

Literature Review – Canine, Feline and Human Overweight and Obesity

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INTRODUCTION AND DEFINITION

It has been estimated that two-thirds of humans are overweight or obese,¹ and the prevalence of obesity alone between 2004-2006 was estimated to be over 33 percent.² In companion animals, the prevalence of canine obesity has been estimated at between 22.4 and 44 percent^{3,4,5} and between 19 and 52 percent for feline obesity.^{1,3,6,7} Most investigators agree that the prevalence of Pet obesity is increasing in a similar fashion to human obesity.¹ The prevalence of human obesity among adults doubled between 1980 and 2004 (*Figure 1*, page 2).²

Obesity is defined as an accumulation of excessive amounts of adipose tissue in the body.⁷ Human obesity is further defined using the body mass index (BMI) scale. Healthy-weight individuals have a BMI in the range of 18.8 to 24.9 kg/m², while overweight is defined as a BMI between 25 and 29.9 kg/m² and obesity as a body mass index (BMI) of >30 kg/m.^{2,8}

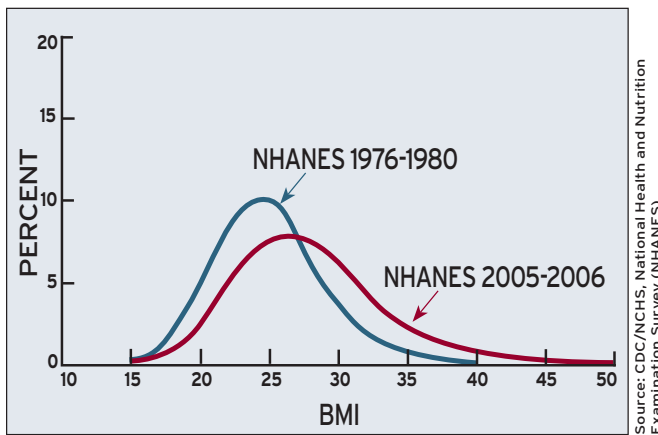
Diagnosis of overweight and obesity in humans is relatively simple, requiring only measurement of height and weight. Due to species, breed and age variation, the diagnosis of overweight and obesity in companion animals is more difficult. Many different systems have been developed for the measurement of body composition in companion animals, but few have been validated for use as routine tests, and some lack precision, accuracy or both.¹ The most widely adopted procedures are various forms

CLINICAL BOTTOM LINE

- The root cause of overweight and obesity is an imbalance between dietary intake and energy utilization, leading to a state of positive energy balance and fat accumulation.
- Factors associated with overweight or obesity in dogs and cats include breed; concurrent disease; demographics and lifestyle; diet and feeding; aspects of the human-animal bond; owners' attitudes toward preventive care and nutrition; owners' characteristics; and aspects of the home environment.
- The nature of the human-animal bond is important. While owners of overweight or obese cats and dogs tend to over-humanize their Pets or use food as a substitute for affection, owners of normal-weight dogs and cats tend to use play or affection (rather than food) as a reward, and normal-weight dog owners are more likely to achieve sufficient activity for health benefits exercising with their dogs.
- Overweight and obesity may predispose dogs and cats to orthopedic disease, diabetes mellitus, abnormalities in circulating lipid profiles, cardiorespiratory disease, urinary disorders, reproductive disorders, dermatological diseases and neoplasia (e.g., mammary tumors and transitional cell carcinoma).
- Effective weight reduction and maintenance of an optimum weight depends on many factors. Gradual weight loss, with careful attention to diet, exercise and regular monitoring as part of a coordinated weight management program offers the best chance of success. In dogs, suitable exercise strategies include leash walking, swimming, hydrotherapy and treadmills. Exercise in cats revolves around play-based activities, using cat toys such as fishing rod toys, motorized toys and feeding toys.

of morphometry, such as dimensional evaluation and body condition scoring, where measured parameters are used to estimate body composition. Dimensional evaluation involves the correlation of a measurement of length (such as the head, thorax or limb) or girth (around the rib cage) with lean body mass or fat mass.^{9,10} These techniques have led to the development of a feline BMI,¹⁰ however variation between canine breeds have made the development of a similar system for dogs problematic.¹¹ A number of body condition scoring (BCS) schemes have been devised¹²⁻¹⁴ all of which are subjective and semi-quantitative and involve visual and tactile assessment of characteristics that correlate with abdominal and subcutaneous fat (such as the rib cage, dorsal spinous processes and waist).

