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B Roopali
Department of Veterinary Medicine, College of Veterinary Science & AH, Durg, Chhattisgarh, India

S Roy
Department of Veterinary Medicine, College of Veterinary Science & AH, Durg, Chhattisgarh, India

M Roy
Department of Physiology and Biochemistry, College of Veterinary Science & AH, Durg, Chhattisgarh, India

SL Ali
Department of Veterinary Medicine, College of Veterinary Science & AH, Durg, Chhattisgarh, India

Corresponding Author:
B Roopali
Department of Veterinary Medicine, College of Veterinary Science & AH, Durg, Chhattisgarh, India

Haematological alterations in hypothyroidism dogs

B Roopali, S Roy, M Roy and SL Ali

Abstract
Hypothyroidism is the clinical syndrome caused by reduced circulating concentrations of the active thyroid hormones T3 and T4. It is widely acknowledged as one of the most common endocrine diseases affecting dogs. The present study was carried out to know the haematological changes in hypothyroidism positive dogs. The dogs presented to the Teaching Veterinary Clinical Complex, College of Veterinary Science & AH, Durg, private clinics and government Veterinary hospitals of Durg-Bhillai, Raipur and Rajnandgaon districts of Chhattisgarh for a period of two years from March 2018 to February 2020 were included for the present study. Blood samples were collected from dogs suspected for hypothyroidism and subjected for the estimation of thyroid hormones (tT3, tT4 and fT4) and haematology. Thyroid hormones estimation showed a significant decrease of tT3, tT4 and fT4 levels in hypothyroidism dogs as compared to healthy control group. Haematological study depicted a non-significant decrease in haemoglobin, packed cell volume, total erythrocyte count in hypothyroid dogs as compared to the healthy control dogs. Hypothyroid dogs had a significant ($P<0.05$) increase ($p\leq0.05$) in total leucocyte count and neutrophils, with a non-significant difference ($p\leq0.05$) in lymphocytes, eosinophils and monocytes between hypothyroid and healthy dogs.

Keywords: hypothyroidism, dogs, thyroid, chhattisgarh, haematology

Introduction
Thyroid hormones (THs) play an important physiological role. Thyroid hormones regulate hematopoiesis in the bone marrow. The association of thyroid disorders and abnormalities in hematological parameters is well known. Hypothyroidism is the clinical syndrome caused by reduced circulating concentrations of the active thyroid hormones T3 and T4. It is widely acknowledged as one of the most common endocrine diseases affecting dogs. In dogs, hypothyroidism usually results from primary thyroid gland failure, caused by either lymphocytic thyroiditis or idiopathic atrophy (Kemppainen and Clark, 1994) [13]. Acquired primary hypothyroidism is a common thyroid disorder in dogs that may cause decreased metabolic rate and dysfunction of almost every organ in the body. The most commonly reported clinical manifestations of primary hypothyroidism in dogs include dermatologic manifestations as well as reproductive, neurological, and cardiovascular abnormalities (Scott-Moncrieff, 2007 and Scott-Moncrieff, 2015) [19 & 20]. The most common clinical characteristics associated with hypothyroidism are metabolic signs like lethargy, obesity or weight gain, exercise intolerance, poor wound healing, and dermatological abnormalities including alopecia, poor skin and hair coat, hair loss/alopecia or abnormal hair turnover, dull and brittle haircoat, hyperpigmentation, oily or dry skin and thickened skin (myxedema). Obesity is observed in more than 40 % of dogs with hypothyroidism in several studies (Panciera, 1994; Dixon *et al.*, 1999; Feldman and Nelson, 2004 and Kaelin *et al.*, 2008) [16,5,8 & 12]. Hence, many dogs in practice that are obese should be screened for hypothyroidism. Clinico-pathological changes commonly observed in dogs with hypothyroidism are anemia, hyponatremia, lipemia, hypercholesterolemia, hypertriglyceridemia, hypoglycemia and hypocapnea may be present (Dixon and Mooney, 1999) [4]. Hypercholesterolemia is observed in approximately 75% of the cases and would be due to a decreased clearance and hepatic use combined with an increased hepatic production of cholesterol (Feldman and Nelson, 2004) [8]. Thyroid hormones influence the function of many organs, hypothyroidism is considered in the diagnosis of wide range of problems. Diagnosis of hypothyroidism should be based on a combination of compatible signalment/history, clinical manifestations, physical examination and clinicopathological abnormalities, supported with thyroid hormone estimation in order to make a definitive diagnosis. Hypothyroidism is a greatly "over-diagnosed" disease because it is hard to differentiate between dogs with primary hypothyroidism and dogs with non-thyroidal illness. Since, there are few studies on canine hypothyroidism in India.

