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# Complications of Overnutrition in Companion Animals

Correct nutrition is vital to the health and well-being of companion animals. Overnutrition occurs when there is an imbalance in the body’s “energy balance equation”—when dietary energy intake exceeds energy utilization (from basal metabolic rate, exercise, and thermoregulation).<sup>1</sup>

**P**rolonged overnutrition leads to obesity, defined as an accumulation of excessive amounts of adipose tissue. Dogs and cats are considered *overweight* when current weight exceeds ideal weight by 10%, and are considered *obese* when current weight is greater than 20% above ideal.<sup>2</sup>

Obesity is thought to be one of the most important medical problems in companion animals, with recent prevalence estimates ranging from 30% to 50%.<sup>2-6</sup> As in humans, obesity in companion animals is a risk factor for many diseases, and there is evidence of decreased longevity in obese dogs (see **Consequences**). These compelling data justify the need for urgent intervention.

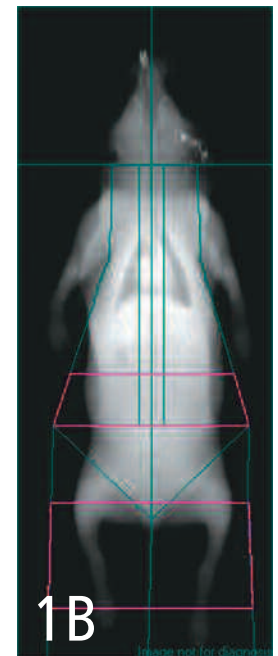
## Causes

Obesity can arise secondary to certain diseases (eg, hypothyroidism and hyperadrenocorticism in dogs), the use of pharmaceutical agents (eg, drug-induced polyphagia caused by glucocorticoids and anticonvulsant drugs), and rare genetic defects (in humans).<sup>1</sup> However, most cases result from simple overnutrition, and numerous factors may influence the relative ease with which weight is gained, including genetics, age, neuter status, amount of physical activity, and caloric content of the diet.

Breed associations include the retriever breeds (Labrador [**Figure 1**], golden retriever), Cairn terrier, cavalier King Charles spaniel, and cocker spaniel for dogs; domestic shorthair cats are also overrepresented.<sup>1,2</sup> Neutering is an important risk factor because it may lead to behavioral changes that result in increased food intake and decreased activity (ie, overnutrition).<sup>7,8</sup> Other

recognized associations include indoor lifestyle, inactivity, and middle age.<sup>1</sup> Dietary factors can also lead to the development of obesity in both species, and include the number of meals and snacks fed, feeding of table scraps, and the animal’s presence at human mealtimes.

continues



Six-year-old neutered male Labrador retriever that presented with multiple-limb lameness (**A**). On physical examination, the dog was obese (body weight, 55 kg [121 lb]; condition score, 9/9). Dual-energy x-ray absorptiometry revealed a fat mass of 55% (optimal range for Labradors, 20% to 35%) (**B**).

The human–animal relationship is also important and has been shown to be more intense in owners of obese cats. An owner’s misinterpretation of normal feline ethology may be a major contributor. For example, cats should be fed many small meals per day rather than 1 or 2 larger meals. In addition, cats have no inherent need for social interaction at feeding times. Therefore, if owner contact is initiated, a cat is more likely to be seeking attention than to be requesting food (initially at least). However, owners misconstrue this as hunger and provide a food reward; the cat quickly learns how to “persuade” its owner to provide food in the future, leading to overnutrition.

### Consequences

In humans, the medical importance of obesity relates to the effect on mortality and morbidity. Obese humans tend to have a shorter life span and are more likely to develop diabetes mellitus, hypertension, coronary heart disease, cancer (eg, esophageal, breast, ovarian, prostate), osteoarthritis, respiratory disease, and reproductive disorders. Similarly, obesity has detrimental effects on the health and longevity of dogs and cats.

