

## **The Comparison Of Total Cholesterol, Triglyceride, High Density Lipoprotein Cholesterol, Low Density Lipoprotein Cholesterol And Total Cholesterol: High Density Lipoprotein Cholesterol Ratios In Breeds Of Labrodor Retriever Dogs, German Shepherd Dogs, Pointer Dogs**

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**Summary:** This study was carried out to compare the levels of total cholesterol, triglyceride, HDL – C, LDL – C, TC: HDL – C ratio and to determine of ischemic heart disease risk in healthy German shepherd, Labrodor retriever and Pointer. Material of this study included a total of 65 healthy dogs from both sexes and 2 to 4 years old, 15 of which were Pointers, 21 of which were German shepherd and 29 of which were Labrodor retrievers. Blood samples were taken from each dog fasted for at least 12 hours, to evaluate total cholesterol, triglyceride, HDL - C, LDL – C. Plasma total cholesterol level was significantly ( $p < 0.001$ ) lower in Pointer than in German shepherd and Labrodor retriever. The serum HDL - C level was significantly ( $p < 0.001$ ) higher in German shepherd and Labrodor retriever than in Pointer. However, LDL - C level was lower in Pointers compared with German shepherd and Labrodor retriever. Also, it was observed that total cholesterol: HDL – C ratio was higher ( $p < 0.001$ ) in Labrodor retriever when compared with other two breeds. As a result, in this study, it was concluded that the prevalence of lipoprotein metabolism disorders and coronary artery disease might be lower in pointer than in German shepherd and Labrodor retriever.

**Key Word:** Total cholesterol, triglyceride, HDL – C, LDL – C, TC: HDL – C ratio

### **Labrodor Retriever, German Shepherd Pointer Köpek Irklarında Total Kolesterol, Trigeriserid, Hdl – C, Ldl – C ve Total Kolesterol: Hdl – C Oranlarının Karşılaştırılması**

**Özet:** Bu Çalışma, sağlıklı German shepherd, Labrodor retriever ve pointer köpeklerinde total kolesterol, trigliserid, HDL – C, LDL – C, TC: HDL – C oranlarını karşılaştırmak ve ishemik kalp hastalıkları riskini tespit etmek için yapıldı. Çalışmanın materyelini 15’ni pointer, 21’ni „German Shepherd ve 29’nü Labrodor retriever olmak üzere her iki cinsiyetten ve 2-4 yaşları arasında toplam 65 sağlıklı köpek oluşturdu. Total kolesterol, trigliserid, HDL – C ve LDL – C değerlendirilmesi için 12 saat aç olan her bir köpektan kan örnekleri alındı. Pointerlerdeki plasma total kolesterol seviyesi German shepherd ve Labrodor retriever’lardan önemli düzeyde düşük bulundu ( $p < 0.001$ ). Serum HDL –C miktarı German shepherd ve Labrodor retriever’larda Pointer’den önemli düzeyde daha yüksekti ( $p < 0.001$ ). Bununla birlikte LDL – C seviyesi German shepherd ve Labrodor retriever’lara göre Pointer’lerde daha düşüktü. Diğer ırklarla karşılaştırıldığında total kolesterol: HDL – C oranlarının Labrodor retriever’larda daha yüksek olduğu görüldü. Sonuç olarak bu çalışmada lipoprotein metabolizması bozuklarının ve korener arter hastalıklarının prevalansı Pointer ırkı köpeklerde German shepherd ve Labrodor retriever’lardan daha düşük olabileceği kanısına varıldı.

**Anahtar Kelimeler:** Total kolesterol, trigiserid, HDL – C, LDL – C, TC: HDL – C oranı

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## Introduction

Cholesterol and triglyceride are vital to a number of body functions. Cholesterol is a key component of cell membranes and myelin sheaths. Also, it is the precursor compound for steroid hormones and bile salts. Triglyceride is the major constituent of adipose tissue and as such represents the body's energy reserve and is derived equally from the diet and de nova synthesis in the liver<sup>7,17</sup>.

