

# STUDY ON OBESITY, NUTRITION AND METABOLIC DISEASES ASSOCIATED WITH OR EXACERBATED BY OBESITY IN DOGS - A REVIEW

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## Abstract

*Overeating and a sedentary lifestyle are two of the leading causes for a worrying increase in obesity in the canine population. The present study focuses on dogs with a constant excess weight, framed in a higher body condition score of what is considered "ideal" and suffering from other nutritional and metabolic disorders such as diabetes, hyperlipidemia and hyperadrenocorticism. The listed diseases are most common in veterinary clinics and hospitals, according to experts in the field.*

**Key words:** body condition score, obesity, hiperlipidemia

## INTRODUCTION

There is a growing interest in studying the eating behavior of domestic dogs, because, just like in humans, obesity is now widespread in companion animals [10].

The research scientists opinionated that obesity in pets like domestic dogs could be determined by the same environmental changes that caused the obesity crisis in humans [15].

The incidence rate of obesity in dogs varies from 24% to 44% depending on each country, such as the United Kingdom, Germany, Austria, USA, and Australia. During these studies, which were conducted in veterinary clinics in industrialized countries, there was identified a prevalence of obesity in dogs of at least 20% [4].

## MATERIALS AND METHOD

The current paper tries to provide a theoretical documentation by consulting studies in the country and abroad about obesity as a metabolic disease but also the diseases associated with it.

## RESULTS AND DISCUSSIONS

The term hyperlipidemia refers to growth concentrations of lipids, either triglycerides, cholesterol, or both in the blood [1],[13].

Elevated blood triglycerides are called hypertriglyceridemia, while high blood cholesterol levels are called hypercholesterolemia.

The term hyperlipoproteinemia refers to increased concentrations of lipoproteins in the blood, but it is often used interchangeably with the term hyperlipidemia. However, the term hyperlipoproteinemia should ideally be used only in cases where real lipoproteins have been measured [1],[13].

Lipemia, another term used to describe the milky or cloudy appearance of serum or plasma, is the result of hypertriglyceridemia, but not hypercholesterolemia [1], [8], [13], [17]. Lipemia is usually evident when serum triglyceride concentrations exceed 2.26 mmol / L (200 mg / dL) [1].

As the serum triglycerides grow, the serum becomes turbid and then lactescent. Hyperlipidemic conditions can be classified as familial or acquired and postprandial - considered normal states, and not pathological. Familial hyperlipidemia, also called primary hyperlipidemia, refers to those defects in lipoprotein metabolism that are known or suspected to be inherited [7].

Primary hyperlipidemia is most commonly seen as a congenital disorder in

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mini-schnauzers and beagles, although other breeds may also be affected [7].

Studies show that 30% of Schnauzers suffer from congenital hyperlipidemia, although not all dogs show clinical signs - it seems that they mimic the signs of acute pancreatitis, so the disease has been called *pseudopancreatitis* [7]. The breed, family offspring, age, and clinical history can be used to support a diagnosis of hyperlipidemia in dogs.

Triglycerides are the predominant dietary fats in pet food. After eating a meal, dogs and cats will experience transient (postprandial), physiological hyperlipidemia, characterized by an increase in the concentration of triglycerides (circulating chylomicrons), and, depending on the amount of fat consumed, serum turbidity (lipemia) [18].

However, postprandial hyperlipidemia does not necessarily imply that there is a disorder of lipid or lipoprotein metabolism. In healthy dogs and cats, postprandial hyperlipidemia normally persists for 6 to 12 hours after a meal.

Therefore, in order to be able to confirm whether a patient is hyperlipidemic or not, it must fast 10 to 12 hours before blood collection, thus effectively excluding postprandial hyperlipidemia [8].

Acquired hyperlipidemia, also called secondary hyperlipidemia, refers to an excessive concentration of lipids in the blood resulting from an underlying ailment in which the normal metabolism of lipoproteins is significantly altered.

Several endocrine diseases alter lipid metabolism, leading to secondary hyperlipidemia. For example, insulin-deficient conditions alter carbohydrate and lipid metabolism. Animals with insulin-dependent diabetes mellitus may have either hypertriglyceridemia or hypercholesterolemia [8]. Hyperadrenocorticism, kidney conditions, and hypothyroidism are variably associated with secondary hyperlipidemia [8].

In one study it was approximated that between 25% and 30% of dogs with hyperadrenocorticism and 30% of dogs with hypothyroidism left untreated have excess serum cholesterol levels [6].

Spontaneous hyperadrenocorticism, also known as *Cushing's syndrome*, is caused by chronic and pathological overproduction of cortisol and generally occurs in middle-aged and geriatric dogs, being less common in cats [9].

The excess of glucocorticoids (hormones produced by the adrenal glands) lead to an association between physical and biochemical changes that have a considerable impact on the quality of life of the animal [2], [11].

Diabetes is an endocrine disorder that occurs in both dogs and cats.

*Diabetes mellitus* can be caused by the relative or absolute deficiency of the hormone insulin, which is produced by the beta cells of the pancreas. Insulin stimulates the transport of glucose and other nutrients across cell membranes for cellular use and is involved in a number of anabolic processes in the body. Lack of insulin activity leads to increased blood glucose (hyperglycemia) and the inability of the tissues to receive the glucose they need (glucoprivation) [16].