### Clinical Evaluation & Anesthesia

Overall, clinical evaluation is more difficult in obese dogs and cats than in those in ideal body condition. Anesthetic risk is also increased because there may be problems with estimating anesthetic dose, respiratory compromise may occur, and operating times are often prolonged.

### Longevity

A recent prospective study showed that abnormally high weight may shorten life span in dogs.<sup>6</sup> One group of dogs was fed ad libitum,\* and the second had food intake restricted. Dogs in the ad libitum group tended to be overweight, whereas those in the restricted group remained in ideal condition. By the end of the study, on average, those in the restricted group lived almost 2 years longer.

\* These dogs were fed ad libitum until 3.5 years of age, after which the amount was reduced (62.1 kcal metabolizable energy/kg of estimated lean body weight) and held constant to prevent insidious development of obesity.

### Endocrine & Metabolic Diseases

Hormonal diseases with a reported association with obesity include diabetes mellitus, hyperadrenocorticism, and hypothyroidism.

**Insulin resistance & diabetes mellitus.** Cats most often develop diabetes mellitus (a form that resembles type 2 diabetes mellitus in humans) and obesity is a major risk factor. The most common type of canine diabetes mellitus resembles human type 1 diabetes mellitus, although obesity is a known risk factor in this species.<sup>2</sup> However, the reasons for this association are not currently known.

**Hypothyroidism.** Although hypothyroidism is commonly cited as an underlying cause of obesity, such cases are the exception rather than the rule. The prevalence of hypothyroidism is under 1%, with less than half of such patients presenting with obesity; in contrast, the prevalence of obesity is 30% to 50%. Thus, although hypothyroidism should always be considered, it is rarely the reason for the obesity.

### Hyperlipidemia & Dyslipidemia

The link between hepatic lipidosis and obesity in cats is well known. Experimental studies in obese dogs have demonstrated mild (insignificant) elevations in cholesterol, triglyceride, and phospholipid levels, whereas laboratory dogs made obese have increased plasma levels of

nonesterified fatty acid and triglycerides.<sup>9</sup> Whether lipid alterations account for the increased incidence of pancreatitis in obese dogs requires further study.

### Orthopedic Disorders

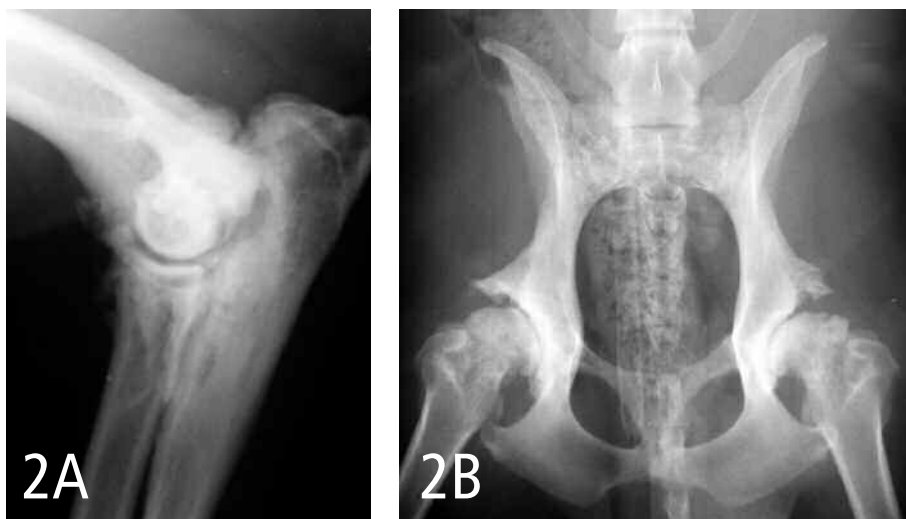
Obesity is a major risk factor for orthopedic diseases in companion animals, especially dogs.<sup>1</sup> Reported associations include cruciate ligament disease, hip dysplasia, osteoarthritis (**Figure 2**), condylar fractures, and thoracolumbar disk disease.