Hyperlipidemia or hyperlipoproteinemia can be divided into two major categories, hypertriglyceridaemia and hypercholesterolaemia<sup>7</sup>. The term hyperlipidaemia is used in clinical practice to define raised concentrations of cholesterol and triglycerides in blood samples taken from animals that have fasted for at least 12 hours. Cholesterol and triglycerides are contained within plasma special complexes called lipoproteins<sup>7,17</sup>. Lipoproteins are macromolecules composed of various lipids, sterols, and apolipoproteins. The five major lipoprotein classes are chylomicrons, very - low - density lipoprotein (VLDL - C), intermediate- density lipoprotein (IDL - C), low- density lipoprotein (LDL - C), and high- density lipoprotein (HDL - C)<sup>3,7,17</sup>. Chylomicrons are the largest and least and least dense lipoprotein particles<sup>4</sup>. These are combined with bile acids, cholesterol and phospholipids to form mixed micelles that transfer the lipids to adjacent mucosal cell for absorption<sup>4,17</sup>. The major function of VLDL - C is the transport and distribution of triglyceride. These particles also carry a significant cholesterol loads as they are used to export cholesterol from the liver<sup>3,4,17</sup>. Low- density lipoprotein particles contains the most cholesterol in humans, and is the major cholesterol-containing (atherosclerogenic) lipoprotein<sup>7</sup>. However, in dogs and cats nearly equal amounts of triglyceride and cholesterol are carried by LDL - C<sup>4</sup>. The high-density lipoprotein are smallest and most abundant lipoproteins, and they are responsible for transporting total cholesterol back to the liver. As a member of the antiatherogenic lipoprotein family, HDL - C are recognized for their ability to remove excess total cholesterol from tissues<sup>3,4</sup>. Also, total cholesterol (TC) to HDL - C ratio are the most important predictors of coronary artery disease events in human<sup>9</sup>. Hypertriglyceridaemia is caused by reduced clearance of chylomicrons and VLDL - C. However, hypercholesterolaemia

results from altered metabolism of HDL - C and LDL - C<sup>17</sup>. In veterinary medicine, hypercholesterolaemia is representative of an underlying metabolic disturbance affecting lipid catabolism or lipoprotein transport. Hypertriglyceridaemia not only signals the presence of an underlying metabolic disorder, but it is an important risk factor to the patient's health that justifies dietary and therapeutic intervention<sup>4,17</sup>.

In this study, it was aimed to compare the levels of total cholesterol, triglyceride, HDL - C, LDL - C, TC: HDL - C ratio and to determine the ischemic heart disease risk in normal healthy German shepherd, Labrador retriever and pointer.

## Materials and Method

Material of this study included a total of 65 healthy dogs from both sexes and 2 to 4 years old, 15 of which were pointer, 21 of which were German shepherd and 29 of which were Labrador retriever.

Blood samples were taken from each dog fasted for at least 12 hours, to evaluate total cholesterol, triglyceride, HDL - C, LDL - C levels. Serum and plasma samples were immediately analysed.

An automated enzymatic colorimetric method was used for serum total cholesterol and triglyceride determination. HDL - C was measured after precipitation of other lipoprotein with phosphotungstic acid-magnesium acetate (cromatest kit). Low density lipoprotein total cholesterol was calculated by using the method of Friedewald et. al. Formula<sup>5</sup>. Total cholesterol : HDL - C ratio was calculated from framingham study<sup>10</sup>.

All data were analyzed by using two sample student-t test.

## Results

Results of this study was presented in table 1. Serum total cholesterol level was significantly ( $P < 0.001$ ) lower in Pointer than in German shepherd and Labrador retriever. Although there was no statistically significant differences between German shepherd and Labrador retrievers; plasma total cholesterol level was higher in Labrador retriever than in German shepherd. Serum

concentrations of triglyceride was not significantly different between the groups.

The serum HDL - C level was significantly higher ( $p < 0.001$ ) in German shepherd and Labrador retrievers than in Pointers. However, plasma HDL - C level was not significantly different between Labrador retriever and German shepherd.

Plasma concentrations of LDL - C was not significantly different in German shepherd and Labrador retriever, LDL - C levels was lower in Pointer compared with German shepherd and Labrador retrievers. Also, it was observed that total cholesterol : HDL - C ratio was higher ( $p < 0.001$ ) in Labrador retriever when compared with other breeds.

**Table I. Statistical results of lipid profiles and total cholesterol / HDL - C ratio of all dogs.**

parameters	pointer	german sheep- HERD	labrador retriever
T. cholesterol (mg/dl)	157.31 ± 29.69 <sup>a</sup>	213.33 ± 62.48 <sup>b</sup>	232.41 ± 41.48 <sup>b***</sup>
Triglyceride (mg/dl)	81.08 ± 21.91	72.43 ± 28.93	75.48 ± 30.52
HDL-C (mg/dl)	114.92 ± 21.46 <sup>a</sup>	141.81 ± 28.96 <sup>b</sup>	147.59 ± 27.35 <sup>b***</sup>
LDL-C (mg/dl)	26.17 ± 9.62 <sup>a</sup>	61.79 ± 32.16 <sup>b</sup>	71.04 ± 21.07 <sup>b***</sup>
TC:HDL-C ratio	1.37 ± 0.07 <sup>a</sup>	1.49 ± 0.13 <sup>ab</sup>	1.57 ± 0.17 <sup>bc***</sup>

