

ARTICLE

Overweight or Nutrient Deficient: The Dilemma in Feeding Less Active Pets

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Introduction

Obesity and overweight are endemic in dogs and cats - 59% of dogs and 61% of cats are affected, according to a 2022 study (Association for Pet Obesity Prevention n.d.). In addition, pets' average activity levels continue to decline, so that the typical dog or cat has a significantly lower activity level than in years past (O'Rourke et al. 2025; Jewell and Jackson 2023). Pet owners utilize many strategies to help their animals either lose weight or prevent weight gain. They may encounter obstacles to success, including begging or other unwanted food-related behaviors, and/or unintended adverse outcomes, such as nutritional deficiencies and potential health consequences, from some of these strategies (Gaylord 2017). The current nutritional standards for dogs and cats assume high calorie intake (National Research Council 2006; AAFCO 2024), which perpetuates this problem. However, diets can be properly formulated to supply adequate nutrients along with appropriate calories for an individual animal's activity level and energy needs.

Factors Contributing to Excess Weight in Dogs and Cats

Weight gain may occur because of excess energy intake or decreased energy expenditure. However, metabolic and endocrine dynamics impact both intake and expenditure of energy (Wakshlag & Loftus 2014), so determining ideal energy intake for any individual animal may be complex. Considerations may include the food type, recommended feeding directions for the specific food, any additional treats or other foods in the pet's diet, whether there is structured exercise in the pet's routine, lifestyle, spay/neuter status, the presence or absence of other pets in the home, environmental conditions, health status and other factors when estimating energy needs.

Obesity Has Significant Health Consequences

Just as humans face increased risk of a number of health conditions as their weight climbs above ideal, the same is true for companion animals. Osteoarthritis, diabetes mellitus and insulin resistance, skin disease, renal disease, urolithiasis and neoplasia have been implicated with obesity in dogs and/or cats (Wakshlag & Loftus 2014). These conditions place a physiologic burden on the animal, as well as financial, logistical, and emotional burdens on the pet owner. Conversely, calorie restriction is associated with an increase in longevity in dogs (Kealy et al. 2002). Therefore, maintaining ideal body condition in pets is a valuable strategy for maximizing quality of life as well as fostering the human-animal bond.

Weight Loss Practices and Pitfalls

Pet owners employ various tactics toward achieving weight loss in their pets. These may be owner-initiated or recommended by the veterinarian, and may include eliminating or reducing treats, increasing exercise, feeding a "light" diet or therapeutic weight loss diet or decreasing the amount fed of the pet's regular diet.

When pets are not satiated, behaviors like begging, constantly looking for food and stealing food from other pets or humans can make diet plan compliance difficult for pet owners. In addition, if all members of the household are not committed to the pet's weight loss plan, the pet may continue to receive treats or larger meal portions that make weight loss unlikely.



Nutritional Deficiencies During Weight Loss

While therapeutic veterinary diets are formulated for weight loss purposes, and so are intended to contain adequate nutrients to meet the needs of dogs and cats when delivered in fewer calories, the same is not true of most over-the-counter diets.

An overview of how commercial maintenance diets are formulated illustrates why they may not be nutritionally complete for weight loss or for feeding low activity pets. Both the National Research Council (2006) and the American Association of Feed Control Officials (AAFCO 2024) have set caloric nutrient profiles for dogs and cats for various life stages. Caloric profiles list the minimum (and in some cases, maximum) amount of each essential nutrient that must be present in every 1000 kilocalories (kcal) of the diet. NRC set these amounts based on the metabolic requirement of each nutrient (amount of the nutrient per day needed per metabolic body weight, which in dogs is body weight in $kg^{0.75}$), as well as on the assumption that animals will consume a given number of kilocalories per metabolic body weight. In the dog, this calorie assumption is 130 x $kg^{0.75}$ for adult maintenance. As an example, a 50 lb adult dog has a metabolic body weight of $22.73^{0.75}$kg, or 10.4 kg. This dog would be expected to consume 130 x 10.4 = 1,352 kcal/day. When the dog consumes 1,352 kcal of a diet formulated to meet the NRC caloric nutrient recommendations for adult dogs, the dog will consume adequate nutrients. But if the dog consumes fewer than 1,352 kcal of this diet, the dog may be consuming less than the recommended allowance for some or all nutrients.

