Research Article

Thyroid Hormones and Some Biochemical Profiles in Different Age Groups of Adult Labrador Dogs

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Abstract

Present study was conducted on total 60 apparently healthy Labrador dogs which were regularly vaccinated and dewormed, belonging to individuals from Mumbai. Dogs were grouped into, 3-4, 4-5 and 5-6 years of age. The blood samples were collected from the cephalic vein of these dogs during morning hours. Clear serum was separated by centrifugation at 3000 rpm for 10 min. The serum samples were analyzed for blood biochemical analytes *viz.*, tri-iodothyronine (T_3), thyroxine (T_4), serum AST, serum ALT and serum bilirubin. Serum T_3 hormone concentration (ng/dl) in age group of 3 - 4years, 4 - 5 years and 5 - 6 were 101.86 ± 1.48, 99.54 ± 0.79 and 96.68 ± 0.60 respectively. Serum T_4 hormone (µg/dl) concentration in age group of 3 – 4 years, 4 - 5 years and 5 - 6 years were 1.23 ± 0.08, 1.10 ± 0.07 and 0.91 ± 0.02 respectively. AST (U/L) concentration in age group of 3 - 4years, 4 - 5 years and 5 - 6 years were 36.60 ± 2.01, 40.20 ± 1.76 and 44.60 ± 1.88 respectively. Serum ALT concentration was significantly increased with increase in age and serum bilirubin (mg/dl) concentration in age group of 3 - 4years, 4 - 5 years and 5 - 6 years were 0.30 ± 0.03, 0.31 ± 0.05 and 0.34 ± 0.02 respectively. These values can be used in future in this particular breed and age as reference values to compare reports.

Keywords: Thyroid hormone, Biochemical profile, liver enzymes, Labrador dogs

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Introduction

One of the most popular family companion, the Labrador dog, is one of the most loyal and dependable breeds in the world [1] and because of these qualities, interest in this dog has been increasing in the last couple of decades. As the animal ages, many changes can be seen in them internally and externally. Some of the physiochemical metabolite levels alter during different life stages from puppyhood to geriatric age group in dogs. Most of the dogs, as they grow older, suffer from liver dysfunction, renal failure or hormonal issues due to paucity of technical knowledge amongst pet owners and die due to unclear laboratory investigations and prognosis of diseased dogs. Hence, blood is considered as an important material for evaluation of the health status in animals [2]. The thyroid is an endocrine organ found in all vertebrates. Thyroid hormones played important role in all major metabolic pathways and are involved in the regulation of the basal metabolism of the majority of tissues and consequently in the metabolism of lipids, carbohydrates and proteins. Bilirubin has a complex metabolism, which is important in relation to several processes involved in drug metabolism [3]. Although, Labrador is a widespread breed in India, there is a scarcity of information about variations in their blood biochemical constituents, particularly, post their complete growth phase. Therefore present study design with the objective to study age-associated changes in laboratory values in Labrador dogs in order to establish standard values. These standard values could serve to judge the health status of this breed in their adult stage.

Material and Methods

The research was conducted on 60 Labrador dogs, which were selected from Bombay Veterinary College, OPD, Goregaon campus and private clinics and divided into 20 dogs from each age group of 3-4 years, 4-5 years and 5-6 years. All the dogs had regular deworming and vaccination and showed no signs of illness, systemic disease or endocrinological dysfunction and had good health condition. They all were kept on common balanced diet consisting

of chicken, rice and vegetables only. The blood samples were collected from the cephalic vein of these dogs during morning hours. They were carried to the Department of Veterinary Biochemistry laboratory, Mumbai Veterinary College, Parel, Mumbai -400012 by maintaining cold chain. Clear serum was separated by centrifugation at 3000 rpm for 10 min. The serum samples were stored at – 20 ^{0} C until used for analysis. Thyroid hormones were estimated by radioimmunoassay using the kits supplied by Board of Radioisotope Technology (BRIT), Bhabha Atomic Research Centre (BARC), Mumbai. AST and ALT and Bilirubin were estimated by using biochemical autoanalyser (Robonic spectrophotometer) and kits were supplied by [ROBONIC (INDIA) PVT. LTD. Plot No.A-374, TTC, MIDC Industrial Area, Navi Mumbai – 400710, INDIA]. Analysis of variance of the data of the serum concentrations of T_3 and T_4, AST, ALT and Total bilirubin was done according to Snedecor and Cochran (1994) [4] using Completely randomized design (CRD). Differences in means were tested using critical difference (CD) test.