\*\*\* $P < 0.001$

## Discussion

In veterinary medicine, quantitative lipid analysis in both dogs and cats provides strong preliminary evidence for the existence of several clinical disorders that can be attributed to abnormal lipoprotein metabolism<sup>4</sup>. In dogs, hyperlipidemia either results from a familial defect in lipoprotein metabolism or is an acquired disorder that develops secondary to a disease in which lipid metabolism is altered, e.g. insulin dependent diabetes mellitus, acute pancreatitis, hypothyroidism, hyperadrenocorticism and cholestasis<sup>4,7,17</sup>. In this study, total cholesterol, triglycerides, HDL, LDL and TC: HDL - C ratio were determined in a total of 65 healthy dogs from both sexes and 2 to 4 years old, 15 of which were Pointer, 21 of which were German shepherd and 29 of which were Labrador retriever. Concentrations of total cholesterol was clearly higher in Labrador retrievers

(232.41 ± 41.48 mg/dl) and German shepherds (213.33 ± 62.48 mg/dl) than in pointers (157.31 ± 29.69 mg/dl). In a similar study<sup>14</sup>, Sato et. al revealed that mean plasma cholesterol level was significantly higher in Shetland shepherd dogs than in mix breeds. Hypercholesterolaemia is most commonly seen secondary to hypothyroidism in dog<sup>3,7,17</sup>. Cholesterol levels are increased in some dogs with diabetes mellitus, acute pancreatitis and the nephrotic syndrome<sup>3,13,17</sup>. Therefore, in this study Labrador Retrievers might be more predisposed to lipoprotein metabolism disorders, Which cause hypercholesterolemia.

The high density lipoprotein - cholesterol are serve two major functions. They act as a circulating reservoir of apoC and apoE which are transferred to chylomicrons and VLDL - C to facilitate their metabolism<sup>17</sup>. Also, they are reversed transport of cholesterol from peripheral tissues to the liver<sup>7,3,17</sup>. Therefore, HDL -C are recognized as a member of the antiatherogenic lipoprotein family<sup>4,10</sup>. Two distinct high density lipoproteins have been recognized in the sera of normal dogs (HDL - C1 and HDL - C2)<sup>4,7,17</sup>. However, the actual role of HDL - C subgroups in predicting or diagnosing disease in animals has not been defined<sup>4</sup>. In this study, plasma HDL - C level was significantly ( $p < 0.001$ ) higher in German shepherd and Labrador retrievers than in Pointers ( $p < 0.001$ ). However, plasma HDL - C level was not significantly different in Labrador retrievers and German shepherds. Several prospective epidemiologic studies have found that serum HDL - C concentrations are an independent risk factor for coronary artery disease in human<sup>1,2,6,9,10,12,15</sup>. However, variation in the elevated TC/HDL - C ratio is significantly more substantial alterations in metabolic indices predictive of ischemic heart disease risk<sup>1,8,10,16</sup>. Although HDL - C level in this study was higher in Labrador retrievers than in pointers, TC/ HDL - C ratio is lower ( $p < 0.001$ ) in pointers than in Labrador retrievers and German shepherds. Thus, risk of coronary heart diseases may be higher in Labrador retrievers than in Pointer. Moreover, Liu et al.<sup>11</sup> reported that prevalence of atherosclerosis was a higher in Labrador retriever than in the other breeds.

In this study, plasma concentrations of LDL - C was lower ( $p < 0.001$ ) in Pointers compared with German shepherds and Labrador retrievers. In human, almost three - fourths of the

total cholesterol is contained within the LDL – C and is the major atherosclerogenic lipoprotein. In dogs, however, nearly equal amounts of triglyceride and cholesterol<sup>4,7</sup>. On that basis, present study suggests that atherogenic metabolic disturbances may not always be adequately reflected by the variation in the LDL – C levels.

Triglyceride assay is almost always available. Triglyceride values of 55±8.1 mg/dl are considered normal, 200 to 400 mg/dl mild elevation, 400 to 1000 mg/dl moderate elevation, and greater than 1000 mg/dl severe elevation<sup>7</sup>. In this study, the serum concentrations of triglyceride was normal in all three breeds (Table-I). Also was similar in all three breeds.

As a result, when compared with German shepherds and Labrodor retrievers, it was concluded that the lipoprotein metabolism disorders and coronary artery disease might be lower in pointer dogs. Also the variations in TC:HDL – C ratios may be more important in evaluating the incidence of ischemic heart disease risk.

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