Figure 1: Changes in the Distribution of Body Mass Index (BMI) between 1976-1980 and 2005-2006, Adults Aged 20-74 Years: United States²



RISK FACTORS

The root cause of overweight and obesity is an imbalance between dietary intake and energy utilization, leading to a state of positive energy balance and fat accumulation. Many risk factors have been identified for obesity in cats and dogs, including genetics, concurrent diseases, demographics, diet, the method of feeding and the effect of the human-animal bond, as described in *Table 1*, page 3.

Some associations between overweight and obesity and concurrent disease are arguably causal (*e.g.*, canine hypothyroidism), and some are an effect (*e.g.*, canine pancreatitis, feline diabetes mellitus). However, it is not clear why there is a difference in risk associated with gender between species. The risk associated with neutering is due to a combination of decreased energy requirements after neutering and an increase in food consumption.^{15,16} Even though the type of food (commercially prepared vs. homemade) was associated with overweight or obesity in cats, this does not appear to be the case in dogs.^{1,17} Many of the dietary risk factors are linked to the dynamic of the human-animal bond. In other words, owners of overweight or obese cats and dogs see food as a convenient and acceptable form of communication and interaction with their Pets.

Factors protecting cats and dogs from overweight and obesity relate to positive aspects of the human-animal bond. While overweight and obesity in felines is associated with a close bond between an owner and their cat^{18,19} this is not the case for dogs,¹⁷ suggesting that the character of relationship is the key factor and not the strength of the bond. Owners of normal-weight cats played with their cat more often than owners of overweight or obese cats and felt that the cat invited play more often and played with a wider variety of objects.¹⁸ Owners of normal-weight cats also used play as a treat or reward more often than food.¹⁸ Just as overweight or obesity in humans is related to overweight or obesity in dogs, dog exercise is a protective factor for human weight control. Bauman et al. found that even though the proportion of dog-owning and non-dog-owning individuals achieving the U.S. Surgeon General's recommended 150 minutes/week total activity was the same, the dog-owning group that walked for more than an hour a week was more likely to achieve sufficient physical activity for health benefits.²⁰ Dog

Literature Review – Canine, Feline and Human Overweight and Obesity

Table 1: Factors Associated with Overweight and Obesity in Dogs and Cats

Association	Details	References
Breed	Dogs: Labrador Retrievers, Cairn Terriers, Cavalier King Charles Spaniels, Scottish Terriers, Cocker Spaniels, Dalmatians, Dachshunds, Rottweilers, Golden Retrievers, Shetland Sheepdogs and “mixed” breeds Cats: Domestic Short Hair, Domestic Long Hair, Domestic Medium Hair, Mixed and Manx breeds	1, 5, 6, 21
Concurrent diseases	Dogs: endocrine dysfunction (hypothyroidism and hyperadrenocorticism), infection-related obesity, cruciate ligament rupture and pancreatitis Cats: urinary tract disease, diabetes mellitus, neoplasia, oral disease or dermatopathy	5, 6, 22
Psychological	Cats: possible factors include anxiety, depression, failure to establish a normal feeding behavior, and failure to develop control of satiety	23
Demographics and lifestyle	Gender (female dogs and male cats), neutering, age (middle age), lack of exercise and residential area (dogs: rural or semirural areas; cats: apartment dwelling, indoor housing)	1, 4, 5, 6, 24, 25, 26, 27, 28
Diet and feeding methods	Dogs and cats: high-fat diets, feeding of kitchen/table scraps, fresh meat and commercial treats Cats: homemade, canned or semi-moist foods or premium or therapeutic food as major diet source, free-choice access to food Dogs: inexpensive foods, number of meals and snacks fed	6, 17, 18, 28
Human-animal bond	Over-humanization or substitution for human companionship, use of food as means of interaction. Owners spend more time watching their Pet eat and spend more time with them during meals. Dogs: Owners spoke to their dogs more and on a greater variety of subjects than owners of dogs of normal weight. Owners allowed them to sleep on the bed more often, were less concerned about zoonotic disease, and rated exercise, work or protection by the dog as less important reasons for ownership. Dogs were more likely to be present when owners prepared or ate their own meals and were fed tidbits at these times. Cats: Owners believe it is more important to talk to their cats, especially about matters related to work, family and friends. Owners felt that the cat was intended to console or encourage them. Owners were more likely to misinterpret their cat’s interaction as a request for food.	17, 18
Preventive care and nutrition	Owner’s obesity status, interest in their own nutrition (less interest in their own preventive health care), their interest in their Pet’s healthcare and nutrition (less interest in their Pet’s preventive health care, less interest in providing balanced nutrition for their dog) and attitude toward their Pet’s body condition (underestimation of body condition in cats).	17
Human and home demographics	Health status of owners (owners of obese dogs were often obese themselves); number of people in the house who stay home (greater in households with overweight or obese cats); gender (female ownership in cats); household income (owners of overweight or obese dogs have a lower net income than owners of normal weight dogs). No differences in age, marital status, number of adult or juvenile persons in the household, education or profession between households with overweight or obese Pets and those with normal weight Pets for both dogs and cats.	17, 18

owners also rate access to parks and nature reserves as more important than non-dog owners did, and they felt they had more social support from family to walk and do other forms of physical activity.²⁹