### Cardiorespiratory Disease & Hypertension

Obesity can have a profound effect on respiratory system function, most notably as a risk factor for such diseases as tracheal collapse (**Figure 3**), laryngeal paralysis, and brachycephalic airway obstruction syndrome. Obesity can also affect cardiac function, cardiac rhythm, and left ventricular volume, leading to hypertension and increased plasma volume.

### Urinary Tract Disorders

An association between obesity and some cases of urethral sphincter mechanism incompetence has been reported. Weight reduction in overweight dogs with urethral sphincter mechanism incompetence can lead to complete resolution of the sign, probably by reducing the amount of retroperitoneal fat. This reduction, in turn,



Lateral radiograph of the left elbow of the dog in Figure 1 showed severe osteoarthritis (A); ventrodorsal radiograph of the pelvis demonstrated severe osteoarthritis of both coxofemoral joints (B).

2A and 2B courtesy Dr. John E. Innes, University of Liverpool

decreases intraabdominal pressure while the animal is lying down, and reduces the chance of postural incontinence.

### Neoplasia

In humans, obesity is known to predispose to various types of neoplasia, including breast (postmenopausal), colonic/rectal, renal cell, and esophageal cancers.<sup>10</sup> An association between obesity and neoplasia has recently been reported in a large epidemiologic study in dogs.<sup>2</sup>

### Dermatologic Disorders

Obese animals have been reported to be at increased risk for certain dermatologic disorders. Diffuse scale is commonly observed (especially in cats), most likely due to the reduced ability to groom efficiently. Severely obese animals can develop pressure sores.

### Management

Rather than simply reducing body weight, the principal aim of weight management is to improve long-term health and quality of life. To ensure long-term success, it is vital that a healthier relationship between pet and owner develops. Without this, weight will inevitably rebound once intervention ceases. Successful weight reduction depends mainly on owner commitment, so it is vital to ensure that the owner has realistic expectations from the outset.

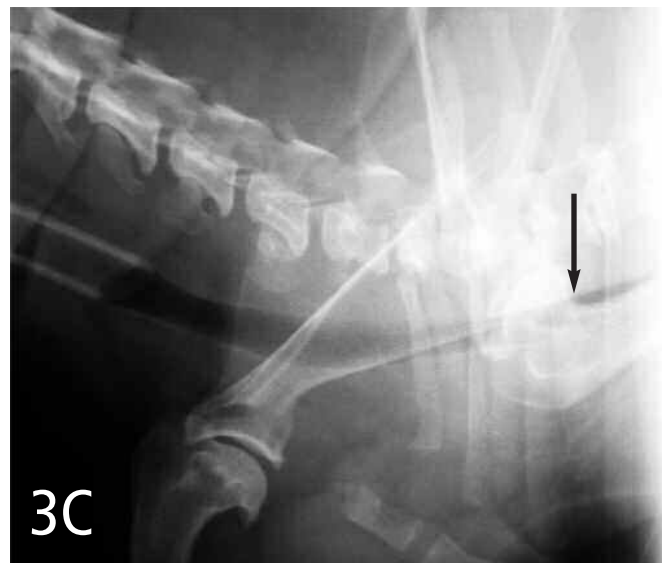
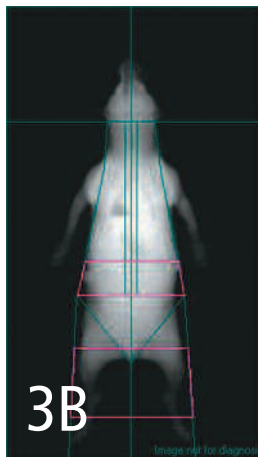
The options available for intervention in dogs include diet, lifestyle changes, and drug therapy. In cats, drug therapy is not an option. All methods involve a reduction in energy intake (dietary management, pharmaceuticals) or an increase in energy expenditure (increasing physical activity through lifestyle changes). A combination of strategies is likely to be most successful. For any intervention to be successful, close monitoring is vital.

