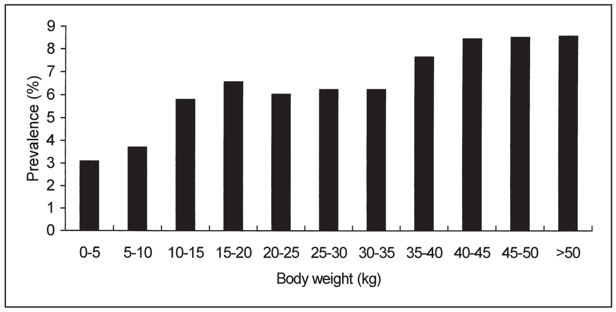

Figure 4—Prevalence of serum THAA as a function of body weight for 287,948 dogs with clinical signs consistent with hypothyroidism.

Twenty-six breeds were significantly ($P < 0.05$) more likely to have THAA, compared with dogs of all other breeds, and 65 breeds were significantly ($P < 0.05$) less likely to have THAA, compared with dogs of all other breeds **(Tables 1 and 2)**. The remaining 50 breeds were not significantly more or less likely to have THAA than were dogs of all other breeds **(Table 3)**.

Discussion

Previous studies have shown that detection of Tg AA is significantly associated with detection of THAA (13/13 dogs in 1 study,[4] 39/47 dogs in the other[6]). Because T_4 and T_3 are haptens, Tg appears to be the antigenic stimulus needed for THAA production. Furthermore, because Tg AA have been associated with hypothyroidism (48% of dogs with primary hypothyroidism have Tg AA[7]) and are an indicator of lymphocytic thyroiditis,[8] THAA can also be considered an indicator of lymphocytic thyroiditis and, possibly, as an indicator of the potential for development of hypothyroidism in dogs.

The impact of THAA on results of thyroid function testing depends on the assay used. For most commercially available T_4 assays, THAA will falsely elevate the measured T_4 concentration. In the present study, T_4 AA were detected in 1.66% of the dogs (0.63% of the dogs had T_4 AA alone, and 1.03% had T_4 and T_3 AA). Thus, measured total T_4 concentration could be expected to be falsely elevated in approximately 17 of every 1,000 dogs with hypothyroidism. The false increase may be enough to raise a hypothyroid dog's result into the reference or hyperthyroid range. The same false elevation would be expected with "direct" assays of free T_4 concentration. However, if free T_4 concentration is measured by use of a dialysis procedure, false elevations in assay results would not be expected, because AA cannot pass through the dialysis membrane and interfere with the assay. Hence, the dialysis procedure would be expected to give correct results.

A familial tendency for hypothyroidism and autoimmune thyroid disease in dogs has been reported as early as 1968.[9] A number of breeds have been reported to have an increased prevalence of these diseases, including Beagles,[9-12] Golden Retrievers,[11] Shetland Sheepdogs,[11] Airedales,[11] Cocker Spaniels,[11,13] Old

Table 1—Odds of having serum thyroid hormone autoantibodies (THAA) among breeds with an increased risk of having THAA, compared with dogs of all other breeds