Further clinical study of hypothyroidism in dogs has not been explored in Chhattisgarh state till date. Therefore, keeping in view the above issues and to address them, the present study was undertaken to know the haemato-biochemical changes in hypothyroidism affected dogs.

Materials and methods

The dogs presented to the Teaching Veterinary Clinical Complex, College of Veterinary Science & AH, Durg, private clinics and government Veterinary hospitals of Durg-Bhilai, Raipur and Rajnandgaon districts of Chhattisgarh for a period of two years from March 2018 to February 2020 were included for the present study. Dogs suspected for hypothyroidism having clinical signs either of bilateral symmetrical alopecia, rat tailed appearance, hyper pigmentation, pruritus, pyoderma, seborrhea, erythema, thinning of hair coat, lethargy, weight gain, exercise and cold intolerance were considered for the estimation of thyroid hormones Futhermore, haematological parameters were estimated in dogs positive for hypothyroidism.

Healthy dogs

Healthy dogs well vaccinated and dewormed without any clinical signs suggestive of canine hypothyroidism were kept as healthy control group for comparing the oxidative markers and thyroid profiles with hypothyroidism positive dogs.

Estimation of thyroid hormones

Blood samples (2ml) from hypothyroidism suspected dogs (n=22) and healthy dogs were collected either from cephalic or saphenous veins aspetically. After collection, blood was allowed to clot at room temperature, and then centrifuged at 1,500 rpm for 10 minutes. Serum was collected and stored at -20°C until further assay. Total triiodothyronine (tT3) (nmol/l), total Thyroxine (tT4) (nmol/l) and free Thyroxine (fT4) (pmol/l) were estimated by Radio immuno assay kits (RIA) (Gnanasekar *et al.*, 2010) [10].

Estimation of haematological parameters

About 1ml blood was collected aseptically either from cephalic or saphenous vein of hypothyroid dogs and healthy dogs in EDTA coated vial using. The blood samples were subjected for the estimation of following haematological parameters: haemoglobin (gm/dL), total erythrocyte count (10^6/mm^3), packed cell volume (%), total leucocyte count (10^3/mm^3) and differential leucocyte count [(neutrophils, lymphocytes, monocytes, eosinophils and basophils) (%)] using Vet MS39 semi-automatic haematological analyzer of Melet Schloesing Laboratories of Sussi France.

Results and discussion

Thyroid hormones

There was a significant decrease in tT3, tT4 and fT4 levels in hypothyroidism dogs as compared to healthy ones (Fig.1). Similar findings of reduced thyroid hormones were reported by Meyer *et al*. (1992); Cote (2015); Randolph *et al.* (2015); Morre *et al.* (2017); Anand (2018) and Alenka *et al.* (2019) [14, 3, 18, 15, 1 & 2] in hypothyroidism dogs.