### Dietary Management

It is inadvisable to use a standard maintenance ration and simply restrict the amount fed. In such diets, most nutrients are balanced to energy content; when this content is restricted, malnutrition states may develop. Thus, a diet



Seven-year-old neutered male Jack Russell terrier that presented with collapse and exercise intolerance (A). On physical examination, the dog was obese (body weight, 16.3 kg [36 lb]; condition score, 9/9). Dual-energy x-ray absorptiometry revealed a fat mass of 39% (optimal range for Jack Russell terriers, 20% to 30%) (B). Right lateral radiograph of the thoracic inlet revealed tracheal collapse (arrow C).



purpose-formulated for weight reduction is recommended. All diets work by means of caloric energy restriction. Other characteristics include:

- Increased micronutrient (vitamin and mineral) content, which ensures that malnutrition does not occur
- Increased protein content, which prevents protein malnutrition and may improve satiety
- L-carnitine supplementation, which facilitates fatty acid oxidation, and fiber supplementation, which increases the bulk of the diet and improves satiety.

For weight loss to occur, caloric intake must be restricted (eg, a portion of the maintenance

energy requirement is fed). Calculations are based on the target body weight, not the current weight. The exact allocation will vary depending on the characteristics of the dog or cat, the chosen diet, and other factors (eg, amount of and ability to exercise). During the weight reduction program, food allocation usually needs to be reduced to ensure that weight loss progresses.

### Drug Therapy

Dirlotapide (Slentrol, [www.pfizer.com](http://www.pfizer.com)) and mitratapide (available in Europe only) have recently been licensed for managing obesity in



### Dual-Energy X-ray Absorptiometry (DEXA)

DEXA is a technique that measures the lean and fat tissue components of the body. It is widely used in human medicine because it is fast, relatively accurate, and precise. All-in-all it is the best, noninvasive measure of body composition currently available.

Two different frequencies of x-rays, which are absorbed to varying degrees in different body tissues, are used during DEXA. A computer then analyzes the signals, and results include body fat, lean tissue mass, and bone mineral content. Subregions of the body (eg, limbs, chest, and abdomen) can also be analyzed. The x-ray exposure is very small, typically about 1/50 of that for a chest radiograph. The machine scans very quickly; a complete scan of the body takes only 4 to 6 minutes to complete.

dogs but not cats. Both are microsomal triglyceride transfer protein inhibitors; they have a local effect at the level of the enterocyte, blocking lipid absorption. Dietary caloric intake is decreased, partly by reducing lipid absorption, but mainly by decreasing appetite; this effect is probably due to release of a “satiety signal” from the enterocyte.

Dirlotapide can be used as sole therapy for up to 12 months and is usually well tolerated; however, side effects (predominantly gastrointestinal) can occur in up to 20% of dogs.<sup>11</sup> Weight loss is successful in most cases but, after discontinuation, appetite will return. Unless other strategies (feeding and behavioral) are implemented, a rapid and predictable rebound in body weight occurs. Thus, other strategies are essential to ensure long-term success.

### Lifestyle Changes

Alterations in lifestyle include those designed to increase energy expenditure (eg, increasing level of physical activity, introducing regular play

sessions), improve quality of life (eg, ensuring regular play activity in cats), and changes in feeding pattern (eg, accurate measuring and recording of daily food intake, avoiding uncontrolled feeding of extras). In conjunction with diet or drug therapy, they help to facilitate weight loss and are essential to ensure long-term success.

### Prevention

As with any medical disease, prevention is better than cure. Obesity has many health and welfare implications; thus, health and welfare of all dogs and cats are likely to be improved more dramatically by preventing obesity than by treating it. Veterinarians must be proactive in their approach to weight problems and should provide adequate client education about the dangers of obesity in their pets. ■

See Aids & Resources, back page, for references, contacts, and appendices.

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