SHORT COMMUNICATION

Studies on Haemato-Biochemical Findings in Hypothyroid Dogs

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Abstract

Hypothyroidism is an endocrine disorder due to diminished synthesis and secretion of triiodothyronine (T3) and thyroxine (T4) by the thyroid glands. The present study was carried out at Veterinary Clinical Complex of NTR College of Veterinary Science, Gannavaram (India) during the period from March to November 2023. The hospital prevalence of hypothyroidism was found to be 0.45 % (27/5957). The mean values of TT4 (0.60±0.05 µg/dL) and FT4 (0.32±0.04 ng/dL) in hypothyroid dogs were significantly ($p \leq 0.01$) lower when compared to healthy dogs. Haemato-biochemical changes included significantly ($p<0.01$) reduced levels of haemoglobin, packed cell volume, and total erythrocyte count, along with elevated total leukocyte count, hypercholesterolemia, hypertriglyceridemia, and significantly ($p<0.05$) higher levels of alkaline phosphatase and blood urea nitrogen. These findings emphasize the significant role of thyroid hormones in regulating the body›s metabolic balance and ensuring the integrity of various organs.

Key words: Dogs, Hypercholesterolemia, Hypertriglyceridemia, Hypothyroidism, Thyroxine, Radioimmunoassay.

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Introduction

Hypothyroidism is most commonly an acquired condition of adult dogs characterized by primary failure of the thyroid gland to produce adequate amounts of thyroxine (T4) and triiodothyronine (T3) (Bugbee *et al*., 2023). Any dysfunction within the hypothalamic-pituitary-adrenal axis has the potential to lead to thyroid hormone deficiency (Gulzar *et al*., 2014). The condition can manifest as either primary or secondary hypothyroidism, with primary hypothyroidism predominantly associated with lymphocytic thyroiditis. Clinical signs of hypothyroidism are vague and non-specific due to the impact of thyroxine deficiency on all systems of the body (Nelson and Maggiore, 2020). Diagnosing hypothyroidism in dogs is challenging due to the presence of similar clinical signs in several other diseases (Kour *et al*., 2021). The present study was aimed to study the haemato-biochemical alterations in hypothyroid dogs.

Materials and Methods

Out of 5957 dogs presented to Veterinary Clinical Complex, NTR College of Veterinary Science, Gannavaram (AP, India) during the study period from March 2023 to November 2023, 78 dogs with one or two clinical signs suggestive of hypothyroidism were selected and subjected for estimation of thyroid hormone and haemato-biochemical examination. Detailed information was obtained from the owners and standardized physical examination of dogs was carried out with special reference to clinical signs of hypothyroidism. Dogs with low total T4 and free T4 levels, along with compatible clinical or biochemical abnormalities were considered as hypothyroid (Bugbee *et al*., 2023). Dogs (n=27) with total T4 less than 1 µg/dL according to the RIA assay and free T4 below 0.80 ng/dL based on CLIA method were confirmed as hypothyroid (Nelson and Couto, 2020).

Estimation of Thyroid Function

Estimation of total T4 was undertaken at Department of Veterinary Physiology, Veterinary College and Research Institute, Namakkal by using RIA kit procured from M/S Beckman Coulter. The total T4 value of 1-3.50 µg/dL was considered as the reference range in healthy dogs (Jaiswal *et al*., 2018). Quantitative measurement of total T3, free T4 and

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TSH was undertaken by Chemiluminescent Immunoassay (CLIA) technique and the values were expressed as ng/mL, ng/dL and µIU/mL, respectively.

Estimation of Haemato-Biochemical Parameters

Haematological parameters were estimated in hypothyroid dogs in accordance with established procedures outlined by Jain *et al.* (2000). The serum biochemical parameters were analysed using a Thermo Scientific Multiskan Go semi-auto analyzer, manufactured by Thermo Fisher Scientific Corporation, Mumbai. Standard assay kits produced by Tranasia Biomedicals Ltd, Erba Mannheim, were employed for analyses.

