Feline Obesity: Clinical Recognition and Management

Abstract: Obesity is one of the most common clinical problems in cats presenting to veterinary practitioners. Because it is a risk factor for other conditions, such as diabetes mellitus and hepatic lipidosis, it not only increases the morbidity of affected cats but may also shorten their life span. In cats, a body weight of greater than 20% over the ideal weight of the animal is generally accepted as obese. The goal of this article is to help all members of the health care team understand how to prevent the development of obesity in young cats and, when confronted with an obese adult cat, how to develop a safe and effective weight-loss program.

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At a Glance

Depending on the study cited, the number of obese or overweight cats in Western societies ranges from 15% to 35%, with practitioners estimating even higher numbers in some areas.\textsuperscript{1-5} A body weight of greater than 20% over the ideal weight of the animal is generally accepted as obese for cats, which means that a 4-kg (9-lb) cat that gains 1 kg (2 lb) is considered obese. Obesity in cats not only is a cosmetic problem but also increases the risk of development of diabetes\textsuperscript{6} and hepatic lipidosis\textsuperscript{7} and is associated with increased incidences of many other conditions, such as lower urinary tract disease and osteoarthritis.\textsuperscript{8} Presuming that obesity in cats is similar to that in dogs and humans, this condition will also shorten the life span of affected cats.\textsuperscript{8-11} Considering the number of cats already affected and the great difficulty in getting a 12-kg (25-lb) cat to weigh 4.5 kg (10 lb) again, it is clear that the situation demands veterinarians' full attention.

Preventing Obesity

The commonly stated reason for development of obesity is that an animal is consuming more energy than it is expending.\textsuperscript{12} This energy imbalance can be due to excessive dietary intake of calories or a reduction in energy expenditure. However, obesity is not just a simple matter of intake or output. Many other factors that can influence or control appetite, metabolism, and homeostasis, including genetic predisposition, sex, neuter status, and hormonal disturbances, may play significant roles in the development of obesity.\textsuperscript{5,8,12} As a result, it is important to make a concentrated effort to recognize risk factors, monitor young and middle-aged cats carefully to detect excess weight gain early, promote the importance of obesity prevention and the health benefits of weight control from the first veterinary visit, and be actively involved in body assessment (weight and body condition score [BCS]) of all cats at every visit. In other words,
obesity prevention must start early, and the veterinary team is essential to recognition, early intervention, and success.

There is now ample evidence that neutering is an important risk factor for obesity in male and female cats.\textsuperscript{13–19} For some time, it has been recognized that many cats have significant weight gain after neutering or during their adolescent years, but most clinicians believed this was due entirely to the type or amount of food fed. However, several recent studies\textsuperscript{13–18} have shown that multiple hormonal changes that significantly affect feline metabolism immediately follow removal of the gonads.\textsuperscript{a} These changes affect food intake and energy metabolism and result in an increase in body fat mass that is almost inevitable unless appropriate measures to limit intake are taken immediately.\textsuperscript{14–19}

**Controlling Food Intake**

Because gonadectomy is now recognized as a risk factor for obesity,\textsuperscript{13–18} the key factor for prevention of obesity in neutered animals appears to be careful control of intake immediately after neutering (e.g., no free-choice feeding) and close monitoring of body weight and BCS to allow adjustments in intake if needed.\textsuperscript{14,16,18} As a rule of thumb, intake recommendations based on commercial food labels should be reduced by 30\% for neutered animals to account for the hormonal changes resulting in reduced energy needs.\textsuperscript{14,16,18} Several studies have evaluated the role of different amounts of dietary components (e.g., fat, carbohydrates) in the development of obesity after neutering, but the key factors that result in increase in body weight are gonadectomy and free-choice access to food.\textsuperscript{17,19} Free-choice access to dry food is not an appropriate method of feeding for many cats—particularly indoor, neutered, inactive cats—for many reasons (BOX 1). The most important with regard to obesity is the risk of overfeeding (or overeating), which even in very small amounts can exceed appropriate caloric intake and result in weight gain. Further, due to the feline preference (and, when eating small meals such as mice, physiologic need) for eating multiple meals a day, it is best to provide cats’ caloric requirements in two to four meals/day.\textsuperscript{20}