Results and Discussion

Tri-iodothyronine (T_3)

The tri-iodothyronine (ng/dl) concentration in the serum of experimental Labrador dogs is presented in **Table 1** and the levels are depicted in **Figure 1**. The serum concentration of triiodothyronine has shown significant decrease from 3- 4 years of age to 4-5 years of age and 5-6 years of age as the animal grew older, but was within normal reference range of 82 – 138 ng/dl [5]. The values are in close agreement with Megha *et al.* (2016) [6]. The thyroxine has shown decrease from 3 - 4 years of age to 4 - 5 years of age and significant decrease from 4 – 5 to 5 - 6 years of age as the animal grew older. This was in concurrence with Megha *et al.*, (2016) [6] and Carter *et al.*, (2009) [7]. Increasing trends of AST has been noticed with the age of the dogs, highest being in the age group of 5 - 6 years. There is close resemblance in the values and increasing trend observed by Mundim *et al.*, (2006) [8] and Muhsen *et al.*, (2010) [9]. The findings of increased T_3 levels with the age in the present study were in concurrence with the earlier studies, who opined that the measurement of T_3 concentration is a valuable diagnostic tool for the detection of canine hypothyroidism [10] and T_3 levels progressively shift to lower values with age.

Table 1 Mean ± S.E. of serum T_3, T_4, AST, ALT and total bilirubin of Labrador dogs

Age Group	T_3(ng/dl)	T_4(ng/dl)	AST(U/L)	ALT(U/L)	Total Bilirubin(mg/dl)
3 – 4 years	101.86 ± 1.48^a	1.23 ± 0.08^a	36.60 ± 2.01	43.75± 2.01	0.30 ± 0.03
4 – 5 years	99.54 ± 0.79^{ab}	1.10 ± 0.07^a	40.20 ± 1.76	48.55± 2.63	0.31 ± 0.05
5– 6 years	96.68 ± 0.60^b	0.91± 0.02^b	44.60 ± 1.88	55.60± 2.36	0.34 ± 0.02

Means with different superscripts differ significantly

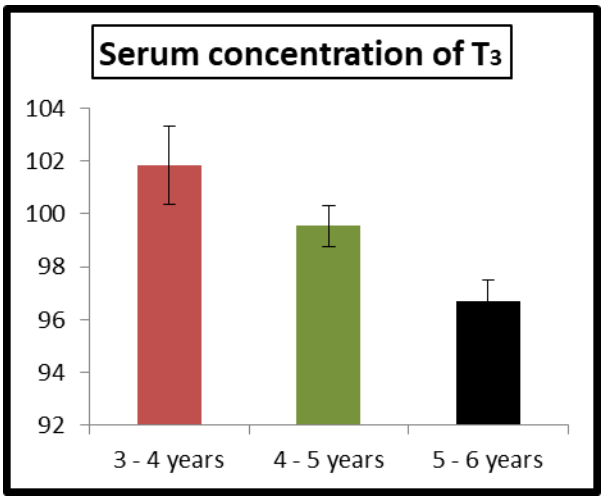

Figure 1 Mean ± S.E. levels of T_3 in Labrador dogs

Thyroxine (T_4)

The Thyroxine (µg/dl) concentration in the serum of Labrador dogs is presented in Table 1and the levels are depicted in **Figure 2**. The mean ± S.E. levels of the T_4 during 3 - 4 years of age group, 4 – 5 years of age group and 5 – 6 years of age group were 1.23 ± 0.08, 1.10 ± 0.07 and 0.91 ± 0.02 respectively. The thyroxine has shown decrease from 3 - 4 years of age to 4 - 5 years of age and significant decrease from 4 – 5 to 5 - 6 years of age as the animal grew older. Highest level of 1.23 ± 0.08 was reported in 3 – 4 year of age group. Then serum T_4 levels were slightly decreased to

1.10 ± 0.07 in 4 – 5 years of age but it was statistically non significant. Later it decreased ($p<0.05$) to 0.91±0.02 µg/dl in 5 – 6 years of age, which was statistically significant. All the values were within normal reference range of 0.6 - 3.6 µg/dl [11]. Steady decrease in the serum level of T_4 could be the evidence for hypothyroidism in adult aged dog, i.e., if the concentrations go below normal range. Reason for rapid decline in T_4 could probably be due to maturation of the endocrine system.