AAFCO set their nutrient profiles based on NRC recommendations, and their calorie assumption for maintenance of adult dogs to meet those recommendations equates to 132 x $kg^{0.75}$, slightly higher than NRC. So the 50 lb dog in the above example would need to consume 132 x 10.4 = 1,373 kcal per day of a diet formulated to the AAFCO caloric nutrient profile to meet its nutrient needs. AAFCO's adult cat nutrient profile is similar to NRC for most, but not all nutrients. AAFCO does not offer any guidance about caloric intake needed to meet nutrient needs, but based on the similarity to the NRC profile, it may be assumed that both are based on the energy intake assumption defined by NRC: 100 x $kg^{0.67}$. This equation yields 276 kcal/day for an adult cat weighing 10 lb, and the cat must consume 276 kcal in order to consume recommended amounts of essential nutrients. Foods in the United States are formulated to AAFCO nutrient profile standards, and these standards are in relatively wide use in other areas around the world.

If the feeding directions on a commercial food do not direct pet owners to feed the number of kilocalories that align with the caloric profile (and its associated energy intake assumption) to which the food was formulated, adequate nutrients may not be delivered. Similarly, if a pet owner decides to feed less than recommended by the manufacturer, or if the veterinarian directs the pet owner to feed less, adequate nutrients may not be delivered.

Gaylord, Remillard and Saker (2014) found that US adult maintenance and over-the-counter weight management diets (often called "light" diets) - but not therapeutic veterinary weight loss diets - were often deficient in several nutrients when fed at energy intake levels needed to produce weight loss. These nutrients included choline, selenium, some B vitamins, omega-3 fatty acids and some amino acids.

Another study (Olivindo et al. 2022) found that even veterinary therapeutic weight loss diets in Brazil had nutrient deficiencies when fed at manufacturer intake recommendations.

The problem is not restricted to pets undergoing weight loss, however. Depending on the formulation of the diet, deficiencies may also be present if the diet is fed at reduced amounts aimed at preventing a lower-activity animal from gaining weight. The energy intake assumptions by NRC and AAFCO are far higher than the average dog or cat actually requires (O'Rourke et al. 2025; Jewell & Jackson 2023), so a large percentage of the pet population is not well-served by the current caloric nutrient

profiles that are designed for extremely highly active pets. When less active pets eat at the energy intake level required to meet nutrient needs, they are at great risk of becoming overweight; if they eat at the appropriate energy intake level for their activity level, they are at risk of nutrient deficiencies.



Consequences of Nutritional Deficiencies

While overt disease may not be obvious in the short term with many nutritional deficiencies, some could become clinically significant quickly. One study (Abel et al.1979) found that dogs on a protein-deficient calorie restriction diet plan over a seven week period experienced decreased heart function and myofiber atrophy.

Furthermore, some breeds may have higher requirements for specific amino acids than the values reflected in NRC's metabolic requirements. Mansilla et al. (2020) found differences between the methionine requirement for Dachshunds versus that of Beagles and Labrador Retrievers, where Dachshunds' requirement aligned with the NRC minimum for methionine while the Beagles and Labrador Retrievers had higher requirements compared to the NRC. This suggests that there may be some breeds at higher risk of nutritional deficiencies when fed at less than the formulated energy intake assumption. It also raises additional questions about the role of nutritional deficiencies from feeding less than recommended amounts in the recent dilated cardiomyopathy crisis.

Fresh meat-based diets are often high in protein, but ultra-processed pet food diets generally have lower overall protein content in comparison, and so may be associated with a higher risk of amino acid deficiency when fed at lower energy intake.