Even when owners measure the amount of food they give their cats, feeding recommendations based on the label recommendations for a particular food or traditional maintenance energy calculations are likely to result in significant overfeeding. These recommendations are based on feeding trials in intact, young, active cats—not neutered, indoor (sedentary) cats—and as a result, they are approximately 30\% higher than most housecats need. While the appropriate number of calories proposed in the veterinary literature for the maintenance energy requirement in cats ranges from 20 to 100 kcal metabolizable energy (ME)/kg/day, multiple papers have suggested that $70(BW_{kg})^{0.75}$ represents the resting energy requirement and $94$ to $125(BW_{kg})^{0.75}$ the accepted range for the maintenance energy requirement for cats.

However, in 2006, the National Research Council recommended maintenance amounts of $130(BW_{kg})^{0.40}$ for obese cats and $100(BW)^{0.67}$ for lean cats,\textsuperscript{21} and several recent studies of neutered cats have shown that feeding cats typical maintenance amounts of food results in weight and (more importantly) fat mass gain.\textsuperscript{22} Kienzle and colleagues\textsuperscript{23} analyzed the caloric needs in

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**QuickNotes**

Obesity is a common, serious medical problem in cats.

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\textsuperscript{a}For an overview of some of the metabolic changes related to obesity, see the companion article on CompendiumVet.com.

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**BOX 1**

**Free-Choice Feeding and Feline Health**

Free-choice feeding of dry food affects overall feline health in many ways, including:

- Inadequate water intake, which can lead to an increased risk of constipation and uroliths\textsuperscript{2,6}
- Learned preference for dry food, which may make it difficult to change to a therapeutic canned diet\textsuperscript{c}
- Inability of owners to monitor the amount of food being eaten, which may lead them to miss subtle signs of illness\textsuperscript{d}


colony cats and reported that neutered females required $100(BW_{kg})^{0.40}$ and neutered males required $120(BW_{kg})^{0.40}$ to maintain ideal body condition. In two other feeding studies, investigators determined that neutered cats consuming more than $50$ to $60(BW_{kg})^{0.67}$ gained weight and underwent a change in BCS from ideal to obese in just 3 months.

In simple terms, an intake of 30% less than maintenance requirements means that most average-sized, indoor, neutered cats weighing 4 to 5 kg (9 to 11 lb) need to eat less than 200 kcal/day, and many may need even less than 180 kcal/day to maintain lean body condition (BOX 2). This is a significantly smaller amount of food than is often recommended and represents a critical change in feeding recommendations for cats—one that will be extremely difficult to achieve in cats being fed a calorie-dense (high-fat) food or allowed free access to dry food.

**Increasing Exercise**

Like many people, indoor cats are sedentary, which has detrimental effects on their physiologic and psychologic health and well-being. Therefore, increasing activity and energy expenditure are very important aspects of weight management in indoor cats. However, it is not easy to induce cats to exercise. Lifestyle alteration is, then, one of the most important additions to any program of obesity prevention or management.

Exercise is a key factor in health for several reasons: (1) it helps maintain and strengthen lean muscle tissues, (2) it promotes cardiovascular health, (3) it provides mental stimulation and improves overall quality of life, (4) it increases energy expenditure and fat oxida-

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**QuickNotes**

Indoor, neutered cats are at greatest risk of becoming obese if their intake is not carefully limited soon after they achieve adult size.