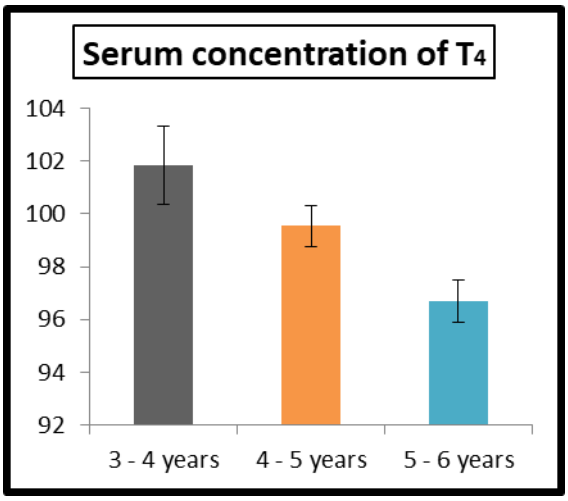

Figure 2 Mean ± S.E. levels of T_4

Aspartate Amino Transferase (AST)

The concentration of Aspartate Amino Transferase (AST) in Labrador dogs of different age groups is presented in Table 1and the levels are depicted in **Figure 3**. The mean ± S.E. levels of the AST(U/L) during 3 - 4 years of age group, 4 – 5 years of age group and 5 – 6 years of age group were 36.60 ± 2.01, 40.20 ± 1.76 and 44.60 ± 1.80 respectively. All the values are within normal reference range of 23 - 66 U/L [11] Increasing trends of AST has been noticed with the age of the dogs, highest being in the age group of 5 - 6 years. Elevated serum hepatic enzyme activities, above its normal range, may be associated with a high prevalence of fatty liver, which is frequently observed in obese humans [12]. This increasing trend of AST could be due to continuous wear and tear and pressure on liver to maintain its performance. Further, this increase in serum concentration of AST may be due to physiological variations related with age, hormone action and reproductive phases (gestation, lactation).

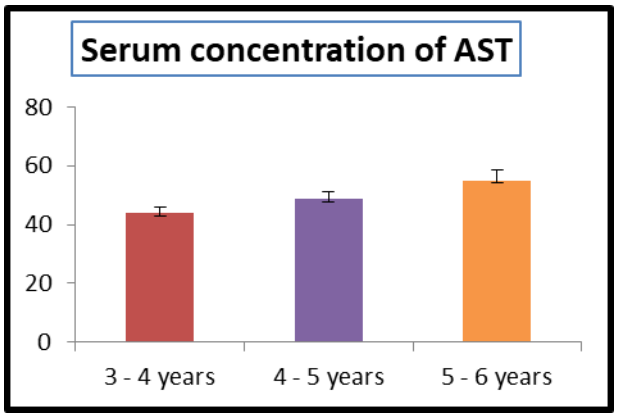

Figure 3 Mean ± S.E. levels of serum AST in Labrador dogs

Alanine Amino Transferase (ALT)

The concentration of Alanine amino transferase (ALT) in Labrador dogs of different age groups is presented in Table 1 and the levels are depicted in **Figure 4**. The mean ± S.E. levels of the ALT (U/L) during 3 - 4 years of age group, 4 - 5years of age group and 5 – 6 years of age group were 43.75 ± 2.01, 48.55 ± 2.63 and 55.60 ± 2.36 respectively. All the values are within the normal reference values of 21 – 102 U/L (Kaneko, 1997). The serum ALT has shown significant increasing trend from 3 - 4 years of age to 4 - 5 years of age and 5 - 6 years of age as the animal grew older. Highest level of 55.60 ± 2.36 was recorded in 5 – 6 years of age group. Lowest level of 43.75 ± 2.01 was

