



Prevalence and risk factors for canine obesity surveyed in veterinary practices in Beijing, China



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ABSTRACT

An epidemiological survey of canine obesity was carried out in Beijing, China. Cases ($n=2391$, 7 districts) were collected at 14 animal hospitals between April 2008 and April 2011. The body condition score (scales of 1–5) was used to assess obesity of the dogs (Burkholder and Toll, 2000; Laflamme, 1997). Obesity rates were analyzed with respect to breed, age, sex, neutering, food control, feeding frequency, reproduction status, food type, nutritional supplements, living environment, feeding time, number of pets per household, feeding purpose, activity control, exercise duration, exercise status and exercise type. The overall canine obesity rate was 44.4% in this survey. The risk factors for dog obesity were food type (non-commercial food, $OR=1.377$, $p<0.05$), age (1–2 y, $OR=0.044$, $p<0.001$), activity control (free activity, $OR=0.685$, $p<0.05$), neutering (intact, $OR=0.629$, $p<0.01$), sex (male, $OR=0.628$, $p<0.001$), feeding frequency (Once per day, $OR=0.521$, $p<0.01$). By dog breed, prevalence of obesity was high in pugs (70.7%), Cocker Spaniel (69.4%), Pekingese (51.9%), Pomeranian (54.6%) and Golden Retriever (51.9%). This is the first report of the epidemiology of canine obesity in China.

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1. Introduction

Obesity is a nutritional disease due to the accumulation of excessive amounts of adipose tissues leading to a positive energy balance (Burkholder and Toll, 2000); the survey reported canine obesity in developed countries, such as the USA (34.1%, $n=21,754$) (Lund et al., 2006), Sweden (9%, $n=10,993$) (Krook et al., 1960), the United Kingdom (28%, $n=1000$) (Mason, 1970), and Australia (25%, $n=860$; 41.1%, $n=1093$) (McGreevy et al., 2005; Robertson, 2003). Obesity in dogs may be associated with dysfunction in multiple organ systems (Radin et al., 2009), such as osteoarthritis (Marshall et al., 2009), cardiopulmonary disease (Bach et al., 2007; Kume et al., 2009), glucose

intolerance, oxidative stress (Laflamme, 2012a), diabetes mellitus (Rand et al., 2004), other endocrine disorders (Zoran, 2010), and reduces the animal's life span (German, 2006). Multiple risk factors have been identified for canine obesity including diet, exercise, breed, neutering, and genetic pre-disposition (Bland et al., 2010).

Dogs are popular companion animals in Beijing, China. Canine obesity is a problem increasing in veterinary practices across Beijing over the last decade. The purpose of this study was to investigate the prevalence and risk factors for obesity of dogs examined in Beijing veterinary clinics.

2. Materials and methods

2.1. Data collection

All data ($n=2391$) were collected from dogs that visited animal hospitals between April 2008 and April 2011 in

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Beijing, China. A convenience sample of 14 animal hospitals in seven districts was selected for this investigation. All clinics recruited agreed to participate in this study. The dogs that were diagnosed with chronic diseases such as chronic hepatopathy, nephropathy, diarrhea, vomiting, endocrine disorders, and long-time pathologic anorexia were not included in this study by local veterinarians. The breed, age, sex, neutering (neutered and intact), food control (free feeding and controlled feeding), feeding frequency (once per day, twice per day, several times per day), reproduction status (multiparity or nullparity), food type (commercial dog food or non-commercial sources), nutritional supplements (yes or no), living environment (apartment building, single story building or cage), feeding time (fixed or non-fixed), snacks (yes or no), number of pets per household (one or more than one), feeding purpose (working dogs such as sniffer dogs or guide dogs, non-working dogs), activity control (free movement or restricted exercise), exercise duration (less than one half hour, between half and 1 h, or more than 1 h per day), exercise status (yes or no) and exercise type (walking only or walking and other types of exercises) were obtained by clinic staff inquiry through a questionnaire in the animal hospital. The data were collected specifically for this research. Some data such as nutrition supplements, exercise duration and exercise type were not obtained from the owner.