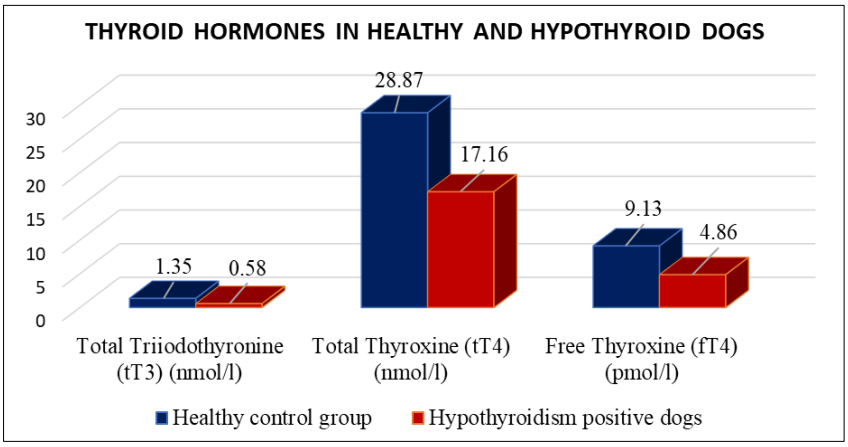

Fig 1: Thyroid hormones in healthy group and hypothyroid dogs

Haematological parameters

There was a non-significant decrease (P<0.05) in haemoglobin, packed cell volume and total erythrocyte count in hypothyroid dogs as compared to the healthy control group (Fig. 2, 3 and 4). The present findings are in corroboration with the reports of Dixon *et al.* (1999); Durga (2017) and Anand (2018) [5, 7 & 1]. Whereas, Ramesh *et al.* (2018) [17] reported that the haematological parameters in hypothyroid dogs were within the normal limits. Anemia noticed in the present study might be due to the decreased plasma erythropoietin or decreased erythroid progenitor response to erythropoietin, or due to a direct effect of thyroid hormone on early hemopoietic system and pluripotent stem cells (Panciera, 1994) [16]. Thyroid hormones have important effect on erythropoiesis and it enhances erythropoiesis through hyper proliferation of immature erythroid progenitors and increase secretion of erythropoietin (EPO) by inducing erythropoietin gene expression. Thyroid hormones also augment repletion of hypoxia inducible factor 1 (HIF-1) and then motivate growth of erythroid colonies (BFU-E, CFU-E) (Dorgalaleh *et al.*, 2013) [6].

In hypothyroid dogs there was a significant increase ($p \leq 0.05$) in total leucocyte count when compared to healthy control group (Fig. 5). Similar findings were reported by Gupta (2016) and Anand (2018) [11 & 1] whereas, Srikala and Kumar (2014) [21] found no significant difference in total leucocyte count in hypothyroid dogs. In hypothyroid state, there is decreased T- cell function and humoral immunity. This decrease in local immunity causes the skin to become more susceptible to infection. Skin becomes more susceptible to secondary bacterial/fungal or parasitic infection, leading to elevation of total leukocyte count (Panciera, 1994) [16].

There was a significant (P<0.05) increase ($p \leq 0.05$) in neutrophils (Fig. 6) with no significant difference ($p \leq 0.05$) in lymphocytes, eosinophils and monocytes between hypothyroid and healthy dogs (Fig. 7, 8 and 9). These

findings were in agreement to the earlier findings reported by Ghodasara *et al.* (2013) [9]. The neutrophilia observed in hypothyroid dogs could be attributed to the presence of secondary infections like pyoderma, Malassezia dermatitis or due to chronic systemic illness.

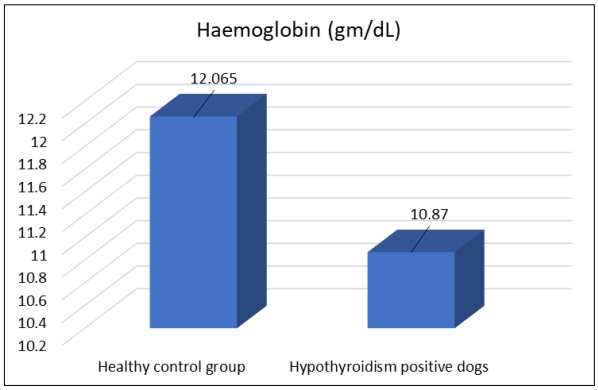

Fig 2: Haemoglobin (gm/dL) in healthy control group and hypothyroidism positive dogs

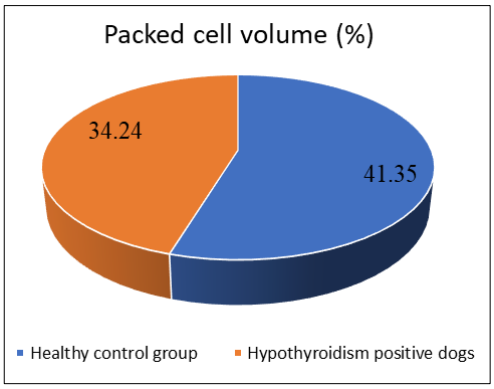

Fig 3: Packed cell volume (%) in healthy control group and hypothyroidism positive dogs

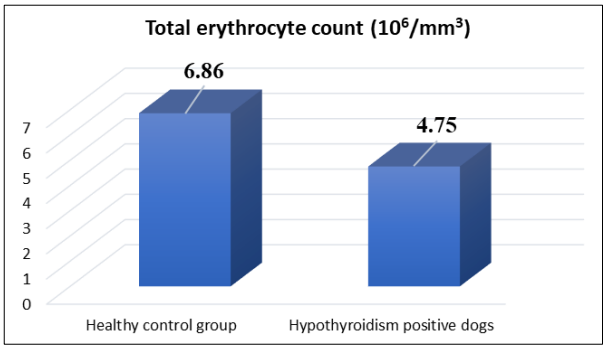

Fig 4: Total erythrocyte count (10^6/mm^3) in healthy control group and hypothyroidism positive dogs