Breed	No. of dogs	Percentage with AA				Odds ratio	*P* value
		T_3 AA	T_4 AA	Both	Total		
Pointer	118	11.86	0.85	6.78	19.49	3.61	0.001
English Setter	1,246	13.88	1.2	3.53	18.61	3.44	0.001
English Pointer	99	14.14	2.02	2.02	18.18	3.31	0.001
Skye Terrier	53	13.21	1.89	1.89	16.99	3.04	0.001
German Wirehaired Pointer	324	11.42	1.54	2.47	15.43	2.72	0.001
Old English Sheepdog	1,031	10.96	0.87	3.20	15.03	2.65	0.001
Boxer	5,239	9.14	0.88	3.47	13.49	2.37	0.001
Maltese	962	9.56	0.94	2.60	13.10	2.25	0.001
Kuvasz	180	10.56	2.22	0.00	12.78	2.18	0.001
Petit Basset Griffon Vendeen	63	6.35	3.17	3.17	12.69	2.16	0.036
American Staffordshire Terrier	246	8.54	1.22	1.22	10.98	1.84	0.003
Beagle	3,988	7.70	0.80	2.16	10.66	1.79	0.001
American Pit Bull Terrier	676	9.02	0.44	1.18	10.64	1.78	0.001
Dalmatian	2,332	6.82	1.07	2.53	10.42	1.74	0.001
Giant Schnauzer	406	8.37	0.74	1.23	10.34	1.72	0.001
Rhodesian Ridgeback	1,025	8.39	0.39	1.56	10.34	1.72	0.001
Golden Retriever	36,016	7.19	0.77	2.37	10.33	1.90	0.001
Shetland Sheepdog	11,423	7.84	0.61	1.51	9.96	1.69	0.001
Chesapeake Bay Retriever	1,005	7.26	0.70	1.49	9.45	1.56	0.001
Siberian Husky	1,153	6.94	0.69	1.21	8.84	1.45	0.001
Brittany	1,257	6.76	0.72	1.19	8.67	1.42	0.001
Borzoi	527	7.21	0.19	1.14	8.54	1.39	0.034
Australian Shepherd	1,328	5.72	0.60	1.58	7.90	1.28	0.016
Doberman Pinscher	11,084	6.21	0.64	0.77	7.62	1.24	0.001
Malamute	1,449	6.21	0.48	0.90	7.59	1.22	0.042
Cocker Spaniel	18,976	5.83	0.63	0.76	7.22	1.17	0.001
Mixed	42,647	4.92	0.66	0.99	6.57	1.05	0.012
Total all breeds	**287,948**	**4.64**	**0.63**	**1.03**	**6.30**	**NA**	**NA**

NA = Not applicable. T_3 = Triiodothyronine. T_4 = Thyroxine. AA = Autoantibodies.

English Sheepdogs,[13] Doberman Pinschers,[11,14,15] Irish Setters,[11,13,14] Miniature Schnauzers,[11,14] Great Danes,[13,14] Pomeranians,[11] Poodles,[14] Boxers,[14] Dachshunds,[11] and Borzois.[16] Results of the present study generally agree with these previous findings, except that in the present study, Great Danes, Pomeranians, Poodles, Miniature Schnauzers, and Dachshunds were significantly less likely to have THAA, compared with dogs of all other breeds, whereas Airedales and Irish Setters were neither significantly more or less likely to have THAA than were dogs of all other breeds. Breeds previously reported to be under-represented in surveys of hypothyroidism include German Shepherd Dogs[11] and mixed breed dogs[15]; however, mixed breed dogs were significantly more likely to have THAA in the present study. The finding that certain breeds were significantly more or less likely to have THAA in the present study is a further indication of a familial predisposition for autoimmune thyroid disease and suggests that autoimmune thyroid disease has a genetic component. However, previous studies did not use detection of THAA as a criterion for inclusion of dogs but used clinical signs of hypothyroidism, histologic evidence of thyroiditis, or detection of Tg AA. This may account for some of the discrepancies in regard to breed prevalence between the present and previous studies.

Breeds identified in previous studies as having a higher incidence of hypothyroidism tended to be large breeds. This agrees with the finding in the present study that heavier dogs had a higher prevalence of THAA. Of course, because hypothyroidism is associated with weight gain, the disease itself may promote some correlation between body weight and detection of THAA.

Women are reported to have a 5- to 7-fold incidence of autoimmune thyroid disease, compared with men.[17] We did not find this extreme a difference in prevalence of THAA between female and male dogs in the present study, but female dogs did have significantly higher odds of being positive for THAA. Sexually intact dogs had significantly lower odds of being positive for THAA than did neutered dogs, indicating that sexually intact male and female dogs may be slightly protected from this autoimmune disease. A previous report[11] also indicated that castration and spaying resulted in a trend towards higher prevalence of hypothyroidism in dogs, particularly in high-risk breeds. Others, however, did not find a significant difference between male and female dogs in regard to prevalence of autoimmune thyroid disease.[9,10,12,15,18,19]

Age at the onset of histologic evidence of autoimmune thyroid disease has been well documented in a number of studies. No thyroid lesions were reported prior to 1 year of age in a colony of Beagles,[10] but lesions were evident between 2.75 and 7 years of age. Another study[9] found the first evidence of thyroiditis at 7 to 8 months of age and peak occurrence at 13 months. Two more recent studies[12,19] had similar findings. One study[12] reported that Beagles had no lesions until 2.1 years of age and that severity of lymphocytic thyroiditis steadily increased prior to development of clinical hypothyroidism after 5 years of age. Another study[19] first found evidence of lymphocytic infiltration

