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Gabriela Dal'Agnol Lara
Verônica Lordello Gulin
Gilberto Serighelli-Júnior
Ester Hanna de Pauli Flaksberg
César Jun Hironaka Nakao
Gabriellye Tavares de Abreu
Rosângela Locatelli Dittrich

AUTHOR FOR CORRESPONDENCE

Gabriela Dal'Agnol Lara
gabrielalara@ufpr.br

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Obesity-Related Dyslipidemia in Domestic Cats: A Comparative Analysis of Lipid Profile Alterations

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Gabriela Dal'Agnol Lara¹, Verônica Lordello Gulini², Gilberto Serighelli-Junior¹, Ester Hanna de Pauli Flaksberg², César Jun Hironaka Nakao¹, Gabriellye Tavares de Abreu³, Rosângela Locatelli Dittrich³

¹Department of Veterinary Medicine, Federal University of Paraná (UFPR), Curitiba, Brazil, State of Paraná, Brazil. ORCID 0009-0002-9527-6765 (G.D.L.); 0000-0002-0979-7939 (G.S.J.); 0000-0002-5971-4943 (C.J.H.N.)

²Undergraduate Veterinary Medicine, Federal University of Paraná (UFPR), Curitiba, Brazil, State of Paraná, Brazil. ORCID 0009-0009-7622-9411 (E.H.F.); ORCID 0009-0003-0008-4099 (V.L.G.)

³Laboratory of Clinical Pathology, Federal University of Paraná (UFPR), Curitiba, Brazil, State of Paraná, Brazil. ORCID 0000-0001-5144-6422 (R.L.D.); ORCID: 0009-0001-9261-1866 (G.T.A.)

Author for correspondence: Gabriela Dal'Agnol Lara – gabrielalara@ufpr.br

Abstract: Feline obesity is a prevalent disorder that predisposes cats to metabolic diseases, but comprehensive data on its specific effects on serum lipid profiles are lacking. This study aimed to establish reference intervals for HDL cholesterol and a lipid profile in healthy, lean cats. It characterized serum concentrations of total cholesterol, HDL, VLDL, LDL, and triglycerides, and examined alterations across body condition scores, age groups, and between sexes. In a prospective cross-sectional study of eighty-five client-owned cats (25 lean, 60 overweight/obese), body condition was assessed using body weight and a 9-point BCS system. Biochemical analyses were performed using a Mindray® BS200 automated analyzer. Results established an HDL reference interval of 39.1–163.9 mg/dL for lean cats. Obesity was linked to a distinct dyslipidemia, characterized by a pronounced 58% increase in triglycerides and rising VLDL. Interestingly, while HDL levels increased with obesity, total cholesterol was up to 13% higher in overweight cats compared to lean cats, indicating a complex metabolic relationship. A significant finding was that 71.2% of young adult cats were already above ideal BCS, with the highest obesity rate (40%) in mature adults. A notable sex disparity was observed, with male cats showing a greater tendency toward higher adiposity.

Keywords: triglycerides; body condition score; overweight; HDL cholesterol.

1. Introduction

Obesity is a significant health concern in domestic cats, and it is estimated to affect over 35% of the global domestic feline population (Mori et al., 2016; Blanchard et al., 2025; Montoya et al., 2025). The relationship between being overweight and its associated metabolic diseases has been a growing concern in veterinary medicine. The definition of obesity is an excessive accumulation of triglycerides in adipose tissues, resulting from an energy imbalance where energy intake exceeds energy expenditure. Studies indicate that long-term obesity in cats leads to lipoprotein abnormalities similar to those in obese humans, including increased triglycerides and non-esterified fatty acids in the plasma (Mori et al., 2015). These changes are associated with insulin resistance, a typical progression in obese cats that can lead to type 2 diabetes.