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**1. Determine ideal body weight: Set a target goal for weight loss.**

- A record of the cat’s ideal weight at an earlier age is the most accurate guide.
- If you have no previous record of ideal weight, you must estimate an ideal from the current weight. This can be done by using the body condition score (BCS). On a 9-point scale, each point above a 5 represents a 10% to 15% increase in body weight (BW).
- Using this approach, a cat weighing 10 kg (22 lb) and having a BCS of 9/9 is 40% to 60% above its ideal weight. Using an equation with both BW and the percentage over BCS can provide an estimate of ideal BW:

$$\text{Ideal BW} = \frac{100\% \text{ (normal BCS)}}{100\% + \% \text{ above normal BCS}} \times \text{current weight}$$

If the cat is considered to be 40% above its ideal weight, the ideal BW is calculated as follows:

$$\frac{100\%}{140\%} \times 10 \text{ kg} = 7.1 \text{ kg (15 lb)}$$

**2. Determine the amount to feed: Energy allocation.**

- If possible, determine how much the cat is currently consuming. This may be difficult if the cat is being fed free-choice or lives in a multiscat household without careful observation of intake.
- If the amount is known, an intake reduction of 20% to 40% from the calculated maintenance requirements for a cat of ideal body condition is a good starting point for weight loss. The diet fed should contain >45% metabolizable energy of protein and be low in fat.
- The current National Research Council recommendations for maintenance requirements in lean and obese cats are as follows:

**Lean cat:** 100 kcal(BW)^{0.67} or 60 kcal/kg/day. For a 4-kg cat, this equals 240 kcal/day (4 kg × 60 kcal/kg/day = 240 kcal/day). Note that many indoor, neutered cats, even if they are lean, need 20% to 30% less than this amount, or less than 200 kcal/day.
Play and activity are essential components of a healthy feline lifestyle and are necessary for indoor cats to increase their muscle mass and reduce their risk of obesity.

Clinical Evaluation of Obese Cats
The first step in identifying and correcting obesity is recognizing it. Obviously, it is not difficult to recognize a severely obese animal, but the veterinarian’s goal is to recognize changes in body weight and condition early so that corrections in diet, intake, and exercise can be initiated to prevent progression to obesity, with all of its associated hormonal changes and comorbid conditions.

For assessment purposes, body composition is typically separated into fat mass and fat-free mass (FFM). The FFM is the largest, heaviest portion and includes protein (muscle mass), minerals (bones), and water (intracellular and extracellular). Measuring or assessing the FFM provides essential information about an animal’s

Obese cat: 130 kcal(BW)\(^{0.40}\) or 37 kcal/kg/day. For an 8-kg cat, this equals 296 kcal/day (8 kg × 37 kcal/kg/day = 296 kcal/day).

However, to achieve weight loss in an obese cat, its intake must be decreased to 60% of the maintenance requirements: 0.60 × 296 = 178 kcal/day. In practice, this can be rounded up to 180 kcal/day.

Some obese cats may need to consume as little as 20 to 30 kcal/kg/day to achieve weight loss. This amount of food is very small, and the greatest concern is to maintain adequate protein intake.

3. Monitor the weight-loss program and make adjustments.

- The goal of weight loss is 1% to 2% of BW per week. At this rate, the cat is less likely to lose lean muscle mass or develop hepatic lipidosis.
- Typically, cats lose weight more quickly at the start of the program, but metabolic and physiologic responses to weight loss result in significant slowing or even cessation of weight loss over a short period of time. Thus, monitoring progress and making adjustments are essential to continued success.
- Adjustments in the weight-loss program are based on results. If the cat is not losing weight at a rate of 1% per week, the amount of food intake should be decreased by 5% to 10%.
- Weight loss should be monitored frequently (every 2 to 4 weeks) and, to avoid discrepancies, always using the same scale.
- Other recommended monitoring tools include BCS, morphometric measurements, and photographs.
- As with any chronic disease, weight management requires a good veterinarian–client–patient relationship to achieve optimal care and results.
- It may be helpful to give owners an estimated time line for weight loss so that they have realistic expectations for results. In general, for a cat to have a 30% decrease in BW, it takes approximately 12 months if the cat is losing 0.5%/week, 7 months if the cat is losing 1%/week, or 4 months if the cat is losing 2%/week.

Clinicians should familiarize themselves with at least one of the clinical techniques for assessment of body composition and use it daily.