Micronutrient deficiencies are often not recognized clinically but could contribute to chronic disease. In cats, potassium deficiency over time has been linked to potential renal dysfunction (German et al. 2023). While fresh meat-based diets typically meet even relatively low-activity pets' protein needs, they could present a higher risk of deficiencies of some micronutrients, such as potassium. In particular, when whole foods are utilized to meet nutrient needs, there is often not a significant safety margin between the AAFCO minimum nutrient requirement and the as fed nutrient content of the diet. When the diet is fed at lower energy intake than the energy intake assumption to which the diet is formulated, daily micronutrient consumption can be deficient. In contrast, ultra-processed foods often contain vitamin and mineral premixes that supply micronutrients in high levels, where excess may be of greater concern than deficiency in some cases, although micronutrient deficiencies may also exist when these foods are fed to low-activity animals.

Although there is a dearth of information on the effects of nutrient deficiencies during weight loss diets in animals, there are established metabolic requirements for each essential nutrient (NRC 2006). It seems prudent to ensure these requirements are met, even during weight loss. Moreover, the many animals with an activity level below the energy intake assumption of AAFCO and NRC caloric nutrient profiles may be chronically deficient in several nutrients when eating commercially available pet foods at lower energy intake levels. It is reasonable to speculate that chronic nutrient deficiencies may contribute to chronic disease. More research is needed to identify potential links between disease development in lower activity animals and their long-term consumption of less than the established recommended allowance of essential nutrients.



Do Nutritional Deficiencies Interfere with Weight Loss Efforts?

There is limited research in pets regarding nutrient deficiencies and the connection with weight gain or loss, but choline demonstrates lipotropic action in dogs (Germán David Mendoza-Martínez et al. 2022) and so may be helpful in aiding loss of excess body fat and/or preventing excess fat accumulation.

In the human literature, ensuring adequate levels of both B vitamins (Khamassi et al. 2025) and selenium (Cavedon et al. 2020) have been associated with improved weight loss for obese or overweight persons.

Given the difficulty that pet owners often experience in helping their pets lose weight, removing the potential obstacle of nutrient deficiencies may be a simple strategy to add to the weight loss plan. Additionally, protein and fiber have been shown to increase satiety and reduce food-seeking behaviors in dogs (Gaylord 2017), so ensuring adequate intake of all nutrients may assist pet owners in staying the course during the duration of the weight loss diet.

Diet Management for Lower Activity Pets

If a dog or cat successfully completes a weight loss diet, there is risk of gaining excess weight once they return to their regular diet, especially if the pet owner follows manufacturer feeding directions. However, feeding less often results in nutrient deficiencies.

Whether a pet has undergone weight loss or is at their ideal weight but is less active than the NRC/AAFCO energy intake assumption, careful diet evaluation is needed. The energy needs should be accurately assessed - with the understanding that any calorie requirement calculation is an estimation, and the energy needs should be reassessed often to adjust as needed - and a diet plan that provides adequate nutrients within the framework of appropriate calories should be developed for long term feeding.

There are many calorie recommendation equations in use, along with many activity level multipliers. Perhaps the most common starts with calculating the resting energy requirement (RER) as 70 x $kg^{0.75}$ for dogs and 70 x $kg^{0.67}$ for cats. This product is then multiplied by a factor assigned to an activity level to determine the MER, or maintenance energy requirement (Sanderson 2023). For example, an intact adult dog's calorie requirement might be 1.8 x RER. Animals undergoing weight loss might have multipliers less than one, such as 0.8 x RER.

However, recent studies that investigated caloric needs in dogs and cats suggest that the use of the multiplier 70 in calculating RER may overestimate caloric needs in today's pets (O'Rourke et al. 2025; Jewell & Jackson 2023).



Based on this apparent decrease in overall caloric requirements in the average dog and cat, the following activity levels with their corresponding multipliers may be more useful. Here, the caloric requirement calculation is simplified by using one multiplier, the K factor (named after Max Kleiber, who established the RER equation (Kleiber 1947) in popular use) to determine MER, rather than using the K factor 70 to determine RER followed by a second multiplier to determine MER. This is similar to the approach used by FEDIAF, the European pet food organization, which does recognize a nutrient profile for active adult dogs or cats, and another for less active adult dogs or cats (FEDIAF 2025). While this is a huge improvement over the one caloric profile (and lack of metabolic recommended allowances) that AAFCO provides, it remains limited in utility to the still relatively higher activity level than most pets of today. However, FEDIAF, like NRC, provides nutrient levels on a metabolic basis, allowing for formulation to accommodate any activity level.