Table 2—Odds of having serum THAA among breeds with a decreased risk of having THAA, compared with dogs of all other breeds

Breed	No. of dogs	Percentage with AA				Odds ratio	*P* value
		T_3 AA	T_4 AA	Both	Total		
Akita	2,579	4.07	0.16	0.50	4.73	0.74	0.001
Cockapoo	1,059	3.40	0.76	0.57	4.73	0.74	0.034
Samoyed	1,921	3.59	0.16	0.78	4.53	0.71	0.002
Schnauzer (unspecified variety)	2,078	3.51	0.43	0.58	4.52	0.70	0.001
Great Dane	1,681	3.27	0.71	0.54	4.52	0.70	0.003
Bullmastiff	863	3.01	0.58	0.81	4.40	0.68	0.022
Standard Schnauzer	1,828	2.19	1.75	0.44	4.38	0.73	0.006
Scottish Terrier	1,686	2.55	1.25	0.47	4.27	0.66	0.001
Labrador Retriever	26,954	3.07	0.40	0.60	4.07	0.61	0.001
Rottweiler	4,568	2.50	0.92	0.53	3.95	0.61	0.001
Portuguese Water Dog	409	2.93	0.49	0.49	3.91	0.61	0.047
English Springer Spaniel	1,007	2.98	0.30	0.60	3.88	0.60	0.002
Great Pyrenees	604	2.98	0.33	0.50	3.81	0.59	0.012
Pug	1,150	2.78	0.26	0.70	3.74	0.58	0.001
Italian Greyhound	327	2.14	1.53	0.00	3.67	0.57	0.050
Yorkshire Terrier	2,275	2.55	0.44	0.62	3.61	0.55	0.001
Wire Fox Terrier	364	2.47	0.82	0.27	3.56	0.55	0.032
Newfoundland	1,834	2.29	0.87	0.38	3.54	0.55	0.001
Bouvier Des Flandres	1,161	2.67	0.52	0.34	3.53	0.54	0.001
Springer Spaniel	3,452	2.55	0.55	0.43	3.53	0.54	0.001
German Shepherd Dog	6,594	2.47	0.67	0.33	3.47	0.53	0.001
Chow Chow	2,797	2.29	0.54	0.46	3.29	0.50	0.001
Collie	3,276	2.23	0.89	0.12	3.24	0.49	0.001
Miniature Schnauzer	1,373	2.62	0.15	0.36	3.13	0.48	0.001
Afghan Hound	677	1.48	1.03	0.59	3.10	0.48	0.001
Poodle	6,216	2.08	0.66	0.29	3.03	0.46	0.001
Basset Hound	1,501	2.40	0.27	0.33	3.00	0.46	0.001
Greyhound (racing)	280	1.07	1.07	0.71	2.85	0.44	0.018
Bichon Frise	988	2.13	0.51	0.20	2.84	0.43	0.001
Dachshund	7,438	1.99	0.48	0.23	2.70	0.41	0.001
Pomeranian	2,025	1.88	0.49	0.30	2.67	0.41	0.001
Chihuahua	963	1.77	0.62	0.21	2.60	0.40	0.001
Bearded Collie	548	1.64	0.36	0.55	2.55	0.39	0.001
Lhasa Apso	2,284	1.93	0.39	0.22	2.54	0.39	0.001
Bernese Mountain Dog	869	1.50	0.58	0.46	2.54	0.39	0.001
Welsh Corgi	607	2.14	0.33	0.00	2.47	0.38	0.001
Pekingese	773	2.07	0.13	0.26	2.46	0.37	0.001
Smooth Fox Terrier	204	0.98	0.98	0.49	2.45	0.37	0.024
Cavalier King Charles Spaniel	502	1.79	0.60	0.00	2.39	0.36	0.001
Whippet	261	1.53	0.38	0.38	2.29	0.35	0.008
Chinese Shar-pei	2,894	1.45	0.48	0.28	2.21	0.33	0.001
Papillon	141	1.42	0.71	0.00	2.13	0.32	0.041
Belgian Tervuren	435	1.61	0.23	0.23	2.07	0.31	0.001
Shih Tzu	3,322	1.57	0.33	0.12	2.02	0.30	0.001
English Bulldog	2,259	1.06	0.66	0.18	1.90	0.29	0.001
Cairn Terrier	1,309	1.07	0.46	0.31	1.84	0.28	0.001
Kerry Blue Terrier	167	1.20	0.60	0.00	1.80	0.27	0.017
West Highland White Terrier	2,116	1.32	0.33	0.14	1.79	0.27	0.001
Rat Terrier	114	0.88	0.88	0.00	1.76	0.27	0.046
Border Terrier	119	0.84	0.84	0.00	1.68	0.25	0.038
Norwegian Elkhound	614	1.14	0.33	0.16	1.63	0.25	0.001
Boston Terrier	1,058	0.66	0.66	0.28	1.60	0.24	0.001
Irish Wolfhound	461	1.08	0.43	0.00	1.51	0.23	0.001
Flat-Coated Retriever	273	1.10	0.37	0.00	1.47	0.22	0.001
Soft Coated Wheaten Terrier	447	0.89	0.22	0.00	1.11	0.17	0.001
Irish Terrier	90	1.11	0.00	0.00	1.11	0.17	0.043
Greyhound	1,953	0.72	0.26	0.10	1.08	0.16	0.001
Irish Water Spaniel	189	1.06	0.00	0.00	1.06	0.16	0.003
Shiba Inu	114	0.88	0.00	0.00	0.88	0.13	0.017
American Water Spaniel	130	0.00	0.00	0.00	0.00	0.00	0.003
Norwich Terrier	95	0.00	0.00	0.00	0.00	0.00	0.011
Bluetick Coonhound	65	0.00	0.00	0.00	0.00	0.00	0.037
Belgian Sheepdog	259	0.00	0.00	0.00	0.00	0.00	0.001
French Bulldog	146	0.00	0.00	0.00	0.00	0.00	0.001
Welsh Corgi (Pembroke)	129	0.00	0.00	0.00	0.00	0.00	0.003
Total all breeds	**287,948**	**4.64**	**0.63**	**1.03**	**6.30**	**NA**	**NA**