**QuickNotes**

**Methods of Assessing Body Condition**

- **Clinically useful methods**
  - Serial body weight
  - Body condition score
  - Morphometric measurements
  - Bioelectric impedance
  - Body mass index

- **Research methods**
  - Dual energy x-ray absorptiometry (DEXA)
  - Dilution/isotope techniques
  - Ultrasonography, computed tomography, or magnetic resonance imaging
  - Electrical conductance
  - Chemical analysis
  - Neutron activation analysis

**Body Condition Scoring**

Body mass index (BMI) is a tool that is used to evaluate body composition and assess fat mass. However, using only BMI alone does not distinguish the loss of FFM from the loss of fat mass, and BMI is not helpful in overall body condition assessment of FFM. For example, a cat with diabetes may be obese but have also lost muscle mass due to the lack of insulin resulting in muscle wasting. Simple assessment of BCS by palpation cannot accurately distinguish these changes. Another disadvantage of BCS is its lack of repeatability in inexperienced observers. However, for estimating body fat mass in a clinical setting, BCS is an important tool. It provides owners with tangible information about their pets and, when used repeatedly so that familiarity and comfort are achieved, can provide highly reproducible results.

**Morphometry and Body Mass Index**

Morphometric measurements and determination of BMI are also easy to use in a clinical setting; however, they are less well known and require more time. Morphometric analysis uses measured parameters to provide an estimate of body composition. The simplest measurements are dimensional evaluations, whereby a tape measure is used to obtain specific dimensions of the animal. In general, length measurements of the head, thorax, and limbs correlate well with lean body mass, while circumference measurements (truncal/ribcage) correlate with fat mass. By using a measurement of lean body mass (leg index) with a measurement of metabolic and physiologic status, cats in thin body condition with loss of muscle mass are known to have higher morbidity and mortality and should be evaluated to determine the cause of the loss. By contrast, obesity is the accumulation of body fat or an increase in the fat mass. In most cats, obesity represents an increase in fat mass that causes increases in body weight and changes in body composition.

Measurement of body weight is the simplest technique for determining increased fat mass. However, there are two main concerns with using only body weight monitoring: (1) measurement of body weight alone does not distinguish the loss of FFM from the loss of fat mass, and (2) scales are notoriously inaccurate or variable—measurements made on different scales can vary significantly. When weighing cats, it is important to use a reliable, well-maintained scale intended for small animals (pediatric scales are excellent) and to use the same scale for all weight tracking to minimize variability and maximize accuracy. However, to better assess body condition, most nutritionists recommend that techniques for specific assessment of fat mass be incorporated in the physical examination in addition to measuring body weight. In general, the techniques available to clinical practitioners (BOX 3) are easy to use, require no special instrumentation, and can be performed on an awake cat. They include BCS, morphometric measurements, and body mass index (BMI). Tools used in clinical or basic research also exist; detailed information on these techniques has been published elsewhere.
fat mass (ribcage circumference) in the following equation, BMI can be predicted\textsuperscript{28}:

\[
\text{Feline BMI} = \frac{1.5 \times (\text{ribcage circumference [cm]} - \text{leg index measurement [cm]})}{9}
\]

In this equation, the ribcage circumference is measured at the ninth cranial rib, and the leg index is the distance from the patella to the calcaneal tuber of one hindlimb.\textsuperscript{36}

Other morphometric measurements of body composition use specific tools to assess fat composition, such as ultrasonography (this technique has not been validated in cats) or bioelectric impedance analysis (BIA). In BIA, the conductance of an applied electric current in the patient is measured and used to calculate body composition.\textsuperscript{29,35,37} Because body fluids and electrolytes are responsible for the highest conductance and adipose tissue is dehydrated, increased adipose tissue results in lower conductance and greater impedance.\textsuperscript{29} Although several BIA systems exist, none are widely available, and there are few reports of their use in cats. BIA can be affected by electrode position, hydration status, consumption of food or water, physical activity, conductance of the examination table, and other variables.\textsuperscript{37} Thus, further evaluation of this technique is needed before it can be recommended for routine use in the assessment of fat mass in cats.