2.2. Determination of body condition score

The body condition score (BCS) was determined by veterinarians. Body condition scores were assigned as a whole number value from 1 to 5 by veterinarians at the time of clinical examination in the veterinary practice (Burkholder and Toll, 2000; Laflamme, 1997). All investigators and veterinary practitioners were trained and instructed before the survey. For the purpose of this survey, dogs with a body condition score of 4 or 5 were regarded as obese.

2.3. Data analysis

The data were analyzed using the software of SPSS (Statistical Package for Social Science, 12.0, SPSS Incorporation, Chicago, IL, USA). The categorical data (including sex, feeding purpose, neutering, etc.) were analyzed by univariate chi-square (χ^2) test. Then multivariable logistic regression analysis was used to establish the associations of those factors and the incidence of obesity [$p \leq 0.25$ in univariate chi-square (χ^2) test]. Risk factors were deleted by stepwise backward elimination ($p > 0.05$ at each step). Due to missing data, not all risk factors were analyzed using multivariable logistic regression analysis; cases without complete information on all variables in the model were not included in the multiple logistic regression analysis.

3. Results

Of 2391 dogs examined, 1062 (44.4%) were classified as obese. The mean age of all obese dogs was 5.66 ± 3.53 years, and that of non-obese dogs was 4.36 ± 3.34 years ($p < 0.01$). The highest obesity rate was 68.6% in 11 years old dogs.

The animals were divided into five groups: 1–2 years, 3–4 years, 5–6 years, 7–8 years, ≥ 9 years. Obesity rate had an increasing trend with age; the elder group (7–8 years) had the highest obesity rate (55.2%). The canine obesity rates (COR) of Pugs (70.7%) and Cocker Spaniel (69.4%) had the higher values, while Husky (25%), Miniature Poodle (23.9%) and Poodle (20.3%) had the lower obesity rates. High rates of obesity were also Pomeranian (54.6%), Pekingese (51.9%) and Golden Retriever (51.9%), crossbred (48.1%), Chihuahua (46.9%), Labrador (46%), Schnauzer (35.6%), Chow chow (34%), Shih Tzu (32.2%). For neutered dogs, the obesity rate of female dogs (67.3%) was more than that of male ones (52.7%), while the obesity rate of male intact dogs (47.3%) was more than that of female ones (38.7%).

The univariate Chi square analysis of obesity against each risk factor is shown in Table 1. The factors associated with a higher prevalence of canine obesity were (all $p < 0.01$) older age, female sex, neutering, feeding twice per day, non-commercial food sources, cage living, restricted activity, exercise duration less than one half hour per day, only walking, exercise, and ($0.01 < p < 0.05$) free feeding, and no exercise. These factors, as well as several other factors ($0.25 > p > 0.05$), i.e., breed, number of pets, feeding purpose, and use of the nutritional supplements were entered into the multivariable logistic regression analysis.

The results of the multivariable logistic regression (Table 2) indicate that a decreased risk of canine obesity was associated with age in the one-to-two year category (OR = 0.444), feeding only once per day (OR = 0.521), male sex (OR = 0.628), not neutering (OR = 0.629), and free activity (OR = 0.685), and an increased risk of obesity was associated with feeding non-commercial food (OR = 1.377).

4. Discussion

Obesity is an increasing problem in dogs (Corbee, 2012). Our survey found that canine obesity was prevalent in Beijing, with an obesity rate of 44.4%, higher than the result of the Australian survey (McGreevy et al., 2005) and a Netherlands' study (Corbee, 2012). There are multiple factors contributing to obesity. The results of this epidemiologic study of canine obesity in Beijing may not generalize to other geographic regions.

Both sex and neutering are major contributing factors to obesity. The obesity rate of female dogs was significantly higher than that of males, with spayed female dogs having the highest obesity, similar to the reported prevalence in USA (Edney and Smith, 1986). Houpt et al. (1979) reported that neutered dogs ate more food than ovariectomized dogs (Houpt et al., 1979). Another study found that ovariectomy resulted in a significant decrease in daily energy expenditure in dogs (Jeusette et al., 2004). Increased daily food intake and reduced daily energy expenditure lead to a positive energy balance, and thus obesity.

In our study, diet was found to be an important factor in the occurrence of obesity. The obesity rate of dogs fed only commercial dog food was significantly lower than that of animals fed non-commercial one. Commercial dog foods are of high quality and a rationed formula, and meet the nutritional requirements of dogs. Some dog owners

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