See Table 1 for key.

Table 3—Odds of having serum THAA among breeds with neither an increased nor decreased risk of having THAA, compared with dogs of all other breeds

Breed	No. of dogs	Percentage with AA				Odds ratio	*P* value
		T_3 AA	T_4 AA	Both	Total		
Duck Tolling Retriever	70	8.57	1.43	1.43	11.43	1.92	0.077
Leonberger	100	8.00	1.00	0.00	9.00	1.47	0.266
Bedlington Terrier	68	8.82	0.00	0.00	8.82	1.44	0.391
Tibetan Terrier	188	5.85	1.60	1.06	8.51	1.38	0.212
American Eskimo Dog	475	6.53	0.84	0.84	8.21	1.33	0.086
Siberian Husky	962	5.72	0.42	1.46	7.60	1.22	0.099
Miniature Pinscher	530	5.66	0.94	0.94	7.54	1.22	0.236
Schipperke	363	5.51	0.83	1.10	7.44	1.20	0.371
Curly-Coated Retriever	54	5.56	1.85	0.00	7.41	1.19	0.737
Welsh Springer Spaniel	69	4.35	1.45	1.45	7.25	1.16	0.746
Spitz	198	4.04	1.52	1.52	7.08	1.13	0.654
Irish Setter	2,534	5.41	0.75	0.71	6.87	1.10	0.237
English Cocker Spaniel	437	5.49	0.46	0.92	6.87	1.10	0.625
Keeshond	1,603	4.68	0.69	1.50	6.87	1.10	0.351
Australian Queensland Heeler	300	5.33	1.33	0.00	6.66	1.06	0.793
Bloodhound	227	5.29	0.44	0.88	6.61	1.05	0.848
Border Collie	1,042	4.70	0.77	1.06	6.53	1.04	0.395
Alaskan Husky	250	4.80	0.80	0.80	6.40	1.02	0.947
Gordon Setter	774	4.65	0.52	0.90	6.07	0.96	0.796
Unspecified	6,069	4.42	0.69	0.89	6.00	0.95	0.330
Basenji	373	4.29	0.54	1.07	5.90	0.93	0.750
Walker Hound	85	3.53	2.35	0.00	5.88	0.93	0.875
German Shorthaired Pointer	900	4.33	0.33	1.22	5.88	0.93	0.613
Mastiff	1,180	4.49	0.85	0.34	5.68	0.90	0.380
Airedale Terrier	1,516	3.63	1.39	0.33	5.35	0.84	0.125
Saint Bernard	549	3.83	0.73	0.73	5.29	0.83	0.327
Welsh Terrier	209	2.39	0.96	1.91	5.26	0.83	0.538
Puli	77	2.60	1.30	1.30	5.20	0.82	0.690
Clumber Spaniel	83	2.41	2.41	0.00	4.82	0.75	0.579
Coonhound	166	4.82	0.00	0.00	4.82	0.75	0.433
Weimaraner	876	3.65	0.23	0.91	4.79	0.75	0.067
Neapolitan Mastiff	147	2.72	1.36	0.68	4.76	0.74	0.443
Bull Terrier	357	3.92	0.84	0.00	4.76	0.74	0.232
Jack Russell Terrier	460	2.61	0.87	0.65	4.13	0.64	0.055
Silky Terrier	157	0.64	1.91	1.27	3.82	0.59	0.201
Vizsla	341	2.35	0.29	1.17	3.81	0.59	0.059
Briard	181	1.66	1.10	0.55	3.31	0.51	0.133
Saluki	156	1.92	0.64	0.64	3.20	0.49	0.112
Australian Terrier	128	2.34	0.78	0.00	3.12	0.48	0.139
Dandie Dinmont Terrier	69	1.45	1.45	0.00	2.90	0.44	0.245
Belgian Malinois	76	2.63	0.00	0.00	2.63	0.40	0.188
Manchester Terrier	158	1.90	0.63	0.00	2.53	0.39	0.051
Welsh Corgi (Cardigan)	158	0.63	1.90	0.00	2.53	0.39	0.051
Scottish Deerhound	87	1.15	1.15	0.00	2.30	0.35	0.125
Dogue De Bordeaux	56	1.79	0.00	0.00	1.79	0.27	0.164
Brussels Griffon	58	1.72	0.00	0.00	1.72	0.26	0.152