Clinicians should familiarize themselves with at least one of the clinical techniques for assessment of body composition and use it daily so that it becomes not only a normal part of every physical examination but also a more reliable and repeatable tool for assessing fat mass. Routine use of BCS also shows clients that their veterinarian considers body condition assessment to be an important part of their cat’s physical examination and health evaluation. Perception is reality: owners need to know that obesity is important not only from what veterinarians say but also from what we do.

**Obesity and Diet**

Diet must be considered in any prevention or treatment plan for feline obesity. Unlike most domestic species, cats are true carnivores. They must consume animal flesh and fat to meet their nutritional needs, or their diets must be supplemented appropriately with the necessary amino acids and fatty acids that they are unable to synthesize from other food sources as omnivorous species do.\textsuperscript{38} The most commonly used foods for cats are dry, extruded diets. These foods meet the minimum requirements of the National Research Council and are nutritionally complete and balanced, readily available, easy to use and store, and quite palatable. However, they bear little resemblance to a diet of a natural carnivore. Therefore, the distinctive nutrient requirements of cats should be taken into account when designing a weight-loss or maintenance diet.

**Protein**

As obligate carnivores, cats use protein as an energy source even when other energy sources such as fat or carbohydrates are available.\textsuperscript{38} However, most researchers have focused on fat and carbohydrate energy sources as having the primary roles in the prevention and management of obesity. While it is critically important to reduce caloric intake in cats to achieve successful weight loss, this approach has overlooked the important role of protein in feline metabolism. Hoenig and colleagues\textsuperscript{39} showed that cats consuming high-protein diets (>45% ME) had increased energy metabolism, higher fat oxidation, and improved glucose tolerance, while cats consuming high-carbohydrate diets had lower energy metabolism, required fewer calories to meet their needs, and gained fat mass. Others\textsuperscript{40–43} have also shown that in obese cats, diets containing high levels of protein result in greater loss of fat mass and improved preservation of muscle mass. This is important because muscle mass is a major determinant of metabolism. Muscle mass loss provokes a “starvation” response as the body seeks to preserve itself either through energy metabolism changes or increased intake. Therefore, loss of muscle mass increases the likelihood of weight regain, and, particularly in cats, maintaining muscle mass may be a key to successful weight loss.\textsuperscript{44} Research has shown that even cats consuming protein at 45% ME lost some muscle mass during diet restriction. This finding suggests that >45% ME of protein may be needed during weight loss due to the severe restriction of intake necessary to achieve reduction in calories and loss of weight.\textsuperscript{40,41}
Obese cats appear to adapt to lower-protein, higher-carbohydrate diets; however, obese cats on high-protein diets have not only improved insulin sensitivity but also greater energy and fat metabolism, resulting in greater loss of fat mass during calorie restriction and weight loss. Increased protein intake may be particularly important in cats after weight loss, as research also shows that energy expenditure remains decreased.

In summary, high protein levels are essential for preservation of lean body mass during calorie restriction and weight loss in obese cats and are important for increasing insulin sensitivity, thereby preventing further development of glucose intolerance. In addition, high-protein diets (>45% protein ME) allow a more optimum metabolic status in lean cats.

**Carbohydrates**

While protein is a very important component of the feline diet, it is only one part. Carbohydrates serve two major purposes: as an energy source (simple carbohydrates, such as starches) or as dietary fiber (complex carbohydrates). The role of fiber is discussed in a separate section below.

Carbohydrates are a major part of most dry and some canned commercial feline and canine diets due to issues of processing, preservation, and cost. The digestibility and glycemic index of dietary carbohydrate varies by source: highly digestible carbohydrates include cooked white rice and potato; less digestible sources include complex grains (e.g., barley, wheat, whole corn). Carbohydrates in high-quality commercial pet foods are generally highly digestible and provide a readily available energy source. If the pet is active and needs energy, carbohydrates are used efficiently; however, if the pet is sedentary, any carbohydrates that are not used for energy are stored as fat.