recorded in 3 – 4 years of age group, which increased ($p<0.01$) to 48.55 ± 2.63. Then serum ALT levels were increased significantly, ($p<0.05$) to 55.60 ± 2.36 in 5 – 6 years of age. The serum ALT has shown significant increasing trend from 3 - 4 years of age to 4 - 5 years of age and 5 - 6 years of age as the animal grew older. This increasing trend is in accordance with Mundim *et al.,* (2006) [8]. Vahala *et al.,* (1991) [13] also noticed similar increasing trend but lower mean values in 2 – 6 years of age group in his study on cape dogs. Results obtained in our study corroborate with the findings of Jangsangthong *et al.* (2001) [14] who reported an increasing trend of serum ALT values with age. Moreover, marginally higher serum concentration of ALT activity from the age of 2 years and onwards could be due to physiological variations related with age, hormone action and reproductive phases (gestation, lactation). The results obtained in our study indicated that there was no evidence of liver damage in adult Labrador dogs.

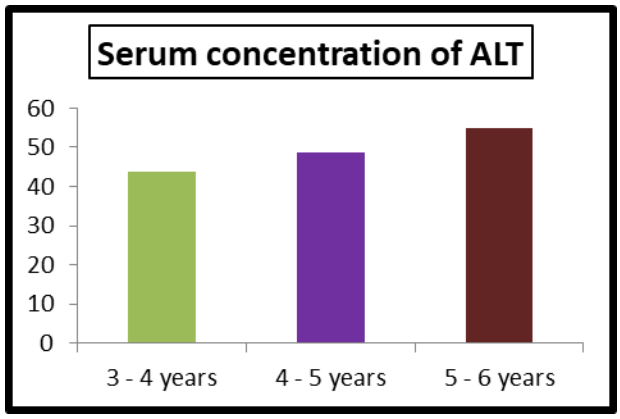

Figure 4 Mean ± S.E. levels of ALT in Labrador dogs

Serum total bilirubin

The concentration of serum total bilirubin in Labrador dogs of different age groups is presented in Table 1 and the levels are depicted in **Figure 5**. The mean ± S.E. levels of the total bilirubin (mg/dl) during 3 - 4 years of age group, 4 – 5 years of age group and 5 – 6 years of age group were 0.30 ± 0.03, 0.31 ± 0.05 and 0.34 ± 0.02 respectively. All the values are within normal reference range of 0.1 – 0.5 mg/dl [11]. The total bilirubin has shown marginal increase from 3- 4 years of age to 4-5 years of age and 5-6 years of age as the animal grew older, but it is not significant enough. This result is in accordance with Yu Mei Chang *et al.,* (2016) [15] who noticed similar marginal change in his study. Serum bilirubin is considered as sensitive marker for the assessment of liver functions in canines. Liver has a large reserve capacity for many of the functions it carries out, which results in relatively specific clinical indications of hepatobiliary diseases, such as icterus, ascites, coagulopathy or hepatic encephalopathy. However, these signs would occur later in the course of the disease.

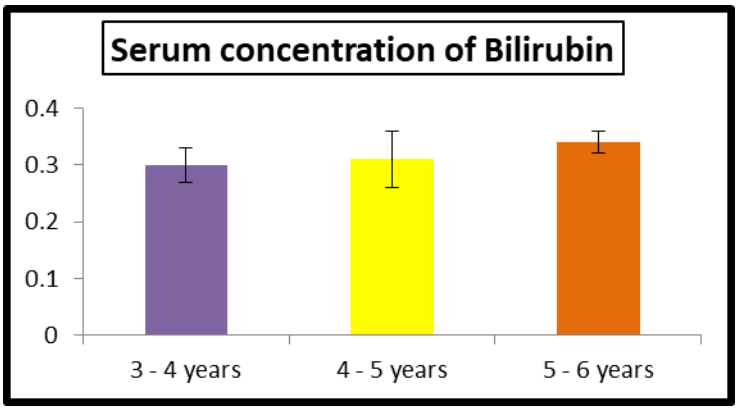

Figure 4 Mean ± S.E. levels of serum bilirubin in Labrador dogs

Conclusion

Significant decreasing trends of T_3 and T_4 values were seen in dogs, as they grew older. Significant increasing trends of Aspartate Amino Transferase (AST), Alanine Amino Transferase (ALT) and marginal increase in bilirubin were seen as age of the Labrador dog advanced. These results may be useful as the complementary diagnostic tool in

clinical evaluation of adult Labrador dogs and could contribute to physiological knowledge on some baseline values of biochemical metabolites in these animals.

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