Known risk factors for human overweight or obesity include socioeconomic status and race/ethnicity. People of low socioeconomic status, African American race and Hispanic ethnicity are more likely to be overweight or obese.^{2,30} Other factors previously studied include access to and type of food or grocery store (supermarkets, small groceries, convenience stores, restaurants and fast food outlets), walkability of the neighborhood, neighborhood aesthetics, condition of sidewalks, access to parks or walking trails, access to exercise facilities and safety (crime or traffic). Results of studies examining these risk factors are inconsistent, indicating that there is greater complexity in the interaction between individuals and putative risk factors than can be elucidated by these studies.³¹⁻³³

HEALTH EFFECTS AND COST OF TREATMENT

Overweight and obesity predispose both humans and animals to other diseases, however there is more data on these associations in humans than in animals. Overweight or obese humans are at greater risk of type II diabetes mellitus, hypertension, coronary heart disease, osteoarthritis, respiratory disease, reproductive disorders and certain cancers (e.g. breast, ovarian and prostate).³⁴⁻³⁷ Although data on the effects of overweight or obesity in dogs and cats is more limited, research suggests that they may be predisposed to orthopedic disease, diabetes mellitus, and other endocrine dysfunction, abnormalities in circulating lipid profiles, cardiorespiratory disease, urinary disorders, reproductive disorders, dermatological diseases and neoplasia (e.g., mammary tumors and transitional cell carcinoma).^{7,21,38-41}

As well as predisposing to certain diseases, being overweight or obese is also likely to increase morbidity in sick feline patients with poor body condition.⁴² Anesthetic risk has also been reported to be increased in overweight or obese dogs,⁴³ and heat tolerance and stamina is lower when compared to dogs and cats of normal weight.⁴⁴ Overweight or obese dogs have also been shown to require medication for osteoarthritis three years earlier than dogs of normal weight.⁴⁵ Overweight or obese humans do not live as long as humans of healthy body weight³⁴⁻³⁶ and there is evidence to suggest that this is also the case in dogs and cats.^{26,46}

Adipose tissue was once thought to be physiologically inert, however research has shown this is not the case. Adipose tissue is an active producer of hormones, such as leptin and resistin, and numerous cytokines, including tumor necrosis factor- α (TNF- α), interleukins-1B and -6, and C-reactive protein.²⁸ These cytokines result in a persistent state of low-grade inflammation, which is thought to play a role in chronic diseases such as osteoarthritis, cardiovascular disease and diabetes mellitus.²⁸ Obesity is also related to oxidative stress, which may also contribute to obesity-related diseases.²⁸

While data on the costs associated with canine and feline overweight and obesity are lacking, data does exist on the costs of human overweight and obesity. The direct cost for treatment of obesity and related co-morbidities in England was conservatively estimated at £480 million (or 1.5 percent of the total National Health Service expenditure) in 1998. Obesity also accounted for 18 million lost working days due to associated illness and 30,000 deaths in that year. Indirect costs due to lost earnings were estimated at £2,150 million in 1998.³⁷ Trasande et al. also found higher treatment-associated costs and greater utilization

Literature Review – Canine, Feline and Human Overweight and Obesity

of health care services in overweight and obese children aged 6 to 19 years between 2002 and 2005. Children who were overweight during both years, or overweight in one year and obese in the other had \$79 higher outpatient visit expenditures, \$64 higher prescription drug expenditures, and \$25 higher emergency room expenditures than normal/underweight children.⁴⁷