The amount and type of carbohydrate in the feline diet are of considerable importance for several reasons: (1) cats’ ability to handle dietary carbohydrate loads are very different from those of omnivores (BOX 4); (2) because cats use protein for energy, even when excess energy is available in their diet, sedentary indoor cats often do not use the carbohydrate energy present in a diet; and (3) high-carbohydrate diets result in a reduced resting energy metabolism, so cats must consume less food to maintain appropriate body weight.

However, cats are not unable to use carbohydrates; on the contrary, they can digest, absorb, and use them quite well. Nevertheless, the type of carbohydrate is important, as there are significant differences in glycemia, postprandial glucose levels, insulin secretion, and food intake between normal-weight and obese cats.

Fat

The role of dietary fat is also very important in feline obesity, as fat provides the greatest amount of energy per gram of diet. As a result, there are a number of commercially available low-fat feline diets for calorie control. Further, several recent studies show that controlling calories from fat in weight-loss programs is essential to achieving successful weight loss. Nevertheless, dietary fat has many roles in metabolism beyond being a powerful source of energy, and there are key differences in feline requirements for fat that must be considered when choosing a diet.

As carnivores, cats require additional supplementation of fatty acids (especially arachidonic acid) and fat-soluble vitamins in their diet that normally would come from the fat stores of prey. Also, fat is a major palatability enhancer, and cats often reject diets with too little fat or in which the fat is oxidized.

**BOX 4**

**Major Metabolic/Anatomic Differences in Feline Carbohydrate Handling Compared With Omnivores**

- Lack of a sweet taste receptor and gene for sweet taste
- Lack of salivary amylase (enzyme that initiates digestion of starches)
- Low levels (5% to 10%) of intestinal amylase and intestinal disaccharidases
- Minimally functioning levels of hepatic glucokinase (inducible enzyme that affects glucose uptake)
- Minimally functioning levels of hepatic glycogen synthetase (enzyme that converts glucose to glycogen)
- Lack of fructokinase and ability to metabolize fructose sugars

However, while reducing fat is an important method of controlling calories in feline diets, there are no studies in cats showing the ideal amount of fat in the diet. And as with protein and carbohydrates, it is essential to consider the whole: diets for weight loss in cats should ideally be higher in protein (at least >45% ME), lower in fat (to control calories) but containing enough essential fatty acids to meet feline requirements, and lower in carbohydrates (to prevent reduction in energy metabolism and conversion of excess carbohydrate to fat).

Fiber
The final dietary component to consider in weight-loss diets is fiber. Most weight-loss diets add insoluble or mixed sources of fiber, such as cellulose or beet pulp. Dietary fibers have been used in weight-loss diets for many years because of their ability to dilute calories and provide bulk to the diet so that larger volumes of food can be eaten during energy restriction. Fiber aids in glycemic and weight control by promoting slow, sustained absorption of glucose (and other nutrients) from the gastrointestinal tract and by increasing the speed of passage of food through the small intestine. However, this effect, while beneficial for weight loss, results in reduced digestibility of protein and may have other untoward effects, such as increased fecal volume, constipation, food refusal, and dry skin. As a result, many owners and cats do not tolerate diets with moderate to high levels of dietary fiber (>15% dry matter). No studies demonstrate an optimum amount or type of dietary fiber for use in cat foods for any purpose; however, a moderate amount (5% to 12% dry matter) of mixed fiber may be best.

If a moderate- to high-fiber diet is chosen, the effects on protein digestibility must be considered and an appropriate amount of protein added to the food to prevent a reduction in protein availability. As with any dietary strategy, increased fiber in the diet should not be considered a “cure-all” for weight loss, but it can be included as part of the overall approach to controlling caloric intake.