Dog activity level descriptions and corresponding K factors for use in calculating energy requirement, where K factor x $kg^{0.75}$ = MER

Activity Level Label	K Factor $^{(0.75)}$	Type of activity
Adult - Weight loss	<65	
Adult - Inactive	65-70	Outside in fenced yard or on tie out >1 hour/day
Adult - Sedentary	70-75	Outside in fenced yard or on tie out 1-3 hours/day
Adult - Low activity	80-85	Low impact (walking, digging, pacing) 1 hour/day
FEDIAF Less active adult dog	95	
Adult - Active	90-100	Low impact (walking, digging, pacing) 1-3 hours/day
FEDIAF Active adult dog	110	
Adult - More Active	100-120	Vigorous activity (playing fetch/with other dogs, agility/other sports, swimming) for 1-3 hours/day OR paces anxiously >3 hours/day
NRC Adult dog	130	
AAFCO Adult dog	132	
Adult - Very Active	130-160	Vigorous activity (playing fetch/with other dogs, agility/other sports, swimming) for 3-6 hours/day OR caged laboratory dogs OR 1-3 hours/day in extreme environmental conditions
Adult - Working Dog	150-170	Strenuous activity (herding, hunting) for 3-6 hours/day
Adult - Sled Dog	860-1240	High activity under extreme environmental conditions – racing sled dogs in extreme cold

Cat activity level descriptions and corresponding K factors for use in calculating calories, where K factor x $kg^{0.67}$ = MER

Activity Level Label	K Factor $^{(0.75)}$	Type of activity
Adult indoor sedentary **spayed female 1-12 years**	50	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult indoor sedentary **intact female1-12 years**	53	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult Indoor Sedentary **neutered male 1-12 years**	55	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult indoor sedentary **intact male 1-12 years**	57	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult indoor **sedentary spayed female 12+ years**	62	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult Indoor Sedentary **neutered male 12+ years**	65	Less than 30 minutes cumulative running/jumping/climbing/hunting per day
Adult Indoor active **1-12 years**	75	More than 30 minutes cumulative running/jumping/climbing/hunting per day; or spends at 1-3 hours outside in extreme environmental conditions
FEDIAF less active	75	
Adult Indoor active **12+ years**	85	More than 30 minutes cumulative running/jumping/climbing/hunting per day; or spends 1-3 hours outside in extreme environmental conditions
Adult Outdoor Active **1-12 years**	100	Resides entirely outdoors or spends more than 3 hours outside in extreme environmental conditions
FEDIAF active	100	
NRC lean domestic cat*	100	
Adult Outdoor Active **12+ years**	120	Resides entirely outdoors or spends more than 3 hours outside in extreme environmental conditions

**NRC overweight domestic cat: 130 x $kg^{0.4}$ = MER*

Home prepared diets allow for customization to the energy and nutrient needs of the individual animal when they are properly formulated. Achieving this calorie-nutrient match cannot be accurately produced by guessing or estimating and depends on the use of specific ingredients in specific amounts. General-purpose recipes available online or from other sources may not provide the required nutrients in the appropriate number of calories, unless they are specifically formulated on a metabolic basis for less active pets.

If a commercial diet is used, it should be evaluated to determine the serving size that delivers the needed calories, and whether that serving size also delivers the metabolic recommended allowance for each essential nutrient. This can be challenging, if not impossible, if the food manufacturer will not supply a complete nutritional analysis of their product. Unfortunately, this is a common occurrence. Commercial diets can be formulated to address the needs of less active pets, but for the most part, manufacturers are not yet effectively doing so, even if the messaging on the label suggests it.

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