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ORIGINAL ARTICLE

Relationship between analytic values and canine obesity

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Summary

The objective of this study was to assess the relationship between canine body condition and metabolic parameters like serum lipids, blood glucose and alanine aminotransferase (ALT) concentrations. We selected 127 dogs (42 males and 85 females) that were taken to our veterinary medicine service during routine visits. The mean age was 6.67 ± 5.24 years. Body condition (BC) was measured by Laflamme scale and dogs were considered as obese when BC score was over 6. The following variables were collected: total cholesterol, high-density lipoprotein cholesterol, triglycerides, basal glucose and ALT. 66.1% of the dog cohort were obese. Total cholesterol and triglycerides were found to be higher ($p < 0.05$) in obese dogs with respect to normal weight dogs. In conclusion, obesity in dogs is associated with higher serum lipid levels.

Introduction

Canine obesity is the most frequent nutritional alteration in the canine population, with an estimated prevalence of 24–30% (Remillard, 2006). Although several factors can contribute to the development of canine obesity, the aetiology has not been well established yet. In order to maintain the energy balance there needs to be a mid- and long-term equilibrium between energy intake and energy expenditure. Although hyperphagia could play a relevant role in the development of obesity, more recent studies have focused on diet composition, promoting an excess of positive energy balance. Another factor that can influence the pathogenesis of obesity is physical inactivity.

Obesity in dogs is associated with higher mortality and morbidity, with an increased risk of high blood pressure, cardiac disease (Montoya et al., 2006), diabetes, dyslipidaemia, osteoarthritis (Impellizeri et al., 2000), some forms of cancer (Pérez-Alenza et al., 1998), increased surgical risk and physical activity intolerance. On the other hand, for the treatment of obesity, an adequate control of associated cardiovascular and metabolic risk factors is fundamental (Juste et al., 2005). The objective of this study was to assess the relationship between canine body condition and metabolic parameters like serum lipids, blood glucose and alanine aminotransferase (ALT) concentrations.

Methods

The study design was a single-centred cross-sectional study. Dogs were randomly selected from those taken to our veterinary medicine service during routine visits. The study population was 127 dogs (33.1% (42) males and 66.9% (85) females). As regards size, 17.3% (22) of the dogs were big-sized, 35.4% (45) mid-sized, 33.9% (43) small-sized, 12.6% (16) toy-sized and 0.8% (1) giant. There were 29 different breeds, although the biggest proportion, 33.1% (42), was mixed-breed dogs. The age range was between 1.6 and 14 years (mean 6.67; SD 5.24). Body condition (BC) was assessed using a 9-point scale (Laflamme, 1997) and dogs were zconsidered as obese when BC score was over 6. Blood samples were collected after a 12-h food-deprived period. The following variables were measured: total cholesterol, high-density lipoprotein cholesterol (HDL-C), trigly-

cerides, glucose and ALT. Measurement was performed in plasma using enzymatic methods in the SPOTCHEM EZ SP-4430 auto-analyzer (Arkray, Inc., Kyoto, Japan). The SPSS statistical package (Version 12.0 for Windows) was used throughout the whole process. The comparisons of absolute means between groups were made with the Student's *t*-test for normally distributed variables (glucose, total cholesterol and HDL-C) and with the non-parametric Wilcoxon test of sum of ranges for non-normal distributed variables (triglycerides and ALT).

For continuous variables, the Kolmogorov–Smirnov test was used in order to check that the variables were normally distributed. Normality was accepted at $p > 0.05$. For the comparison of variables such as triglycerides and ALT in which the distribution was non-normal, the comparison of absolute means between groups was made with the non-parametric Wilcoxon test of sum of ranges. For the comparison of variables such as glucose, total cholesterol and HDL-C in which the distributions were normal, the comparison of absolute means between groups was made with the Student's *t*-test.

Results

Of the 127 dogs in the study sample, 84 (66.1%) were classified as being obese. Table 1 summarizes the levels of the analytic parameters studied, segregated in terms of being obese or not. Glucose, lipids and ALT tended to be higher in obese dogs. The differences were significant only for triglycerides (1.38 vs. 0.75 mmol/l) and total cholesterol (6.14 vs. 5.04 mmol/l).

In our survey of recent literature, our results have been found to coincide with those of Kimura et al. (1991), of Díez et al. (2004) with Beagle dogs and of Jeusette et al. (2005). In all these studies higher serum lipid levels were observed in obese dogs.

Díez et al. (2004) and Jeusette et al. (2005) obtained good results over lipid levels by changing the diet composition. Elevated levels of serum total cholesterol would be more related to diets high in saturated fats, which are typical in 'obesogenic' lifestyles.

Table 1 Levels of glucose, lipids, and ALT in obese and non-obese dogs

Biochemical parameters (Mean ± SD)	Dog obesity		p-value
	No	Yes	
Glucose (mmol/l)	4.66 ± 0.90	4.82 ± 0.83	0.383
Total cholesterol (mmol/l)	5.04 ± 1.35	6.14 ± 2.0	0.002*
HDL-cholesterol (mmol/l)	2.90 ± 0.82	3.28 ± 0.87	0.054
Triglycerides (mmol/l)	0.75 ± 086	1.38 ± 1.41	0.002*
ALT (U/l)	51.80 ± 49.46	69.10 ± 100.75	0.570

ALT, alanine aminotransferase; HDL, high-density lipoprotein.
*$p < 0.05$.

In conclusion, our results seem to suggest that obesity in dogs is associated with higher serum lipid levels.

It would be of considerable interest to develop clinical evolution follow-ups of weight gain in dogs. It would be important to assess mobility in obese dogs because preventing intervention and treatment actions such as low-fat diets, increased exercise and weight loss should all be considered for the canine population.

A further study will therefore develop a program of weight loss in obese dogs using dietary modifications and recommendations for physical exercise and to evaluate the impact of the treatment on lipids levels.

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