Choosing a Weight-Loss Diet
Healthy weight loss requires loss of adipose tissue along with maintenance of lean body mass, which is an important arbiter of basal energy metabolism. Ideally, weight-loss diets should contain protein levels >45% ME and be low in fat and carbohydrates. The number of dry diet choices that meet this profile is extremely small, primarily because most high-protein, low-carbohydrate dry foods are formulated as either diabetic or kitten diets and thus contain a large number of calories due to a high fat content. For example, a typical dry diabetic or kitten food contains 500 to 600 kcal/cup of food. As a result, it is extremely difficult to feed an appropriate amount to a cat that requires weight loss, which, in an obese cat, may be as low as 130 to 150 kcal/day. In this scenario, the amount of the high-calorie diabetic dry food fed at a meal will be small (<½ cup twice daily)—likely too small to achieve any sense of “fullness” and resulting in annoying begging behavior that makes owner compliance with feeding recommendations very difficult.

This point cannot be overstated: too many calories of any kind, including protein calories, will cause weight gain or failure to lose weight. Thus, at this time, the best commercial diets for achieving a high-protein, low-carbohydrate, low- to moderate-fat profile that can provide reasonable portion sizes are canned cat foods. For example, a typical diabetic (high-protein/low-carbohydrate) canned diet contains 165 to 190 kcal/5.5-oz can. Thus, when the target for caloric intake is 180 kcal or less, it can be easier to achieve the high protein necessary to preserve muscle mass in a portion-controlled diet with these foods. However, canned foods can also be high in carbohydrate or low in protein or have poor-quality ingredients, resulting in ineffective or unhealthy weight loss. One size does not fit all in cat foods, and careful reading of the label can help determine the protein, carbohydrate, and fat levels, which is the start of the process.

Creating a Treatment Plan
Successful weight loss in an obese cat requires patience, setting goals, frequent monitoring and readjustment of strategy, and an understanding that reversing obesity is a challenge similar to the management of any chronic medical condition. Persistence and diligence are essential. The key is to set a target calorie intake, weigh the cat monthly, and adjust the amount of food based on weight loss.
the most appropriate rate of weight loss is debated, most sources agree that a goal of 1% weight loss per week or 3% to 4% per month is a safe target.\textsuperscript{8,12,29} If, during periods of monitoring, this goal is not being achieved, calories must be reduced by 5% to 10% and the effects of the new amount monitored.

To achieve loss of fat mass, the weight-loss program must consider the cat’s body condition at the start of weight loss, the degree of calorie restriction required, the desired rate of weight loss, and the cat’s environment and ability to increase exercise.\textsuperscript{29} BOX 2 provides a step-by-step overview of the process. Although this strategy is relatively straightforward (reduce energy intake), it requires patience; careful, long-term monitoring; encouragement and support for the owner; and frequent assessment and readjustment to meet the needs of the cat.

Conclusion

The key to obesity prevention (or correction) is balancing the energy intake/energy expenditure equation. Because obesity is incredibly difficult to reverse in adult cats and, in many cases, requires lifelong management because of changes in energy metabolism and hormone status, prevention is an essential goal. All neutered cats are at risk for becoming obese due to the changes in their hormonal balance that affect appetite, energy balance, and fat metabolism. Because of these changes, food intake must be carefully restricted following gonadectomy in all cats, and free-choice feeding of dry foods should be strongly discouraged.

In indoor cats, for which exercise is reduced by the nature of their lifestyle, energy restriction also becomes paramount to preventing or correcting obesity. Energy restriction can be achieved by low-fat, high-fiber diets, but many of these diets are not high enough in protein to preserve muscle and thus result in loss of muscle mass, unhealthy weight loss, and a strong tendency to regain weight. High-protein, low-carbohydrate, low-fat diets are ideal for weight loss in cats because they preserve muscle mass while restricting energy sources to induce fat loss. However, portion control is ultimately the key to controlling energy intake and is most easily achieved by feeding canned food with a protein content of >45% ME and a carbohydrate content of <10% ME. The key to any successful weight-loss program is patience, persistence, frequent and careful monitoring and assessment, and readjustment of the caloric intake and diet as needed to achieve fat loss and preserve lean muscle tissue.

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