Fox Terrier (unspecified variety)	61	1.64	0.00	0.00	1.64	0.25	0.134
Field Spaniel	66	1.52	0.00	0.00	1.52	0.23	0.110
Toy Poodle	82	1.22	0.00	0.00	1.22	0.18	0.058
Boykin Spaniel	83	1.20	0.00	0.00	1.20	0.18	0.056
Toy Fox Terrier	50	0.00	0.00	0.00	0.00	0.00	0.067
Total all breeds	**287,948**	**4.64**	**0.63**	**1.03**	**6.30**	**NA**	**NA**

See Table 1 for key.

of the thyroid at 9 months of age, and numbers of affected dogs peaked at 2 years of age. Eight percent of 2,238 Beagles from that colony had some degree of lymphocytic thyroiditis; however, percentages of dogs affected within age groups were not reported in that study. Results of our study tend to agree with results of these previous studies, because a small percentage of dogs < 1 year old were positive for THAA, and prevalence was highest at 2, 3, and 4 years of age. Age data in the present study must be interpreted with caution, however, as samples were not collected from these dogs until after clinical signs suggestive of hypothyroidism appeared. Because the disease does not rapidly destroy the thyroid tissues, many dogs may have had THAA for years prior to testing for hypothyroidism.

The finding of a negative correlation between age and prevalence of THAA may be related to the progression of the disease in dogs. Because the antigen causing AA formation is Tg, the eventual atrophy of the gland results in very little Tg to maintain AA production. As the final stages of the disease occur, Tg AA and THAA titers likely will decrease until the dogs become seronegative. This has been observed in dogs biopsied every 6 months during a 3.5-year period in our laboratory (unpublished observation). If Tg AA and THAA are no longer detectable after severe atrophy of the thyroid gland, then many dogs with idiopathic hypothyroidism may simply be in the end stage of autoimmune thyroid disease.

False increases in measured T_4 and T_3 concentrations are of importance to decision making by clinicians. The increase may be enough to cause measured T_4 or T_3 concentrations to be in the hyperthyroid range. Yet, most clinicians would not make an erroneous diagnosis of hyperthyroidism in these dogs because of the clinical signs present. More important is a false increase of the measured concentration from the hypothyroid range into the reference range, because most clinicians would rule out hypothyroidism when T_4 and T_3 concentrations are normal. By measuring TSH concentration and testing for Tg AA or THAA, in addition to measuring T_4 and T_3 concentrations, these diagnostic errors can be avoided.

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