Data on haemato-biochemical and endocrine profiles was statistically analysed using independent sample 't' test as per the methods described by Snedecor and Cochran (1994) using SPSS 20.00 version.

Results and Discussion

Hormonal Status of Hypothyroid Dogs

On the basis of low levels of total T4 and free T4 along with clinical and haemato-biochemical alterations suggestive of hypothyroidism, a total of 27 dogs were diagnosed with hypothyroidism. In the present study, the hospital prevalence of hypothyroidism was found to be 0.45% (27/5957). The mean total T4 and free T4 concentrations in Group I (healthy dogs) were significantly higher ($p<0.01$) than hypothyroid dogs (Group II) (Table 1). These observations gained support from earlier reports of Jaiswal *et al.* (2018), Ko *et al.* (2018) and Nelson and Couto (2020).

Table 1: Thyroid profile in healthy (Group I) and hypothyroid (Group II) dogs

Thyroid hormones	Group I (n=8)	Group II (n=27)
TT_4 (µg/dL)	2.71 ± 0.33	0.60 ± 0.05**
FT_4 (ng/dL)	0.96 ± 0.05	0.32 ± 0.04**
TT_3 (ng/mL)	0.72 ± 0.04	0.57 ± 0.07
TSH (µIU/mL)	0.02 ± 0.01	0.02 ± 0.01

*p<0.05, **p<0.01 between healthy and hypothyroid dogs

Physiological Parameters of Hypothyroid Dogs

Mean values of various physiological parameters like rectal temperature, heart rate and respiratory rate are presented in Table 2. Highly significant differences ($p<0.01$) in the mean heart rates and respiratory rates were recorded between healthy and hypothyroid dogs. These observations corroborated with earlier reports of Gaalova *et al.* (2008) and Kour *et al.* (2021).

Table 2: Vital signs recorded in healthy (Group I) and hypothyroid (Group II) dogs

Parameter	Group I (n=8)	Group II (n=27)
Rectal temperature (^{0}F)	102.30 ± 0.21	102.10 ± 0.25
Heart rate (bpm)	80.63 ± 2.17	72.37 ± 1.59**
Respiratory rate (per min)	23.50 ± 0.87	34.15 ± 1.54**

**p<0.01 between healthy and hypothyroid dogs

Haematological Alterations

The haematological findings in hypothyroid dogs revealed a significant difference ($p<0.01$) in the means of haemoglobin, packed cell volume, total erythrocyte count, and total leukocyte count between healthy and hypothyroid dogs (Table 3). These findings corroborated with earlier reports of Chakrabarthi *et al.* (2001) and Kour *et al.* (2021), who stated that anaemia in hypothyroid dogs might be attributed to reduced plasma erythropoietin, diminished response of erythroid progenitors to erythropoietin, or a direct impact of thyroid hormone on early haematopoietic and pluripotent stem cells. The decrease in T-cell function and humoral immunity might contribute to secondary bacterial, fungal, or parasitic infections, consequently leading to an increase in the total leukocyte count (Andronic *et al*., 2008; Kour *et al.,* 2021). In contrary, Srikala and Kumar (2014) reported no significant difference in total leucocyte count of hypothyroid dogs when compared to healthy control.

Table 3: Haematological findings in healthy (Group I) and hypothyroid (Group II) dogs

Parameter	Group I (n=8)	Group II (n=27)
Haemoglobin (g/dL)	14.88 ± 0.57	10.89 ± 0.60**
Packed cell volume (%)	39.75 ± 0.70	33.79 ± 1.47**
Total erythrocyte count (x 10^6/mm^3)	6.30 ± 0.24	4.99 ± 0.17**
Total leucocyte count (x 10^3/mm^3)	11.71 ± 0.46	16.05 ± 1.13**
Differential leucocyte count (%)		
Neutrophils (%)	66.25 ± 1.64	67.37 ± 3.77
Lymphocytes (%)	31.88 ± 1.64	29.07 ± 3.64
Monocytes (%)	1.25 ± 0.31	2.78 ± 0.75
Eosinophils (%)	0.63 ± 0.26	0.78 ± 0.20