INTERVENTIONS TO REDUCE THE INCIDENCE OF OBESITY

The principal means of weight loss and weight control in both cats and dogs are formulated diets and exercise programs. Most weight reduction diets are low in energy density, while being supplemented with protein and micronutrients.^{1,48} These diets usually have an increased protein-to-carbohydrate ratio compared to maintenance diets and are often high in fiber, which is thought to promote satiety.²⁸ Protein supplementation, while not increasing the rate of weight loss, is important as it minimizes the amount of lean tissue lost, and micronutrient supplementation ensures that deficiency states do not arise while dieting.¹ Supplementation with L-carnitine has been shown to reduce fat mass and reduce lean tissue loss during weight loss.⁴⁹ Conjugated linoleic acid is thought to limit the synthesis of monounsaturated fatty acids for triglyceride synthesis and suppress production of long-chain fatty acids, however data on its efficacy in humans and cats is conflicting.⁵⁰ Exercise is often used in combination with dietary management to promote fat loss and assist in lean tissue preservation. In dogs, suitable exercise strategies include leash walking, swimming, hydrotherapy and treadmills.¹ Exercise in cats revolves around play-based activities, using cat toys such as fishing rod toys, motorized toys and feeding toys. Cats can also be encouraged to work for their food by moving the

food bowl between rooms before feeding or by the use of feeding toys.⁵¹

Various pharmaceutical agents have been evaluated for treatment of obesity in dogs and humans. Dirlotapide has been developed specifically for weight reduction in dogs and has been shown to be effective, however rebound weight gain occurs at the end of treatment when appropriate diet and exercise strategies are not in place.⁴⁸ Other agents that have been assessed for weight reduction in dogs and cats include sibutramine, dexfenfluramine, herbal products containing guarana and ma huang, α_3 -adrenergic receptor agonists and inhibitors of pancreatic lipase (such as orlistat). Many of these products have insufficient data on their efficacy or are not recommended for weight management in dogs and cats.⁴⁸ Sibutramine and orlistat appear to be beneficial for the treatment of obesity in human adults, and metformin appears to be effective in human adults with diabetes.³⁷

If the above interventions are to be able to effectively reduce fat mass and prevent weight regain, they must be combined into a successful strategy. Most cats enrolled in clinical trials using weight-reducing diets do not complete the study and only a small percentage of cats fed weight-reducing diets actually lose weight.¹⁸ However, weight reduction has been achieved through food restriction in controlled laboratory trials,⁵² indicating that owner compliance with the weight loss strategy or program is of vital importance. An organized approach with regular weigh-in sessions has been shown to be more successful⁵³ than a sole focus on diet and exercise. Indeed, it is important to continue to monitor body weight once the ideal weight has been reached to ensure that the lost weight is not regained; rebound weight gain has been demonstrated in both humans and dogs.⁵⁴ As is the case with humans, gradual

weight loss in dogs is more likely to allow long-term maintenance of the reduced body weight.²⁸

When considering weight reduction programs for their Pets, primary reasons owners put their Pets on a weight loss program include recommendations by a veterinarian or veterinary staff member, access to supervision of the program by the veterinary health-care team, and the perception that weight loss will improve the health of their dogs.⁴⁸ These same reasons were important for the maintenance of the weight reduction program, along with the requirements to maintain a daily food diary and make regular visits to their veterinarian.⁴⁸ Although involvement in the weight reduction program is important for successful weight loss, extended owner education (such as monthly classes addressing nutrition-related topics) to-date have not been shown to improve mean weight loss or body condition score compared to dogs whose owners received no additional education.⁵³ In dogs, the major problems associated with continuing weight-loss programs include difficulty keeping them from the food of other Pets and difficulty with limits on feeding snacks.

The main recommendations for any successful weight reduction program are to maintain a balanced diet of an appropriate caloric density, limit treats to 10 percent of the total calorie allowance, increase exercise either overtly or through play, keep regular track of progress and then monitor body weight after weight loss to prevent against rebound weight gain.

SUMMARY AND CONCLUSIONS

Overweight and obesity are prevalent in both humans and dogs and cats and are becoming more common. Many risk factors have been described for both humans and animals with overweight and obesity, and some of these risk factors are common to both humans and animals. Pet owner risk factors

for overweight and obesity differ between species. Shared risk factors include a calorie-dense diet, over-use of treats and over-humanization of the dog or cat. Being overweight or obese is also associated with other diseases, such as cardiovascular disease, musculoskeletal disease and certain cancers. Research into human overweight and obesity has shown that the costs associated with treatment of these conditions and related diseases represent a significant burden on the healthcare system. At present, there is limited data on the costs associated with canine and feline overweight and obesity, but it would be reasonable to assume that overweight or obese Pets incur greater healthcare costs during their lifetime. Effective weight reduction and maintenance of an optimum weight depends on many factors, but careful attention to diet, exercise and regular monitoring as part of a coordinated weight management program offers the best chance of success.

Literature Review – Canine, Feline and Human Overweight and Obesity

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