*Diabetes mellitus* is currently one of the most commonly diagnosed endocrine disorders in dogs and pet cats.

In one study of a population of Swedish dogs (medically insured) estimated that 1.2% of dogs would develop diabetes before the age of 12, a prevalence which has dramatically increased in the last 30 years [5].

The risk factors for the development of diabetes in dogs include previous or concomitant hyperadrenocorticism, stress, recurrent episodes of pancreatitis - estimated at 28% of the cases, and the presence of a genetic predisposition [3].

Type I diabetes (formerly called insulin-dependent *diabetes mellitus*) is identified by an absolute lack of endogenous insulin and a consequent dependence on exogenous insulin for survival. This form of the disease is often caused by the immune destruction of pancreatic beta cells by T-cells and antibodies.

It is estimated that at least 50% of diabetic dogs have immune-mediated type I diabetes, as indicated by the presence of island cell antibodies [12].

In the case of the following metabolic disorders, obesity can be their cause or it can be determined by them, as they will be shown in table 1[6].

Table 1 Main metabolic changes and endocrinopathies associated with or exacerbated by obesity

Metabolic changes	Endocrinopathies
Dyslipidemia or hyperlipidemia Glucose intolerance Liver lipidosis (cats) Insulin resistance Anaesthetic complications	Diabetes mellitus Hyperadrenocorticism Hypopituitarism Hypothalamic lesions Hypothyroidism Insulinoma Pituitary chromophobe adenoma

Source: [14]

## CONCLUSIONS

Nutritional programmes to monitor body weight and hormonal and biochemical testing in veterinary clinics and hospitals could prevent the onset of obesity and other associated diseases.

## REFERENCES

- [1] Bauer J. E. 2004. Lipoprotein-mediated transport of dietary and synthesized lipids and lipid abnormalities of dogs and cats. *Journal of the American Veterinary Medical Association* 224: 668-675.
- [2] Carotenuto G., Malerba E., Dolfini C., Brugnoli F., Giannuzzi P., Semprini G., Tosolini P., & Fracassi F., 2019 - Cushing's syndrome-an epidemiological study based on a canine population of 21,281 dogs. *Open veterinary journal*, 9(1), 27–32.
- [3] Catchpole B., Ristic J.M., Fleeman L.M., Daviso L.J., 2005 - Canine diabetes mellitus: can old dogs teach us new tricks?, *Diabetologia*, vol. 48, p: 1948–1956.
- [4] Diez M., Nguyen P., 2006 - The epidemiology of canine and feline obesity, *WALTHAM Focus*;
- [5] Fall T., Hamlin H.H., Hedhammer A., 2008 - Diabetes mellitus in a population of 180,000 insured dogs: incidence, survival and breed distribution, *Journal Veterinary Internal Medicine* 21:1209–1216.
- [6] Ford R.B., Ludlow C.L., 1994 - Disorders of Lipid Metabolism, *Small Animal Clinical Nutrition*, p.546-557.
- [7] Ford R.B., 1993. Idiopathic hyperchylomicronemia in Miniature Schnauzers. *Journal of Small Animal Practice* 34, 488–492.
- [8] Ford, R.B., 1996. Clinical management of lipemic patients. *Compendium on Continuing Education for the Practicing Veterinarian* 18, p. 1053–1060.
- [9] Gallelli M.F., Cabrera Blatter M.F., Castillo V. A, 2010- Comparative study by age and gender of the pituitary adenoma and ACTH and a-MSH

secretion in dogs with pituitary-dependent hyperadrenocorticism. *Res. Vet. Sci.*;88:33–40.

- [10] German, A. J., Woods, G. R. T., Holden, S. L., Brennan, L., & Burke, C. (2018). Dangerous trends in pet obesity. *Veterinary Record*, 182(1)
- [11] Gilor C., Graves T. K. 2011 - Interpretation of laboratory tests for canine Cushing's syndrome. *Topics in Companion Animal Medicine*. 26: p:98–108.
- [12] Hoenig M., 1995 - Pathophysiology of Canine Diabetes, *Veterinary Clinics of North America: Small Animal Practice*, Volume 25, 1995, p. 553-561.
- [13] Johnson M. C. 2005 - Hyperlipidemia disorders in dogs, *Compendium Vet.com*.
- [14] Laflamme D.P., 2006 - Understanding and managing obesity in dogs and cats, *Veterinary Clinic Small Animal Practice*.
- [15] Pretlow R., Corbee, R., 2016 - Similarities between obesity in pets and children: The addiction model. *British Journal of Nutrition*, 116, p. 944-949.
- [16] Rand J.S., Fleeman M.L., Farrow H.A., Appleton D.J., Lederer R., 2004 - Canine and Feline Diabetes Mellitus: Nature or Nurture?, *The Journal of Nutrition*, Volume 134, Issue 8, p. 2072S–2080S.
- [17] Watson T. D. G., Barrie, J. 1993 - Lipoprotein metabolism and hyperlipidaemia in the dog and cat: A review. *Journal of Small Animal Practice*, 34(10), p. 479–487.
- [18] Xenoulis, P. G., Steiner, J. M. 2015 - Canine hyperlipidaemia. *Journal of Small Animal Practice*, 56(10), p. 595–60.