Plasma lipoproteins in cats, including chylomicrons, VLDL, LDL, and HDL sub-classes (HDL1, HDL2, HDL3), play distinct roles in lipid transport and metabolism (Xenoulis and Steiner, 2010). Dyslipidemia, characterized by elevated triglycerides and non-esterified fatty acids, can also exacerbate other obesity-related health problems in cats, such as hepatic lipidosis or fatty liver disease (Valtolina, 2017; Pazak et al., 1998). The increased flux of non-esterified fatty acids to the liver, a hallmark of dyslipidemia, can overwhelm the liver's capacity for processing lipids, leading to fat accumulation and liver dysfunction, which is thought to be a factor in increasing the production and secretion of very-low-density lipoproteins (VLDL), which raises plasma VLDL concentrations. This condition can further impair metabolic regulation and overall health.

While previous studies (Bauer, 1996; Jordan et al., 2008) compared lean vs. obese cats, the gradation of lipid alterations across body condition scores (BCS 5–9) remains unclear. For instance, do mildly overweight (BCS 6–7) cats exhibit intermediate dyslipidemia, or is there a threshold effect? No studies have correlated VLDL and HDL with BCS in cats, despite their predictive value in human cardiovascular risk (Vekic et al., 2023; Liu et al., 2006). In the veterinary field, there are relatively few studies on the role of HDL and its relationship with complications of hyperlipidemia (Choi, 2024; Hoenig, 2007).

The objectives of this study were to: (1) establish reference intervals for HDL cholesterol in healthy lean cats; (2) characterize serum concentrations of total cholesterol, HDL, VLDL, LDL, and triglycerides across body condition scores (BCS 5–9); (3) assess the impact of overweight and obesity (BCS ≥ 6) on lipid metabolism alterations; and (4) assess lipid profiles across different age groups and between males and female cats. These aims address critical gaps in understanding the interplay between adiposity and dyslipidemia in cats, particularly the lack of BCS-stratified lipid data.

2. Material e Methods

2.1. Animals and Sample Size

This study was approved by the Ethics Committee (Comitê de Ética no Uso de Animais do Setor de Ciências Agrárias, CEUA-SCA) at the Federal University of Paraná (Protocol No. 063/2024), adhering to the Brazilian National Council for Animal Experimentation Control (CONCEA) guidelines. Sample size was estimated a priori using G*Power 3.1.7 (Heinrich Heine University, Düsseldorf, Germany). HDL cholesterol was considered the primary outcome. Assuming a two-tailed α of 0.05, a power

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GRAPHICAL ABSTRACT

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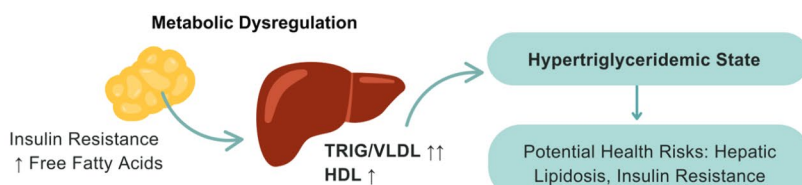
Methods and Cohort

- Lean n=25 (28.8%)
- Overweight n=36 (42.3%)
- Obese n=24 (28.2%)

- Evaluation of Body Condition Score;
- 8 to 12-hour fasting period: 3mL of blood collected via cephalic or jugular venipuncture;
- Serum Lipid Profile: TRIG, TC, HDL, VLDL and LDL.
- Biochemical analyses: Mindray® BS200 automated analyzer.

Findings

- High Prevalence of Excess Weight:** 71% of young adult cats were already overweight or obese;
- Males show higher adiposity risk;



HDL (LEAN) reference interval: 39.1–163.9 mg/dL

Conclusion

Feline obesity is linked to a distinct dyslipidemia, marked by a pronounced increase in TRIG and VLDL that escalates with body condition score. While HDL also rises with obesity, total cholesterol elevation is up to 13% higher in overweight cats compared to obese cats, revealing a complex relationship between adiposity and cholesterol metabolism.



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