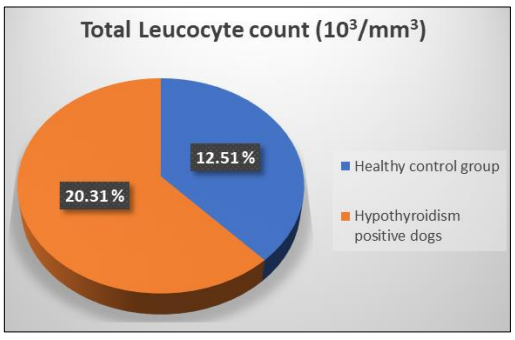

Fig 5: Total leucocyte count (10^6/mm^3) in healthy control group and hypothyroidism positive dogs

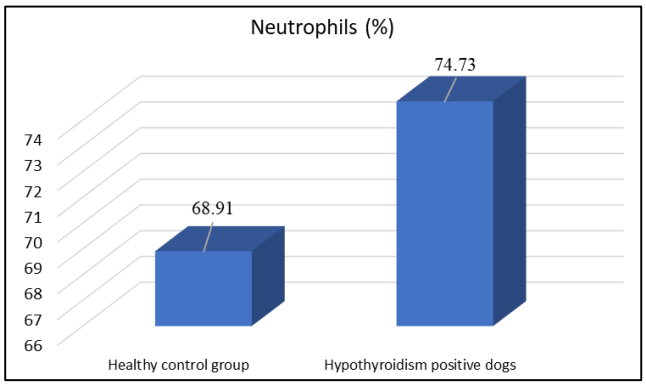

Fig 6: Neutrophils (%) count in healthy control group and hypothyroidism positive dogs

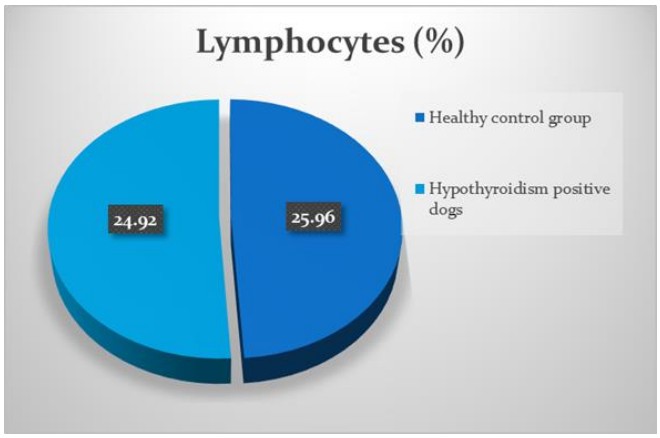

Fig 7: Lymphocytes (%) count in healthy control group and hypothyroidism positive dogs

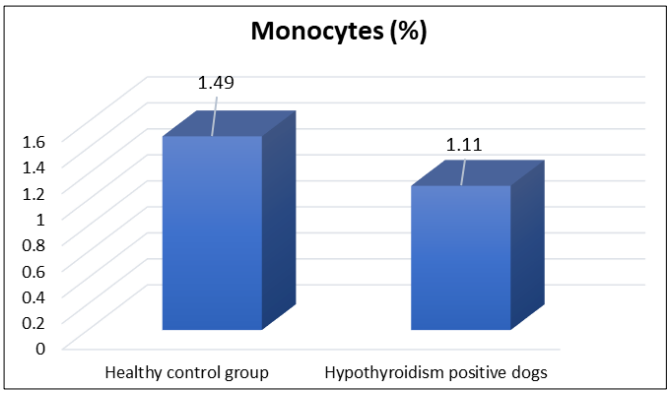

Fig 8: Monocytes (%) count in healthy control group and hypothyroidism positive dogs

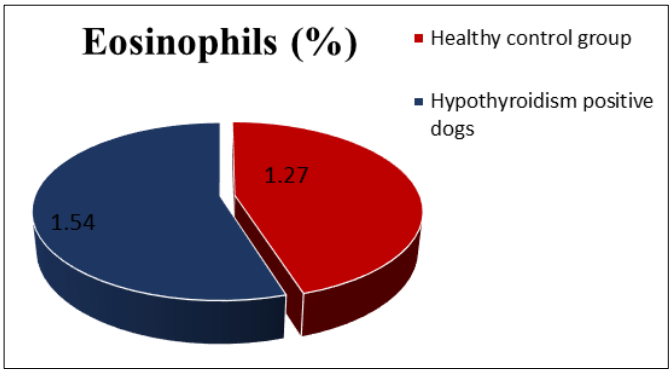

Fig 9: Eosinophils (%) count in healthy control group and hypothyroidism positive dogs

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