**p<0.01) between healthy and hypothyroid dogs

Serum Biochemical Alterations

The mean values of ALP and BUN were significantly higher in hypothyroid dogs when compared to healthy dogs. These findings were in accordance with Andronic *et al.* (2008) and Kour *et al.* (2021), who opined that elevation of liver enzymes in hypothyroidism might be due to degenerative hepatopathy and myopathy caused by fatty infiltration and hyperlipidemia. On the contrary, Ryad *et al.* (2020) reported normal values of ALP in hypothyroid dogs and stated that biochemical alterations may not exist in hypothyroid dogs. Though there was a significant difference ($p<0.05$) in the mean value of BUN in hypothyroid dogs compared

Table 4: Serum biochemical findings in healthy (Group I) and hypothyroid (Group II) dogs

Clinical markers	Parameter	Group I (n=8)	Group II (n=27)
Hepatic profile	Glucose (mg/dL)	77.76 ± 1.31	89.93 ± 14.04
	Total bilirubin (mg/dL)	0.36 ± 0.03	0.43 ± 0.04
	ALT (IU/L)	44.24 ± 1.07	77.52 ± 26.05
	AST (IU/L)	47.31 ± 0.81	76.82 ± 23.37
	ALP (IU/L)	49.35 ± 1.68	107.46 ± 27.08*
	Total protein (g/dL)	7.16 ± 0.06	7.14 ± 0.15
	Albumin (g/dL)	3.55 ± 0.06	3.49 ± 0.10
	Globulin (g/dL)	3.61 ± 0.10	3.65 ± 0.13
	A: G	0.99 ± 0.05	1.01 ± 0.07
Renal markers	Creatinine (mg/dL)	0.95 ± 0.06	2.55 ± 0.80
	BUN (mg/dL)	18.46 ± 1.24	24.80 ± 2.06*
Obesity markers	Cholesterol (mg/dL)	136.11 ± 4.32	262.44 ± 17.64**
	Triglycerides (mg/dL)	79.38 ± 7.81	109.21 ± 5.62**
Minerals	Calcium (mg/dL)	10.57 ± 0.26	10.12 ± 0.13
	Phosphorus (mg/dL)	3.84 ± 0.05	4.23 ± 0.22

*p<0.05, **p<0.01 between healthy and hypothyroid dogs

to healthy control, it was within the reference range, and concurred with the reports of Bhatt *et al.* (2018) and Kour *et al.* (2021). A highly significant increase (p<0.01) was observed in the mean values of cholesterol and triglycerides in hypothyroid dogs (group II) when compared to healthy dogs (Group I) (Table 4). Similar findings were reported by earlier researchers (Simpson and Van-Den Broek, 1991; Jaiswal *et al.,* 2018; Mitrevska *et al*., 2023). According to them hypercholesterolemia in hypothyroid dogs was due to impaired lipid metabolism including synthesis, mobilization, and degradation resulting in accumulation of plasma lipids and the potential for development of atherosclerosis. Simpson and Van-Den Broek (1991) stated that hypertriglyceridemia in hypothyroid dogs was attributed to impaired plasma clearance. Calcium and phosphorus levels however did not vary between healthy and hypothyroid dogs (Table 4).

From the present study it was inferred that the haemato-biochemical alterations observed in hypothyroid dogs were, a significant reduction in serum total T4, free T4, haemoglobin, PCV and TEC, and a significant increase in TLC serum ALP, cholesterol, and triglycerides. These findings emphasize the substantial influence of thyroid hormones in maintaining the body's metabolic equilibrium and upholding the functional integrity of various organs.

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